MIDLANDS STATE UNIVERSITY

FACULTY OF SOCIAL SCIENCES

DEPARTMENT OF LOCAL GOVERNANCE STUDIES

WATER SUPPLY AND WASTEWATER MANAGEMENT IN URBAN AREAS AND THE IMPACT THEY POSE ON HUMAN HEALTH. THE CASE OF CHIREDZI TOWN.

BY

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(R136740X)

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The undersigned certify that they have supervised, read and recommend to Midlands State University for acceptance, a research project entitled: **"Water supply and wastewater management in urban areas and the impact they pose on human health: The case of Chiredzi Town."** Submitted by **Mauro Blessing (R136740X)** in partial fulfillment of the requirements of the Bachelor of Science Honours Degree in Local Governance Studies.

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DECLARATION

I, Mauro Blessing, declare that this work is my own original work, that it has not been plagiarized nor submitted for similar degree in any other University. All the sources that were used have been indicated and acknowledged.

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DEDICATION

I dedicate this this dissertation to my late mother; **Joyce Mauro** who inspired me in everything I do even today, she always told me that education is the key to success. She was my rock, my joy and my happiness. Her warm gentle hands, hopeful encouragement, all abiding love; good-humored advice will be greatly appreciated. Indeed, I miss her as my pillar of strength. Really, no words are sufficient to describe your contribution to my life mother but only just to owe every bit of my existence to you mother. To my young sister Taonga Hulda Chitate, I have set a pace which I believe by God's grace you will overtake.

ABSTRACT

The Zimbabwean urban LAs are facing a lot of challenges in service delivery due to a number of reasons but financial constraints being the major cause. The main focus of the research study was on water supply and wastewater management in urban areas and the impact they pose on human health, the case of Chiredzi town. The study sought to achieve the following objectives; to determine the impacts of poor water supply and waste water management on human health" , to identify the relationship between water supply management and waste water management and the impact they pose on human health, , to establish the root causes of poor water supply and waste water management in Chiredzi Town, to assess the capability of the Chiredzi Town Council in improving the water supply and waste water management, to determine the influence of stakeholder participation in water supply and wastewater management in Chiredzi Town and to come up with strategies to overcome the problems of water supply and waste water management. The literature review established the meaning of the terms water supply, wastewater management and health, and various schools of thought aired their views pertaining the key words. Types and sources of wastewater in urban areas, that is industrial, commercial, domestic and storm water runoff wastewater were explained and the impact they pose on human health. Water supply and wastewater management in developed and developing nations were discussed, Germany, Denmark, Thailand, Ghana, Mozambique, Malawi and Zambia were used as case studies. The study also shows how wastewater is being treated and re-used in both developed and developing nations. Impacts of wastewater and water supply on human health were discussed. The researcher used sampling techniques and these are stratified, SRS and purposive sampling. The population comprised of the councilors, CTC management and CTC general employees, Chiredzi General Hospital (CGH) employees, ZINWA employees and householders. The total sample size for this research was one hundred (100) people of which seventy-seven (77) responded. To extract data, the researcher, used both primary and secondary research instruments. Interviews, questionnaires (open and closed), focus group discussions and observations were used. The research findings of the research were presented using tables, narratives, graphs, pictures and charts. The research findings shows that, water is a challenge in Chiredzi town and water borne diseases are rampant in the town thereby impacting human health and wastewater have been seen to be managed poorly and sewers are seen flowing in streets and this have a negative impact on the health of people and wastewater is not being recycled and this contributed to water shortages as wastewater is let go into Chiredzi river. Recommendations that have been given include that the council should seek funds from external helpers, engage PPPs and stakeholder participation and limit political interference as well as motivate employees. Areas for future research were also highlighted and one of the area the researcher indicated is, water resources management in urban areas.

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LIST OF ABBREVIATIONS AND ACRONYMS

CBD	Central Business District
CEO	Chief Executive Officer
CGH	Chiredzi General Hospital
CHIRA	Chiredzi Residents Association
CRDC	Chiredzi Rural District Council
CSOs	Civil Society Organizations
CTC	Chiredzi Town Council
CWTP	Chiredzi Water Treatment Plant
IDWSSD	International Drinking Water Supply and Sanitation Decade
NGOs	Non- Governmental Organizations
PPPs	Public Private Partnerships
RWH	Rain Water Harvesting
SRS	Simple Random Sampling
UNICEF	United Nations International Children Education Fund
WHO	World Health Organizations
WRM	Water Resources Management
WWTPs	Wastewater Treatment Plant
ZINWA	Zimbabwe National Water Authority

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CHAPTER I

INTRODUCTION

1.0 Introduction

The challenge of water supply and wastewater management has been a growing concern globally, regionally and nationally. Local Authorities, researchers and the communities at large are concerned about water supply and wastewater management as they impact negatively on human health if not addressed properly. This chapter outlines the background of the study, statement of the problem, research objectives, research questions, justification / significance of the study, the assumptions, limitations and delimitations of the study and the summary of the chapter in that order.

1.1 Back ground of the study

The world is facing a global water crisis, continuing population growth and urbanization, rapid industrialization and expanding and intensifying food production which all putting water resources under pressure and increasing the regulated or illegal discharge of contaminated water within and beyond national borders, thus according to UNEP (2010). They further states that, globally two millions tones of sewage, industrial and agricultural waste are discharged in the world's water ways. Annually at least 1.8 million children who are under five years old die every year from water related diseases. In addition, wastewater has serious consequences to the environment, human health and economic development in nation. WHO (2011) add on by stating that, in adequate handling of wastewater or untreated water can lead to severe sanitary consequences worldwide and impacting on human health.

OECD (2012) states that, there is deterioration in water quality, therefore reducing biodiversity in rivers, lakes and wetlands by about one-third globally. For example China as a nation faces persistent shortages of water. According to information found at http://www.wssinfo.org , China though facing numerous challenges such as rapid urbanization, a widening gap between rich and poor as well as urban and rural areas, water scarcity, contamination and pollution, it is

undergoing a massive transition. According to survey data analyzed by the Joint Monitoring Programme for water and sanitation, about one hundred million Chinese did not have access to an improved water source in 2008 and about four hundred and sixty (460) millions of people do not have access to improved sanitation. In addition, reports in 2015 states that, the number of people lacking access to improved water was sixty-three million.

According to World Bank (2015), about 13% of urban water users receive water at in adequate pressure. They further states that, 60% of China's 661 cities face seasonal water shortages and this impact on human health. At times, water supplied in most cities in China is contaminated from faeces and this causes critical health problems such as diarrhea and typhoid. WHO (2011) states that, many cities in China who have access to adequate water suffer from poor water quality due to faeces contamination , high levels of naturally occurring fluoride, arsenic, agriculture chemicals pollution and salts. They further states that, Shanghai, a city in China depends on surface water that is heavily polluted such as Huangu River, whose water comes through Suzhou Creek from the heavily polluted lake Tai and this impact on the health lives of people in the city of Shanghai- China. Therefore, water Supply is a big challenge globally, for example in China, hence becomes an issue to be researched on.

In addition, wastewater management is also a challenge globally, this is evidenced by a sewerage network that has lacked maintenance over the years and overflow of raw sewage in open drains which have become common, due to blockage and in adequate pumping capacities in Delhi the city in India. In addition, 27% of India's wastewater was being treated in 2003 with the remainder flowing into rivers, canals, ground water or the sea and this has impacting the health lives of people in India as water borne diseases are rampant in most cities in India, thus according to WHO (2015).

Furthermore, Laugesen et al (2010) states that, domestic waste water is prevalent and consists black water (excreta, urine and faecal sludge) and grey water, thus kitchen and bathing waste water. Half of the world's population has no means of disposing of sanitary wastewater from toilets and wastewater contains pathogens causing diarrheal diseases and intestinal parasites, therefore globally wastewater problems have posed a threat on the health of people in the urban centers of most countries, UN-HABITAT (2008).

Regionally the challenges of water supply and wastewater management continue to be rampant and this is evidenced in countries which include, Dar es Salaam, Mozambique, Burkina Faso and Morocco. The African Development Bank Group (2015) viewed that, by the end of 2011, 89% of the world's population used improved drinking water sources. Slightly more than half the population 55% enjoyed the convenience and associated health benefits of piped supply on their premises. The reports indicates that, of the 768 million people without sources of improved drinking water, 344 million people live in Africa .Providing safe drinking water and improved sanitation is one of the major challenges facing African countries and the water sources available to provide clean drinking water to Africa's population are limited. Demand for water grows due to rapid urbanization and population growth, a rising share of informal settlements, in adequate infrastructure, in adequate governance and deteriorating water sources impact on water management in urban centers.

Jacobsen et al (2013) states that, Africa is urbanizing more quickly than any other region in the world and has faster growing slums, currently approximately 409 million Africans or 40% of the continent's population lives in urban areas, more than twice the numbers in the 1990s. According to the UN, approximately 2.6 billion people, one billion children lack access to safe drinking water and sanitation; hence diarrhea causes illness and deaths. Therefore, the issue of water supply and waste water management has become a concern in countries in Africa as it impacts on human health if not addressed properly.

In Africa wastewater management has said to be one of major challenges which urban cities face, for example in Ghana current urban sanitation infrastructure is inadequate and seems not to be keeping pace with population growth rate, about 5% of the population is linked with infrequently functional sewage systems and sewage treatment plants. Most untreated waste water ends up in storm water gutters, streams and other water bodies, thus according to Keraita et al (2006). Gyampo (2006) observed that ten regions in Ghana are very abysmal, most industries are located along the coast discharge their effluent directly into the ocean without any form of treatment, while those located in land discharge their effluent into major streams and urban storm drains. In Ghana only 5% of the households are connected to pipe sewerage systems, UNEP (2010). Reynolds (2000), states that, inadequate sanitation contributes to 70% of diseases in Accra-

Ghana and 21 % of the households use flood drains (gutters) as open sewerage that ends up in nearby urban water bodies.

In Zimbabwe, water shortages is among the major ills to be faced by many cities in the 21st century especially in urban areas due to increased urbanization, thus according to Matsa and Tapfuma (2015). They further states that, water supply in most urban cities is a challenge, it is worsened by the ever increasing population and also unreliable rainfall patterns. According to Rukuni (2010), Sewer management has become the most prioritized work by the councils in Zimbabwe. Sewer blockages have been recognized as the main cause of sanitation problems in the country despite other waste water affluences. In Zimbabwe, most urban and city residential areas have been experiencing sewer blockages and spillages since the year 2000 UNICEF (2010). The majority of blockages were due to an accumulation of sand mixed with biodegradable organic effluent consisting primarily of human excrement, some fats and oils, and other organic waste matter.

In 2013 there was an implementation of US$ 30 million by UNICEF on small towns for water and sanitation programme. This was to improve water and sewer system in 14 towns of Zimbabwe. Residents of Zimbabwe state that out dated and overflowing sewer systems dirty the streets contaminating the water supply and threaten their health, Chiramba (2010). City council officials at Harare City Council, states that the government is aware of the problem but can't afford to overhaul the infrastructure. Nyoka (2016) state that, Harare the capital city of Zimbabwe is experiencing regular water shortages because the supplier ZINWA lacks funds to treat water and has also been unable to maintain its ageing water pipes and as a result ZINWA's mandate is to give raw water to councils around the nation and the councils will treat water for themselves, which most councils are failing.

In addition, the taps are dry and they are not working, the pipes haven't had water in them for a while and have rust, this clearly shows that, water supply is a challenge in the city. In addition, to this an editor Mapimhidze (2014) states that, Harare and its surrounding areas have been stressed in terms of water supply and wastewater management due to a number of reasons, water demand that has outstripped supply capacity. Reports postulates that, the last water production facilities upgrade was done in 1994 and the past 20 years have seen no expansion even though the demand has been increasing. The water supply plant and equipment is now aged with most of having

outlived its economic life span. Therefore, this indicates that nationally water supply is a challenge in Zimbabwe and together with wastewater poorly managed, it impacts on human health.

The quality of water available to residents in Bulawayo is poor, and most urban centers have few functional taps and the sewer system which was designed for a small population is becoming inadequate causing sanitation problems, Rukuni (2010). A yearlong outbreak of cholera in 2008 killed more than 4 000 people and infected about 100 000 others and since there have been regular outbreaks of water borne diseases in urban areas UNICEF (2010). In addition, water supply is said to be a challenge in Zimbabwe as the cities' sources have dried up, Mlotshwa (2016) state that, the delay in rainy season is set to worsen the water sanitation in Bulawayo-Zimbabwe's second largest city. Dams are almost running dry and water supply to the city is now becoming a challenge, therefore leading the city to ration water.

Today, 789 million urban dwellers live without access to improved sanitation facilities, UNICEF (2010). According to this enumeration sewer problems have become a major problem leading to health problems to the residents in the urban centers. Urban municipalities have a major impairment to deal with since the sewer problems are increasing and bang up-to-date in all towns. This research will seek to find solutions to the sewer problems and safe drinking water so as to deal with the health problems emanating from sewer blockages and shortages of water supply.

The research study was carried out in Chiredzi District which is governed by the Town Clerk in the Town Council and the CEO in the Chiredzi Rural District Council, together with the elected councilors thirty two from the CRDC and eight from the CTC. Being nicknamed "Chilas", Chiredzi town is a small town in Masvingo province near Runde River. The town was established in the late 19th century and it is geographically located in the south eastern part of Zimbabwe, about 203km from the city of Masvingo. The census of 2012, shows that, the total population in Chiredzi urban was at 30 594.The economy of this small town is centered around sugar production and the town is surrounded by vast sugarcane plantations and these includes Hippo Valley Estate, Triangle Estate, Mkwasine Estate and Mwenezana Estate. Simba etal (2012), states that, it is found in region 5 known as low veld region, describable and characterized by aridity and in determinate precipitation, unfit for agriculture depending on

precipitation. Normally the district receives an average rainfall of 620mm per annum and has an average potential evapo-transpiration of between 600-1000mm which by a wide margin surpasses the accessible water supply. Chagutah (2010) states that, temperatures are high in summer (+39.0 C) creating evaporation losses of 10-13 mm every day.

1.2 Statement of the problem

Currently there is persistent water shortages in Chiredzi town and can go up to two weeks per every month. Shortage of running water from the taps is causing blockage problems to the sewer reticulation as it will go for weeks without flashed water in it as there will be no enough water for that purpose. The streets of Chiredzi are seen overflowing with sewers, therefore posing a high threat of water borne diseases and odour to the nearby residents. Therefore, the town of Chiredzi should have adequate water supply which is safe to drink and sewers should not be seen flowing unattended in the streets and in that case the human health in the town will not be at risk. Therefore, this can only be achieved through servicing of septic tanks so that they do not spill out and also use of borehole water to curb the water supply shortages. Water supply in Chiredzi is so poor because water is being gravitated to Mteri dam a night storage dam at Hippo Valley, then from this dam it is aggravated to the purification plant, then to the reservoir tanks and then pumped to the residents. However, Chiredzi Town Council should get water direct from ZINWA, treat and supply water to residents.

1.3 Objectives

1.3.1 General objective

- To determine the impacts of poor water supply and waste water management on human health.

1.3.2 Specific objectives

- To identify the relationship between water supply management and waste water management and the impact they pose on human health.
- To identify the existing and potential health effects emanating from poor water supply and waste water management.

- To establish the root causes of poor water supply and waste water management in Chiredzi Town.
- To assess the capability of the Chiredzi Town Council in improving the water supply and waste water management.
- To determine the influence of stakeholder participation in water supply and wastewater management in Chiredzi Town.
- To come up strategies to overcome the problems of water supply and waste water management.

1.4 Research questions

- What do you think is the relationship between water supply management and waste water management in promoting good health within the citizens in Chiredzi?
- Which factors are causing ineffective water supply and waste water management?
- What are the likely negative impacts to be caused by poor water supply and waste water management?
- How is the council handling water shortage problems as well as waste water issues?
- Does the influence of stakeholder participation affect water supply and wastewater management in Chiredzi Town?
- What are the solutions to problems faced by inadequate water supply and poor waste water management?

1.5 Justification of the study

This section focused on the following, that is who is going to benefit from the study and the significance of the research topic to the following, thus the researcher, the Midlands State University, Chiredzi Town Council, the residents and the government at large.

- **To the researcher**

The researcher will acquire skills to interact with different people, among them Chiredzi Town Council (CTC) employees, Chiredzi Residents Association (CHIRA) Officials, residents and other stakeholders. The research findings will be of significance to the researcher, in the sense

that the researcher will have the knowhow of the root causes of poor water supply and waste water management and come up with strategies to overcome the aforementioned problems. The researcher will also have an opportunity to explore and give Chiredzi Town Council Management recommendations on ways to improve water supply and wastewater management in the town.

- **To Midlands State University**

The Midlands State University as the learning institution will benefit from the study and the importance of the study will be that, the learners will benefit from the research and also the requisite departments on which the topic falls under will have to address the challenges which urban local authorities in Zimbabwe face and among them is poor water supply and waste water management. The research findings will be used by future researchers as reference material for their studies. The university will also be proud of producing public administrators of high quality through producing a well-researched project.

- **To Chiredzi Town Council**

The findings of this project will assist Chiredzi Town Council Management to know the root causes of poor water supply and wastewater management. The management will also benefit from recommended solutions identified by the researcher in order to provide good services on water supply and wastewater management. The Town Council will be able to draft the proper budget which will encompass the water and waste water management. More over the CTC will then come up with the best schemes to promote water provision and deal with waste water problems. The engineering and works department will be able to tackle water delivery problems and service sewers in time as they now they understand the impact they pose on human health in Chiredzi Town.

- **Other Beneficials (Residents, Civil Societies Organizations, NGOs and Ministries)**

The residents of Chiredzi Town and Civil Society Organizations (CSOs) will also get to understand how water supply is a challenge in the town, therefore they will try by all means to preserve the little amount of water they get and also get to report the sewer blockages in time as they now understand the consequences to their health. The NGOs for instance UNICEF and WHO will be able to establish proper funding towards the safe water delivery and waste water management as they will understand these challenges bear on human health. The government at

large will be benefit from the research findings in the sense that, there are to achieve the sustainable development goals and some of them mention something on water and sanitation and also about health issues and these will be easily attainable if the challenge facing Chiredzi Town are addressed as poor water supply and wastewater management is also tackled, therefore the government at large will benefit from the research and this comprise the Ministry of Health and Child Welfare. Therefore, the research will be of great significance to various sectors, hence it worth to be carried out.

1.6 Assumptions of the study

The research was based on the assumptions that, the respondents would have time to cooperate and as well as giving information which will be useful and relevant to the study. The researcher assumed that, the people in Chiredzi urban understands what is meant by water supply and wastewater management as well as knowing the impacts associated when poorly managed, are aware of the water borne diseases as well as the role of community participation in enhancing adequate water supply and effective management of wastewater in urban areas.

1.7 Limitations of the study

In carrying out the research, there are a number of challenges the researcher faced and these are laid out in this section and the researcher addressed them in order to carry out the research effectively.

- **Shortage or lack of resources**

This is one of the major limitations to this study and resources consists of financial resources and equipment's which enhance the study to be carried out effectively. The research requires a considerable amount of money to be completed and it also needs equipment such as recording machines, laptop which used to type and the printer and all these needs funds .In order to overcome these challenges, the researcher source funds from donors and the well-wishers in order for the research to be carried out effectively.

- **Time**

Another key challenge for the research to be carried out effectively is time, as the researcher have other duties to attend to as well as the research need to be done, time to do the research was

a great challenge. Therefore, the researcher worked on during the night and during vacation so as for the research to be done.

- **Language barrier**

Language barrier is also a great challenge, the area of study is a town which is more dominantly by the Shangainans speaking clan and therefore, language barrier is a challenge. However, to facilitate the study researcher had to use friends which understands the language to interpret the meanings and also try to accommodate them using the international language.

1.8 Delimitations of the study

The research is to be carried in Chiredzi District which housed the main target of the research area the Chiredzi Town. According to the information found on http://www.zimbabwepeople.blogspot.nl, the district of Chiredzi is housed with Mwenezi district on the south, Chipinge district to the east, Zaka district to the west and Bikita and Gutu to the north. The district is also dominated by the Save, Runde and Mtilikwe river systems research study was mainly focused in Chiredzi Town which is surrounded by sugar plantations and these are Triangle Estate from the west, Hippo Valley Estate and Mwenezana Estate from the south and Mkwasine Estate from the north, while the Chisumbanje power plant is located to the east of the town.

The research was more focused in the Chiredzi Town which has a large population and according to the census of 2012, the total population in Chiredzi Town was at 30 594. The population on which the study was centered on, composed of the councilors, residents of Chiredzi Town, the Chiredzi Town Council (CTC) employees, the Chiredzi General Hospital (CGH) employees and ZINWA employees.

In addition, there are a number of challenges which are affecting the small town of Chiredzi and these challenges caused the council to in effectively and in efficiently deliver the services to the public. These challenges includes air and water pollution, refuse collection, housing, street lights, traffic problems, poor infrastructure for example roads and poor recreational facilities. However, the research focused on the water supply and wastewater management and highlighting the impacts they pose on human health if not properly addressed. The research did not focus on

refuse collection, housing, street lighting, roads, recreational facilities (parks, gardens and swimming pools as well as playing grounds) but the focus of this research study was on water supply and wastewater management in urban areas and the impact they pose on human health.

1.9 Definitions of key terms

Waste Water- is defined as a combination of one or more of, domestic effluent consisting of black water urine and faecal sludge and grey water, water from commercial sites and institutions including hospitals, industrial effluent and agricultural, horticultural and aquaculture effluent either dissolved or as suspended matter, Corcoran et al (2010).

Wastewater- According to the information found at http://www.water.unl.edu, wastewater is water which comes from ordinary living process bathing, toilet flashing, laundry, dish washing and in other terms it comes from the residential, domestic and industrial sources.

Wastewater- UN HABITAT (2010) defined waste water as water that contains a number of pollutants and contaminant including, plant nutrients, pathogenic microorganisms, heavy metals, organic pollutants and micro pollutants. They described these as the causes of waste water, and all these variables causes' health problems to human health.

Water Supply- is the provision of water by public utilities, commercial organizations, community endeavors or by individuals usually via a system of pumps pipes, thus according to the UNICEF (2010).

Health- is a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity, thus according to WHO (2006).

Health- According to the information found at www.businessdictionary.com, health is a dynamic condition resulting from a body's constant adjustment and adaptation in response to stresses and changes in the environment for maintaining an inner equilibrium called homeostasis.

1.10 Summary

The chapter gave an insight into the area of study highlighting the background of the study that is Water supply and Wastewater management in urban areas and the impact they pose on human health, statement of the problem, research objectives as well as research questions were

discussed as this guide the research study, justification or importance of the study have been taken into consideration, limitations that were faced by the researcher, The research was focused and only centered in Chiredzi as shown in the delimitations of the study were also noted down.

The next chapter, literature review and on this, the researcher focused on other literature which are related to the study area. Conceptual and theoretical framework as well as empirical evidence on water supply and wastewater management in urban areas and the impact they pose on human health were discussed to understand the research under study.

CHAPTER II

LITERATURE REVIEW

2.0 Introduction

The chapter will outline what other school of thoughts lay out pertaining water supply and wastewater management in urban areas and the impact they pose on human health. The main purpose of literature review is to help the researcher to develop a good understanding on the area of study. In order to come up with a clear understanding of this study, the researcher finds it necessary to review the literature from other authors and researchers and also diagrams will be included where necessary.

2.1 Literature Review

Saunders et al (2009) states that reviewing the literature critically will provide the foundation on which one's research is built on. Literature review discusses published information in a particular subject area, and sometimes information in a particular subject. It can be just a simple summary of the sources, but it usually has an organizational pattern and combines both summary and synthesis. According to information found at www.writingcenter.unc.edu, literature review is of great importance because it gives an overview or act as a stepping stone, where one has limited time to conduct research and keep researcher up to date with what current in the field of study and finally it provide a solid background for a research paper' investigation. This therefore means that, the researcher will use books, journals and articles written by other scholars pertaining the area under study.

2.2 Classification of Urban wastewater

Urban wastewater can be classified in two depending on the source of the wastewater generation. According to UN-HABITAT (2010) states that, grey wastewater also known as sludge, is a non-industrial wastewater produced from household processes such as dish washing, laundry and bathing. Grey wastewater consist of residential wastewater and it gets its name from dull appearances and from its status as being neither fresh nor severely polluted. On the other hand

there is black wastewater which contain major food residues and high concentrations of toxic chemicals from household cleaners and also industrial waste. This may also comprise of suspended solids that in larger measures could be blanket species or lessen light penetration within the receiving waters.

2.2.0 Types and Sources of Wastewater in Urban Areas

2.2.1. Industrial Wastewater

Industrial wastewater according to WHO (2010), is water produced after manufacturing or chemical processes. In organic industrial wastewater is produced mostly in the coal and steel industry, non-metallic and processing of metals. On the other hand, organic industrial wastewater comprises of biological industrial waste flow from those chemical industries and huge scale chemical works which uses biological elements from chemical reaction. Industrial wastewater means process and non-process wastewater from manufacturing, commercial, mining and forestry facilities or activities, including the runoff and leachate from areas that receive pollutants associated with industrial or commercial storage, handling or processing.

2.2.2 Commercial wastewater

This originates from non-domestic sources such as beauty salons, furniture refining, musical instrument cleaning or motor body repair shops. Commercial wastewater comprise of hazardous materials and requires special treatment or disposal. This wastewater means non-toxic, non-hazardous waste water from commercial facilities which is usually alike in composition to domestic wastewater, but which may rarely have one or more of its constituents surpass typical domestic ranges. In this definition are wastewaters from commercial and institutional food service operations, commercial laundry and beauty salons, provided that toxic, hazardous or industrial wastes are not introduced into the system. WHO (2010).

2.2.3 Domestic wastewater

Mara (2006) states that, Domestic wastewater is the water that has been used by a community and which contains all the materials added to the water during its use. It is thus composed of human body wastes (faeces and urine) together with the water used for flushing toilets, and

sullage, which is the wastewater resulting from personal washing, laundry, food preparation and the cleaning of kitchen utensils. Laugesen et al (2010) states that, domestic waste water is prevalent and consists black water (excreta, urine and faecal sludge) and grey water, thus kitchen and bathing waste water. This wastewater comprises of used water from houses and apartments, it is also termed sanitary sewage. Domestic wastewater is the main source of pathogens and putrescible biological substances. Most sewer from cities and towns is expected to have pathogens of some kind, hypothetically giving a direct threat to public health. Domestic wastewater is viewed as wastewater derived principally from apartments, business buildings, institutions and waste water sanitary sewage.

2.2.4 Storm water runoff

Festing et al (2013), state that, storm water runoff is water from rainfall that is collected in a system of pipes or open channels. There are two main sorts of storm wastewater drain channels and these are side inlets and grated inlets. Storm drains are often incapable to capacitate the amount of rain that falls during heavy rains, in addition, some storm drains are distinct from sanitary sewer system and the separation helps to avoid sewer treatment plants to become overwhelmed by rain storm which can result in untreated sewer being discharged into the environment, therefore impacting human health.

2.3 Urban wastewater (effluent) management

Corcoran et al (2010) states that, globally, populations are growing rapidly, in urban areas where the rate of urbanization have outstrips planning and wastewater infrastructure development in most urban areas. Existing wastewater infrastructure of most cities have decayed or no longer appropriate and in slum areas there is no planning and few facilities. Management of wastewater in the urban context must be adapted according, not only to the size, but also to the economic development and governance capacity of the urban area. Therefore, working together and cooperating across municipalities the challenges of addressing wastewater management can be met and potential benefits realized.

Wastewater management should consider the sustainable management of waste water from source to re-entry into the environment. Different management approaches are required

depending on the size of and density of the population, level economic development, technical capacity and system of governance in place. Wastewater management can be conducted through centralized systems, which are large scale systems that gather wastewater from many users for treatment at one or few sites and through decentralized systems which are typically on site systems, dealing with wastewater from individual users or small clusters of users at the neighborhood or small community level.

2.3.1 Urban wastewater management in developed countries

Traditionally, much of the urban wastewater management in developed countries has relied on centralized systems. Industrial effluent in developed countries is generally treated on site, although some may also be sent to centralized municipal systems following pre-treatment onsite, thus according to UNEP (2010). In addition, Hutton and Wood (2013) states that, water, sanitation and wastewater are expensive and capital- intensive, but the available evidence all suggests that the costs of in adequate investment are far greater in terms of actual money spent and also both direct and indirect damages to human health. Hutton and Wood (2013), further states that, wastewater management is done effectively as frequently services are provided using a mixture of financing sources which includes the public-private partnerships (PPPs), which includes community contractors, service contracts, management contracts and build- operate transfers. These enables wastewater in developed countries to be monitored effectively because financially they are stable.

2.3.1.1 Wastewater management in Denmark

The Danish wastewater treatment system is characterized by advanced technology and effective treatment plants. In the capital of Copenhagen, the harbor has been transformed from being badly polluted, due to the city's old sewage system and local industry. It offers expertise and is acclaimed internationally for its in depth know how and technology. Today it is handled by around 1400 water treatment plants before released back into nature. Recently, Denmark has been said to kick start energy positive wastewater treatment project. In addition, it is embarking of a journey to turn its fleet of wastewater treatment plants, for example the Ega Renseanlaeg treatment plant in Aarhus, when fully operational is expected to produce 50%. Aarhus Municipality is a wastewater service provider to about 310 000 residents. It operates 4 larger 6

smaller wastewater treatment plants (WWTPs) that combined, receive about 35 million cubic meters of wastewater a year and this have been deemed the successful wastewater in Denmark, thus according to Freyberg (2016) from the article found at http://www.waterworld.com.

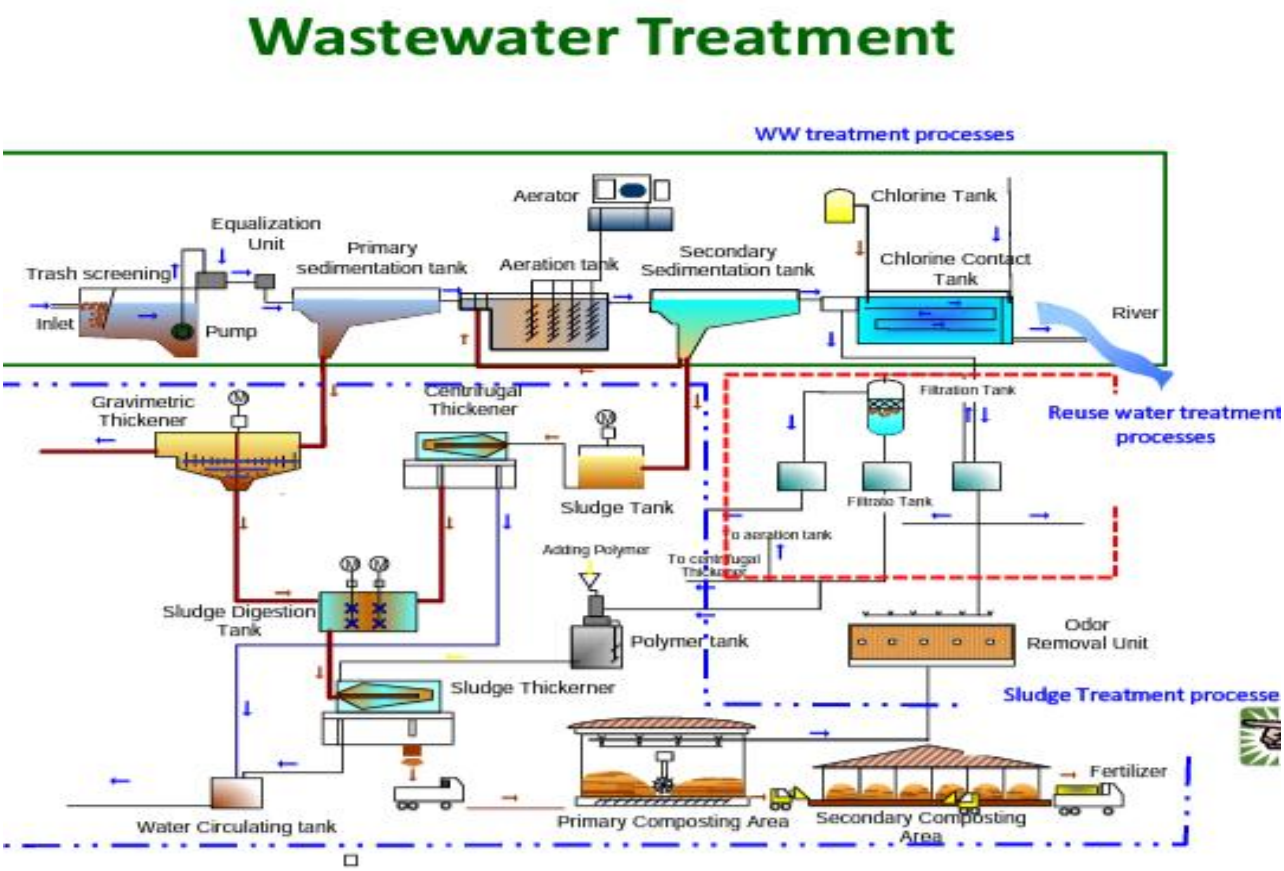
2.3.1.2 Wastewater management in Germany

Germany is the European country with the highest wastewater reprocessing and recycling rate. More than 96% of the wastewater from private households and public facilities is discharged into nearby sewage treatment plants for processing. In Germany, it is not permitted to discharge untreated wastewater into rivers and lakes regardless of whether it originates from private households, trade or large scale. The Federal Water Act states that, discharges of wastewater into water into water bodies is only permissible if the pollution load of wastewater is kept to the lowest levels. The wastewater management in Germany is effective as it postulates that, more 96% of the German population is connected to the public sewage system.

Wastewater from private households is collected in the public sewage system covering 540 723 km of sewers and discharged into 10 000 wastewater treatment facilities. It is therefore, 10.07 billion cubic meters of wastewater are annually treated and public sewage treatment facilities, while 0,1 % receive only mechanical treatment, 1,9 % undergo biological treatment without nutrient removal and 98% pass through a biological treatment process with a targeted nutrient elimination, thus according to the information found at http://www.bmub.bund.de.

The diagram (fig 1) shows the wastewater treatment process in developed countries and this helps in preventing water shortages in these developed nations. The diagram highlight that, when wastewater is being treated, odor is also being removed and the wastewater is purified to the extent that it is safe for reuse, therefore helping to curb water shortages in most developed countries.

Fig 1. Shows wastewater treatment in developed countries.

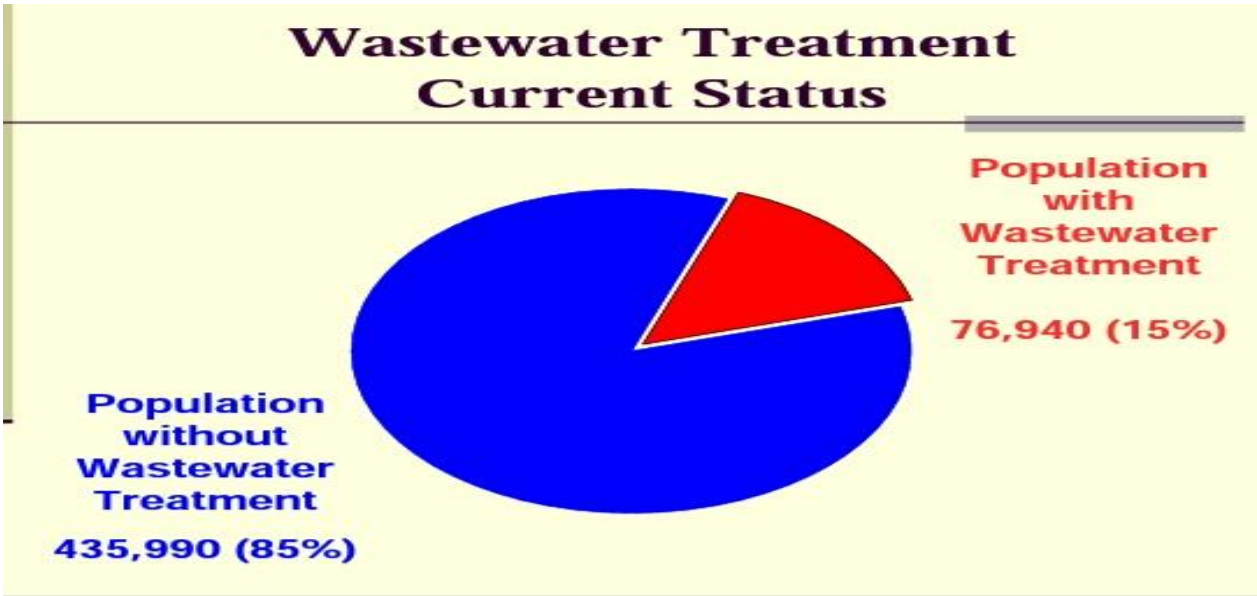


Source: UNEP (2010)

2.3.2 Urban wastewater management in developing countries

Simachaya and Yolthantham (2006) states that, wastewater management is one of the most serious environment problems in developing countries. Thailand have about 101 treatment plants and these cover the treatment capacity of 23% of total wastewater and this indicates that wastewater is poorly managed in other developed countries. Although the wastewater management in Bangkok, Thailand is so poor, they are trying to maintain it and they do so by putting legislation measures and the act effluent standards and enforcement and the wastewater discharge fees ensures that wastewater is properly managed in the city. Therefore, this shows that, the city of Bangkok in Thailand is facing a challenge in managing its wastewater, though some measures are put in place to minimize the situation.

Fig 2. Shows the numbers in percentages of wastewater treatment in developing countries.



Source: Hassen (2001).

The above diagram indicates that, in developing countries most countries have poor wastewater management and this shows only a small amount is being treated, which means that the rest will be left flowing in streets and rivers, hence causing impacts on human health.

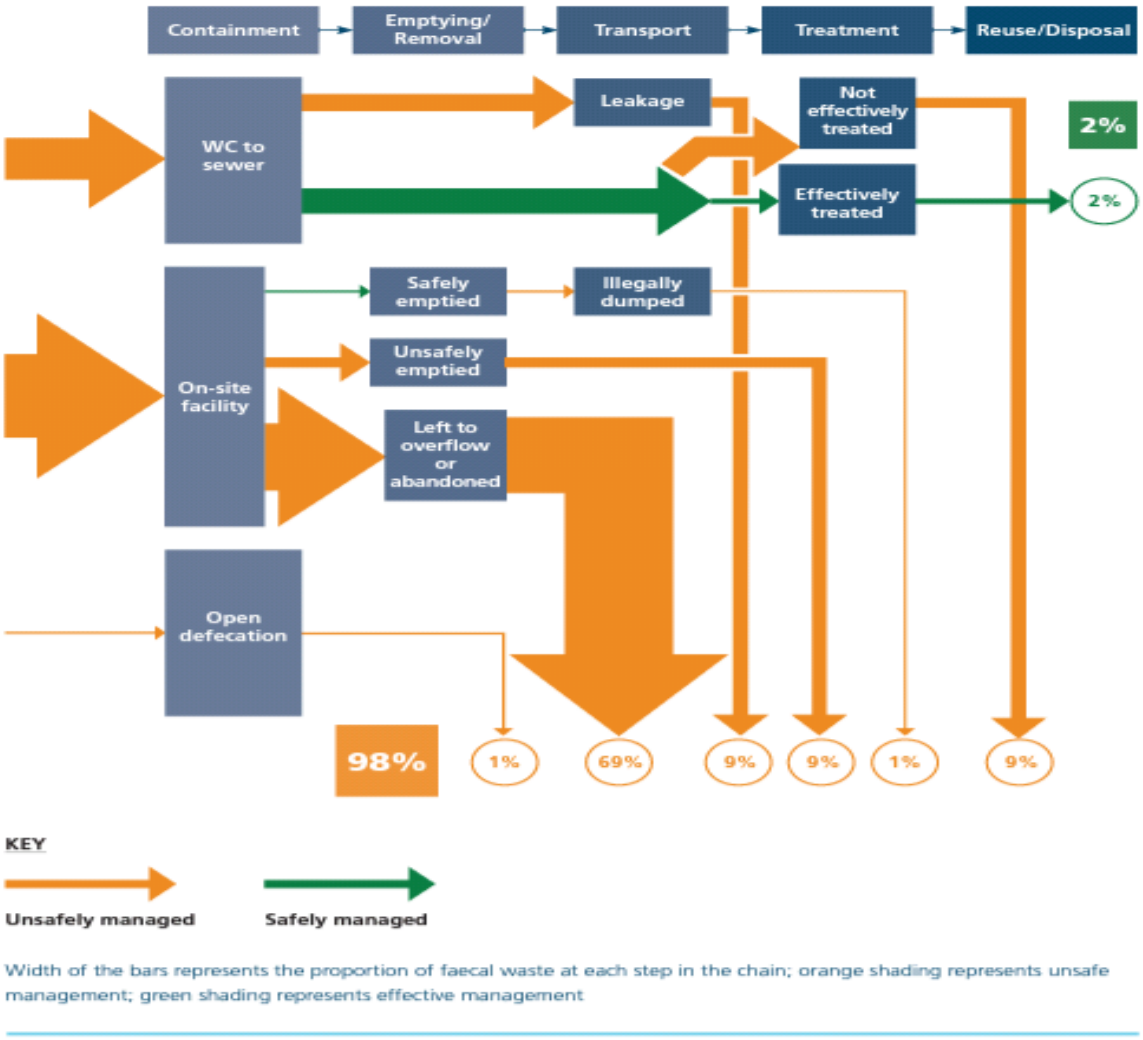
In addition, most of urban cities in developing countries experiences challenges in wastewater management due to a number of factors which are the absence of efficient institutions, lack of technological knowledge and empirical know-how of wastewater treatment processes and their implementation and in appropriate management practices. Reports states that, there is growing awareness of the impact of sewage contamination on rivers and lakes, therefore wastewater, water and wastewater fees and environmental education according to water saving is now receiving greater attention from a lot of international organizations and government regulatory bodies. WHO (2011), states that, approximately it is around three hundred (300) million urban residents have no access to sanitation and these are mainly the low-income urban dwellers, therefore their health is affected and they are prone to waterborne diseases. In addition, it is said approximately two-thirds of the population in developing countries has no hygienic means of disposing excreta and an even greater number lack adequate means of disposing of total wastewater.

In Africa waste water management has said to be one of major challenges which urban cities face, for example in Ghana current urban sanitation infrastructure is inadequate and seems not to be keeping pace with population growth rate, about 5% of the population is linked with infrequently functional sewage systems and sewage treatment plants. Most untreated waste water ends up in storm water gutters, streams and other water bodies, thus according to Keraita et al (2006). Gyampo (2006) observed that ten regions in Ghana are very abysmal, most industries are located along the coast discharge their effluent directly into the ocean without any form of treatment, while those located in land discharge their effluent into major streams and urban storm drains. In Ghana only 5% of the households are connected to pipe sewerage systems, UNEP (2010). Inadequate sanitation contributes to 70% of diseases in Accra and 21 % of the households use flood drains (gutters) as open sewerage that ends up in nearby urban water bodies.

The population in developing countries increases on daily bases and the wastewater systems are not upgraded to meet the increasing population and hence it is difficult for municipalities, cities and towns to keep up with the population growth. Poor wastewater management is said to be one of the prime causes of diseases in urban areas in developing countries. WHO (2011) states that, in the developing countries, the provision of sanitation is not keeping up with population growth. The total numbers of population with and without sanitation in all developing countries is higher than 1,500 and 3,000 million respectively, in which the gap is always increasing. The waste water treatment systems in developing countries are not successful and therefore unsustainable because they were simply copied from Western treatment systems without considering the appropriateness of the technology for the culture, land, and climate.

The diagram below shows wastewater (faecal) treatment in developing countries, Bangladesh to be more specific. The diagram also indicates that, wastewater is poorly managed in developing countries and in this case it is in Bangladesh, as shown in the diagram, 98% of the wastewater is being let go, that is through leakages, illegally dumped, left to overflow and through open defecation, while 9% of the 98% is not effectively treated, only 2% of wastewater is effectively treated.

Fig 3. Wastewater treatment in Dhaka-Bangladesh



Source: Peal and Lambert (1962).

The plate below shows how wastewater (sewers) being managed in developing countries, by discharged into the river in the city of ACCRA in Ghana. The wastewater in developing nations is not properly managed as the wastewater is straight away disposed into the streams and rivers without any attempt to treat it as they lack resources that is finance and suitable infrastructure to treat wastewater for reuse. Therefore this shows that the people living downstream will be impacted on their human health.

Plate 1: Sewers being discharged into the river.

Source: WHO (2006)

2.3.3 Wastewater Management in Zimbabwe

Nhapi et al (2006) states that, wastewater management is governed by several pieces of legislation that are the responsibility of different Government Ministries and Agencies. The Environmental Management Act Chapter 20:27 of 2002 attempted to bring the Public Health Act, The Water Act (Chapter20:24), the Water Pollution Control Act (1976), the Natural Resources Act (Chapter 20:13), and the Urban Councils Act (Chapter 29:15) under one governing framework. These legislations specify how wastewater is supposed to be managed in Zimbabwe and if managed well human health won't be affected. These guidelines forbid the irrigation of root crops such as potatoes and sets restrictions that are not greatly enforced presently in Zimbabwe.

The Water and Sanitation Sector Coordination Mechanisms of the Ministry of Water 2010 outline the following key government ministries in the management of wastewater, Ministry of Water Resources Development and Management; the Ministry of Health and Child Welfare; the Ministry of Transport and Infrastructural Development; The Ministry of Agriculture, Mechanization, and Irrigation Development; the Ministry of Local Government and Rural and Urban Development, the Ministry of Environment and Natural resources Management, the Ministry of Energy, and the Ministry of Women Affairs, Gender and Community Development as key institutions for water and wastewater management. In terms of Zimbabwean law in the form of Urban Councils Act, Chapter 29.15 and Regional Town and Country Planning Act, Chapter 29.6; all households are compelled to have an acceptable sanitation system before an occupation certificate is issued Nhapi et al (2006) and this has led to the high sanitation coverage in Zimbabwe urban centers.

In addition, wastewater in Zimbabwe is collected to semi-centralized wastewater treatment plants using conventional sewerage infrastructure. Combined sewers are not permitted in Zimbabwe, Nhapi and Gijzen, meaning that storm water drains directly into streams, rivers, and reservoirs in the proximity of the city or town. Some industries discharge partially treated or untreated wastewater into storm drains leading to the direct pollution of streams and reservoirs with industrial effluent, therefore impacting human health to water consumers downstream. Madyiwa (2006) states that, there are 137 wastewater treatment plants in Zimbabwe and of these, 101 are waste stabilization ponds. However, in terms of volumes of wastewater treated, the largest amount of volume is treated by modified activated sludge systems with biological nutrient removal in Harare and Bulawayo as an attempt to conform to effluent discharge regulations. The second dominant type of wastewater treatment in terms of treatment capacity is the conventional trickling filter system. Urban Councils or Municipalities are responsible for wastewater treatment in Zimbabwe. The major constraint to wastewater treatment in urban centers is lack of financial capacity to overhaul aged wastewater collection and treatment infrastructure rather than lack of technical capacity.

2.3.4 Wastewater disposal/ use in developing countries (Zimbabwe)

Thebe and Mangore (2012) indicates that, wastewater use or water reuse is an established practice in Zimbabwe that started in the 1950s in Bulawayo at Aisleby Farm, and in 1959 with the reclamation of wastewater from Thorngrove Wastewater Treatment Plant for non-potable use. Wastewater is still used to irrigate public amenities in Bulawayo although the dilapidation of wastewater infrastructure has resulted in reduced areas being irrigated. Most of the major cities and towns in Zimbabwe including Harare, Bulawayo, and Gweru lie on the edges of the hydrological boundaries or drainage divides. This means that they lie on the main watershed. In Harare in particular, the water supply dams are located downstream of the City in order to increase the catchment yields. Bulawayo is different from Harare in terms of its water supply as it mainly rely on inter-basin transfers from an adjacent water catchment and augments this supply with groundwater resulting in fewer pollution problems of the water source by wastewater generated in the City.

The major direct wastewater disposal projects through land application are located in Harare and Bulawayo with the City of Harare having three farms namely Ingwe, Pension, and Crowbrough with an estimated total irrigated of 1500ha, while the City of Bulawayo has Aisleby and Good Hope with a total area of about 1000ha. Pasture grass and cereal crops are the main crops grown on these farms. Gweru and Mutare practice agro-forestry through the land application of wastewater to irrigate eucalyptus trees totaling approximately 100ha. Surface irrigation methods are the most common. The wastewater disposal guidelines contained in Statutory Instrument 6/2007 of the Environmental Management Act of Zimbabwe might not be adhered to as wastewater is over-applied on land. In Bulawayo, there are limited informal wastewater irrigation schemes due to the strict enforcement of Council By-Laws. It has been reported that some farmers in Harare practice informal wastewater irrigation to grow vegetables but the total cultivated area has not been determined.

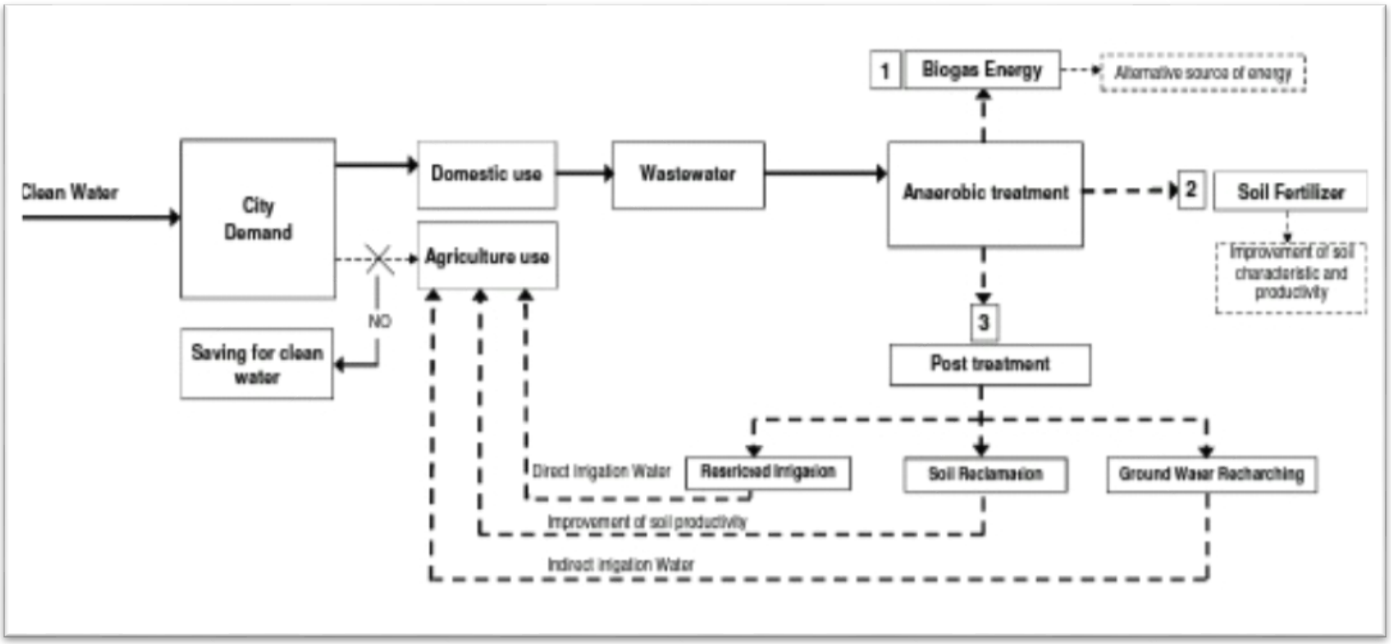
Qadir et al (2010), there are several other formal wastewater irrigation schemes in Bulawayo with the major area being Umguza Irrigation Lots where farmers practice unrestricted irrigation using mainly the sprinkler irrigation method on an area covering approximately 1000ha. Wastewater from Bulawayo has widely been known to be stronger than from other cities in Zimbabwe due to the lower per capita water consumption in Bulawayo, Bagg (1998) meaning

that slight dilutions in Umguza River result in wastewater that could be as strong as effluent directly disposed of onto land in Harare, therefore impacting the close communities through odor and impacting the environment and the health of people.

In addition, Nhapi et al (2006) states that, the existing wastewater treatment plants in Harare are overloaded and they can't bear the overpopulation in the city and this has a serious implications for downstream water quality. This indicates that, overpopulation in the city of Harare has become a cause for poor wastewater disposal which will pose impacts on human health. They further illustrate that, wastewater in the city of Harare is being disposed in the main water sources in the city and this is Lake Chivero. Lake Chivero receives large amounts of wastewater effluent and is prone to pollution discharges from urban areas in the city, thereby risking human health down the stream.

The diagram below shows how wastewater is being used and disposed in developing countries.

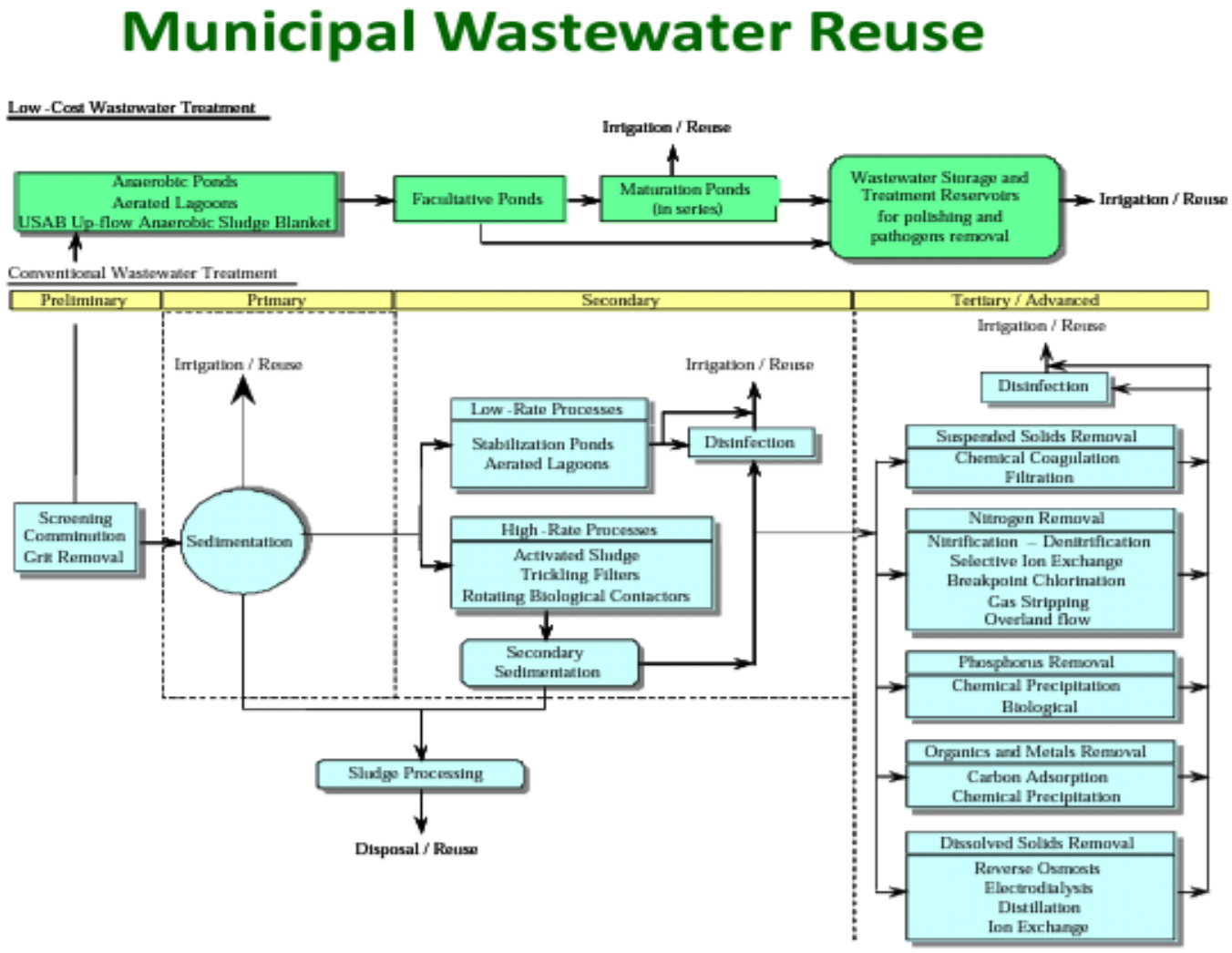
Fig 4. Integrated Concept for wastewater treatment and re-use.



Source: Abdel-Halim et al (2009)

The diagram below shows how wastewater is being used in developing countries and thus South Africa to be more specific.

Fig 5. Wastewater reuse in South Africa



Source: UNEP (2010)

Most urban Local Authorities in Zimbabwe face financial challenges and they cannot afford to dispose wastewater in a good manner and they dispose it on rivers, streams and in land dams. Therefore, it is different from what is being shown on fig 3 and fig 4 above. Wastewater is being used for irrigation on a large scale rather in most areas in Zimbabwe, were the communities take water from wastewater ponds illegally for irrigation.

2.3.5 Impacts of wastewater on human health.

African Development Bank Group (2015) states that, wastewater if poorly addressed it impacts negatively on human health. According to this group, wastewater pose negative impacts on human health and these impacts will be social impacts. Overflowing wastewater impact humans in the sense that, they will be nuisance to communities living near overflowing sewage, health problems such as cholera, diarrhea, typhoid etc. and soil contamination. In addition, wastewater flowing on open spaces causes soil erosion and this will impact on agricultural activities. Research also indicates that, wastewater causes soil and groundwater contamination through leaks from the rehabilitation of pumping and treatment facilities and replacement of pipes. This soil contamination mostly affect babies (toddlers) who are on the crawling stage as they usually play with soil and their health will be at risk due to overflowing wastewater.

2.4 Water Supply Management

2.4.1 Water Supply Management in Developed Countries

A number of scholars have aired out their thoughts pertaining water supply management and the impacts they pose on human health if not properly addressed. The UN states that, without water there is no life and no development, therefore it has to be managed properly, water has been featuring prominently on the international agenda. In 1996, the United Nations Conference on Human Settlement in Vancouver, Canada called on its member states '...to adopt programs with realistic standards for quality and quantity to provide water for urban and rural areas by 1990 if possible'. The same conference recommended,' to adopt and accelerate programs for the sanitary disposal of excreta and wastewater in urban and rural areas'. On the suggestion of the United Nations Water Conference in Mar del Plata, Argentina in 1977 United Nations, the UN General Assembly of 1980 subsequently made the period of 1981 to 1990 the International Drinking Water Supply and Sanitation Decade (IDWSSD). Therefore, by making this period a decade for water supply and sanitation really shows that, they are concerned as this impact on human health.

In addition, the United Nations state that, rapid urbanization increases the pressure on water sources by and large cities. The world urban population was at 2.4 billion in 1990 and will probably grow to 3.2 billion in 2000 and to 5.5 billion in 2025. The challenges to find adequate

sources of water to supply the burgeoning city populations, trade and industries are large. Other cities, such as Shanghai are over pumping the city's aquifers for water, causing groundwater depletion and subsidence of parts of the city. Competition with agriculture for water resources around the cities grows; hence water supply becomes a challenge in some developed countries.

2.4.2 Water Supply Management in Developing Countries

Wang et al (2013) states that, the lack of water in Africa is further aggravated by insufficient treatment of water and wastewater, particularly with rapid population growth and urbanization. At present, however the efforts to improve drinking water quality and wastewater treatment are not keeping with pace with population growth and urbanization. The growing population and rising economy has resulted in increasing consumption of water and discharge of wastewater which cause heavy pollution which also affects human health.

Water Supply is said to be a challenge to most developing countries as they lack resources, which is financial resources and equipment to maintain water treatment plants which are aging. Chukwu (2015), in Nigeria, water supply has been said to be a great challenge as the most cities face shortage of water and this have been impacted negatively on human health. In a related study of the NDES 2004, it was found that the available quantity for water to residents in Nigeria was less than ten litres per person per day in the late 90s and had been reduced to 5, 5 litres per person per day in the early 20th century. This shows that there have been dramatic reduction in the quality and quality of water supply in Nigeria for the past years and this was due to rampant population increase. Water scarcity already affects almost every continent, especially in developing regions. Around 1.2 billion people, constituting about one-fifth of the world's population, live in areas of physical water scarcity, and 500million people are approaching this situation, thus according to the UNEP (2010).

In addition, Seckler et al (1998) states that, another 1.6 billion people, almost one quarter of the world's population, face economic water shortages. Water shortage is among the major ills to be faced by many societies in the 21st century especially in urban areas due to increased urbanization. Chenje (1996) postulates that, domestic water demand has been growing at more than twice the rate of population increase, and there is an increasing number of developing cities in the world that are chronically short of water. This shows a problem in access to domestic

water the world over especially in urban areas. African cities today face quite a number of domestic water challenges which are worsened by the ever increasing population and also unreliable rainfall patterns. In 2008, less than 10% of the population in sub Saharan African countries like Uganda, Zambia and Rwanda had access to reliable water supply, World Health Organization (2010). UN-WATER, observed that Sub-Saharan Africa has the largest number of water-stressed cities of any region of the world.

WHO (2010) indicates that, in the Eastern Mediterranean region, water supply is a challenge. Water supplied through piped networks is intermittent in many cities of the region for example in Beirut and Damascus. In some cases people have to wait for several days, perhaps weeks for their turn to get water, so they use private vendors to secure their water needs. This shows that, water supply in most cities in the Eastern Mediterranean region is a challenge and the human health is greatly affected due to shortage of water.

Most cities in Sub-Saharan Africa experience acute domestic water shortages due to additive effects associated with lack of efficient, socio-politically acceptable, and transparent management of water resources. Banda (2011), states that, one of Malawi's largest cities, Blantyre was hit by domestic water shortage in 2011 and several areas in the city went for three weeks without water. In Zambia the Luapula province is facing challenges of safe and clean drinking water and residents queue for water at a community tap, UNEP (2010). Domestic water has also been a challenge in Southern Africa's cities, this is according to Tevera (2004). Therefore, this clearly shows that water supply is one of the services which most municipalities, cities and towns in developing countries are failing to offer to the residents and the main cause has been said to be lack of finance, corruption, un reliable rainfall patterns and rampant urbanization resulting in overpopulation.

In addition, in adequate water supply and water quality give rise to health and other societal issues. The research study took place in Nigeria showed that majority of the people, that is 85.7% do not have access to safe drinking water and this indicates that, at some point the cities are getting water but it will be not safe to drink due to lack of resources to make it safe for drinking. In addition, 14.3 % get their water from taps which is treated and the percentage ration shows that the cities in Nigeria are struggling to get safe drinking water.

WHO (2013), states that, Maputo in Mozambique like any other developing countries suffers from freshwater shortage, improper sanitation and limited access to safe drinking water. In Mozambique, more than 50% of the population still lack access to improved water sources and this have been impacting on human health through water borne diseases.

2.4.3 Water Supply Management in Zimbabwe

Today Zimbabwe's urban settlements encounter several constraints in the delivery of services such as provision of power, water, sewage and waste management. Undoubtedly, water is the life blood of the biosphere. Access to this fugitive, finite, vital yet vulnerable resource in its safe form is limited. As population multiplies, the amount of water used by society escalates and thus 'the thirst grows'. Nhapi and Gijzen (2006) states that, most of the suburbs hit by the diseases have long been without water, a fact acknowledged by both municipalities and ZINWA who said they could not supply water to all the residents. Matsa and Tapfuma (2015), also points it out that, water for domestic purposes is also a problem in Zimbabwe and unreliable rainfall amounts have lowered the levels of water in the major reservoirs that supply towns and cities.

Makwara and Tavuyanago (2012) states that, Zimbabwe's urban areas are choking under the weight of over-crowdedness amidst dilapidated infrastructure that is characterized by constant service failure. The water and sewer systems of the country's major urban centers are on the verge of collapse, thus putting millions of people in danger of consuming contaminated water, including that from underground sources. Waste management and water supply problems manifest themselves as challenges bedeviling many an urban area in the country. The quality and quantity of water supplied in Zimbabwe's urban centers has plummeted in recent years and has assumed crisis proportions owing to the difficult economic situation and other challenges faced by the country. The situation is desperate and dire, as is evidenced by the poor quality of delivered water, severe water rationing and the outbreak of water-borne diseases in the urban areas dotted across the country. The situation demands and dictates that solutions be proffered as a matter of urgency.

The recent outbreak of epidemics has been blamed on lack of access to safe water and poor sanitation, two crucial factors in controlling the spread of diseases. Therefore, the situation has resulted in the transmission of such communicable disease as cholera, diarrhea, dysentery and

most recently typhoid, easily preventable diseases which have wreaked havoc in the country. Mangizvo and Kapungu (2010) states that, water treatment plants have become absolute and most of cities are still using aging water treatment and supply infrastructure which were commissioned in the late 1930s to the 1950s. Therefore, these aging water treatment and supply infrastructure impacting on the poor water supply in most cities and towns in Zimbabwe. In addition, due to absolute equipment, water treatment plants are producing less amounts of water than they are capable of producing, hence causing water shortages throughout the nation.

Since the late 1990s, an increasing number of urban areas in Zimbabwe have been haunted by water problems. This has been attributed to poor rainfall, insufficiently trained water resources personnel, population growth, aging infrastructure, lack of funds, and corruption, The Herald 2011. Some suburbs go for weeks or months without running water as Zimbabwean municipalities struggle to keep up services. More than 6,000 cases of diarrhea were reported in the southern towns of Masvingo and Kadoma and children were the worst affected. Two deaths were reported in Harare following a typhoid outbreak, while over 3000 people have presented typhoid symptoms at various clinics as the disease threatens to engulf the country yet the ministry does not have the capacity to combat a major typhoid outbreak, and this was a result of poor water supply in urban areas.

Water supply remains erratic, sewer bursts are still common and servicing and maintenance is not being done on a regular basis. Consequently, there has been an upsurge in common diarrheal diseases largely due to poor sanitation and the continuing failure by towns and cities to provide clean water and manage sewage treatment, UNICEF (2010). Some parts of Harare have not had water for periods exceeding two months and yet others have not had water running in the taps for over a year. The water distribution systems, built long before the country's independence, have gone without proper maintenance for many years. Pumps that have an expected lifespan of between 15 and 20 years have not been replaced since they were installed, thus according to Kwidini (2007).

The plate below shows the residents in Harare suburbs scramble for un safe drinking water because their taps have gone for ages without running water and this clearly shows that water was scarce in the city for the past years and this impact on human health negatively.

Plate 2: Residents scramble for water in Harare.

Source: The Zimbabwean (2012)

Dungumaro (2007), points out that, the situation is exacerbated by pumps and the water distribution pipe system that are having to contend with larger volumes of water that should be distributed so that water supply is commensurate with the ever increasing demand as urbanization takes place. Since the water systems have seen better days, they continuously breakdown, this translates into water shortages. When provision and availability of water becomes inadequate, people are forced to use contaminated water, resulting in water-related diseases such as cholera and typhoid as they fetch water from unprotected sources and use the bush system as toilets are closed because of the non-availability of water.

Murinda (2011) state that, in Zimbabwe, urban water supply presents challenges that is unique in water resource management. These primarily relate to the need for very high reliability and security of water supply. Most of the urban areas in Zimbabwe have obsolete infrastructure. Urban councils are not able to provide services owing to aging pumps and motors. In Gweru, the White waters and Gwenhoro water treatment works are old and malfunctioning, thus according to the Standard paper (2010). Residents, especially in Gweru's high density suburbs for example

Ascot, Mkoba and Senga can go for two weeks without water because the city council does not have the funds to replace the infrastructure. In Harare, the water distribution system was built long before independence in 1980, and has gone without proper maintenance for many years, and its pumps, that have an expected lifespan of between 15 and 20 years, have not been replaced since they were installed, Kwidini (2007). This means that the water systems are dilapidated and will continuously breakdown; this translates into water shortages.

Dungumaro (2007), indicates that, when provision and availability of water becomes inadequate, people are forced to use contaminated water, resulting into water-related diseases, such as cholera, dysentery, and diarrhea, as they fetch water from unprotected sources and use the bush system, as toilets are closed because of the shortage of water. Most city treatment works have parts, such as automatic valve actuators, which are out of commission. Delivery pipes and joints leak because of old age .At the height of the cholera epidemic in 2008, Beitbridge, a border town on the South African-Zimbabwe border, had problems bringing water from its water station to town as it did not have the parts to repair a pump.

Water crisis in Zimbabwe is attributed to power outages affecting all urban centers in Zimbabwe. The city of Bulawayo cannot pump enough water as its operations are interrupted by power cuts. The water treatment and pumping stations are severely affected, resulting in a trickledown effect on water supply to the different residential areas. In addition, Hug (2009) states that, Beitbridge experienced serious water problems during the cholera outbreak in 2008.Its pump station could not pump water from the tower to the town as there was no electricity.

2.4.4 Impacts of in adequate water supply in Zimbabwe on human health

Urban local authorities are grappling with the outbreak of water-borne diseases particularly cholera, typhoid, dysentery, bilharzia and diarrhea.

2.4.4.1 Cholera

A yearlong outbreak of cholera in 2008 killed more than 4 000 people and infected about 100 000 others and since there have been regular outbreaks of water borne diseases in urban areas UNICEF (2010).The outbreak of cholera (mid 2008-mid 2009) and typhoid (late 2011to present) in Harare got amplified nationwide. The outbreaks have been attributed to the disintegration of

sewer systems, poor sanitation in the cities' high density suburbs, bad policies, the decline and subsequent collapse of health services and contaminated water most of which is drawn from unprotected sources and is by and large consumed raw. The cholera epidemic engulfed and literally set Zimbabwe ablaze, with the disease ravaging almost the entire country. During Zimbabwe's last and worst cholera epidemic between August2008 and July 2009, [regarded as the worst in Africa] over 4000 people needlessly lost their lives out of the more than 100 000 infections before it was brought under control.

2.4.4.2 Typhoid

The typhoid outbreak comes four years after cholera played havoc with the lives of thousands of people also in Greater Harare, BeitBridge and Kadoma in particular and in one or two other urban centers. Two deaths were reported in Harare following a typhoid outbreak, while over 3000 people have presented typhoid symptoms at various clinics as the disease threatens to engulf the country yet the ministry does not have the capacity to combat a major typhoid outbreak, and this was a result of poor water supply in urban areas.

2.4.4.3. Bilharzia

Water shortages have had a number of negative impacts. They generally result in stringent water rationing, which further causes an increase in diseases as people are unable to bath or flush their toilets, Nyoni (2007). Manyanhaire et al (2009), observed that the collapse of Mhangura mine in Zimbabwe has worsened the water situation in the mining town due to equipment damage and disrepair. The shortage has affected the normal functions of schools as mostly affected were children and hospitals in the area. Therefore, this shows that, in adequate water supply impacts negatively on the human health.

2.4.4.4 Diarrhea

More than 6,000 cases of diarrhea were reported in the southern towns of Masvingo and Kadoma and children were the worst affected. Water supply remains erratic, sewer bursts are still common and servicing and maintenance is not being done on a regular basis. Consequently, there has been an upsurge in common diarrheal diseases largely due to poor sanitation and the continuing failure by towns and cities to provide clean water and manage sewage treatment, UNICEF (2010).

2.5 Sources of water supply in Urban Areas

Okoye (2015) states that, there are two broad categories of water sources that are surface and underground sources.

2.5.1 Surface water

This is water that is abstracted directly from streams, rivers and lakes. These sources generally contain larger quantities of turbidity and bacteria than ground water and often the surface waters of rivers and lakes are polluted by the influx of sewage or industrial wastes. According to the World Bank (2010), 39 percent of urban dwellers had access to piped water and this water is piped from the rivers or lakes, hence it is surface water.

2.5.2 Ground water

According to Okoye (2015) this is water obtained from wells, boreholes and springs that feed streams, rivers and lakes. Wang et al (2013), states that, approximately75% of Africans rely on groundwater for drinking. Ground water contains high concentration of dissolved chemicals, for example Nigeria has extensive ground water resources, hence a number a number health problems emanating from this source of water supply in most urban areas. In recent years, extracting groundwater in many areas has become more difficult because of over exploitation in groundwater. In the city of Kampala in Uganda, pit-latrine deteriorates the groundwater quality while dilapidated pipelines result in the contamination of groundwater in Sirte in Libya. In addition, groundwater is becoming salted because of Mediterranean Sea water intrusion. The salted water results in higher cost for. In addition, the water quality of ground water is becoming a major concern, fluoride, iron, and manganese are widely detected desalination.

2.5.3 Rain Water Harvest (RWH)

Wang et al (2013) viewed rain water harvesting as a source of water in most urban areas. Rainwater harvesting (RWH) is usually a system of collecting rainwater from rooftops and yards and to storing it in a tank for later use. RWH is a common practice in Africa and it improves water supply. For example, in Rhodes University, South Africa, a project is promoted to collect and utilize rainwater for agricultural irrigation, cooking, and drinking .A recent research

indicated that rainwater is safer than water from unimproved water supplies. However, it should be noted that the quality of rainwater might be doubtful. The consumption of rainwater may result in risk of illness. For example, Salmonella and Campylobacter can cause bacterial diarrheas.

In Masvingo province, research by Machiwana (2010) shows that the main sources of water supply in the province are household connection, public standpipe, boreholes, protected dug well, protected spring and rain water collection and some of these sources are not safe, hence causing negative impacts on human health.

2.6 Stakeholder Participation in Water Supply and Wastewater Management

Water supply and wastewater management are haunting many cities and towns throughout the whole world and because these cities and towns alone cannot fight these challenges, they have to engage various stakeholders in order to get help. In Thailand, in the city of Bangkok, community participate in water quality and monitoring and this was to ensure that the water provided to residents is safe to use. In addition, public-private partnerships in the city of Bangkok in Thailand, helped in the management and administration of wastewater, thus according to Simachaya and Yolthantham (2006). In order to improve access to clean water and ultimately prevent the spread of water borne diseases, Harare City Council engage ICRC, while Bulawayo City Council involve World Vision as well as Beitbridge and Action Faim helped Masvingo City Council out of it water woes.

These Non-Governmental Organizations provide these councils with resources, which is both human and financial resources which can be used in the water supply and wastewater management, Makwara and Tavuyanago (2012). The improvement of water and wastewater treatment needs joint efforts from different stakeholders, including the public .Currently, many decisions for water and wastewater treatment are taken without public involvement, and most people are not aware of the significance and methods to protect water quality. In fact, public participation may enhance the political will if politicians seek public support. Training and education is necessary to promote public awareness on the nexus between water and energy, water and health, as well as water conservation, thus according to Wang et al (2013).

2.7 Empirical Evidence

The information which is found from other nations that are either developed or developing, pertaining the area under study. On this the researcher presented both the information of the nation which was a success and also the one which was a failure.

In Germany WS&WWM has been a success, it is the European country with the highest wastewater reprocessing and recycling rate. More than 96% of the wastewater from private households and public facilities is discharged into nearby sewage treatment plants for processing. In Germany, it is not permitted to discharge untreated wastewater into rivers and lakes regardless of whether it originates from private households, trade or large scale. However, WS&WWM in Thailand has been described as poor because, Thailand have about 101 treatment plants and these cover the treatment capacity of 23% of total wastewater and this indicates that wastewater is poorly managed in other developed countries

2.8 Knowledge Gap

In developing countries there is no concrete measures like policies and laws that regulate the issue of sewer system management as well as water supply. There is lack of training, awareness, education and financial resources to carter for water supply and wastewater management. There are no any penalties in the abuse and vandalism of the sewer system reticulation. There is little monitoring and supervision of the water supply and wastewater systems. Residents should be educated in the management of the water supply wastewater systems as they also play a major role in the management of water supply and wastewater because they are directly in contact with these systems. Therefore, the researcher intend to cover the gap in literature, and this include, the relationship between water supply and wastewater in impacting the human health.

2.9 Summary

In this chapter, the researcher have tried by all means to acknowledge what other school of thoughts have said pertaining the topic on study that is Water supply and wastewater management in urban areas and the impact they pose on human health. Diagrams have been also included to give an insight of the impacts caused by poor water supply and wastewater management. Evidence from developed, developing countries and the area of study Zimbabwe have been discussed pertaining issues of water supply and wastewater management in urban areas and the impact they pose on human health. The next chapter focused on research

methodologies, which is chapter III, research methodologies, research design, population (population size and target population), sampling (sampling techniques and sample size), research instruments (questionnaires, interviews, observations and group discussions) data collection techniques (primary and secondary), used, population, sample size, sampling methods used to collect data.

CHAPTER III

RESEARCH METHODOLOGY

3.0 Introduction

In an effort to explore on the topic, water supply and wastewater management in urban areas and the impact they pose on human health, the case of Chiredzi Town, different techniques were employed in the process of data collection. This chapter discusses the research methodology and generally presents the methods that were used by the researcher to collect data. This chapter will describe the research methodology, research design, population (population size and target population), sampling (sampling techniques and sample size), research instruments (questionnaires, interviews, observations and group discussions) data collection techniques (primary and secondary), ethical considerations, reliability and validity, pre-test and data presentation and analysis in that order.

3.1 Research Methodology

Penneerselvan (2013) defined research methodology as a system of models, procedures and techniques used to find the results of a research problem. According to Polit and Hungler (2004), methodology refers to ways of obtaining, organizing and analyzing data. Methodology decisions depend on the nature of the research question. According to Burns and Grove (2003), methodology includes the design, setting, sample, methodological limitations, and the data collection and analysis techniques in a study. Henning (2004) also describes methodology as coherent group of methods that complement one another and that have the ability to fit to deliver data and findings that will reflect the research question and suit the researcher purpose. Methodology means a framework of theories and principles on which methods and procedures are based, thus according to Holloway (2005).

These maybe termed as strategies of inquiry which moves from the underlying philosophical assumptions to research design and data collection. Both Quantitative and qualitative methods

were used in the research in the collection of data as to be outlined in the research design that outlines data collection, presentation and analysis procedures to be carried out in the research.

3.2 Research Design

According to Avison (2005) a research design means all the issues involved in planning and executing a research project from identifying the problems through to reporting and publication of results. The research adopted qualitative and quantitative analysis on the research design. Saunders et al (2009) asserted that basically there are four major designs namely descriptive, casual, explanatory and predictive. On this note, Orodho (2003) viewed the types of research designs as descriptive, the case study design and the experimental design and in this study the researcher used the descriptive research design that seeks to add on already existing knowledge. Burns and Groove (2003), states that descriptive design may be used for the purpose of developing theory, identifying problems with current practice, justifying current practice, making judgements, or determining what others in similar situations are doing.

3.2.1 Importance of research design in research methodology

According to the information found at www.universalteacher.com research design is crucial in research methodology and the importance includes:

- It allows one to get optimum efficiency and reliability.
- It cuts down on in accuracy and reduces wastage of time.
- It reduces uncertainty, confusion and practical haphazard related to any research problem.
- It sets boundaries and helps to prevent blind search, as it anticipates problems.

3.3 Population

Descombe (2008) defines a population as a group of people or items that a researcher wants to get information from. Population is the totality of all subjects that conform to a set of specifications, comprising the entire group of persons that is of interest to the researcher and to whom the research results can be generalized, thus according to Polit and Hungler (2004). Burns and Grove (2003) states that, a population refers to all elements that encompass individuals, objects and events that meet the sample criteria for inclusion in a study.

From the total population in Chiredzi Town which is at 30,594 and that was according to the 2012 census, and the researcher targeted those individuals who have been staying in Chiredzi for more than five years to get the data. The target population of this research was finite list of all people in Chiredzi Town because the survey was concerned with this town. The target population was 3021 which consists of the people who lives in Chiredzi urban. To select the target population the researcher used sampling techniques and these were stratified, simple random and purposive or judgmental sampling. The target population comprised of the councilors, CTC management and CTC general employees, Chiredzi General Hospital (CGH) employees, ZINWA employees and householders. From the target population, a sample was to be drawn and this was the people lived in the low, medium and high densities suburbs of Chiredzi or those who work in Chiredzi town .The total sample size for this research was one hundred (100).

3.4 Sampling

Burns and Grove (2003) state that sampling is a process of selecting a group of people, events or behaviour with which to conduct a study. In addition to this, Polit et al (2009) confirm that in sampling a portion that represents the whole population is selected. The advantages of sampling were portrayed rather than using the whole population in Chiredzi urban and these stipulates that sampling was cost effective (cheap) and time economical for this research as opposed to the census method which if it was used could have been costly and time consuming because every element must be reached. Sampling was not exhaustive as compared to the census method which would be tiresome as it demands the researcher's energy through a door to door approach. The sample provided more accurate data to this research as the researcher obtained an amount/quantity of data which was manageable than lots of data which could be generated through the census method. Polit et al (2009) further postulates that, a sample is being defined as a proportion of a population and the sample for the study was chosen from Chiredzi Town Council (CTC) employees, Chiredzi General Hospital employees, ZINWA employees and the householders in Chiredzi urban.

3.5 Sampling Methods

3.5.1 Probability and the non-probability sampling

There are the two broad categories of sampling and these are the probability and the non-probability sampling methods. Below these two broad categories falls the types of sampling techniques and the ones used in this research. Doherty (1994) state that, in probability based sampling the first step is to decide on the population of interest and in this study, the researcher was interested in all people who are eighteen years and above in Chiredzi urban. All probability sampling techniques use the random system of selecting respondents which increases the chances of any member of the study population to participate in a study. On this note, Professor Rosalyn state the types of sampling which falls under the probability sampling and these are random sampling, systematic or the interval sampling, stratified sampling and cluster or multistage sampling.

Non-probability sampling state that all the techniques used to select the respondents reduces the chances of any member in the study population to participate and they are judgmental in nature. According to Rosalyn, the types of sampling to fall under the non-probability sampling category are convenience sampling, quota sampling, dimensional sampling, purposive or judgmental sampling and the snowball sampling. Therefore in this study, the researcher used both the probability and non-probability sampling techniques as simple random sampling and stratified sampling which falls under the probability sampling and the purposive or judgmental sampling which thereof falls under non-probability sampling were used.

3.6 Sampling Techniques

3.6.1 Stratified Sampling

Westfall (2008) views stratified sampling as a technique in which a researcher divides the population into subgroups (strata) based on mutually exclusive criteria, and then samples are randomly or systematically taken from each group. This means that the researcher divides a heterogeneous population into homogeneous small units and selects a sample from each group using a random procedure. On the other hand Rosalyn states that, this kind of data is obtained by

separating the population elements into overlapping groups called strata and then select a simple random sample from each stratum, for example using rank order or profession. A point to note is that stratified sampling method uses strata which will be of people with similar characteristics or have something in common. In this research a stratified sampling technique was therefore used to select the councilors, employees at Chiredzi Town Council (CTC) and the Chiredzi General Hospital (CGH) employees as these group of people have similar profession.

3.6.1.1 Advantages and Disadvantages of Stratified Sampling

Stratified sampling is crucial in data collection because, it helps in correcting sampling errors, inclusion of all elements of the study is likely to take place, and any person has an equal chance to be selected and it improves the quality of data to be collected since it focuses on a specific strata looking at the profession. The disadvantages of stratified sampling are, it is time consuming as much time is needed to properly classify the strata. The researcher has used the knowledge acquired during the work related learning period to determine homogeneous groups in Chiredzi and this helps in saving time. Sampling errors could go unnoticed since some groups that represent particular portions of the population could be omitted unknowingly from the research. The researcher also used work related learning knowledge and consulted insiders to ensure that all groups were represented.

3.6.2 Simple Random Sampling

According to Parahoo (2006), simple random sampling states that, each element of the population has the same chance or likely hood or probability of being chosen for the sample and also as for to sample the population, so that it becomes manageable. In addition, Rosalyn states each person in the universe has an equal probability of being chosen for the sample and every collection of persons of the same size has an equal probability of becoming the actual sample. In other words, Rosalyn viewed simple random sampling as sampling without replacement. This technique was mainly used on the householders, Chiredzi General Hospital employees as well as the CTC employees. The researcher used register of residents and picks the name of the person to be given questionnaire, on CGH employees and CTC employees the researcher picks the numbers of papers which represent the total number of workers and the number picked will align

with a name and that person will be among the respondents, for example if the number three will be picked that means the person on number three will participate.

3.6.2.1 Advantages and Disadvantages of Simple Random Sampling (SRS)

O'Leary (2010) states the advantages of using simple random sampling over other sampling techniques and these are, it would be fair and allow generalization, putting small pieces of papers in a container and select is time economical and very cheap and it is very easy to use than other techniques. The disadvantages of simple random sampling according to O'Leary (2010) are, the process of identifying, listing, and randomly selecting elements is unfeasible. The researcher do it with the help of a co-worker, the resulting sample may not capture enough elements of particular subgroups you are interested in studying. The researcher did not rely only on one type of sampling but use other types for perfection and it is biased in nature and the researcher tried to be professional on this one.

3.6.3 Purposive/Judgmental Sampling

Purposive sampling is being viewed as a method of sampling where the researcher deliberately chooses who to include in the study based on their ability to provide necessary data, thus according to Parahoo (2006). This type of technique was mainly used to target and select the councillors in Chiredzi urban, the CTC management employees and the ZINWA employees because the researcher assumes that these hold onto important and crucial data which was much needed. Therefore the researcher mainly target this group of people on purpose and through judging that the target will provide the much needed information about water supply and wastewater management in urban areas and the impact they pose on human health. This technique falls under the non-probability sampling and as such it dwell much on judging rather than all other attributes. Marshall stipulate that, there is a lot of discretion involved in purposive sampling and furthermore O'Leary (2010) states that, this is handpicking method, where selection of certain individuals or group is done by researcher with a certain aspect in mind, for example the researcher selected the ZINWA employees with the thought that these are the water authorities and the questions asked to them were more specific for them.

3.6.3.1 Advantages and Disadvantages of Purposive Sampling

The merits for purposive sampling stipulates that it is cheap and time economical, the researcher opted to use this technique because accurate data would be obtained and the respondents are selected on purpose thereby mass sampling by rather focus on the ones needed. The demerits of purposive sampling are, high risk of sampling error which is highly probable with this technique because if wrong groups were targeted and selected wrong information would be obtained. The researcher used information obtained at work related learning and it is limited in nature as it can leave out some individuals with reliable data. The researcher used other types of sampling.

3.7 Sample Size

Sample size is the actual number of elements that would be selected from the target population of 3021 to provide data for the research. The total sample size for this research was one hundred and the total number of respondents was 77. The table below shows the numbers of target population, sample size and the number of respondents.

TABLE 3.1 Response Rate

Target Population	Sample Size	Number of respondents
3021	100	77

Source: Research Data (2017).

3.8 Primary data

Makore (2001) asserts that primary data refers to original raw data collected by the researcher at the point where it is generated. It is captured for the first time and with a specific purpose in mind. Primary data collected by the researcher and this was done through questionnaires, interviews, observations and focus group discussions. The primary data was collected from various stakeholders. Primary data which was used to collect data, generally have its own advantages and disadvantages to the researcher, thus according to the information found at www.communitymedicine4assess.wordpress.com, and these are portrayed below.

3.8.1 Advantages and Disadvantages of using primary data

The advantages of using primary data are, the researcher collects data specific to the problem under study, there is no doubt about the quality of data collected, hence the degree of accuracy is very high, it is usually current, can include a large population and wide geographical coverage and it is collected from a number of ways, for example focus group discussions and interviews.
The disadvantages includes, it is time consuming. The researcher used these primary data on holidays and semester break where time was available and sometimes respondents give fake, socially acceptable and sweet answers and try to cover up the realities. The researcher used observations and this was used to reveal the unrevealed data

3.9 Questionnaires

Harper (2001) points out that a questionnaire is an important instrument for observing and recording data beyond the physical reaction of the observer which can either be structured or unstructured in with aim of recording information that is being researched upon. The researcher designed questionnaires which were composed of simple and structured questionnaires as well as those that need more input and explanation. These questions targeted the sample population who are able to read and write. The questionnaires were administered to the CTC management, councillors, general employees at CTC, ZINWA employees, Chiredzi General Hospital employees and householders in the Chiredzi urban that is in the low, medium and high density.

3.9.1 Merits

- It allows for the collection of data in large quantities over a short space of time.
- It uses many people such that it provides broad information.
- It is faster and cheaper hence time saving.

3.9.2 Demerits

- Officials may refuse to give information. The researcher used other data collection techniques, for example.
- Distortion of information is high because it uses many people. The researcher read and analyse the data before put it on paper.

- Questionnaires may not be returned. The researcher used other methods which encouraged the collection of data thereof, for example interviews.

3.10 Interviews

Kumar et al (2016) defined an interview as direct contact between the interviewer and the respondent in a suitable environment. They are closely related to questionnaires although interviews are an independent entity. One on one interviews give more information as the interviewed people can elaborate more on issues being asked. Some respondents were sensitive and emotional hence the researcher conducted structured and semi structured interviews. Interviews helped the interviewer to benefit from the body language expressed and facial expressions. Through interviews the interviewees come to understand the kind of person they were associating with and they were free to express their innermost feelings concerning the subject under discussion.

Creswell (2013) state that, interviewers have the flexibility to use their knowledge, expertise, and interpersonal skills to explore interesting or unexpected ideas or themes raised by participants. This study deploys qualitative interviews because they allow the interviewee to describe what is meaningful or important using own words .Within the realm of case study, interviewing is the primary data collection method, Creswell (2013). Fontana and Frey have a view that, different forms of interviewing exist, however this research used a face–to-face semi-structured interviews, a strategy used in numerous case study researches, Charmaz (2007). Data was collected through one-to-one semi-structured interviews because they have predetermined questions which can be re-worded, modified, clarified to the respondent, or left out if suitable to do so, Robson (2002).

The researcher, through use of sampling techniques, selected individuals which were interviewed and these were meant to provide specific data which cannot obtained through other means of collecting data. The Town Secretary, the town engineer or the assistant, director of health and the Chiredzi General Hospital Superintendent were interviewed to get data on the topic under study which is water supply and wastewater in urban areas and the impact they pose on human health.

3.10.1 Merits

- Interviews are a faster and flexible way in collecting information.
- There is room for explanation to be given to clarify some situation.
- One can observe non - verbal responses during the interview.

Burns and Grove (2003) states that, interviews has the following advantages which are:

- Interviewing is a flexible technique that allows the researcher to explore greater depth of meaning than can be obtained with other techniques.
- Interpersonal skills can be used to facilitate co-operation and elicit more information.

3.10.2 Demerits

- It is time consuming. The researcher limit on the number of people to be interviewed.
- It can be affected by the influence of officials who can give biased information. The researcher used other methods and compare with what obtained from interviews.
- Small sampling can distort the objectivity of a wider population as a result of a prejudiced selection of respondents.
- Creswell (2003) state that there is the risk of the researcher asking leading questions which may compromise the quality and validity of the research.

In addition, to guard against these disadvantages Robson (2002) argues that the researcher should be professional and follow strict interviewing techniques.

3.11 Observations

Observation techniques are methods by which an individual or individuals get first hand data on programs, processes and behaviours being studied. They provide the evaluator with an opportunity to collect a wide range of behaviours, to capture a great variety of interactions and to openly explore the study topic. The researcher used observation as a method of data gathering. The researcher travelled to the district and observed the situation concerning "water supply and wastewater management in urban areas and the impact they pose on human health".

Observation as a method of gathering data is an unavoidable process, particularly when the researcher engages directly with research subjects. Yin (2003) argues that by visiting the site of the study the researcher situates himself in an observing position on what is intended to be researched. According to Robson (2002), observation is not so much a distinct data collection method that requires planning, designing and executing; rather it is a "technically in-built" process that happens parallel and simultaneously with data collection techniques such as documentary analysis and interviews.

The importance of this is that issues that relate to the research study can be identified or acknowledged as they occur and then implied to illuminate on going interviews as concrete referral points or themes. Therefore, the researcher observed the situation in Chiredzi urban, that is at market places, workplaces (both private and public), at Chiredzi water treatment plant, water reservoir tanks, wastewater ponds and residential areas that is low, medium and high density concerning the area under study and make conclusions.

3.11.1 Advantages

- Provides direct information about behaviour of individuals and groups.
- Permits the researcher to enter into and understand the situation/ context.

3.11.2 Disadvantages

- May affect the behaviour of participants and thus provide a biased view. The researcher did not inform any that observations are made.
- Researcher perception may distort the data. The researcher supported observations by other methods, questionnaires for instance.

3.12 Focus Group Discussion

Parahoo (2006) viewed a focus group discussion as an interaction between one or more researchers and more than one participant for the purpose of collecting data. Halloway and Wheeler (2002) state that in focus group discussion the researcher interviews participants with common characteristics or experience for the purpose of eliciting ideas, thoughts and perceptions. The researcher does group discussions with the workers from the council, those

from the works and engineering department and also those from the health department and also from the residents in Chiredzi urban as it was not be feasible to distribute questionnaires and carry out interviews with everyone.

3.12.1 Advantages

- Parahoo (2006) it is cheaper and quicker way of obtaining data.
- Colleagues and friends are more comfortable in voicing opinions in each other's company than on their own with the researcher.
- Holloway and Wheeler (2002) informants can build on the answers of others.
- Questions asked in a group enables the researcher to have more information than individual's interviews.

3.12.2 Disadvantages

- Holloway and Wheeler (2002) the researcher has a difficult in managing a debate and controlling the process than in individual interview. The researcher chaired and led the discussion.
- Some participants may dominate the discussion and it influence the outcome or even introduce bias. The researcher chaired and led the discussion.
- Recording data can be present problems; it is not feasible to take notes when people are talking at the same time. The researcher used the recording gadget and then listens to it later.

3.13 Secondary data

Secondary data was collected from existing records to help come up with historical background to the water supply and wastewater management in urban areas. Secondary data is also used to gain initial insight into the research problem. It is classified in terms of its source that is either internal or external. This data was used to substantiate research findings and also for the purpose of literature view. This data was collected from CTC complaint register, internet, journals, textbooks, articles, web information and newspapers. Such information helped the researcher to familiarize with the area under investigation as well as in identifying gaps that need

to filled, especially considering that the researcher was able to compare different sources. However secondary data is highly susceptible to subjective biases emanating from personal, local and political ideological orientations. In addition, checking its validity and reliability maybe difficult since some changes would have taken place.

3.13.1 Merits and Demerits of using secondary data

Secondary data were used in the research because, it is cheaper and faster to access, it provides a way to access the work of the best scholars all over the world, it saves time, efforts and funds and it adds to the value of the research study and the data is already there, no hassles of data collection. The demerits of using secondary data

3.13.2 Demerits of using secondary data

- One can only hope that the data is of good quality. The researcher read and analyze the data before put it on paper.
- With passage of time the data becomes obsolete and very old. The secondary data was supported by primary, for example questionnaires and observations.
- It raises issues of authenticity and copyright. The researcher acknowledge the sources used.
- Obtaining additional data about something can be difficult. The researcher weighs the data before put it on paper.

3.14 Methods of Data Collection

Polit and Hungler (2004) defines data as "information obtained during the course of an investigation or study". In this study, questionnaires, interviews, observations and focus group discussions were used to obtain data relevant to the study's objectives and research questions. Data gathering is the precise, systematic gathering of information relevant to the research sub-problems, using methods such as interviews, participant observation, focus group discussion, narratives and case histories, Burns and Grove (2003). Data collection begins with the researcher deciding from where and from whom data was collected.

According to information found at www.libweb.survey.ac.uk, in collecting data, researchers need to consider the sources on which to base and confirm their research and findings. They have a choice between primary and secondary data and use of both which is termed triangulation or dual methodology. Therefore, in this case the researcher used both primary and secondary data, which is termed triangulation or dual methodology.

3.15 Ethical Considerations

Baumhart (2010) viewed ethics as well founded standards of right and wrong that prescribe what humans ought to do, usually in terms of rights, obligations, benefits to the society, fairness or specific virtues. Polit and Hungler (2004) states that, the conducting of research requires not only expertise and diligence, but also honesty and integrity. They further postulates that, ethical measures includes informed consent, confidentiality and anonymity, self- determination, scientific honesty, privacy, dissemination of results and the right to withdraw from the study and these will be maintained in this study.

3.15.1 Informed Consent

Burns and Grove (2003) defines informed consent as the prospective subject's agreement to participate voluntarily in a study, which is reached after assimilation of essential information about the study. The subjects were informed of their rights to voluntarily consent or decline to participate, and to withdraw participation at any time without penalty. Polit and Hungler (2004) states that, there is need for permission to conduct the study and this was requested from Chiredzi local authority. The residents and the town council staff to participate in the research were informed about the study and the local authority's permission to request residents to complete questionnaires. The residents' cooperation was requested and questionnaires were given to those who were willing to participate.

3.15.2 Anonymity and Confidentiality

Burns and Grove (2003) defines anonymity as when subjects cannot be linked, even by the researcher, with his or her individual responses. In this study anonymity was ensured by not disclosing the respondent's name on the questionnaire and research reports and detaching the

written consent from the questionnaire. Therefore, anonymity and confidentiality was maintained throughout the study.

When subjects are promised confidentiality, it means that the information they provide will not be publicly reported in a way which identifies them, thus according to Polit and Hungler (2004). In this study, confidentiality was maintained by keeping the collected data confidential and not revealing the subjects' identities when reporting or publishing the study. Confidentiality and anonymity was guaranteed by ensuring that data obtained was used in such a way that no one other than the researcher knows the source. In this study no names were attached to the information obtained, thus how anonymity and confidentiality was uplifted.

3.15.3 Self-Determination

The ethical principle of self-determination was also maintained. Subjects were treated as autonomous agents by informing them about the study and allowing them to voluntarily choose to participate or not. Lastly, information was provided about the researcher in the event of further questions or complaints.

3.15.4 Scientific Honesty

Scientific honesty is regarded as a very important ethical responsibility when conducting research. The researcher should also be open and honest. Dishonest conduct includes manipulation of design and methods, and retention or manipulation of data, thus according to Brink's view. The researcher tried to avoid any form of dishonesty by recording truthfully the answers of those subjects who could not read or write. Manipulation of data were not done as it is viewed as being dishonesty by the researcher.

3.15.5 Privacy

According to De Vos, privacy refers to agreements between persons that limit the access of others to private information. In this study, the researcher ensures that when participants described their experiences of being involved in water supply crises and poor wastewater management, the information given were not divulged. Privacy refers to the freedom an individual has to determine the time, extent and general circumstances under which private

information was shared with or withheld from others, Burns and Grove (2003). In this study, privacy was also maintained by not attaching participant's names to the information given.

3.15.6 Dissemination of results

Results are disseminated in the form of a research report. The report should stimulate readers to want to study it and also determine its feasibility for implementation, De Vos. The report should not expose the secrets or weaknesses of the institution to the readers, but should recommend improvements of the service. The participants were informed that a copy of the findings would be handed to the nearest office as well as to the town house where the study was conducted. The information will be available whenever the respondents need it, therefore a copy will be given to the Chiredzi local authority for safekeeping and for easy accessible.

3.15.7 The right to withdraw from the study

Holloway (2005) states that it is of great importance to give participants the right to withdraw from the study. Therefore the participants were informed that they could withdraw from the study at any time if they wished to. This right was explained to them prior to engagement in the study, before the interview, this right is part of the informed consent.

In addition, ethical considerations can be viewed as that information the researcher has to take note of when going to collect data or when interacting with the residents in a study area. For instance the research carried out in Chiredzi which is dominated by the Shanganians speaking people who are culture- oriented; hence the researcher take note of dressing whenever going out to collect data. Good communication skills were needed and the researcher take note of language barriers between the researcher and the target population, so that the language used suit all. A point to note is that, the researcher is not supposed to disclose people's names and also has to wait for the people to give the responds, not forcing them to, and in this case the researcher waited and collected the questionnaires after three days.

3.16 Reliability and Validity

Reliability and Validity are important concepts in research as they are used for enhancing the accuracy of the assessment and evaluation of a research work, Tavakol and Dennick (2011).

Creswell (2014) states that, they have different meanings under the different types of research that is quantitative and qualitative research.

3.16.1 Reliability

Polit and Hungler (2004), refer to reliability as the degree of consistency with which an instrument measures the attribute it is designed to measure. Reliability refers to the consistency, stability and repeatability of results that is the result of a researcher is considered reliable if consistent results have been obtained in identical situations but different circumstances thus according to Twycross and Shields (2004). Reliability was censured by minimizing sources of measurement error like data collector bias. Data collector bias was minimized by the researchers' being the only one to administer the questionnaires, and standardizing conditions such as exhibiting similar personal attributes such as friendliness and support to all respondents. To make the questionnaires more reliable the researcher used questions that were clear, short and precise.

3.16.2 Validity

Validity refers to the degree of congruence between the explanations of the issue being investigated and the realities of the world, McMillan and Schumacher (2006). It also means the degree to which the interpretations have mutual meaning between the participants and the researcher, McMillan and Schumacher (2006). Validity is the extent to which any measuring instrument measures what it is intended to measure, thus according to Thatcher (2010). It is possible for a measurement to be reliable but invalid, however if a measurement is unreliable, then it cannot be valid. Gibbs (2012) identified five types of validity which include descriptive, interpretive, theoretical reliability and evaluative validity.

Descriptive validity was used in this study as the researcher constantly presents factual, accurate descriptions of data generated. According to Drost (2011), there are four types of validity that researchers should consider and these are statistical conclusion validity, internal validity, construct validity and external validity. However the researcher focused more on external and internal validity as they impact on the data to be collected.

3.17 Pre-test

The researcher carry out a pilot test to make sure that the questions contained in the questionnaire and the interview guides were clear and correctly phrased before actual administering. According to Polit and Hungler (2004) a pretest refers to a trial administration of an instrument to identify flaws. When a questionnaire is used as a data gathering instrument, it is necessary to determine whether questions and directions are clear to subjects and whether they understand what is required from them, therefore the researcher distribute questionnaires to about five individuals so as to deduce whether the questionnaire are understandable. The researcher pretest the questionnaire and the interview guide with the residents in Gweru-Senga residential area and with other co-students. Minor errors of grammar and spellings were corrected by the co-students on the questionnaires and the question which requires yes or no answer were removed, that is *"Do you experience water shortages in Chiredzi urban".*

The data gathered in the pretest for this research was not analyzed nor presented in chapter IV of this research so as to avoid lying and distorting the results.

3.18 Data Collection Process

The researcher, first of all before distributed questionnaires and administer interviews, focus group discussions as well as making observations. The researcher seek permission from the Chiredzi Town authorities as data was to be collected in Chiredzi urban and in this case it was the Town Secretary who signed and stamped on the research introductory letter the researcher has as a sign to show that access was granted for the researcher to carry out a research topic, "water supply and wastewater management in urban areas and the impact they pose on human health. The case of Chiredzi Town." The research would start by self-introduction by presenting a letter from the institution which confirmed that the researcher was a registered Midlands State University student seeking permission to conduct a research in the town. The researcher also explained the purpose of the research to all respondents so that they would fully understand the motive of the researcher. The confidentiality of the information was strengthened, so that the respondents will be free to give information.

After the access was granted, the researcher distributed questionnaires to Chiredzi Town Council general employees, Chiredzi General Hospital employees, CTC management, Chiredzi urban councilors, ZINWA employees and householders who reside in Tshovani, Makondo and the new stands in Chiredzi urban. Interviews and focus group discussions were arranged with the selected respondents, the researcher also moved around the areas in Chiredzi urban making some observations pertaining the area under study.

3.19 Data presentation and analysis

Marshall and Rossman (2006) describes data analysis as the process of bringing order, structure and meaning to the mass of collected data. It is described as messy, ambiguous and time-consuming, but also as a creative and fascinating process, Best and Kahn (2006).They further pose that the analysis and interpretation of data represent the application of deductive and inductive logic to the research. Therefore one could infer that data analysis requires some sort or form of logic applied to research. Data analysis is a mechanism for reducing and organizing data to produce findings that require interpretation by the researcher, thus according to Burns and Grove (2003). Various methods of data presentation shall be employed. It was presented in the form of graphs, pie charts and tables. These provide for a systematic analysis of data from which research findings and conclusions were drawn. The analysis were also assisted by the literature obtained from secondary data sources. After the data was collected it was organized and analyzed. The open-ended questions were analyzed through quantitative content analysis by the researcher with the aim of quantifying emerging characteristics and concepts. Certain steps take place in data analysis and these included editing, classification and data entry.

3.19.1 Purpose of data presentation and analysis

Marshall and Rossman (2006) outlined the purpose on why data has to be presented and analyzed and these includes the following:

- Helps in obtaining usable and useful information in research.
- Forecasting outcomes.
- It helps to describe and summarize the data.
- It helps in identifying relationships between variables.

- Used in comparing variables.

3.20 Summary

This chapter discussed the research methodology of the study and described the research design, population size and composition, sampling techniques, sample size and data-collection instrument and ethical considerations. The chapter has given the research design for the study and its justification. Both qualitative and quantitative approaches were employed. The target population of the study was 3021 and the composition for the study includes the councilors, CTC management and general employees, Chiredzi General Hospital employees, ZINWA employees and residents. The sample size of 100 respondents was selected and the sampling techniques used were simple random sampling (SRS), stratified sampling and purposive sampling. The data collected from the selected respondents by way of questionnaires, observations, focus group discussions and interviews, as well as the secondary data and was presented and analyzed in tables, charts and graphs and this were indicated in the next chapter. The next chapter will cover the data presentation, analysis and interpretation.

CHAPTER IV

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.0 Introduction

This chapter presents, analyze and interpret the data that the researcher has collected from the respondents and research field that is through research instruments which are questionnaires, interviews, focus groups and observations. The data for this research was taken from householders, councilors, employees at Chiredzi Town Council, employees at ZINWA and employees at Chiredzi General District Hospital. The information obtained was then used to analyze the water supply and wastewater in urban areas and the impact they pose on human health in Chiredzi Town. Data obtained is presented in the form of tables, pie-charts, pictures and graphs. For easy understanding of data by various respondents, responses and findings will also be expressed in percentages. The interrelations between the research objectives, literature review and the research findings will then be analyzed and discussed. Problems faced in water supply and wastewater management and suggestions/ solutions provided by respondents to overcome the problems will be discussed.

4.1 Response Rate

Response rate is the actual number of the population that participated in the research against the sample size. In this study, the response rate was sample size one hundred (100) versus the actual number which participated that is seventy-seven (77). It is of great concern to note that, a higher response rate minimized the risk of response bias and it increased the validity and reliability of the research results. The table below summarizes and weighs the sample size against the response as well as the response rates for questionnaires, interview and focus groups.

TABLE 4.1 RESPONSE RATES FOR QUESTIONNAIRES, INTERVIEWS AND FOCUS GROUPS

	Population	**Sample Size**	**Response**	**Response Rate %**
Questionnaires	Householders	20	16	80
	CTC Management	8	6	75
	CTC General Employees	10	5	50
	Councilors	8	4	50
	CGH Employees	10	8	80
	ZINWA Employees	10	10	100
	TOTAL	**66**	**49**	**74.2**
Interviews	CTC top Management	4	3	75
	CGH Management	2	1	50
	TOTAL	**6**	**4**	**66.7**
Focus Group Discussions	CTC Health department Employees	12	10	83.3
	CTC Works and Engineering Employees	10	8	80
	CGH Outpatient department Employees	6	6	100
	TOTAL	**28**	**24**	**85.7**

Source: Research data (2017)

Questionnaires were distributed and sixty-six (66) respondents were systematically selected. Householders, CTC management, CTC general employees, councilors, Chiredzi General Hospital (CGH) employees and ZINWA employees were among the respondents on which the questionnaires were distributed. Out of 66 questionnaires distributed to respondents, only 49

were returned and 17 were not returned. The response rate of the questionnaires administered and returned was 74.2%. Interviews were conducted with the top management and CGH management and the total number of interviewed individuals was six (6), but however the researcher only managed to interview 4 individuals and leave the 2 individuals not interviewed. Out of the interviewed individuals, the response rate was at 66.7%.

The researcher went on to have focus group discussions with the CTC health department employees, CTC works and engineering department employees and CGH outpatient department employees and these have a total number of twenty-eight(28) and only 24 turned on, implying 4 individuals did not attend and the response rate for focus group discussions was at 85.7%. Wilkinson and Birmingham (2003) states that an ideal focus group should not have fewer than four and more than twelve participants, therefore the focus group discussions held were accuracy as the attendant number for each was above 4 people.

The research findings made the researcher to claim the data obtained valid, reliable and tolerable because of the percentages which were obtained from the respondents. Out of 66 questionnaires distributed the response rate was 74.2%, while 6 respondents targeted for interviews and the response rate was 66.7% and finally out of 28 respondents booked for group discussions 24 turned up and thus 85.7% response rate. Backer (2012) states that, response rate below 50% is viewed as intolerable as it represents the minority of the research population. Therefore, all the response rate were above the percentage which Backer (2012) claims to be tolerable.

Therefore, 77 people responded in this research study and out of the sample size of 100 people, thus making the response rate 77%. %. Dornyei (2007) noted that, a response rate within the range of 75-100% can be used to justify that the results are authentic. Therefore the research findings can be termed to be true, reliable and valid as supported by Dornyei (2007). The researcher did not manage to score 100% response rate as some respondents were busy to respond, for example the respondents from Chiredzi General Hospital states they were busy attending patients and as a result they could not complete the questionnaires, while some residents state that we are not educative enough to complete the questionnaire and the respondents who did not show up on the date scheduled for interviews state that they have work related issues to attend, while on some households the researcher could not find time to go back and collect them.

4.2 Demographic Data

4.2.1 Sex of Respondents

Table 4.2 shows sex of respondents

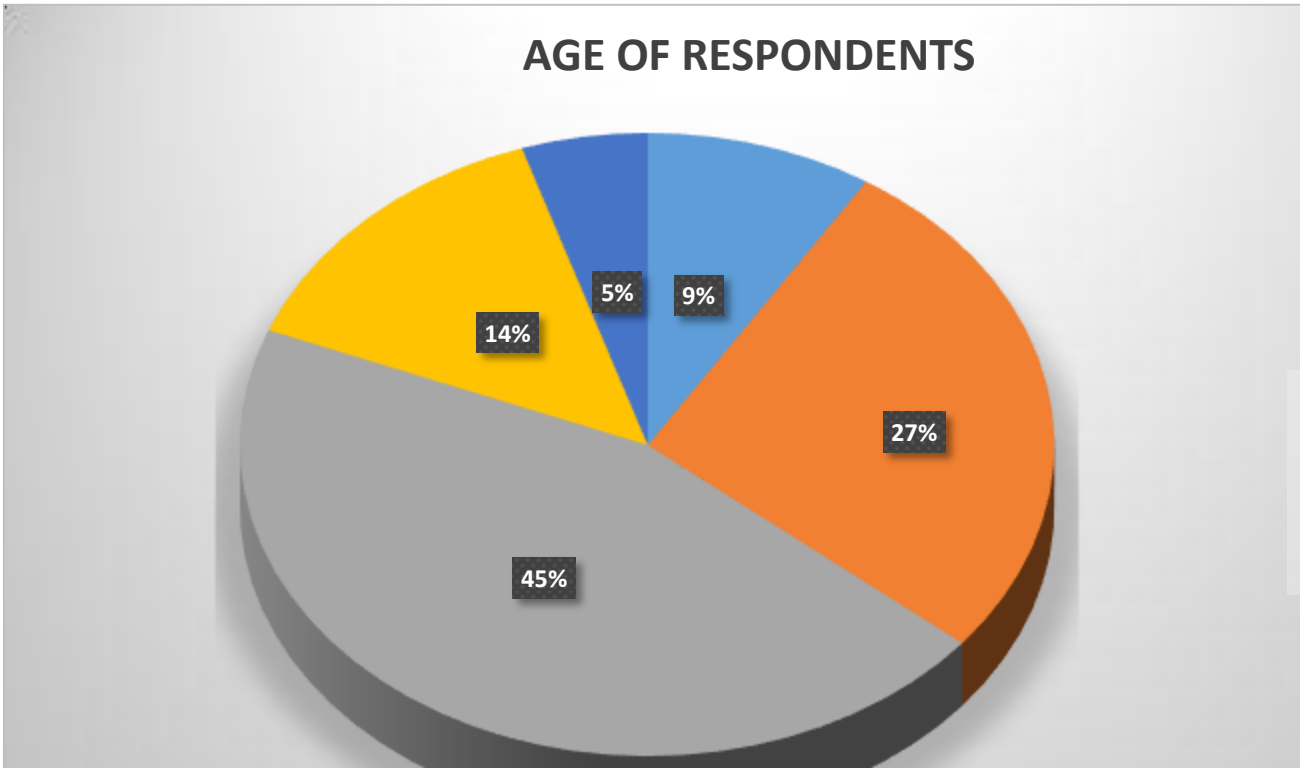
Sex	Number of respondents	Percentage %
Male	43	56
Female	34	44
TOTAL	**77**	**100**

Source: Research Data (2017)

The total sample size was 77 and out of that 77 respondents 43 were men and this equaled to 56% and 34 of them were female and this was 44%. Out of the 66 questionnaires distributed, the total number which were responded to be 49 and out of the responded questionnaires 22 of them were women while 27 of them were men. 20 questionnaires were specifically prepared for householders and 16 responded and out of the ones which responded, 5 were men while 11 were women and this have shown that most women in Chiredzi are not formally employed, but they are self-employed because questionnaires were distributed during working hours while most men were at work. In addition, women only dominated on responds from the Chiredzi General Hospital employees where the women were 5 over men 3, and this is so because most women are employed in health sector rather than men. Therefore helps in the findings, woman are always at home and they witness burst water pipes and sewers flowing in the streets, hence they give relevant information.

4.2.2 Age of Respondents

FIGURE 6 shows the ages of respondents



Source: Research Data (2017)

The pie chart above shows the age of respondents in Chiredzi Town and it indicates that, the most participating age group was between 18- 50 years and this age group constitutes the most number of respondents, thus 55 out of 77, hence constitutes about 71.4% of the total respondents. In addition, the most participating age group indicates that people aged between 18-50 are the working class still fit to work on daily basis and most of these participants work at Chiredzi Town Council, Chiredzi General Hospital and ZINWA. The age group which was between 31-49 years had the most number of respondents that is 35, thus 45% of the total respondents, 18-30 years had 27% and these have seen to be comprised of fresh graduates from universities as well as colleges and also students on work related learning who aired their views pertaining the topic under study.

50-60 years have seen 11 respondents and this was 14% of the total respondents, they were also some residents which were below 18 years and air out their views since some of them have noted to be house wives which engage in early marriage. Below 18 years have seen 7 respondents and this was 9% of the total respondents and lastly there was the age group which was above 60 years and about 4 respondents turned up equaling to 5% and this have caused the researcher to conclude that retirement age in public institutions is almost the same, thus 60 years and the ones who responded have been noted to be the pensioners. Therefore, the data was crafted and collected from partly mature people who have experienced some of the problems haunting the town of Chiredzi and thus water supply and wastewater management and the impact they pose on human health.

4.2.3 Number of Years Resided In Chiredzi Town By Respondents

TABLE 4.3 shows the number of years resided in Chiredzi town by respondents

No. of years resided in Chiredzi Town	0-5 Years	6-10 Years	11-15 Years	16-20 Years	Above 20 Years	TOTAL
No. of Respondents	16	16	21	12	12	77
Percentage %	21	21	26	16	16	100

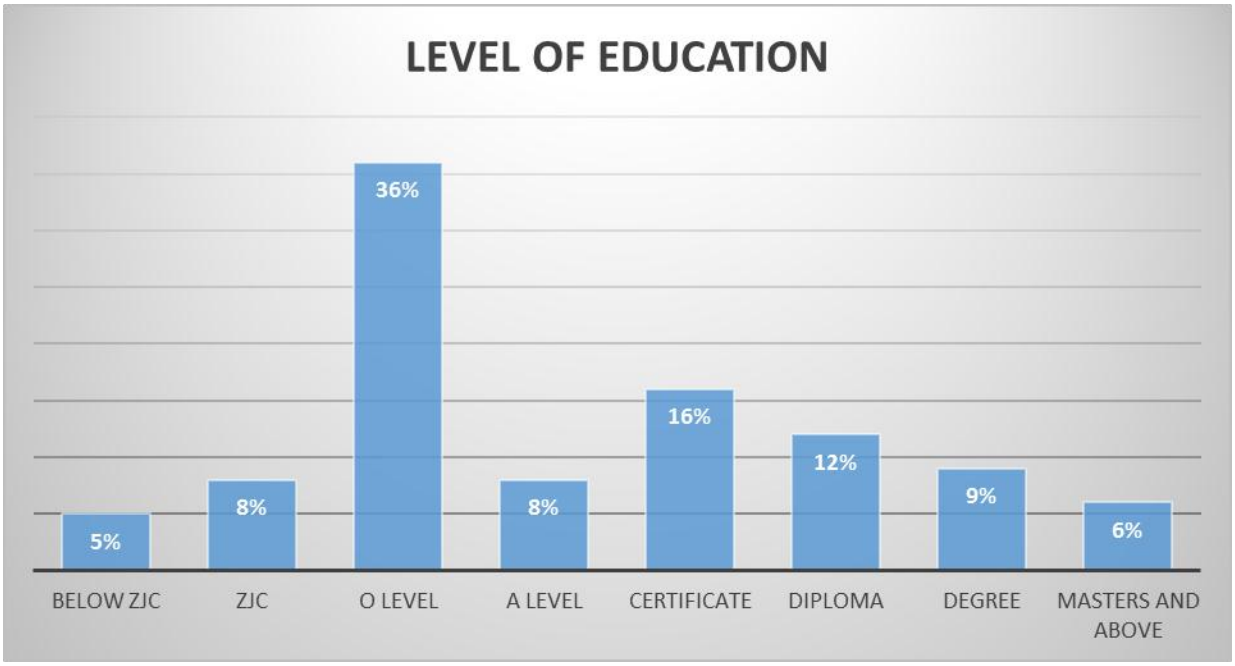
Source: Research Data (2017)

The above data indicates the number of years the respondents have stayed in Chiredzi Town, and it is seen that the respondents who have stayed in Chiredzi Town between 11 and 15 years have a high number which is 21 and the percentage response is 26%, those who have stayed in Chiredzi urban for 10 years and below have a response percentage of 42%, that is the ones who have stayed for less than 5 years and those who have stayed between 6-10 years and this was seen that they share the percentage half by half. The respondents who have stayed in the area of study between 16-20 have a respond number of 12 and the percentage is 16%, and lastly the number of respondents resided in Chiredzi for over 20 years has total number of 12 and the percentage response is 16%, but however the researcher have noticed that although their numbers are not that convincing, the respondents who have stayed in Chiredzi for over 16 years, tell the actual

facts because some of the respondents have witnessed the water shortages and the negative impacts of poor wastewater management in Chiredzi, hence they have concrete evidence therefore their responses were valid and reliable.

4.2.4 Level of education of the respondents

FIGURE 7 shows the respondents' level of education



Source: Research Data (2017)

The research results above shows that, 5% of the respondents have below ZJC as their academic qualifications and these group of individuals some of them did not attend school and they are residents who are not able to write and read and they make their response hard to interpret. 8% of the respondents have gone to school up to ZJC and these occupy low ranked jobs in their organizations and they are cleaners at council offices. The responses portrayed by these individual who have gone as far as ZJC in their education was not good as most of the responses were, "I do not know" and this makes the researcher to know the view of respondents on what water supply and wastewater management means.

Respondents who have achieved their education up to 'O' Level has the most respondents that is 28 out of 77 and this makes 36% of the total respondents. Most general employees at ZINWA, Chiredzi General Hospital and Chiredzi Town Council, as well as most householders have 'O' Level and their responses were quite well and most of the answers given were based on experience gained at work and they helped in understanding water supply and wastewater management. 8% of the respondents achieved their education up to 'A' Level and some of them are householders and some general employees, Certificate holders from the respondents equaled to 16%, while diploma holders equaled to 12%. The respondents who have degrees and those above masters level, 9% and 6% respectively.

The research findings shows that of all the respondents who reached 'A' Level up to masters level defined the terms water supply and wastewater management correctly, water supply was viewed as the provision of water by public utilities, commercial organizations, community endeavors or by individuals usually via a system pumps, pipes or canals and this was according to UNICEF (2010) **,** while the ones who obtained 'O' Level viewed the terms under concern as, " when the water reaches the consumers in the right amount" and most of them were householders.

4.3 Causes of in adequate water supply and poor wastewater management in Chiredzi Urban.

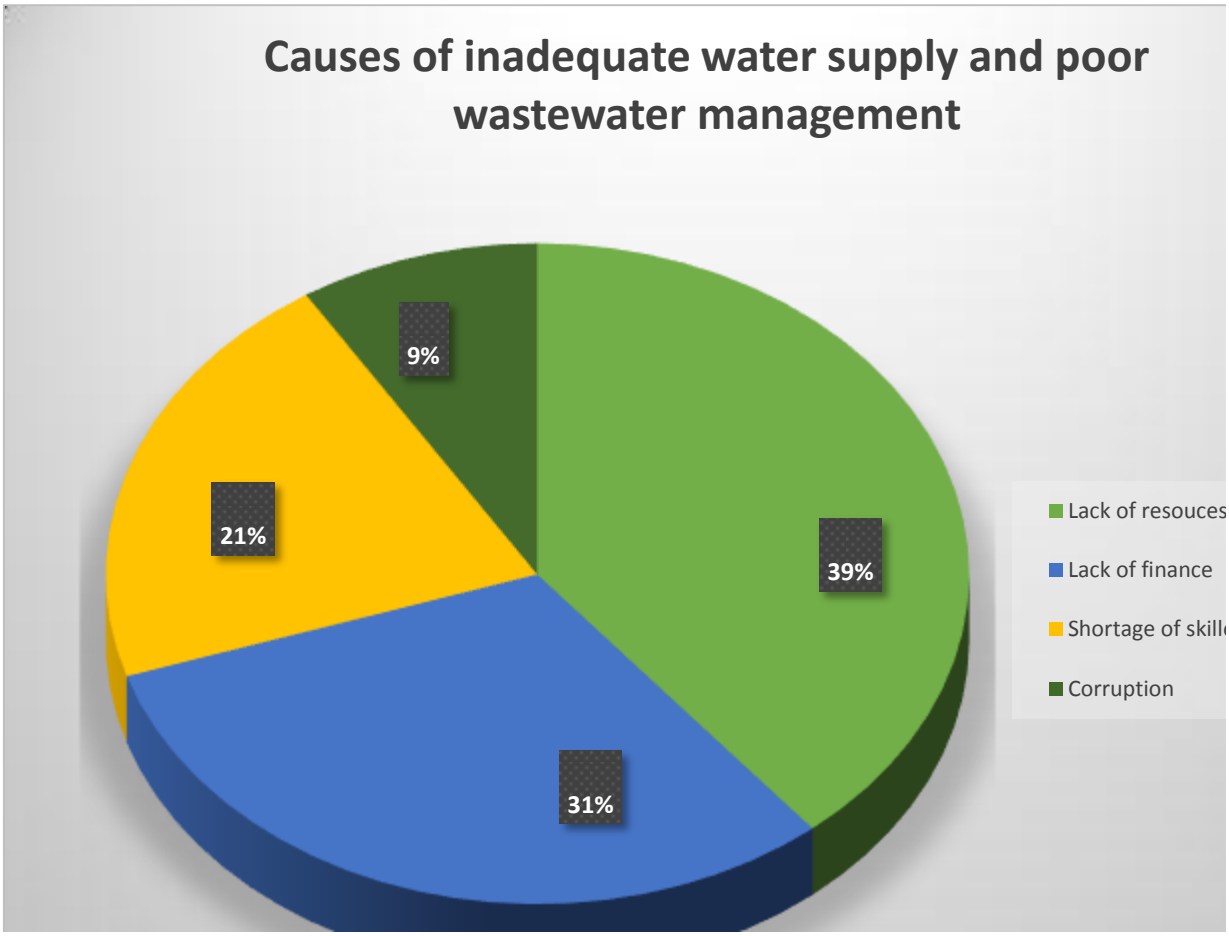
The respondents from management and general of CTC, employees at Chiredzi General Hospital, ZINWA and householders noticed that there are a number of factors which caused inadequate water supply and poor wastewater management in Chiredzi urban which have impacted on human health. The researcher in the questionnaires, interviews and focus group discussions portrayed the question about the causes of in adequate water supply and wastewater management in Chiredzi and the respondents aired their views revolving around lack of resources, lack of finance, shortages of labor and corruption. Out of 77 respondents, 30 of them have the view that lack of resources that is infrastructure, chemicals to treat water and machinery to use on water and wastewater treatment is main cause of in adequate water supply and poor wastewater management ,as 39% of the total respondents responded in that view. 31% of the total respondents has the view that, the cause of in adequate water supply and poor wastewater management is also lack of finance by Chiredzi Town Council. In addition, 21% of the

respondents state that shortage of skilled labor force contributes to the in adequate water supply and poor wastewater management and corruption was also viewed as the cause of in adequate water supply, as water distribution will favor the location where the officials resides and they stipulate that, funds which are to fund service delivery thus water supply and wastewater are channeled towards individual use and 9% of the total respondents state that it is corruption that led to shortage of water in Chiredzi Town. The pie-chart below shows the respondents' perspective towards the causes of in adequate water supply and wastewater management in Chiredzi urban.

Therefore, the research findings highlighted that, lack of resources, lack of finance, shortage of skilled labor force and corruption as the causes of in adequate water supply and wastewater in Chiredzi Town and they are different from what Corcoran et al (2010) stated when the writers viewed causes of in adequate water supply and wastewater in developed countries as overpopulation and lack of planning by town planners. WHO (2011), state that, it is the absence efficient institutions and lack of technological knowledge, empirical know-how of wastewater treatment processes and their implementation and in appropriate management practices caused in adequate water supply and wastewater in developing countries.

However, there was similarity, where WHO (2011) state that, population in developing countries increases on daily bases and the wastewater systems are not upgraded to meet the increasing population and thus also the situation in Chiredzi town as increase in population is giving pressure to wastewater systems which are not upgraded. Wang et al (2013) states that, the lack of water in Africa is further aggravated by insufficient treatment of water and wastewater and wastewater is not treated and let go and thus also the situation in Chiredzi town. Water Supply is said to be a challenge to most developing countries as they lack resources, which is financial resources and equipment to maintain water treatment plants which are aging and such is the situation in Chiredzi town as financial resources is the key.

FIGURE 8 shows the causes of inadequate water supply and poor wastewater management in Chiredzi town.



Source: Research Data (2017)

After a remarkable comment by one of the works and engineering employee in a focus group discussion, that old pipes are used to transport water to the water users therefore this caused water loses and the other point was that the water tanks which are used to store treated water are old and have cranks beneath them which caused water loses. In addition, the pumps used to pump water from the reservoir tanks to the water users are small to capacitate the growing population in Chiredzi Town. The other point to note was that, residents leave their taps open, therefore when water is being opened from the source it makes streams flowing in the streets and children are left out playing with tap water and these have been noted also to be the causes for in

adequate water supply in Chiredzi town. As result to these points made in a focus group discussion, the researcher visited some of the residential areas in Chiredzi urban as well the water tanks site and made the following observations.

Plate 3 (*A child playing with water in Tshovani*) **Plate 4** (*Old water tank causing water loss*)

Source: Field Data (2017)

The information given by pump operator indicates that Chiredzi Town Council gets the water it ordered from the water treatment plant operated by Hippo Valley in rightful amount, to its reservoir tanks. The challenge now comes in when the water is being discharged into the reservoir tanks, the tanks which are used to store treated water some of them are old and not being repaired, as a result they are cracks beneath them and there are water loses occurring while in storage. Therefore as one of the objectives is to establish the root causes of in adequate water supply in Chiredzi Town, the researcher made an observation that, water is wasted through the taps being left opened and children playing with water as highlighted in plate 3 above. Plate 4 shows the water which is spilling from the cracked water tank and from the observations it shows

that, the water has been coming out of these cracks for such a long time, according to a close source.

In addition, the researcher made an observation that, the sizes of pumps used to pump water to the users are so small as compared to the demanding population in the town of Chiredzi. When Chiredzi town was established in the late 19th century the population was very low and the size of water pumps used did not change up to date no matter the increase of people in the town and this impact on the water supply as the pumps are now too small to pump water as far as Makondo (a new residential area to the east of the town). Plate 5 shows the size of water pumps used to pump for about 30 594 people thus according the Statistical Office (2012). On that note, water pumps uses electricity to pump water and most of the time the town have challenges with electricity hence impacting on water supply causing water shortages in the town. Plate 6 shows the sizes of water pipes used to transport water from the tanks to the residents and looking at the population and the sizes of the pipes used are not compatible to supply adequate water in the town. Therefore, this also is considered to be the root causes of in adequate water supply in the town, hence impacting human health because they say water is a necessity.

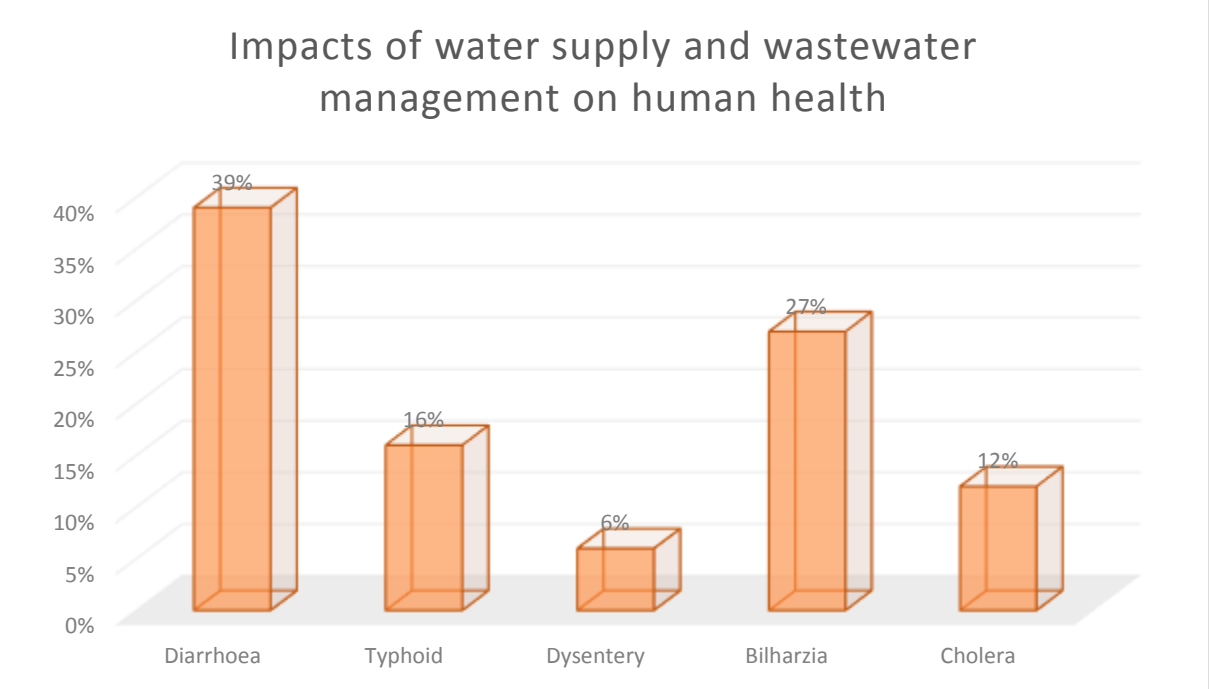
Plate 5 (*Small and old water pumps*) **Plate 6** (*Old and medium water sized pipes*)

Source: Field Data (2017

4.4 Impacts of water supply and wastewater management on human health.

WHO (2006) states that, if water and wastewater are not properly handled they impact on human health and thus through the outbreak of water borne diseases. Human health will be at risk if there is in adequate water supply and poor wastewater management. In Chiredzi town, research shows that, water borne diseases are rampant in the district and thee are diarrhea, typhoid, dysentery, bilharzia and cholera. On a focus group discussions held with the CTC health department and CGH outpatient department employees, they also highlighted that malaria can also be viewed as the impact of water supply and wastewater management as their view was, mosquitoes breed in open spaces where water is not properly managed and drains and open ditches have seen to be the breeding areas for mosquitoes, thus causing malaria which impact on human health.

FIGURE 9 Shows impacts of water supply and wastewater management on human health



Source: Research Data (2017)

Out of 77 respondents, 30 respondents, from the health department as well as from the CGH employees indicate that, diarrhea the most water borne impacting from water supply and

wastewater management and this is about 39%. 16% of the total respondents has the view that, it is typhoid which is affecting human health in Chiredzi while on the other hand 8 respondents which is 6% state that it is dysentery which is dominant and impacting the health of people in Chiredzi town due to water supply and wastewater management. 27% of the total population point it out that it is bilharzia that mostly affect the human health, while 12% of the respondents say it is cholera which impact human health due to in adequate water supply and poor wastewater management.

The research findings shows that, impacts of in adequate water supply and wastewater seem to be similar both in Chiredzi town and other towns in developing and developed countries as bacteria which caused the above mentioned water borne diseases are also observed in other developing and developed countries, for example Bangkok in Thailand and Nigeria.

4.5 Vulnerability water borne diseases in Chiredzi urban

Almost three quarters of the respondents' state that people are the mostly affected ones by in adequate water supply and wastewater management more than plants, crops and the land. Therefore, this caused the researcher to curiously know that among the population in Chiredzi town, which of the groups of people is mostly affected by water borne diseases among the toddlers, teenagers, disabled and old aged people.

Table 4.4 shows the vulnerability of water borne diseases

Rank	Group of people	Response Rate%
1	Disabled	45
2	Toddlers	27
3	Old aged	18
4	Teenagers	10

Source: Field Data (2017)

The table below shows the most group of people which are vulnerable to water borne diseases in Chiredzi urban and 45% of the respondents which includes the Chiredzi General Hospital employees, householders and CTC general employees state that the disabled people are the mostly affected by these diseases as they are the victims, usually to those who do not have somebody to stay with when water is scarce, they cannot afford to walk long distances to boreholes thereby being affected most. 27% of the respondents have a view that it is the toddlers

who are mostly affected because they usually play in sewer waters and their immune system is so weak thereby attacked by all sorts of diseases. The old aged were viewed to be the third group of people which is vulnerable to diseases and 18% of the respondents state that, while 10% of the respondents vowed that teenagers are also vulnerable to waterborne diseases.

The research findings in Chiredzi town shows that, the disabled ones are the most affected by water borne diseases while the researchers, African Development Bank Group (2015) state that, soil contamination mostly affect babies (toddlers) who are on the crawling stage as they usually play with soil and their health will be at risk due to overflowing wastewater, hence children are the most vulnerable group as they have the weak immune system.

Observations made show that the wastewater ponds in Chiredzi town are situated near Makondo residential areas and they are partly at the central point of the newly situated residential area. The ponds are not treated and they are bad odors which continuously affect the nearby residents and this can impact on their health. The researcher also observed that, some residents came to this wastewater ponds for fishing while children play in those waters, therefore impacting diseases in long term. The African Development Bank Group (2015), also have the same view with that one made by the researcher that, odors coming out of ponds which are close to homesteads impact on their health in the long run.

Plate 7 (*Sewer ponds where some residents came for fishing)* **Plate 8** *(Sewer ponds near Makondo houses*)

Source: Field Data (2017)

The researcher visited the water tanks, which are used as storage tanks for the water channeled from the water treatment plant. Treated water is being stored in tanks before it is distributed to the water users. The researcher made an observation that the water tanks are old and according to a close source it has been long before they are renovated and they have rust on them and this rust is not suitable for the health of water users and can cause so much health damages.

The picture below shows old storage water tanks used to store treated water waiting to be distributed to water users in Chiredzi town for consumption.

FIGURE 4.5 shows old water tanks

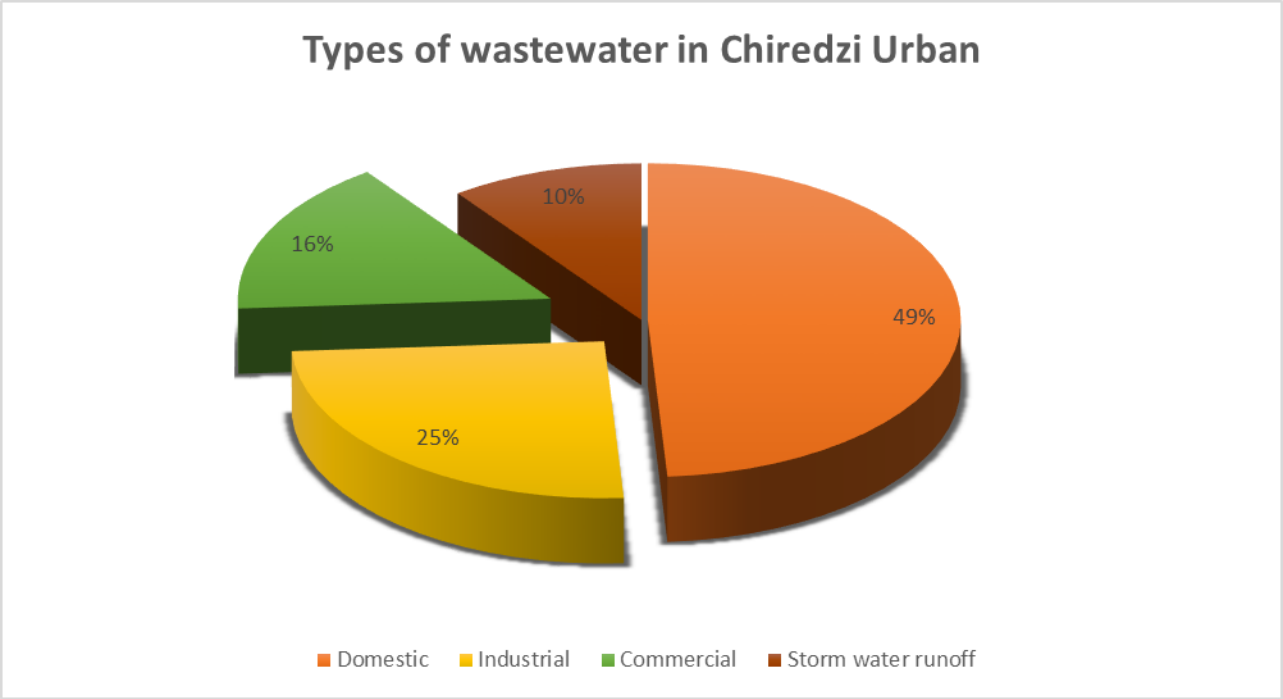
Plate 9 (*Three of the four, 10 000 (mg) litres of water tanks in Chiredzi Town***)**

Source: Field Data (2017)

4.6 Types of wastewater in Chiredzi urban

To understand the types of wastewater which are common in Chiredzi Town, the researcher prepared a question in the questionnaire provided and the responses shows that, domestic, industrial, commercial and storm water runoff are the types of wastewater in Chiredzi and these types of wastewater impact on human health if not properly managed. Among these types of wastewater, some are caused by humans while some of them are naturally driven, for example the storm water runoff.

FIGURE 10 shows the most dominating types of wastewater in Chiredzi urban



Source: Research Data (2017)

The pie-chart above shows the types of wastewater which are dominant in Chiredzi town. The researcher distributed questionnaires to 51 respondents and these came from the management, councilors, CTC general employees and Chiredzi General Hospital (CGH). 25 respondents viewed domestic wastewater as the most dominant type of wastewater and this tallied to 49%. This anchored on the view that, domestic wastewater is being released on daily basis as the householders bath, wash and use their Blair toilets on daily basis. Water shortages are causing less amounts of water to be used when flashing the toilets, hence the newspapers used cannot be pushed, therefore they block causing the sewer to burst and thus how water supply and wastewater have a link in impacting human health in Chiredzi town. 25% of the total respondents state that it is industrial wastewater which is more dominant in the town of Chiredzi and it also bears an impact on the human health. Chiredzi town has a number of industries which can produce wastewater and these include the Delta Beverages, Abattoirs, Ginneries and small garages. Commercial type of wastewater was viewed as it is also dominant in urban areas and 16% postulates that this type is also a type of wastewater in Chiredzi urban. 10% pointed that it

is storm water runoff which is dominant in Chiredzi and this impact on human health as the drainage systems in the study area are poor and this cause this type of wastewater to flow into the streets.

The research findings in Chiredzi town shows that, domestic wastewater is the most common type of wastewater which haunt the town and thereby impacting on human health. However, Gyampo (2006) state that in most developed and some developing countries, it is industrial wastewater which is more dominant due to the fact that, there is high industrialization.

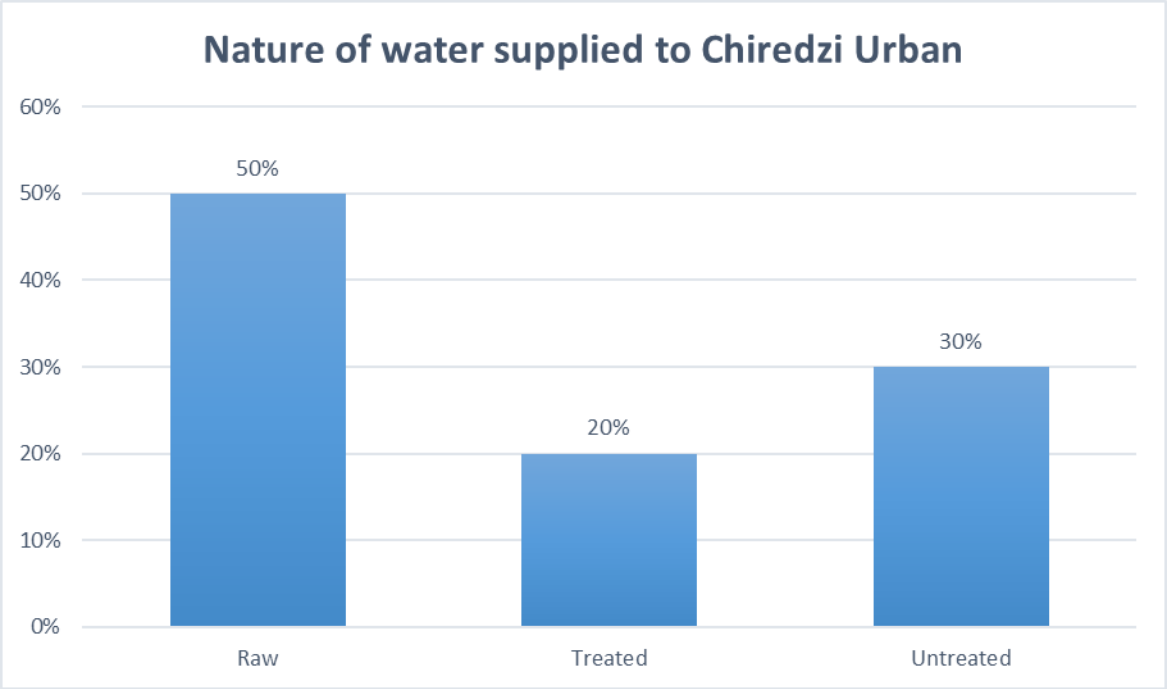
4.7 Nature of water supplied to Chiredzi Urban.

The management and the ZINWA employees state that, water is being supplied to Chiredzi urban by the water authorities which is ZINWA. The Chiredzi Town Council place water order according to the amount of water they need to use and ZINWA supply the water through the use of canals to an overnight storage dam Mteri dam and it will be taken from Mteri via a canal to the water treatment plant (WTP) where the water is being treated. Therefore, the researcher directed this question, the nature of water supplied to Chiredzi town to ZINWA employees who has only respondents from ZINWA employees and CTC management and 50 %, which is half of the total respondents on this specific question answered and show that ZINWA supplies raw water to Chiredzi, while 20% state that the water which is being supplied is treated water and lastly the other respondents voted that, the water supplied is untreated (clear) water. Having a close look on the respondents' views the researcher noted that, those who say the water supplied is raw water are the employees from the operations department who are the ones who opens and close water as it is supplied to Chiredzi, hence their view was valid and reliable.

The research findings shows that, the water supplied by water authorities to the town of Chiredzi is similar to that which is supplied to developed and most developing countries, as raw water which comes from dams is supplied and it will be treated for it to be portable and safe to drink.

The graph below shows the nature of water supplied to Chiredzi urban by the water authorities, ZINWA.

FIGURE 11 shows the nature of water supplied to Chiredzi town by ZINWA.



Source: Research Data (2017)

4.8 Understanding water supply and wastewater management

The researcher's concern was to see if the respondents know what is meant by the term water supply and wastewater management and questionnaire with this kind of question was distributed among other respondents and these are from Chiredzi General Hospital employees and ZINWA employees and this was done purposively. The data pertaining understanding water and wastewater management was put into tables showing the responses and responses rate.

Table 4.5 shows the responses on what is water supply?

Definition	**Response**	**Response Rate %**
Provision of water by public utilities, commercial organizations via a system of pumps or pipes	11	55
Is when water reaches the consumers and in right amount	5	25
Not Sure	4	20
TOTAL	**20**	**100**

Source: Research Data (2017)

The table above shows the number of respondents on what is meant by water supply, and 20 respondents answered this question differently and their views were put in a table for it to be easily interpreted and understood. 11 respondents has the view that water supply is all about the provision of water by public utilities, commercial organizations or individuals via a system of pumps or pipes and these equaled to 55% response rate, agreeing with what UNICEF (2010) postulated. 25% of the respondents has the view water supply is when water reaches its intended destination in the right amount, meaning to say when Chiredzi Town Council supplied 10 000mg litres of water to it users it should be delivered in that amount. 4 of the respondents vowed that, they don't what water supply means and they equaled to 20% and it was hard for the researcher to interpret it.

Table 4.6 shows the responses on what is wastewater?

Definition	**Responses**	**Response Rate %**
Is water comes from bathing, toilet flashing, laundry, dish washing. It comes from residential, domestic and industrial sources.	15	75
Is a combination of one or more of domestic effluent consisting of black water, urine and faecal sludge and grey water.	5	25
Not Sure	-	-
TOTAL	**20**	**100**

Source: Research Data (2017)

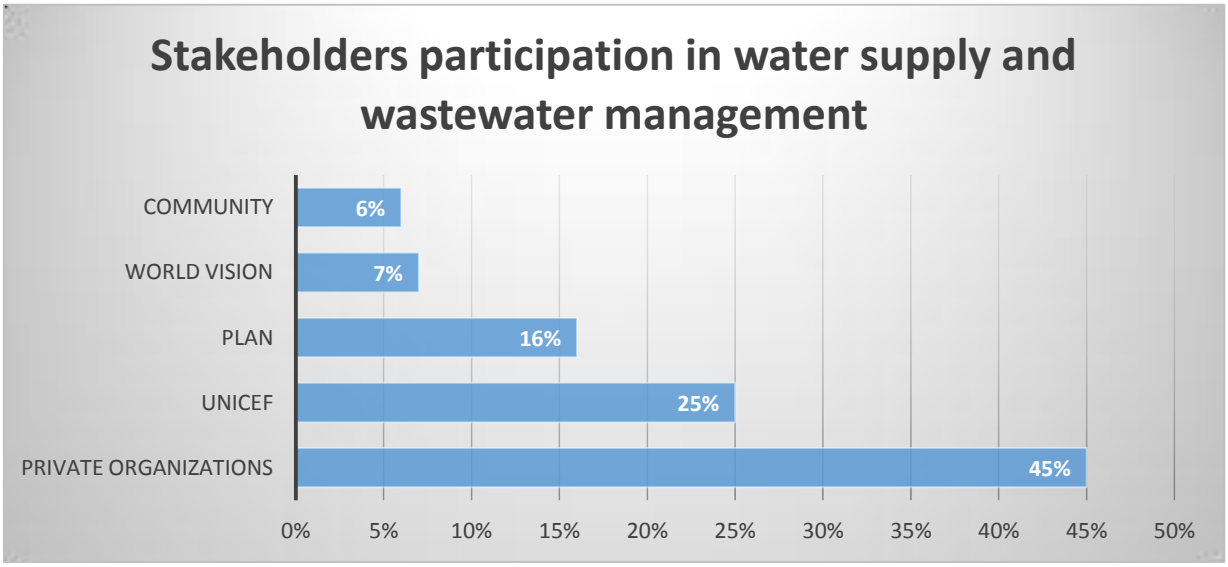
On the above table, the respondents show that, they have a clue on what wastewater is and this makes it easy for the researcher to analyze and interpret the data given. 15 of the respondents' view wastewater as the water which comes from bathing, laundry, dish washing and residential, domestic and industrial sources. 25% of the respondents which was 5 out of 20 respondents state that wastewater is a combination of one or more of domestic effluent consisting of black water, urine, faecal sludge and grey water, agreeing to what Corcoran et al (2010) said, who postulates that wastewater is a combination of one or more of, domestic effluent consisting of black water urine and faecal sludge and grey water, water from commercial sites and institutions including hospitals, industrial effluent and agricultural, horticultural and aquaculture effluent either dissolved or as suspended matter. On this questionnaire none responded that they are not sure.

4.9 Stakeholders participation in water supply and wastewater management

Respondents from CTC management, councilors, CTC general employees, Chiredzi General Hospital employees and ZINWA employees have a view that a number of stakeholders in Chiredzi urban are participating in helping out the town council in the service provision. Water supply and wastewater management has been said to be a challenge in Chiredzi urban and for the

council to provide these services efficiently, it has engaged various stakeholders and these include UNICEF, Plan International, World Vision, Private Organizations and the Community. All the respondents indicated that of course they are stakeholders which are helping the council out and they done this by ticking on "yes" on the question, Are there any stakeholders helping the CTC in water supply and wastewater management.

FIGURE 12 shows stakeholder participation in water supply and wastewater management



Source: Research Data (2017)

A number of respondents from CTC management, councilors, CTC general employees, Chiredzi General Hospital employees and ZINWA employees thus 30 to be more specific indicated that, private organizations are an important player in water supply in Chiredzi Town as they further state that, *"Dai vanga vasiri ivo tingadai tisina mvura muno mu Chiredzi"*, by these one of the respondents was to imply if it was not for the private organizations we would have not have safe and potable water to drink.45% of the respondents state that private organizations are the major player in water supply. An organization on top of the others was Tongaat Hullets (Hippo Valley Estate) to be more specific. Hippo Valley have been engaged by Chiredzi Town and it is the one which treat water for Chiredzi Town because it has the resources. 25% of the respondents

postulates that, UNICEF plays a major role in both water supply and wastewater management as it focuses on water and sanitation in in most of its activities.

PLAN was also mentioned as the key player in the water supply and wastewater management and the respondents to this were 16%, In newly situated residential areas, World Vision, has been drilling boreholes and they were respondents who mentioned it as a key player in service provision and providing safe and portable water, thereby dealing away with health impacts caused by water. 7% of the respondents views World Vision as another stakeholder helping in water supply and wastewater management. Some respondents point it out that they are other well-wishers in helping in water supply and wastewater management among the community members and this caused 6% of the respondents to say they are community members who help in water supply and wastewater management.

Therefore, research findings have a link with what was said in the literature review that cities and town could not handle water supply and wastewater management alone but they need help from stakeholders. In Thailand, in the city of Bangkok, community participate in water quality and monitoring and this was to ensure that the water provided to residents is safe to use. In addition, public-private partnerships in the city of Bangkok in Thailand, helped in the management and administration of wastewater, thus according to Simachaya and Yolthantham (2006).

In addition, Harare City Council engage ICRC, while Bulawayo City Council involve World Vision as well as Beitbridge and Action Faim helped Masvingo City Council out of their water woes. These Non-Governmental Organizations provide these councils with resources, which is both human and financial resources which can be used in the water supply and wastewater management, Makwara and Tavuyanago (2012). However, Hutton and Wood (2013) state that, wastewater is done effectively in developed nations as frequently services are provided using a mixture of financing sources, public-private partnerships which involves community contractors, service contracts, management contracts and Built Operate Transfer (BOT) and these are different from what Chiredzi town is using.

4.10 How are stakeholders being engaged in water supply and wastewater management?

Research findings shows that stakeholders are engaged in water supply and wastewater management in Chiredzi Town and they are engaged using some of the methods in which the respondents agreed to them and these are through meetings, emails, Facebook pages, whatsapp, newsletters and workshops. These methods are used to engage stakeholders who are willing to work hand in hand with the council.

Table 4.7 shows how various stakeholders are being engaged.

Method	**Response**	**Response Rate %**
Meetings	6	33
Emails	2	11
Facebook Page	2	11
Whatsapp	2	11
Newsletters	1	6
Workshops	5	28
TOTAL	**18**	**100**

Source: Research Data (2017)

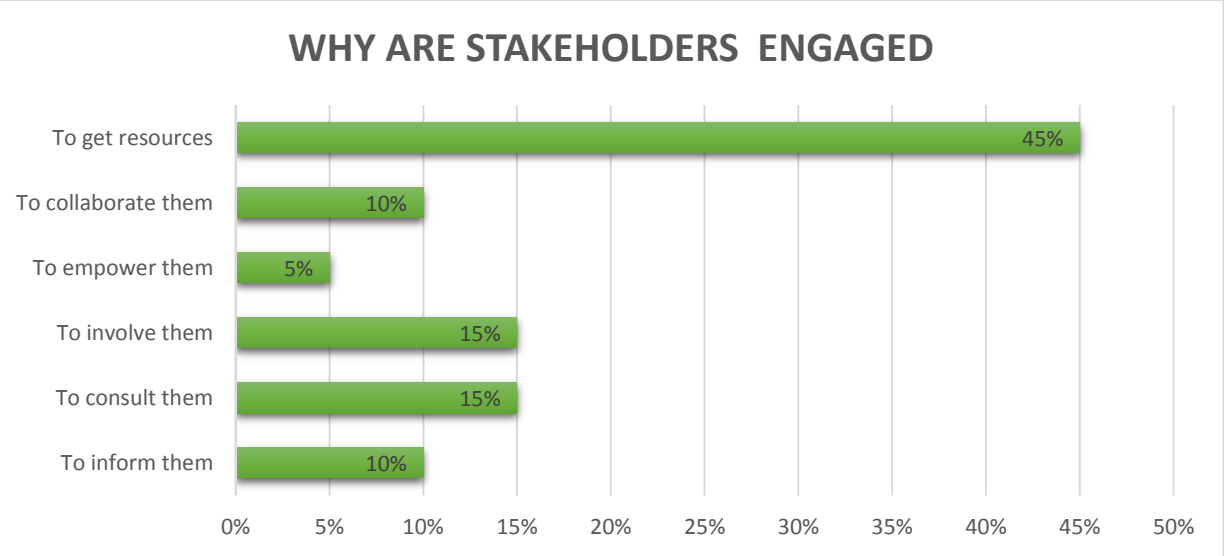
The table above shows how various stakeholders in Chiredzi urban are being engaged to work hand in hand with the Chiredzi Town Council. Out of 18 respondents who answered this question, 33% of them answered that, meetings is the common method which the council used to engage various stakeholders and this. 11% respondents, stated that emails, facebook pages and whatsapp responded that these are used frequently by CTC. Newsletters are also used by the council and 6% of the respondents have a view that the council used newsletters to engage stakeholders. 28% of the respondents, have a view that, workshops are frequently used by the council to engage stakeholders. Therefore the data provided clearly shows that meetings and workshops are frequently used by the council of Chiredzi town to engage various stakeholders.

4.11 Stakeholders participation in water supply and wastewater management

Research findings shows that Chiredzi Town Council engage stakeholders using various methods to lure them in and for them to work with them. The researcher wanted to know why the council

engage with stakeholders and the responds shows that, the council wanted the stakeholders to inform them on decisions they made, to consult them where they are facing difficulties, to involve them in their operations, to empower them, to collaborate them and to get resources thus financial and human resources.

FIGURE 13 shows why stakeholders are being engaged



Source: Research Data (2017)

Research findings indicates that, the council purposively engage stakeholders for it to get resources and about 45% of the total respondents vowed that, 15% of the respondents stated that, CTC engage stakeholders for it consult them as normally stakeholders, for example NGOs have experts who have the knowledge and in this scenario on how to effectively and efficiently provide water and manage wastewater. Stakeholders are being engaged for them to involve them in all their operations and 15% of the respondents have this view. 10% of the total respondents stated that, stakeholders are being engaged for them to be informed on how the council operations and in most cases how the council is being run and they will be informed on regulations to follow, 10% of the respondents state that, they need to collaborate them and 5% of the total respondents state that, CTC engage stakeholders in order to empower them.

4.12 The capability of CTC in improving its water supply and wastewater management.

To assess the capability, of the Chiredzi Town Council in improving the water supply and wastewater management, the researcher asked the driving questions which enhance the respondents to answer this question. Out of the respondents questioned if they experience severe in adequate water supply and poor wastewater management in Chiredzi town, 75% of the respondents responded with a "NO" while 25 % of the respondents responded with a "YES". This data shows that, most people in Chiredzi are not getting adequate water, especially the people who resides in Makondo residential area.

Table 4.8 shows if the respondents experience any water shortages in the town.

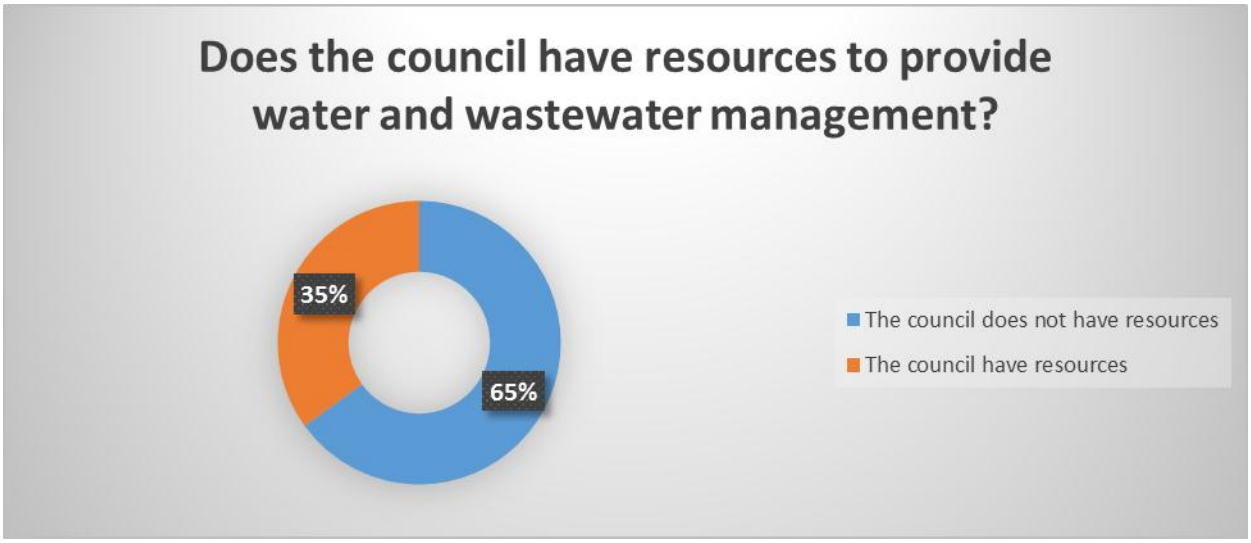
Problem	**Responses**	**Response Rate %**
Experiencing severe water shortages and poor wastewater management.	YES	25
	NO	75
		100

Source: Research Data (2017)

4.13 Water supply and wastewater management

The selected respondent highlighted that, for effective water supply and wastewater to take place in Chiredzi town, they need to have adequate resources. In addition, the respondents were being asked if Chiredzi town council have enough resources to manage its water supply and wastewater and on this again, the respondents indicated that, 65% of the total respondents vowed that the council does not have enough resources to improve its services, that is water supply and wastewater., while 35% of the respondents state that of cause the council have the enough resources to provide its services without fail but other factors for instance, corruption, lack of good prioritizing on which services to provide first or which projects to run first. The pie-chart below shows the respondents' respond towards the question.

FIGURE 14 shows if the council have resources to provide water and wastewater management.



Source: Research Data (2017)

In addition, residents and some council employees portrayed that shortage of water supply in Chiredzi town as well as the management of wastewater is all centered on the action taken by the council sometimes. This therefore, imply that besides other factors which can contribute to the in adequate water supply and poor wastewater management, the council itself contribute due to the reaction they take after a complaint about a burst water pipe and burst sewers has been laid. A number of respondents that is about 30% of the total respondents viewed the reaction of the council as poor as they take hours or sometimes days before they attend and this depends on which areas the burst pipes have been reported. Half of the respondents, that is about 50% stated that the responses of the council after a report has been laid can be said being average and this leaves only 20 % supporting of course it is good while non-vowed that the responses of the council is excellent. Hence, this can be seen as another factor which led to in adequate water supply and waste water management as most of the water is being seen flowing in streets and wastewater not being recycled. This is different to what the literature states, less cases of burst water pipes and sewer blockages have been reported in developed countries as their systems are well functioning.

Plate 10 **(** *Sewer water flooding the gravel roads***)** Plate 11 **(***burst water pipe in Tshovani***)**

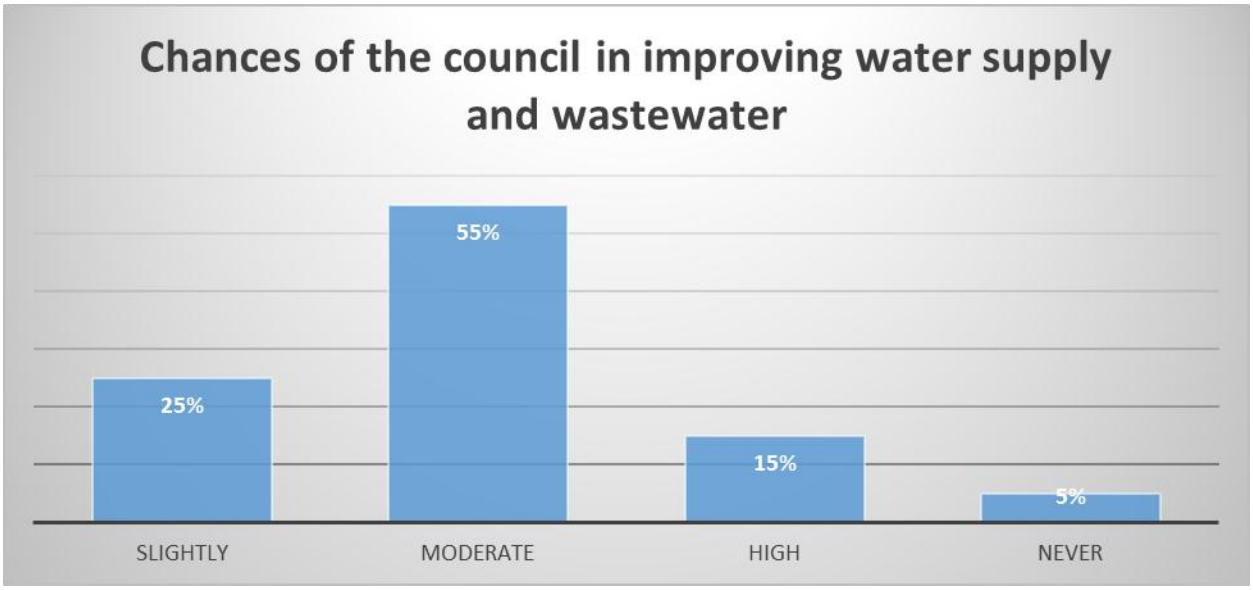
Source: Field Data (2017)

The plates above can be seen as the reaction of the council in attending to burst sewers and burst water pipes which were not being attended in time, therefore this caused the little water which is available to be wasted.

4.14 Chances that CTC can improve its water supply and wastewater management?

The householders were being asked the question, if there are any chances if the council can improve its water supply and wastewater. Pertaining this question some respondents viewed it was hard for Chiredzi Town Council (CTC) to improve its water supply and wastewater management. Some answered this question anger and emotions so that they even state in a vernacular language saying, "*Zvicharema kuti tiwanewo mvura patoidira ivo matsotsi ari kumusoro uko achingofunga kudya mari*" this statement imply that, it will be hard for us to get water whenever we need it as these thugs in council only thinks of spending money on their personal gains. These were the respondents from Makondo who states that instead of getting water coming out of our taps we are getting air and sounds.

FIGURE 15 shows the chances of the council in improving on water supply and wastewater management.



Source: Research Data (2017)

The graph above clearly indicate how the respondents viewed the council improving its services on water supply and wastewater management in the long run. 25% of the respondents state that there is a slight chance in Chiredzi Town Council improving these so demanded services. 55% of the total respondents view the chances as they are moderate and they state that they should focus on services delivery rather than their welfare. Some respondents states that the chances for Chiredzi to improve its water supply is so high as various stakeholders are willing to work with the council and all it needs is to accept and improve on these services. 5% of the respondents can be termed as the bitter and angry ones who resides in Makondo residential areas, who claims that we only have water when it is raining and sometimes we do not have even a drop of running water from the taps and it will be hard for the council to improve these services unless it improve on its spending.

The empirical evidence indicated that, although most cities are struggling to provide portable and safe drinking water some countries in developing nations are trying to improve. According to survey data analyzed by the Joint Monitoring Programme for water and sanitation, about one hundred million Chinese still did not have access to an improved water source in 2008 and about

four hundred and sixty (460) millions of people do not have access to improved sanitation. In addition, reports in 2015 states that, the number of people lacking access to improved water was sixty-three million and the reduction in the number of people who does not have access to safe drinking water shows that, there is a chance.

4.15 Water and wastewater disposal/ use.

Through research findings in Chiredzi town which were made through observations, the way the town council disposes its wastewater poses threats to human health. In Chiredzi urban, most drains have been blocked and some filled with soil due to soil erosion and this causes domestic wastewater to overflow in the streets rather than in trenches and drains. The situation is similar to that in Ghana, as households directs wastewater into the drains (gutters), however the domestic wastewater end up being in streets and some in nearby urban water bodies.

The rest of wastewater in Chiredzi town, is being directed to wastewater ponds, the ponds store this wastewater but however it will be let go and being disposed unto the streams which then divert the water to Chiredzi river, which is a water source for communities living downstream and this will impact the health of the people downstream because the water will be infected with bacteria.

Therefore the situation on wastewater disposal is similar to that in Ghana, as Gyampo (2006) state that, in Ghana industrial wastewater is being discharged directly into the oceans and rivers without any form of treatment, hence impacting the human health as people will use the same water from rivers without being treated. However, the situation is different to that one in Germany it is said, it is not permitted to discharge untreated wastewater into rivers and lakes regardless of whether it originates from private households, traders and large scale, thus according The Federal Water Act.

The researcher observed that, the residents in Makondo residential area use the water from sewer ponds to irrigate their gardens and some were fishing the fishes which flows upstream from Chiredzi River and this on the other hand helps the people to improve their livelihoods because they will have food on their table. However, this causes bacteria penetration as they will be fishing as well as irrigating their crops, therefore impacting human health of people in Chiredzi

town. In this case the situation is different as wastewater is being treated and recycled in South Africa and in other cities in Denmark as they have the resources.

4.16 Observations which were made in the field

This column will outlay the observations which were made by the researcher in the study area, thus in Chiredzi Town. Observations were made at the following sites, water treatment plant, the wastewater ponds, within the CBD, the residential areas and industrial sites. The observations made were all centered on water supply and wastewater management and the impacts they pose on human health. The researcher observed that, the number of wastewater ponds in Chiredzi did not tally the population in the town and as a result some wastewater is let go into the streams and rivers as there is no storage place. They are ten (10) wastewater ponds altogether, seven of them serve the low densities, heavy and light industries as well as the CBD, while three of them serve the high density of Tshovani which according to statistics have a higher population as compared to other areas, and as a result most number of sewer blockages are reported due to overpopulation.

Plate 10 (*Workers cleaning the filters at Chiredzi water treatment plant (CWTP)*).

Source: Research Data (2017)

The researcher have been to Chiredzi Water Treatment Plant (CWTP), and the above observation was made, where workers were cleaning the filters which are used to separate treated clear water and small particles. According to the workers, they clean these filters twice a week and this indicate that, water provided to Chiredzi Town is portable and safe to drink.

Plate 11 (*One of the wastewater ponds, showing poor management in CTC*)

Source: Research Data (2017)

On the above diagram, the researcher made an observation at the wastewater ponds where they are not being managed properly and the picture above indicates that. The wastewater is not treated and the ponds are not maintained and this impacts on the human health of households nearby.

From the field, the researcher noted some of the solutions CTC need to do in order to improve its water supply and wastewater and these are, the council to treat wastewater and re-use it for other chores as this will enhance water supply, to maintain wastewater ponds at least spray to do away with odor which impact the residents nearby, the council opens water from the reservoir at night

while people are asleep and closes in the morning hence they are not using water and they are not paying, at least opens during the day for specific hours.

4.17 Summary

The chapter presented the research findings which were obtained by the researcher through using both primary and secondary data collection techniques. The researcher strive by all means to achieve the objectives and these were achieved as the researcher conducted interviews, questionnaires, focus group discussions and observations. This chapter presents the data obtained from the field using pictures, bar graphs, pie-charts and tables. The response rate for the total respondents of 77 people was 77% as the sample size was 100 people. Bothe men and female participated on data collection, but however men have a larger number of participants as compared to those of women. Out of the 66 questionnaires distributed, 49 of them were responded and returned successfully, whilst from the 6 interviews staggered, the researcher managed to conduct only 4 of the interviews. The data was also obtained through focus group discussions and the observations which were made in the area of study.

The findings obtained were revolving around the causes of water supply and wastewater management, impacts of in adequate water supply and poor wastewater management and the challenges faced by Chiredzi Town Council in trying to provide water and wastewater effectively and effectively. The causes of in adequate water supply and poor wastewater management were viewed as corruption, lack of finance, lack of human labor as well as lack of infrastructure and lack of priorities by the council were it is supposed to obey the 70/30 principle it is doing the vice versa. The impacts of in adequate water supply and poor wastewater management were viewed as mostly spread of water borne diseases, poor production in the agriculture sector and affecting the human livelihoods of people in Chiredzi urban.

The next chapter will be the chapter five, focusing on summarizing the whole piece of work, suggesting recommendations to the problems availed and making conclusions basing on the data obtained from the field.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

The chapter summarizes all what have been said from chapter one to chapter four, concerning the topic under study that is, "water supply and wastewater management in urban areas and the impact they pose on human health". The chapter will also provide conclusions taken from the findings carried out from chapter three, concerning the topic under study. Conclusions based on what on the ground will be laid out, were the researcher will give concluding remarks pertaining the prevailing situation in Chiredzi town pertaining water supply and wastewater management. The researcher will also presents recommendations which will be mainly focused on solving the prevailing situation, so that the ideal situation expected of Chiredzi town will be achieved.

5.1 Summary

This section outlay the contents of the chapters one to four, the research topic," water supply and wastewater management in urban areas and the impact they pose on human health, the case of Chiredzi town". Introduction and background of the study is the chapter I which mainly focused on the background of the study, where the researcher give the geographical location of the study area, history as well as justifying why the researcher has chosen the area. Statement of the problem which state the current problems in which Chiredzi town is facing, the prevailing situation as well as the ideal situation pertaining water supply and wastewater management in urban areas and the impact they pose on human health were stated. The research went on to identify the objectives of the study and the general objective of the study, "to determine the impacts of poor water supply and waste water management on human health". The other objectives in which the study based on are, to identify the relationship between water supply management and waste water management and the impact they pose on human health, to identify the existing and potential health effects emanating from poor water supply and waste water management, to establish the root causes of poor water supply and waste water management in Chiredzi Town, to assess the capability of the Chiredzi Town Council in improving the water

supply and waste water management, to determine the influence of stakeholder participation in water supply and wastewater management in Chiredzi Town and to come up strategies to overcome the problems of water supply and waste water management, as well as the research questions which have been the guidelines to this research study. Significance or justification of the study also come to play in chapter I and this was focused on pointing out the importance of the study and also justifying the need for a research study to be carried out and also stating who is to benefit from the research study, limitations of the study were mentioned and this include shortage of time as well as resources thus to mention in passing, delimitations of the study were also stated as the research focused in Chiredzi Town and only concentrated on service provision, water supply and wastewater management to be more specific and lastly on chapter was the definitions of key terms which were water supply, wastewater management and health. Thus was the outline of chapter I, introduction.

The literature review in this study mainly centralized on the conceptual framework, theoretical and the empirical research findings. All being said was trying to point out these three factors. The research point out the classification of urban wastewater where the types and sources of wastewater in urban areas were being mentioned as industrial, commercial, domestic and storm water runoff. Urban wastewater management in developed countries was ventured into, and in this regard Germany and Denmark were used as case studies. In developing countries, Thailand and Ghana were used as case studies concerning wastewater management. Wastewater nationwide was discussed and it was noted that, in Zimbabwe various pieces of legislations were put in place in order to enhance management of wastewater. Wastewater disposal or use in developing countries were discussed and it was noted that, most countries in developing nations use poor methods of disposing wastewater as most of wastewater is being disposed in rivers, reservoirs, streams and dams, therefore impacting human health. In addition, water supply management both in developed and developing nations was discussed. The impacts of inadequate water supply and poor wastewater management in Zimbabwe were discussed, as well as sources of water supply which were termed to be surface, groundwater and rain water harvest. Stakeholder participation in water supply and wastewater management came into play, as well as the theories of water supply and wastewater management.

Research methodology was used by the researcher to collect data in a study area, which is Chiredzi town pertaining the topic under study, water supply and wastewater management in urban areas and the impact they pose on human health.

The target population is 3021 which consists of the people who lives in Chiredzi urban. To select the target population the researcher uses sampling techniques and these are stratified, simple random and purposive. The target population comprised of the councilors, CTC management and CTC general employees, Chiredzi General Hospital (CGH) employees, ZINWA employees and householders. From the target population, a sample has to be drawn and this will be the people lives in the low, medium and high densities suburbs of Chiredzi or those who work in Chiredzi town .The total sample size for this research was one hundred (100). To extract data, the researcher, uses both primary and secondary research instruments. Interviews, questionnaires, focus group discussions and observations were used. To test the reliability and validity of the research instruments used, the researcher carried out a pre-test with the residents in Senga-Gweru as well as with the co-students at Midlands State University.

Finally, the researcher seek permission from the authorities in Chiredzi town, and the town secretary grant the permission for a research study to be carried out in Chiredzi urban. Out of a sample size of one hundred (100) people, seventy-seven (77) respondents managed to respond. The response rate for the research was 77%. The research findings of the research were presented using tables, narratives, graphs, pictures and charts. The research findings shows that, water is a challenge in Chiredzi town and water borne diseases are rampant in the town thereby impacting human health mostly of the disabled and toddlers and wastewater have been seen to be managed poorly and sewers are seen flowing in streets and wastewater is not being recycled and this contributed to water shortages as wastewater is let go into Chiredzi river. The findings also indicates that many factors are contributing to in adequate water supply and poor wastewater management and these were said to be lack of resources both financial and human, lack of equipment and infrastructure, corruption were funds are used for personal gains.

5.2 Conclusions

The topic under study was carried out in Chiredzi town and the topic being, "water supply and wastewater management in urban areas and the impact they pose on human health". After data

was collected, interpreted and analyzed, the researcher draw the following conclusions towards water supply and wastewater management and the impact they pose on human health in Chiredzi town.

- The research findings shows that, a number of people in Chiredzi town are not educated enough to know what is meant by the terms water supply and wastewater management, therefore it will be hard to manage these services if they do not know what it is.
- The researcher found out that, lack of equipment, lack of skilled labor force, lack of finance as well as corruption and political interference are the major causes of in adequate water supply as well as poor wastewater management in Chiredzi town. Other natural factors were observed and these includes low rainfall received and very hot conditions which caused water sources to dry, thereby causing water shortages in the town.
- Research found that, water borne diseases are reported in Chiredzi town and the mainly reported diseases are bilharzia, diarrhea, typhoid, dysentery and cholera, bilharzia and diarrhea being the most reported ones. All these diseases reported shows the impact caused by in adequate and poor wastewater management on human health.
- The research findings indicated that, the diseases mentioned above are the causes of in adequate water supply and poor wastewater management, however there are groups of people which are vulnerable to these diseases and these are the disabled, toddlers, old aged and the teenagers are mostly affected by these diseases.
- The research shows that, water is an important resource and if not found in right amount the people, animals, crops and plants suffers, but research indicates that people will suffer most as water is a necessity and they cannot live without.
- Research findings indicates that, water tanks used to restore treated water in Chiredzi are not enough to supply the demanding population as well as the water pipes used to deliver water to users are too small and this cause residents to opt for unsafe drinking water sources such as un protected wells, hence impacting their health.
- Water is in adequate and as a result it is being opened late in the night at two o'clock in the morning while most of the people are sleep, therefore benefiting only few people and

this caused people not to pay for water charges because they are not getting the water they pay for.

- Chiredzi Town Council has contracted Hippo Valley to treat its water and as a result, they will have to comply with the water that Hippo Valley delivers and any inconvenience faced by Hippo Valley it will impact CTC too.
- The research findings shows that, the drainage system in Chiredzi town have blocked long back and they are not functioning and this causes, wastewater produced from industries and homes to flow in the streets, impacting human health.
- Stakeholders who are helping the council, helps in other service provision such as health provision, refuse collection and roads maintenance, rather than the topic under study which is water supply and wastewater management.
- The council does not have funds to maintain its wastewater ponds, water tanks and water pipes and this caused the problems to continuously take place.

5.2 Recommendations

After data interpretation and analyses have been made, the researcher suggest solutions or recommendations which Chiredzi Town Council and ZINWA which represent the ministry of environment, water and climate can apply in order to do away with challenges faced by in adequate water supply and poor wastewater management. The recommendations made were based on the data obtained from the respondents and observations.

5.2.1 Cut Costing

Chiredzi Town Council should try by all means to cut unnecessary costs which they incur, which contributed to in efficiency and in effective of service provision. By getting water through another consumer and let Hippo Valley treat its water, the council is facing double tragedy in costs as the water supplier ZINWA charges a certain amount and Hippo Valley which treat the water also charges the council for treated water. Therefore, the council should try and get water straight from ZINWA and treat for themselves, as well as construct their own water treatment plant (WTP) and manage their own water.

5.2.2 Strict Supervision and monitoring

CTC should enforce strict supervision on its employees and ensure that work is done unto perfection. The supervision and monitoring should be enhanced towards the departments which deals with water supply and wastewater and those departments which are impacted by in effective and inefficiency of these services. A number of burst water pipes and wastewater blockages are reported in the early hours of the day and also in the late hours of the day, thus before the working hours have commenced and also after the working hours have completed, therefore the council should have workers on standby who only wait to attend to these issues. The council officials should also monitor the complaint book and make sure that all complaints are attended in time, so as to deal with water loss. On the other hand, ZINWA to monitor the flow of water when it is channeled from the dams to Chiredzi to avoid water obstructers, spillage and water loses

5.2.3 Enhance stakeholder participation and allow them to participate.

Stakeholders participation is a key figure in the service provision and for better service provision, CTC should allow stakeholders to participate. One of the key stakeholders CTC can engage are the communities, this is a key stakeholder in service provision because they are the one who are affected by the service provided by the council. Therefore, the council should engage them and hear where need to be improved pertaining water supply and wastewater. Other stakeholders, for example Non-Governmental Organizations (NGOs) can help the council with ideas and finance so that service provision can be improved in the town.

The council should also do participatory budgeting were communities and various stakeholders are consulted before the budget is finalized and this encourage the stakeholders to air out what areas they thought need attention in their area so that, it may be included in the budget of the council. Research shows that, women are the most vulnerable as most of them are housewives at home and hence all the water shortages and wastewater(sewer blockages) affect them more rather than men who spend most of their time at work, therefore women should also be in cooperated in the budget formulation and ensure they participate in water resources management.

5.2.4 Limit Political Interference

Several times it shall be noted that, political interference limit service provision. International organizations and NGOs who want to help the council can feel restricted if political interference is so much as this can disturb the operations of the well-wishers. The council should let NGOs do their work and operate freely without interference from policies and laws which inconvenience the operations of these well-wishers. A number of organizations who wants to help the council in service provision pulls out due to forces from the politicians and strict laws which caused them not to operate freely.

5.2.5 Motivate Employees

Service provision is down at times as the workers themselves are reluctant to work without the supervision of their bosses. The fact that, workers have backlog in their salaries caused them to work without the love for their work, therefore the Human Resources department in the council should see to it that the workers are happy both at work and at home and this can be done through ensuring that, at work workers have enough safety and they have a good working environment. Workers should be given salary increment, bonuses, rewards and performance appraisal where necessary. Employee of the month and the best disciplined employee should be exercised as this improves performance of employees as well as improving service provision, as employees will work wholeheartedly so as for them to get rewards and by doing so they will be enhancing good service provision in town.

5.2.6 Seek Financial Assistance (Banks , Donors)

Research findings indicate that, water tanks, water pipes, sewer pipes and drainage systems in Chiredzi needs to be revived as they old and some too small to capacitate the growing population in Chiredzi town. For all these facilities to be improved they need funds and therefore, CTC need to source and seek financial assistance from well-wishers, banks and donors so as to get funds to upgrade all relevant infrastructure which enables water supply and wastewater management. Upgrading of water tanks, water pipes and sewer pipes needs funds and CTC can only be able to get funds through seeking funds mainly meant to revive the water and sanitation in the area. CTC needs its water treatment plant (WTP) so that it will be able to treat adequate water for its

population and also use the funds which are used to pay the organization which treat water and it will be used for other activities. The town is experiencing water shortages because the wastewater is being let go and no recycling of water is being done and for the council to curb this water which is let go, it needs to treat wastewater so that it will be of good use again and this needs a good functioning wastewater treatment plant (WWTP).

In some areas, for example Tshovani residential area, there is need for construction of new sewer lines as well as new water pipes which accommodate the increasing population. The pipes in other places of Chiredzi town were constructed when the town was established in the late 19th century and since then there was no refurbishment of these pipes up to date and the population has increased causing pressure on sewer pipes, hence they burst on a daily basis. Therefore, for all this to be done, it needs funds and the council should seek financial help from banks, donors and other well-wishers, so as to improve on water supply and wastewater management.

5.2.7 Ensure that more reservoirs are put in place

CTC should ensure that, more water reservoirs are put in place in order to curb water shortages in the town of Chiredzi. Water is being channeled from the water storage tanks to the residents and there is no other storage point which encourage all residents to get water in good amounts. Therefore, the council should see to it that water storage tanks are situated on a central point so that water can be channeled from that area to all residents and this position was seen to be at Chitsanga Hall where water tanks to receive water can be plotted and the water will be distributed from this point to areas for example Makondo where water is not reaching. Therefore, this can ensure that, water is supplied evenly to all residents. The ministry of environment, water and climate to see to it that, inland dams are situated in the district to avoid water shortages especially in summer when the temperatures are high.

5.2.8 Ensure that there is good relations between the community and CTC

The council should ensure there is good relations between the community and themselves. Formal communication between the two shall be used as these two have something in common, while the other is a service provider, the other one pays for the service provided. If the relations between the council and the residents is good it will be easy for the council to encourage the

residents to pay for their rates in time and if rates are being paid in time, revenues will be raised and service provision will be improved. The two can reach a consensus on the amount of rates to be paid on water, sewer management and other crucial services and the council can revise the rates and ensure that they are affordable to everyone. Methods of payment in these harsh economic conditions can be agreed and thus paying rates using Eco cash, bank transfers and also paying in instalments and this will help the council to raise funds which enables them to improve water supply and wastewater management. The council can also improve on their point of paying or delegate some members of the community to act as agents in collecting rates and this will improve the revenue base of CTC.

5.2.9 Engage in Public Private Partnerships (PPPs) and Contacting Out.

In order for CTC to improve on their service provision, they can engage in PPPs, by this the council can involve private companies to help them out as well as other public organizations which are financially stable and work with them in ensuring that water supply and wastewater management is achieved. For water facilities to be improved, there is need of funds and most privately owned organizations are financially stable and therefore they can help the council. The council can use good approaches to engage these private organizations as well other public organizations and the most seem to be the appropriate method is through meetings and workshops and these meetings and workshops should be attended by people with skills so as to convince other players to work with the council.

Contracting out is another way council should use pertaining issues to do with construction, that is the WTP and WWTP and the council they contract out other organizations who are financially strong to construct the water treatment plant and the wastewater treatment plant on behalf of the council and the council will pay the organization later. The council can also apply built on operate transfer (BOOT) and this imply that the hired organization can construct the water works of the council and operate until it recover the injected funds and let the council operate.

5.2.10 Educate residents on Water Resource Management (WRM)

The council can embark on educating the residents about WRM, and this will help the communities to deal with little water provided and also help water to be conserved and managed

properly. If the water users are educated on the importance of water they will use water wisely and even parents will ensure that their children do not play with water, thereby conserving resources. Most residents did not know the importance of water and they use water reluctantly and also being wasteful.

In addition, the council can also encourage communities to embark on income generating projects which are aimed at improving water resources management in their area of jurisdiction.

5.3 Areas for future research

When the researcher was carrying out the study, the following areas were observed to be crucial for future research and some of these are in line with the topic under study while some of them were parallel to the study topic but crucial in enhancing a viable and well-functioning local authority. The following areas were considered to be areas of future research by the researcher and these are: water resources management in urban areas, water and sanitation in Zimbabwean local authorities, water conflicts in peripheral zones of Chiredzi district. The researcher highlighted other areas of research which are different to the topic under study but and these are effectiveness of community participation in the mitigation of disasters (drought) in resettlement areas, effectiveness of stakeholders in refuse collection, the impact of results based management in service provision in urban local authorities, the effectiveness of leadership styles in service provision.

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APPENDICES

Department of Local Governance Studies

Private Bag 9055

Gweru, Zimbabwe

Introduction

My name is Blessing Mauro an undergraduate student from Midlands State University currently studying towards the completion of a BSc Honours Degree in Local Governance Studies. I am undertaking a research titled, ***"Water supply and wastewater management in urban areas and the impact they pose on human health. The case of Chiredzi town".*** The success of this research depends on your response and participation, therefore your cooperation will be greatly appreciated. Feel free to participate and complete the following questionnaire as your responses will be only used for academic purposes and your responses will be confidential, they will not be disclosed to anyone.

Appendix I: Questionnaire for Residents in Chiredzi urban.

Instructions

- Do not write your name or any other person's name in this questionnaire.
- Please tick [√] where applicable.
- Write your responses in the spaces provided and be eligible.
- Answer all questions.

Section A: Socio-demographic

1. **Sex** Male [ ] Female [ ]
2. **Age**

Below 18 years [ ] 18-30 years [ ] 31-49 years [ ] 50-60 years [ ] 60+ [ ]

3. **Level of Education**

Below ZJC [ ] ZJC [ ] 'O' Level [ ] 'A' Level [ ] Certificate [ ] Diploma [ ]

Degree [ ] Masters and above [ ]

4. **How long have you been staying or working in Chiredzi Town**

0-5 years [ ] 6-10 years [ ] 11-15 years [ ] 16-20 years [ ] Over 20 years [ ]

5. **How people live at your house?**

1-5 people [ ] 6-10 people [ ] other (specify)……

Section B: Water supply and wastewater management and the impacts they pose on human Health.

6. **Are there any water borne diseases prevalence in your area?**

Yes [ ] No [ ] Not Sure [ ]

(a) If yes, state the most prevalent water borne disease.

Diarrhea [ ] Typhoid [ ] Dysentery [ ] Cholera [ ] Bilharzia [ ] Other

(Specify)…….

7. How frequently do you report or experience these water borne diseases

Weekly [ ] after two weeks [ ] Monthly [ ] Yearly [ ] other (Specify)……

8. Is there any decrease in the prevalence of water borne diseases in the area for the past ten years?

Slight [ ] Moderate [ ] High [ ] other (specify)……..

9. Are there any stakeholders helping the council in water supply and waste water management? Yes [ ] No [ ] Not sure [ ].

(a) If yes, which of the following stakeholders is most vibrant in helping in the management of water supply and wastewater?

UNICEF [ ] PLAN [ ] World vision [ ] Government departments [ ]

Community [ ] Other (Specify)……

(b) How are these stakeholders helping out in the water supply and wastewater management?

Provide finance [ ] Provide resources [ ] Skilled Labor [ ]

Other (Specify)……..

Section C: Council's perspective towards service provision.

10. How frequently do you get safe drinking water running out of your taps?

Daily [ ] after a week [ ] after two weeks [ ] after a month [ ]

Other (specify)……

11. How long does the council take before attending to a burst water pipe?

1-6 hours [ ] 7-12 hours [ ] 13-18 hours [ ] 19-24 hours [ ] 24+ [ ]

12. How long does the council take before coming to attend to overflowing wastewater

1-7 days [ ] 8-14 days [ ] 15 days-21 days [ ] Other (Specify)…….

13. How frequently does the water treatment plant in Chiredzi maintained?

After 7 days [ ] after 14 days [ ] Monthly [ ] Other (Specify) ……..

14. How frequently does the wastewater treatment plant maintained.

After 7 days [ ] after 14 days [ ] Monthly [ ] Other (Specify) ……..

15. When was the last time you witness the water tanks and pipes maintained?

5 Years ago [ ] 10 years ago [ ] 15 years ago [ ] Other (Specify)……

16. When was the last time, the wastewater treatment site maintained?

5 years ago [ ] 10 years ago [ ] 15 years ago [ ] Other (Specify)……

Section D: Residents' perspective towards service provision.

17. What is the response of the Town Council to the blockages after the report has been laid.

Poor [ ] Average [ ] Good [ ] Excellent [ ]

18. How often do you pay your water bills to the CTC?

Every month [ ] every two months [ ] every three months [ ] Never [ ] other (Specify)……..

19. What challenges do you face in paying for services that is water and wastewater management?

Distance to the offices [ ] Non-updated balances [ ] the council's reluctance to Have follow ups [ ] Other (Specify)……..

20. What solutions can you give CTC in order for it to improve service provision in water supply and wastewater?

……

……

Thank you for your time in completing this questionnaire,
It is highly appreciated.

Department of Local Governance Studies

Private Bag 9055

Gweru, Zimbabwe

Introduction

My name is Blessing Mauro an undergraduate student from Midlands State University currently studying towards the completion of a BSc Honours Degree in Local Governance Studies. I am undertaking a research titled, ***"Water supply and wastewater management in urban areas and the impact they pose on human health. The case of Chiredzi town".*** The success of this research depends on your response and participation, therefore your cooperation will be greatly appreciated. Feel free to participate and complete the following questionnaire as your responses will be only used for academic purposes and your responses will be confidential, they will not be disclosed to anyone.

Appendix II: Questionnaire for Chiredzi Town Council health department employees and the Chiredzi General Hospital employees.

Instructions

- Do not write your name or any other person's name in this questionnaire.
- Please tick [√] where applicable.
- Write your responses in the spaces provided and be eligible.
- Answer all questions

Section A- Socio-demographic

1. **Sex** Male [ ] Female [ ]
2. **Age**

Below 18 years [ ] 18-30 years [ ] 31-49 years [ ] 50-60 years [ ] 60+ years [ ]

3. **Level of Education**

Below ZJC [ ] ZJC [ ] 'O' Level [ ] 'A' Level [ ] Certificate [ ] Diploma [ ]

Degree [ ] Masters and above [ ]

4. **How long have you been working in Chiredzi Town**

0-5 years [ ] 6-10 years [ ] 11-15 years [ ] 16-20 years [ ] Over 20 years [ ]

Section B- Understanding water supply and wastewater management.

5. **What do you understand by the term water supply?**
   - Is the provision of water by public utilities, commercial organizations, community endeavours or by individuals usually via a system of pumps pipes? [ ]
   - Is when water reaches the consumers and in the right amount. [ ]

- Not sure [ ]
- Other (Specify)…….

6. What do you understand by the term waste water management?

- Is water which comes from ordinary living process bathing, toilet flashing, laundry, dish washing and in other terms it comes from the residential, domestic and industrial sources. [ ]
- Is defined as a combination of one or more of, domestic effluent consisting of black water urine and faecal sludge and grey water. [ ]
- Not sure [ ]
- Other (Specify)…….

7. Is there effective water supply in Chiredzi town? Yes [ ] No [ ] Not Sure [ ]

(a) If **no** explain how the water supply is…….....

……

8. Is there effective wastewater management in Chiredzi town? Yes [ ] No [ ] Not Sure [ ]

(a) If **no** explain how the wastewater management is ……

……

9. Which is the most type of wastewater affecting lives in Chiredzi town?

Industrial wastewater [ ] Commercial wastewater [ ] Domestic wastewater [ ] Storm water runoff [ ]

Section C: Water supply and wastewater management and the impacts they pose on human health.

10. Are there any water borne diseases prevalence in the area?

Yes [ ] No [ ] Not Sure [ ]

(a) If yes, state the most prevalent water borne disease.

Diarrhea [ ] Typhoid [ ] Dysentery [ ] Cholera [ ] Bilharzia [ ] Other (Specify)…….

11. How frequently do you report or experience these water borne diseases?

Weekly [ ] after two weeks [ ] Monthly [ ] Yearly [ ]
Other (Specify)……..

12. Is there any decline in the prevalence of water borne diseases in the area for the past ten years?

Slight [ ] Moderate [ ] High [ ] other (specify)…….

13. What do you think is mostly affected by poor waste supply and waste water management?

People [ ] Plants and crops [ ] Land [ ] other ……..**.....**

(a) **Give the reason for your answer above**……

14. Which group of people is mostly affected by water borne diseases?

Toddlers [ ] Teenagers [ ] Disabled [ ] Old aged people [ ]

Other (Specify) ……

15. What do you think can be done to reduce these water borne diseases.

Ensure that people have safe drinking water [ ]

Provide chemicals to treat water [ ]

Hold campaigns to educate people on cleanliness and health environment [ ]

Other (specify)……

16. Have you ever witnessed the following as the effects of shortage of water supply?

	Yes	**No**	**Not sure**
Death of people	[ ]	[ ]	[ ]
Shortage of food	[ ]	[ ]	[ ]
Insufficient water for domestic use	[ ]	[ ]	[ ]
Death of plants/crops	[ ]	[ ]	[ ]
Resettlement	[ ]	[ ]	[ ]

(a) **If there is any impact/s please specify**……..

17. What solutions can you give CTC in order for it to improve service provision in water supply and wastewater?

……

……

Thank you for your time in completing this questionnaire,
It is highly appreciated.

Department of Local Governance Studies

Private Bag 9055

Gweru, Zimbabwe

Introduction

My name is Blessing Mauro an undergraduate student from Midlands State University currently studying towards the completion of a BSc Honours Degree in Local Governance Studies. I am undertaking a research titled, ***"Water supply and wastewater management in urban areas and the impact they pose on human health. The case of Chiredzi town".*** The success of this research depends on your response and participation, therefore your cooperation will be greatly appreciated. Feel free to participate and complete the following questionnaire as your responses will be only used for academic purposes and your responses will be confidential, they will not be disclosed to anyone.

Appendix III: Questionnaire for CTC general employees

Instructions

- Do not write your name or any other person's name in this questionnaire.
- Please tick [√] where applicable.
- Write your responses in the spaces provided and be eligible.
- Answer all questions.

Name of Department……..

Section A- Socio-demographic

1. **Sex** Male [ ] Female [ ]
2. **Age**

Below 18 years [ ] 18-30 years [ ] 31-49 years [ ] 50-60 years [ ] 60+ years [ ]

3. **Level of Education**

Below ZJC [ ] ZJC [ ] 'O' Level [ ] 'A' Level [ ] Certificate [ ] Diploma [ ]

Degree [ ] Masters and above [ ]

4. **How long have you been working for your organization.**

0-5 years [ ] 6-10 years [ ] 11-15 years [ ] 16-20 years [ ] Over 20 years [ ]

Section B: Council's reaction towards service provision in Chiredzi Urban.

5. **How long is council's reaction time before attending to a burst water pipe?**

1-6 hours [ ] 7-12 hours [ ] 13-18 hours [ ] 19-24 hours [ ] 24 hours and above……

6. How long is council's reaction time before attending to overflowing wastewater?

1-7 days [ ] 8-14 days [ ] 15 days-21 days [ ] Other (Specify)…….

7. How frequently is the water supply systems in your area maintained?

After 7 days [ ] after 14 days [ ] Monthly [ ] Other (Specify) ……..

8. How frequently does the wastewater treatment plant maintained.

After 7 days [ ] after 14 days [ ] Monthly [ ] Other (Specify) ……..

9. When was the last time water tanks and pipes maintained?

5 years ago [ ] 10 years ago [ ] 15 years ago [ ] Other (Specify)……

10. When was the last time wastewater treatment plant maintained?

5 years ago [ ] 10 years ago [ ] 15 years ago [ ] Other (Specify)……

11. What is the response of the Management to the blockages after the report has been laid.

Poor [ ] Average [ ] Good [ ] Excellent [ ]

12. Are there any chances that CTC can improve its water supply and wastewater management?

Slightly [ ] Moderate [ ] High [ ] Never [ ] Other (Specify)……

13. What do you think are the causes of poor water supply and wastewater management?

Corruption [ ] Lack of finance [ ] Lack of Labor [ ] Lack of equipment [ ]
Other (specify)…….

14. Are there any stakeholders helping the council in water supply and waste water management?

Yes [ ] No [ ] Not sure [ ].

(a) If yes, which of the following stakeholders is most vibrant in helping in the management of water supply and wastewater?

UNICEF [ ] PLAN [ ] World vision [ ] Government departments [ ]
Community [ ] Other (Specify)……

(b) How are these stakeholders helping out in the water supply and wastewater management?

Provide finance [ ] Provide resources [ ] Skilled Labor [ ]
Other (Specify)……..

15. What solutions can you give CTC in order for it to improve service provision in water supply and wastewater?

……
……

Thank you for your time in completing this questionnaire,
It is highly appreciated.

Department of Local Governance Studies

Private Bag 9055

Gweru, Zimbabwe

Introduction

My name is Blessing Mauro an undergraduate student from Midlands State University currently studying towards the completion of a BSc Honours Degree in Local Governance Studies. I am undertaking a research titled, ***"Water supply and wastewater management in urban areas and the impact they pose on human health. The case of Chiredzi town".*** The success of this research depends on your response and participation, therefore your cooperation will be greatly appreciated. Feel free to participate and complete the following questionnaire as your responses will be only used for academic purposes and your responses will be confidential, they will not be disclosed to anyone.

Appendix IV: Questionnaire for ZINWA employees

Section A- Socio-Demographic

Instructions

- Do not write your name or any other person's name in this questionnaire.
- Please tick [√] where applicable.
- Write your responses in the spaces provided and be eligible.
- Answer all questions

Section A- Socio-demographic

1. **Sex** Male [ ] Female [ ]
2. **Age**

Below 18 years [ ] 18-30 years [ ] 31-49 years [ ] 50-60 years [ ] 60+ years [ ]

3. **Level of Education**

Below ZJC [ ] ZJC [ ] 'O' Level [ ] 'A' Level [ ] Certificate [ ] Diploma [ ]

Degree [ ] Masters and above [ ]

4. **How long have you been working in ZINWA.**

0-5 years [ ] 6-10 years [ ] 11-15 years [ ] 16-20 years [ ] Over 20 years [ ]

Section B- Understanding water supply and wastewater management.

5. **What do you understand by the term water supply?**
   - Is the provision of water by public utilities, commercial organizations, community endeavours or by individuals usually via a system of pumps pipes? [ ]
   - Is when water reaches the consumers and in the right amount. [ ]
   - Not sure [ ]
   - Other (Specify)…….
6. **What do you understand by the term wastewater?**
   - Is water which comes from ordinary living process bathing, toilet flashing, laundry, dish washing and in other terms it comes from the residential, domestic and industrial sources. [ ]
   - Is defined as a combination of one or more of, domestic effluent consisting of black water urine and faecal sludge and grey water. [ ]
   - Not sure [ ]
   - Other (Specify)…….
7. **How frequently do you supply water to Chiredzi Town?**

Daily [ ] after every 7 days [ ] after 14 days [ ] Monthly [ ] other (specify)….
……..

8. **What is the nature of the water you supply to the consumers in Chiredzi Town?**

Raw water [ ] Treated water [ ] Untreated water [ ]
Other (specify)…….

9. **Do you sometimes face challenges in supplying water to the consumers?**

Yes [ ] No [ ] Not sure [ ]
(a). **If Yes, justify what could be the reason for the challenges**…….
……

10. **In case of water crisis, how do you ration water?**

Limit the mega litres [ ] Cut supply of water [ ] only supply water for domestic use
[ ] Other (specify)…….

11. **Which method do you use to transport water from its sources to the water users?**

River [ ] Canal [ ] Drains [ ] Pipes [ ] other (specify)…….

a. **Why do you use the method selected above** It is cheap [ ] Affordable [ ] Less Loss of water [ ] other (specify)……..

12. **How effective is the method used to transport water in (11)**.

Low [ ] medium [ ] high [ ] very high [ ] other (specify)…….

13. **Are there any water shortages in Chiredzi Town?** Yes [ ] No [ ] Not sure [ ]

a. **What is the cause of water shortages in Chiredzi Town?**

Lack of finance [ ] Lack of labor [ ] Lack of infrastructure (dams) [ ] Corruption [ ] Other (specify)…….....

14. Are there any stakeholders involved in the provision and management of water and Wastewater in Chiredzi. Yes [ ] No [ ] Not sure [ ]

a. If yes, which of the following is most vibrant in helping in the management of water and wastewater? UNICEF [ ] PLAN [ ] Associations [ ] Communities [ ]
Other (specify)…….

15. How long does you take before attending a burst water pipe?
0-6 hours [ ] 6-12 hours [ ] 12-18 hours [ ] 18-24 hours [ ] others (specify)

……

16. **Have you ever witness water borne diseases in Chiredzi Town.** Yes [ ] No [ ] Not sure [ ]

a. **If yes, which is the most prevailing one.** Bilharzia [ ] Diarrhea [ ] Typhoid [ ] Dysentery [ ] Cholera [ ].

17. **Which method do you use mostly for water users to pay for water?** Cash [ ] Eco cash [ ] Bank Transfer [ ] other (specify)……
18. **Are water users willing to pay for water used?** Yes [ ] No [ ] Not sure [ ]
a. **If no, what are the strategies put in use to ensure that they pay**……

……

19. **As the water authorities, what measures can you put in place to ensure that problems of water are solved in Chiredzi Town?**……
…….

Thank you for your time in completing this questionnaire,
It is highly appreciated.

Department of Local Governance Studies

Private Bag 9055

Gweru, Zimbabwe

Introduction

My name is Blessing Mauro an undergraduate student from Midlands State University currently studying towards the completion of a BSc Honours Degree in Local Governance Studies. I am undertaking a research titled, ***"Water supply and wastewater management in urban areas and the impact they pose on human health. The case of Chiredzi town".*** The success of this research depends on your response and participation, therefore your cooperation will be greatly appreciated. Feel free to participate and complete the following questionnaire as your responses will be only used for academic purposes and your responses will be confidential, they will not be disclosed to anyone.

Appendix V: Questionnaire for CTC Management and Councilors

Instructions

- Do not write your name or any other person's name in this questionnaire.
- Please tick [√] where applicable.
- Write your responses in the spaces provided and be eligible.
- Answer all questions.

Position held in an organization……

Section A- Socio-demographic

1. **Sex** Male [ ] Female [ ]
2. **Age**

Below 18 years [ ] 18-30 years [ ] 31-49 years [ ] 50-60 years [ ] 60+ years [ ]

3. **Level of Education**

Below ZJC [ ] ZJC [ ] 'O' Level [ ] 'A' Level [ ] Certificate [ ] Diploma [ ]

Degree [ ] Masters and above [ ]

4. **How long have you been working for your organization.**

   0-6 years [ ] 6-10 years [ ] 11-15 years [ ] 16-20 years [ ] Over 20 years [ ]

5. **What do you think is the cause for ineffective and inefficiency water supply and wastewater management in Chiredzi urban?**

Lack of finance [ ] Shortage of Labor [ ] Lack of resources [ ] Corruption [ ]
Other (Specify)……

6. **What do you think need more attention for CTC to improve on water supply and wastewater management?**

Finance [ ] Infrastructure [ ] Human Resource [ ] Binding Laws [ ]

Other (specify)…….

7. **Are there any stakeholders helping the council in water supply and waste water management?** Yes [ ] No [ ] Not sure [ ].
   (a) If yes, which of the following stakeholders is most vibrant in helping in the management of water supply and wastewater?

UNICEF [ ] PLAN [ ] World vision [ ] Government departments [ ]
Community [ ] Other (Specify)……

8. **How are these stakeholders helping out in the water supply and wastewater management?**

Provide finance [ ] Provide resources [ ] Skilled Labor [ ]
Other (Specify)……..

9. **How do you identify stakeholders to work with in water supply and wastewater management?**

Approach those with resources [ ]
Willing stakeholders approach us [ ]
Approach stakeholders involved in water and sanitation [ ]
Not Sure [ ]

10. Which methods do you use to engage various stakeholders in the management of water and wastewater?

	Yes	**No**		**Yes**	**No**
Meetings	[ ]	[ ]	Emails	[ ]	[ ]
Facebook	[ ]	[ ]	Whatsapp	[ ]	[ ]
Newsletter	[ ]	[ ]	Workshop	[ ]	[ ]

a. Of **the above methods, which one is the mostly used to engage stakeholders?**
……

11. Why do you engage stakeholders?

	Yes	**No**	**Not Sure**
To inform them	[ ]	[ ]	[ ]
To consult them	[ ]	[ ]	[ ]
To involve them	[ ]	[ ]	[ ]
To empower them	[ ]	[ ]	[ ]
To collaborate them	[ ]	[ ]	[ ]
To get resources	[ ]	[ ]	[ ]

12. What benefits do you get from engaging various stakeholders in managing water and wastewater?

Resources [ ] Knowledge/Skills [ ] Improved Decision Making [ ] Nothing [ ]

Other (Specify) ……..

13. Do you have enough resources required to manage water and wastewater in Chiredzi town? Yes [ ] No [ ]

a. If No, explain how you manage water supply and wastewater.

Contracting out [ ] Sourcing resources [ ] Borrowing resources [ ]

Other (specify)……

14. Did you at some time experience severe water supply shortages? Yes [ ] No [ ]

a. If Yes, state the year…….

15. Are there any water borne diseases prevalence in the area? Yes [ ] No [ ] Not Sure [ ]

(a) If yes, state the most prevalent water borne disease.

Diarrhea [ ] Typhoid [ ] Dysentery [ ] Cholera [ ] Bilharzia [ ]

Other (Specify)……

16. How frequently do you report or experience these water borne diseases

Weekly [ ] after two weeks [ ] Monthly [ ] Yearly [ ] other (Specify)……..

17. Is there any decline in the prevalence of water borne diseases in the area for the past ten years?

Slight [ ] Moderate [ ] High [ ] other (specify)……..

18. What do you think is mostly affected by poor waste supply and waste water management?

People [ ] Plants and crops [ ] Land [ ] other …….....

(a) **Give the reason for your answer above**……

19. Which group of people is mostly affected by water borne diseases?

Toddlers [ ] Teenagers [ ] Disabled [ ] Old aged people [ ]

Other (Specify) ……

20. What do you think can be done to reduce these water borne diseases.

Ensure that people have safe drinking water [ ]
Provide chemicals to treat water [ ]

Hold campaigns to educate people on cleanliness and health environment [ ]

Other (specify)……

21. What solutions can you give CTC in order for it to improve service provision in water supply and wastewater?

…….
…….

Thank you for your time in completing this questionnaire,
It is highly appreciated.

Department of Local Governance Studies
Private Bag 9055

Gweru, Zimbabwe

Introduction

My name is Blessing Mauro an undergraduate student from Midlands State University currently studying towards the completion of a BSc Honours Degree in Local Governance Studies. I am undertaking a research titled, ***"Water supply and wastewater management in urban areas and the impact they pose on human health. The case of Chiredzi town".*** The success of this research depends on your response and participation, therefore your cooperation will be greatly appreciated. Feel free to participate as your responses will be only used for academic purposes and your responses will be confidential, they will not be disclosed to anyone.

Appendix VI: Interview guide for the Chiredzi Town Engineer.

Date of Interview……**Start time** ……..**End time**……..

Place (where the interview was held)…….

1. What do you understand by the term water supply and wastewater management?
2. How frequently does council service water pipes and maintain wastewater disposal sites.
3. How frequently do you supply water to the water users and how much are the water charges.
4. What do you think could be the causes of in adequate water supply in Chiredzi urban
5. How frequently do you experience wastewater blockages in the area?
6. How long does it takes before the council attend to blockages or burst water pipes has been attended?
7. How frequently do you maintain water storage tanks?
8. What do you have in mind to solve the challenges of in adequate water supply and poor wastewater management?

Thank you for your time, really appreciate

Department of Local Governance Studies
Private Bag 9055

Gweru, Zimbabwe

Introduction

My name is Blessing Mauro an undergraduate student from Midlands State University currently studying towards the completion of a BSc Honours Degree in Local Governance Studies. I am undertaking a research titled, ***"Water supply and wastewater management in urban areas and the impact they pose on human health. The case of Chiredzi town".*** The success of this research depends on your response and participation, therefore your cooperation will be greatly appreciated. Feel free to participate as your responses will be only used for academic purposes and your responses will be confidential, they will not be disclosed to anyone.

Appendix VII: Interview guide for the Chiredzi Town Council Health Director.

Date of Interview……Start time ……..End time……..

Place (where the interview was held)…….

1. What do you understand by the term water supply and wastewater management?
2. What are the diseases that have been affecting the area for the past ten years in relation to water supply and wastewater?
3. Which diseases are mostly reoccurring due to poor water supply and wastewater management?
4. How often are the diseases reported when there are no wastewater blockages and water shortages.
5. What are the water borne diseases affecting the town?
6. How frequently do you report or experience water borne diseases and what will be your response?
7. What do you think can be done to reduce the spread of water borne diseases in relation to water supply and wastewater management?
8. As the health department, what have you done to reduce the diseases caused by poor water supply and wastewater management?
9. How your relationship with other health institutions is like and how do help each other in tackling the diseases affecting the town.
10. How do you engage other health institutions to counter attack problems associated with water supply and wastewater?
11. What do you have in mind to solve the challenges of in adequate water supply and poor wastewater management?

Thank you for your time, really appreciate

Department of Local Governance Studies

Private Bag 9055

Gweru, Zimbabwe

Introduction

My name is Blessing Mauro an undergraduate student from Midlands State University currently studying towards the completion of a BSc Honours Degree in Local Governance Studies. I am undertaking a research titled, ***"Water supply and wastewater management in urban areas and the impact they pose on human health. The case of Chiredzi town".*** The success of this research depends on your response and participation, therefore your cooperation will be greatly appreciated. Feel free to participate as your responses will be only used for academic purposes and your responses will be confidential, they will not be disclosed to anyone.

Appendix VIII: Interview guide for the Chiredzi General Hospital Matron.

Date of Interview……Start time ……..End time……..

Place (where the interview was held)…….

1. What do you understand by the term water supply and wastewater management?
2. What are the diseases that have been affecting the area for the past ten years in relation to water supply and wastewater?
3. Which diseases are mostly reoccurring due to poor water supply and wastewater management?
4. How often are the diseases reported when there are no wastewater blockages and water shortages.
5. What are the water borne diseases affecting the town?
6. How frequently do you report or experience water borne diseases and what will be your response?
7. What do you think can be done to reduce the spread of water borne diseases in relation to water supply and wastewater management?
8. As the health department, what have you done to reduce the diseases caused by poor water supply and wastewater management?
9. How your relationship with other health institutions is like and how do help each other in tackling the diseases affecting the town.
10. How do you engage other health institutions to counter attack problems associated with water supply and wastewater?
11. What do you have in mind to solve the challenges of in adequate water supply and poor wastewater management?

Thank you for your time, really appreciate

Department of Local Governance Studies

Private Bag 9055

Gweru, Zimbabwe

Introduction

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Appendix IX: Focus Group Discussions with Works and Engineering Department employees

Name of Organization…….Location……Date……..

Start time……End time……..

Attendance: Male……. Female…… Total……

Questions to be discussed on the focus group discussions.

1. What do you understand by the term water supply and wastewater management?
2. Can you explain what the water supply and wastewater management in Chiredzi is like?
3. How frequently does council service water pipes and maintain wastewater disposal sites.
4. How frequently do you supply water to the water users and what are the amount provided like?
5. What do you think could be the causes of in adequate water supply in Chiredzi urban?
6. How frequently do you experience wastewater blockages in the area?
7. How long does it takes before the council attend to blockages or burst water pipes has been attended?
8. How frequently does the water treatment plant maintained?
9. When was the last time the water tanks and pipes in the area refurbished?
10. When was the last time, the wastewater treatment site maintained?
11. What solutions do you have in mind that will overcome the problems associated with poor water supply and wastewater management?

Thank you for your time, really appreciate

Department of Local Governance Studies
Private Bag 9055

Gweru, Zimbabwe

Introduction

My name is Blessing Mauro an undergraduate student from Midlands State University currently studying towards the completion of a BSc Honours Degree in Local Governance Studies. I am undertaking a research titled, ***"Water supply and wastewater management in urban areas and the impact they pose on human health. The case of Chiredzi town".*** The success of this research depends on your response and participation, therefore your cooperation will be greatly appreciated. Feel free to participate as your responses will be only used for academic purposes and your responses will be confidential, they will not be disclosed to anyone.

Appendix X: Focus Group Discussions with Health Department Employees

Name of Organization…….Location…….Date……..

Start time……End time……..

Attendance: Male……. Female…… Total……

Questions to be discussed on the focus group discussions.

1. What do you understand by the term water supply and wastewater management?
2. Can you explain what the water supply and wastewater management in Chiredzi is like?
3. What are the diseases that have been affecting the area for the past ten years in relation to water supply and wastewater?
4. Which diseases are mostly reoccurring due to poor water supply and wastewater management?
5. How often are the diseases reported when there are no wastewater blockages and water shortages.
6. What are the water borne diseases affecting the town?
7. How frequently do you experience water borne diseases and what will be your response?
8. What do you think can be done to reduce the spread of water borne diseases in relation to water supply and wastewater management?
9. As the health department, what have you done to reduce the diseases caused by poor water supply and wastewater management?
10. How is your relationship with other health institutions like and how do you engage other health institutions to counter attack problems associated with water supply and wastewater.
11. What solutions do you have in mind that will overcome the problems associated with poor water supply and wastewater management?

Thank you for your time, really appreciate

Department of Local Governance Studies

Private Bag 9055

Gweru, Zimbabwe

Introduction

My name is Blessing Mauro an undergraduate student from Midlands State University currently studying towards the completion of a BSc Honours Degree in Local Governance Studies. I am undertaking a research titled, ***"Water supply and wastewater management in urban areas and the impact they pose on human health. The case of Chiredzi town".*** The researcher intends to have a walk in an area of study and have a look or observe the following items mentioned below and this will help the researcher to deduce the situation on the ground.

Appendix XI: Observation Checklist

Items to observe	**Observations**	**Remarks**
	Date/s of observation-…….. Location-…….	
	What observed	
-Taps with rust		
-Burst water pipes		
-Flowing wastewater in streets		
-The size of the water pipes which supply Chiredzi town in relation to population size.		
-The size of the septic tanks in relation to population size and amount of wastewater.		
-The type of materials used at the wastewater treatment plant		
-CWTP and Wastewater ponds as well as the water storage tanks.		

Appendix XII: Introductory Letter

Department of Local Governance Studies

Private Bag 9055

Gweru, Zimbabwe

Tel: (263) 54 227411 Fax: (263) 54 260442

Website: www.msu.ac.zw

TO WHOM IT MAY CONCERN

R.E RESEARCH FOR MAURO BLESSING

My name is **BLESSING MAURO** an undergraduate student from Midlands State University currently studying towards the completion of a BSc Honours Degree in Local Governance Studies. I am undertaking a research titled, ***"Water supply and wastewater management in urban areas and the impact they pose on human health. The case of Chiredzi town".*** The success of this research depends on your response and participation, therefore your cooperation will be greatly appreciated. Feel free to participate in any way as your responses will only be used for academic purposes and your responses will be confidential, they will not be disclosed to anyone.

You may contact me on **+263 777 687 660 / +263 716 908 988**

Yours faithfully

MAURO BLESSING