THE ROLE OF THE MILLENNIUM CHALLENGE CORPORATION COMPACT PROJECT IN IMPROVING EQUITABLE ACCESS TO DOMESTIC WATER IN MTENDERE, LUSAKA ZAMBIA.

BY

MAJORY DIMUNA

A Dissertation Submitted to the University of Zambia, School of Natural Sciences, Department of Geography and Environmental Studies in partial fulfilment for the requirement for the award of a Master of Science Degree in Geography

The University of Zambia

Lusaka

2024

COPYRIGHT

DECLARATION

I **MAJORY DIMUNA**, do hereby declare that this dissertation is my own work and to the best of my knowledge, it has never been produced or submitted at any University for academic purposes. All sources of information used in this study have been duly acknowledged.

Signed…….

Date ……

CERTIFICATE OF APPROVAL

This Dissertation by MAJORY DIMUNA is hereby approved as fulfilling the partial requirements for the award of the degree of Master of Science in Geography of the University of Zambia.

Examiner 1: …… Signature: …….....

Date: ……..…….

Examiner 2: …… Signature: ……

Date: ……..……

Examiner 3: ……..……..……. Signature: ……

Date: ……

Chairperson-

Board of Examiners: ……..… Signature: ……...

Date: ……

Supervisor: Dr. Moses Chisola Signature: ……

Date: ……

Supervisor: Prof. Wilma Nchito Signature: ……

Date: ……

DEDICATION

I dedicate this work to my family for their constant support and blessings throughout the composition of this research project, as well as their hard efforts in my path of life.

ACKNOWLEDGMENT

I express my heartfelt gratitude and appreciation to God Almighty and all those who participated in my study. Special thanks to Dr. Moses Chisola and Prof. Wilma Nchito, my supervisors, who deserve special acknowledgement for their guidance, and professional support.

My Husband Whisper and Children; Chipego, Lushomo, Yaandi and Luumuno deserve my deepest appreciation for their love, support and patience during my studies.

Above all, I would like to express my gratitude to all of my friends and lecturers who, since my first year at the University of Zambia, have influenced me with their knowledge, expertise and understanding.

Last but not least, I owe a debt of gratitude to all residents of Mtendere East and key Informants from LWSC, Area Councilor and Millennium Project Completion Agency who willingly participated in the study.

ABSTRACT

Water is an essential component of life such that its sustainable supply is a global concern. Zambia is one of the developing countries working towards meeting the sustainable development goal number 6 by the year, 2030. The Millennium Challenge Corporation Compact project (MCC) is one of the projects designed towards this goal. The MCC focused on water supply and sanitation infrastructure investment and institutional strengthening in Lusaka, institutions like Lusaka city council and Lusaka water supply and Sanitation Company. This study was conducted to investigate the role of the Millennium Challenge Corporation Compact Project in improving equitable access to domestic water in Mtendere, Lusaka Zambia.

Grounded on the principles of constructivism theory, the study applied a mixed method approach with both qualitative and quantitative analysis through the convergent parallel research design. Stratified sampling method was used to select 170 households from section; 5, 6, 7, 8, and 9 of Mtendere East targeting household heads or available senior household members aged 18 years and above. Purposive sampling method was used to select four key informants; Area Councilor, 2 Officials from Lusaka water supply and sanitation company Mtendere branch, and 1 Official from Millennium Project Completion Agency. Semi-structured researcher administered questionnaires were used to collect data from respondents in Mtendere East while open – ended interview guides were used to collect data from key informants. Qualitative data collected was analyzed using thematic analysis. Quantitative data was analysed using descriptive statistics with the aid of STATA version 14 software and Microsoft Excel.

The study found that before the MCC Compact project, the majority of the respondents used borehole water as their source of domestic water. Before the MCC Compact project, most households in Mtendere East hard no water and sanitation infrastructure. The study found that the current domestic tap - water supply in Mtendere East is considerably adequate with a few challenges of intermittent water supply and water shortage caused by inadequate water infrastructure and minor vandalism in some areas. The study also found that people in Mtendere East perceive the MCC Project to be a success, effective albeit with minor challenges such as higher water bills, water shortages and vandalism of water infrastructure. Residents of Mtendere East, except in section 10, have adequate domestic tap - water supply. The MCC Compact project provided and improved water and sanitation infrastructure though some residents still experience water shortage of which they use water sources such as boreholes and shallow wells. The study proposes that LWSC should conduct timely water and sanitation infrastructure maintenance in Mtendere.

Keywords; Compact project, Domestic, Equitable, Water supply, Infrastructure.

TABLE OF CONTENTS

COPYRIGHT i

DECLARATION ii

CERTIFICATE OF APPROVAL iii

DEDICATION iv

ACKNOWLEDGMENT v

ABSTRACT vi

ABBREVIATIONS xiv

CHAPTER ONE 1

INTRODUCTION 1

1.0 Background 1

1.1 Problem Statement 3

1.2 Aim of the study 3

1.3 Objectives of the study 3

1.4 Research questions 4

1.5 Significance of the study. 4

1.6 Organisation of the study 4

CHAPTER TWO 5

LITERATURE REVIEW 5

2.0. Introduction 5

2.1 Global water supply 5

2.2 Regional water supply 6

2.3 Water supply in Zambia 7

2.4 Household water uses 8

2.5 Household water conservation strategies 10
2.6 Water supply indicators 11
2.7 Evaluation of water supply and sanitation projects. 12
2.7.1 Global evaluation of water supply and sanitation projects. 12
2.7.2 Regional evaluation of water and sanitation projects 13
2.7.3 Evaluation of water supply and sanitation projects in Zambia 13
2.8 Conceptual framework 14

CHAPTER THREE 16
STUDY AREA 16
3.0 Introduction 16
3.1 Description and justification of the study area 16
3.2 Climate 19
3.3 Geology and vegetation 19
3.4 Socio-economic activities 20

CHAPTER FOUR 21
RESEARCH METHODOLOGY 21
4.0 Introduction 21
4.1 Research Design 21
4.2 Population 21
4.3 Sample Size and Sampling procedure 22
4.3.1 Sample Size 22
4.4 Data Collection Methods 23
4.5 Data Analysis 24
3.7 Validity and Reliability 24
3.8 Ethical Considerations 24

3.9 Health Considerations of the Participants 25

CHAPTER FIVE 26

RESULTS 26

5.0 Introduction 26

5.1 Background characteristics 26

5.2 Adequacy of domestic water supply 28

5.2.1 Source of domestic water before the MCC Compact project 28
5.2.2 The current source of domestic water 28
5.2.3 Alternative sources of domestic water when there is no water supply 30
5.2.4 Coping strategies used when there is no tap water supply 31
5.2.5 Storage of domestic water 32
5.2.6 Approximated litres of water stored for consumption 32
5.2.7 Approximate distance to the nearest water source 32
5.2.8 Respondent's perceptions on strategies put in place by LWSC to improve water supply 33
5.2.9 Other stakeholders involved in providing domestic water 34

5.3 Perception of the success of the MCC Compact project 34

5.3.1 Respondents perception on the purpose of the MCC Compact project 35
5.3.2 Perception on water infrastructure 35
5.3.3 Vandalism of water infrastructure 36
5.3.4 Cost of water 37
5.3.5 Perception of the MCC Compact Project 37

5.4 Effectiveness of the MCC Compact water project. 38

5.4.1 Availability of water before and after the MCC Compact project 38
5.4.2 Major causes of intermittent water supply and water shortage 39
5.4.3 Period for intermittent water supply and water shortage 40
5.4.4 Effects of domestic water shortages 40
5.4.5 Effectiveness of domestic water supply. 41
5.4.6 Perception of the Effectiveness of the MCC Compact project 42

CHAPTER SIX 43

DISCUSSION OF RESEARCH RESULTS 43

6.0 Introduction 43

6.1 Assessment of adequate domestic water supply in Mtendere East. 43

6.1.1 Source of domestic water before MCC Compact project 43

6.1.2 Daily sources of domestic water 43

6.1.3 Coping strategies used when there is no tap - water supply 44

6.1.4 Storage and approximated litres of domestic water 45

6.1.5 Approximated distance to the nearest water source 45

6.1.6 Respondents perceptions on strategies put in place by LWSC to improve tap - water supply 45

6.1.7 Other stakeholders involved in providing domestic water 46

6.2 Perception of the success of the MCC Compact project ` 46

6.2.1 Respondents perception on the purpose of the MCC Compact project 46

6.2.2 Perception of water infrastructure, vandalism, adequacy of water and paying for water 46

6.2.3 Frequency of vandalism 47

6.2.4 Perception of the MCC Compact Project 47

6.3 Effectiveness of the MCC Compact water project. 48

6.3.1 Availability of water before and after the MCC Compact project 48

6.3.2 Major causes of intermittent water supply and water shortages 48

6.3.3 Period for intermittent water supply and water shortage 49

6.3.4 Effects of domestic water shortages 49

6.3.5 Effectiveness of domestic water supply. 50

6.3.6 Perception of the Effectiveness of the MCC Compact project 50

CHAPTER SEVEN 52

CONCLUSIONS AND RECOMMENDATIONS 52

7.0 Introduction 52

7.1 Conclusions 52

7.2 Recommendations 53

7.3. Suggestions for future area of the study 54

7.4 Limitations to the study 54

REFERENCES 55

APPENDICES 65

Appendix 1: Work schedule 65

Appendix 2: Budget 66

Appendix 3: Questionnaire to be used to collect data from (participants) residents of 67

Mtendere East. 67

Appendix 4: Interview guide - Lusaka Water supply and Sanitation Company 72

Appendix 5: Interview guide - Mtendere East area councilor. 75

Appendix 6: Interview guide - Millennium project completion Agency. 77

Appendix 7: Approval of the study 79

LIST OF FIGURES

Figure 1: Conceptual framework of water supply indicators. 15
Figure 2: Map of Zambia. 17
Figure 3: Lusaka province. 17
Figure 4: Mtendere East. 18
Figure 5: Mtendere sewer and water connection (water supply and sanitation infrastructure). ... 18
Figure 6: One of the current sources of water supply (Tap - water). 29
Figure 7: One of the current sources of water (Shallow well). 30
Figure 8: One of the alternative sources of water (Borehole). 31
Figure 9: Coping strategies used when there is no Tap - water supply. 31
Figure 10: Approximated distance to the nearest water source. 33
Figure 11: Vandalism of the pipe which takes water to the tap. 36
Figure 12: Period of water shortage. 40
Figure 13: Effects of domestic water shortage. 41

LIST OF TABLES

Table 1: Approximated number of household plots with tap-water connected to LWSC in Mtendere East section 5 to 9. 22
Table 2: Number of respondents per section. 23
Table 3: Sample size and sampling. 23
Table 4: Background characteristics. 27
Table 5: Source of domestic water before MCC Compact project. 28
Table 6: Current source of domestic water supply. 29
Table 7: Alternative sources of domestic water. 30
Table 8: Storage of domestic water. 32
Table 9: Approximated litres of water stored for consumption. 32
Table 10: Respondent's perceptions on strategies put in place by LWSC to improve water supply. 34
Table 11: Other stakeholders involved in providing domestic water. 34
Table 12: Respondents perception on the purpose of the MCC Compact project. 35
Table 13: Perception of water infrastructure. 35
Table 14: Frequency of vandalism 36
Table 15: Cost of water. 37
Table 16: Perception of the MCC Compact project. 38
Table 17: Availability of water before and after MCC. 39
Table 18: Major causes of intermittent water supply and water shortage. 39
Table 19: Effectiveness of domestic water supply after the project. 41
Table 20: Perception of the effectiveness of the MCC Compact project. 42

ABBREVIATIONS

JMP	Joint Monitoring Programme
LWSC	Lusaka Water supply and sanitation Company
UNDESA	United Nations Department of Economic and Social Affairs
UNICEF	United Nations International Children's Emergency Fund
WASH	Water sanitation and hygiene
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development
WM	Water Management Committee.
UNSD	United Nations Statistics Division
MCC	Millennium Challenge Corporation
SDGs	Sustainable Development Goals
GRZ	Government of The Republic of Zambia
MPCA	Millennium Project Completion Agency
JICA	Japan International Cooperation Agency
NWASCO	National water supply and sanitation council
MWDSEP	Ministry of Water Developmental, Sanitation and Environmental Protection
WHSTERP	Water Hygiene Sanitation Transformation for Enhance Resiliency Project
PATH	Program for Appropriate Technology and Health
UNEP	United Nations Environment Programme
WHO	World Health Organisation

CHAPTER ONE

INTRODUCTION

1.0 Background

Global water resources are coming under increasing pressure as demand is beginning to outpace supply. The quality and quantity of water is being impacted by a range of factors, including hydrological variability, climate change, and environmental degradation (United States Agency for International Development (USAID), 2009; Fielding *et al*., 2012; World Health Organisation (WHO), 2012). As of 2019 an estimated 2.2 billion people worldwide did not have access to safe water supply (WHO/United Nations Children Fund (UNICEF), 2019; 2021). The present status of water resources calls for improved water resources management (United Nations (UN), 2021). For poor and marginalized populations, reliable access to water is tenuous such that ensuring adequate water quality is becoming increasingly difficult (UNDESA, 2008; USAID, 2009). Access to safe water is a human right (Corcoran, 2010). However, access to potable water in Africa is not yet universal with 1 in 3 Africans facing water scarcity and approximately 400 million people in sub-Saharan Africa lacking access to basic drinking water (WHO/ UNICEF, 2015; 2019; Martínez-Santos, 2017). The ability of society to develop is dependent on sustainable and sufficient supplies of high-quality water, and the reliable maintenance and sufficient capital investment for water and sanitation infrastructure is required for healthy economic development.

The undeniable seriousness of the global water situation was first brought to the attention of the international community at the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, at what came to be known as the Rio Earth Summit (Bigas, 2012). Countries came up with solutions to address water crisis such as, Education/Awareness, New Conservation Technologies, Recycle Wastewater, Improve Irrigation and Agriculture Water Use, Water Pricing, Energy Efficient Desalination Plants, Rain Water Harvesting, Community Governance and Partnerships (Corcoran, 2010). While wider changes are needed, clean technology solution can have a substantial impact on improving access to clean and safe water, which result in having social and environmental benefits.

Over the years, there have been many scholarly studies, government policies, Non-Governmental Organization (NGO) reports, industrial plans, and others all focusing on ways to improve the

management of water and reduce inefficient water use. However, the problem of global water crisis still persists (Citi GPS, 2017) of which Zambia in particular Lusaka, is no exception. Many Lusaka residents including those in Mtendere lack access to adequate water and sanitation services. In some parts of Lusaka, residents cover long distances and stand in long ques just to fetch water in some parts of Lusaka, and so time spent to secure clean water presents high opportunity costs (MCC, 2020).

To address the problems of lack of access to adequate water supply in Zambia's capital city Lusaka, Millennium Challenge Corporation (MCC) a US agency for international development and the Government of Zambia (GRZ) designed a compact that was MCC's largest urban water investment. The Government of Zambia created the Millennium Challenge Account- Zambia (MCA) to implement the Compact. The compact invested in major infrastructure improvement, institutional strengthening of the Lusaka City Council (LCC), the entity responsible for municipal public health and drainage, and the Lusaka Water Supply and Sanitation Company (LWSC), the entity responsible for the city's water supply and sanitation services (MCC, 2019).

Mtendere is one of the areas where the MCC Compact project was implemented. Mtendere Township (meaning a peaceful township in *Nyanja)* is one of the unplanned settlements situated on the Eastern side of Lusaka Central Business District and is one of the high- density residential areas in Lusaka. The township is characterized with, erratic water supply, poor sanitation, poor hygiene practices, poverty, poor waste management practices and lack of adequate safe water supply (Nkole, 2018).

Mtendere residential area has an estimated population of over 120, 000 people, out of which about 50,000 were in Mtendere East as of 2018 (Nkole, 2018). Population growth in Mtendere had caused large numbers of people not to readily obtain water supply services. Residents exploit any other available sources of groundwater supply, thereby exerting enormous pressure on the Lusaka aquifer through construction of private boreholes or hand-dug wells (Nkuwa, 2006).

1.1 Problem Statement

Water is an important resource that sustains life (Lallana *et al*., 2001; Mulwafu *et al*., 2002; WHO/UNICEF, 2019). Water supply to communities is a mandate of the government of the Republic of Zambia through water utility companies established through the Water Resource Management Act No. 21 of 2011. Despite the efforts by Lusaka Water Supply and Sanitation Company (LWSC) to supply water, Mtendere is still facing water challenges (statement by the then Minister of Health Dr Chanda, 6th August, 2020 (https://www.lusakatimes.com)). Inadequate water supply may cause the community to spend more time fetching water in addition to increased risk of water borne diseases such as diarrheal diseases.

There are often projects to improve water supply such that many projects have been implemented in Lusaka city to date, yet water challenges still persist. Among the most recent projects is the Millennium Challenge Corporation (MCC) Compact for Mtendere. Such big projects present an opportunity to derive lessons for the success and sustainability of future projects. Vonk, (2021) evaluated 'Urban WASH' project implemented in George and Chawama townships of Lusaka by Oxfam and Village Water from 2013 to 2017. However, households in George were still using unimproved water sources at the rate of 15% and piped water at 19% (Vonk, 2021). Therefore, this study seeks to ascertain the extent to which the MCC water project has improved equitable domestic water accessibility in Mtendere East, Lusaka Zambia.

1.2 Aim of the study

The aim of this study was to ascertain whether the Millennium Challenge Corporation (MCC) compact water project had improved equitable access to domestic water supply in Mtendere East.

1.3 Objectives of the study

1. To assess the sources of domestic water supply in Mtendere East.
2. To evaluate the effectiveness of the MCC Compact water project in Mtendere East.
3. To investigate people's perceptions on the success of the MCC Compact water project in Mtendere East.

1.4 Research questions

1. What is the current situation of domestic water supply in Mtendere?
2. Which coping strategies do Mtendere residents use when there is a water shortage?
3. How has MCC compact improved water infrastructure in Mtendere?
4. How do residents of Mtendere perceive the effectiveness of MCC Compact water project in improving water supply in their settlement?

1.5 Significance of the study.

The findings of this study have potential to provide valuable evidence on the effectiveness of the MCC Compact project on water supply that may enhance guidance in policy planning on water management projects. The findings may add to the existing body of knowledge on the condition of water supply and sanitation projects in communities. Residents may benefit from the results of the study as policy makers will know the effectiveness of the projects and improve the provision of water supply and sanitation services to Mtendere residents.

1.6 Organisation of the study

This dissertation is divided into seven chapters. Chapter one introduces the study and gives the background of the study, the problem statement and significance of the study. Chapter two discusses the literature review and the conceptual framework adopted. Chapter three presents the study area. Chapter four outlines the research methodology employed in the study which includes; the research design, study population, sample size and sampling procedure, methods of data collection, analysis, research methodology, validity and reliability. Chapter five presents the study results analysed in response to research objectives. Chapter six presents discussion of research results against the background of the literature reviewed. Chapter seven outlines the conclusion based on analysis done and gives recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.0. Introduction

This chapter focused on the review of literature globally, regionally and locally within Zambia. The chapter discusses water supply, household water uses and conservation strategies, water supply indicators and evaluation of the effectiveness of the water and sanitation projects implemented in communities. This was to identify the gap in the literature that can be filled by this study, and add to the existing body of knowledge. The chapter also outlines the conceptual framework adopted.

2.1 Global water supply

Access to quality water remains a key indicator of an improved social and economic life of any community, without water, no life can survive (European Union, 2010). However, its scarcity affects more than 40 percent of the people around the world (WHO/UNICEF, 2021; UNDP, 2015). Natural water is an important material for the sustenance of both animals and plants on earth (WHO, 2012). Consequently, access to safe drinking water is essential for health and a basic human right is integral to the United Nations Resolution of 2010 (UN, 2010). Owing to this, the United Nations set 2030 as the timeline for all countries and people to have universal access to safe drinking water as enshrined in Sustainable Development Goal (SDG) number 6.1 (UN, 2021; UNDP, 2015; WHO/ UNICEF, 2021).

Unclean water has had devastating effects on the health and wellbeing of vulnerable groups such as children and women (WHO/UNICEF, 2008). Diarrhea kills 4000 children every day around the world, making it the second leading cause of death among children under five years old globally and the fifth leading cause of death among all age groups (WHO/UNICEF, 2008). This concurs with the fact that diarrhea (88 percent of which is due to poor water and sanitation) (WHO, 2015), kills more children than HIV and AIDS, Malaria and Measles combined (WHO/ UNICEF, 2008).

Improved water supply is the single most cost-effective means of reducing water related diseases and deaths globally (UNEP, 2005; Ahiablame *et al*., 2012). Globally, domestic water sources are classified as 'improved' or 'unimproved' and whether they meet or not the standards for 'safely managed' (WHO, 2012). The terms 'improved' and 'unimproved' are classified according to delivery modes (such as piped water on or off dwelling/yard/plot, boreholes, traditional wells, or tanker). As of 2011, 89 percent of the world's population used improved drinking water sources, African Ministers' Council on Water (WHO &UNICEF, 2008). About 55 percent of the world population enjoyed piped supply in their homes (Independent Development Evaluation 2015; WHO/ UNICEF, 2014).

2.2 Regional water supply

Access to a regular supply of safe water is a basic human right (UN CESCR, 2003; UN, 2010). However, large numbers of people remain without access to basic levels of drinking Water Supply and Sanitation (WSS), (WHO, 2012). Over two billion people live in countries experiencing water stress (United Nations, 2018). According to data that was compiled by the WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation by 2010, 783 million people were still using unimproved sources to meet their drinking-water needs. The poorest households will have very low access to safe drinking water than the rich communities. In most parts of Africa, many households tend to use the same source of water such as rivers, wells for both drinking and cooking (Odunuga, 2010; WHO/UNICEF, 2012; 2014).

Providing safe drinking water and improved sanitation is one of the major challenges facing African countries (Independent Development Evolution (IDEV), 2015). The Africa Water Vision 2025, launched at the second World Water Forum in the Hague (2000) predicts an Africa where the use and management of water resources are equitable and sustainable and contribute to poverty alleviation, yet access to water and basic sanitation services had worsened by 2015 in some places (IDEV, 2015). As more people move to African cities, they demand better services, like, clean water and sanitation which puts pressure on local and regional water supplies as seen in most cities such as; Cape town in South Africa, Mogadishu in Somalia and Harare in Zimbabwe (National Planning Commission, 2012; IDEV, 2015).

The past decade has witnessed many countries making significant progress towards meeting their water and sanitation access goals as noted by WHO, (2015). However, there is still a large proportion of people in the developing world that lack access to clean water. Rapid urbanization, urban informality, climate change, pollution, and higher demand for water resources, bringing water supply to all, remains a challenge (United States Agency for International Development, 2009; UN; 2014).

Across sub-Saharan Africa, water services for low-income urban communities remain variable and unaffordable (Odunga, 2010). Although water kiosks may be available and households may be connected on shared and metered connections especially in informal settlements, costs often remain prohibitively high, International Institute for Environment and Development (IIED) Briefing, (2016).While access to improved water sources has grown in urban areas, as of 2012 progress had stagnated at 85 percent as urban populations grow (WHO/UNICEF, 2008). Between 2000 and 2010, 84 million urban Africans gained access to improved water supply.

Domestic water supplies in towns and cities across Sub-Saharan Africa comprise a heterogenous mix of piped and non-piped supplies, with groundwater contributing to both (Ahiablame *et al*., 2012). Individual decisions on the choice of household water supplies reflect matters of availability, affordability, reliability or convenience (United Nations Economic and Social Council, 2005). The minimum core obligations for the human right to safe drinking water requires that an adequate standard of living is ensured with respect to availability, accessibility, affordability and safety for personal and domestic use (UN, 2010). With no prescription regarding who should provide the service or how, availability, accessibility and safety are reflected in the Sustainable Development Goal, target 6.1.

2.3 Water supply in Zambia

In Zambia, the water sector has four sub-sectors; Water Resource Development, Water Resources Management, Water Supply and Sanitation, and Environmental Management (M and E framework 2020-2030). Zambia started to address the mismanagement of its water sector in the mid-1990s. The government introduced reforms, such as the 1997 Water Supply and Sanitation Act, establishing a legal and regulatory structure for water in keeping with international standards (MMC, 2020).

Water supply and sanitation in Zambia is characterized by achievements and challenges. The achievements are; the creation of the regional commercial utilities for urban areas, councils, such as the National Water Supply and Sanitation (NWASCO) which was established under the Water Supply and Sanitation Act No. 28 of 1997 to regulate water providers for efficiency and sustainability of water supply and sanitation services, the establishment of a regulator agency that has substantially improved information on service provision in urban areas, Water Resources Management Authority (WARMA), which was established under the 2011 Water Act, the establishment of a devolution trust fund to focus donor support on poor peri-urban areas, an increase in the access to water in rural areas (Water Resource Management Act of 2011).

The government of Zambia established and funded a Millennium Project Completion Agency (MPCA) to continue the work on water infrastructure. The MPCA in Zambia prepares documents and schedules for MCC missions to Zambia. The growing demand for water supply presents a growing challenge to meeting all citizen's needs. Population growth and poor water infrastructure leads to insufficient safe water supply (Sternberg, 2016; Musambo, 2017; Senna, 2021; WHO/UNICEF, 2021).

2.4 Household water uses

Household water use patterns and the factors that drive water use provide information that can be used to better plan and manage the resource (Molenaar, 2018). Households use water for many purposes: drinking, preparing food, washing hands and body, washing clothes, cleaning cooking utensils, cleaning the house, irrigating the garden (Heinrich, 2008; WHO, 2012). Domestic water use is water used for indoor and outdoor activities. Outdoor water use support seasonal small-scale crops in backyards and contribute to quality of life (Dziedzic, 2015; Makwiza & Jacobs, 2016). Household water use standards vary with, lifestyle, culture, technology, climatic conditions and economy.

A water-use is defined in this study as the specific activity, which can be indoor or outdoor, for which water is used. Showering, washing clothes, cleaning the house, and car washing are examples of water-use activities. Some water-use activities are associated with appliances or fixtures, including dishwashing using a dishwasher, laundry using a washing machine, shower and toilet. Higher standards of living are changing water demand patterns. This is reflected mainly in increased domestic water use, especially for personal hygiene (Lanllana *et al*., 2001; WHO, 2015:

Cheruseril, 2007). Domestic water use is affected by many factors, such as; the age, occupation, cultural preferences, and household income of the individuals using water. For example, the age of the occupants affects water use as the activities of an individual change with age and their associated lifestyle (Browne *et al*., 2014; WHO, 2012; Crouch, 2020; Crouch, *et al*., 2021).

When showers are used, children and teenagers were found to shower for longer than adults, thus increasing household water use (Mayer *et al.* 1999). In Germany, household water use was also found to increase with age, often because the elderly who are retired spend more time in the house, which implies an increased likelihood to use water while at home (Schleich & Hillenbrand, 2009). Willis *et al.* (2011) classified types of household water uses as being non-discretionary or discretionary. Under this definition, non-discretionary water use is 40–70 litres per capita per Day (LPCD) and any water use above this value should be considered discretionary water use, irrespective of what it is being used for. A number of studies have examined household water use, using metering data, surveys and other methods, yielding typical values from 93 LPCD (Athuraliya *et al*., 2012) to 430 LPCD (Cheruseril, 2007; Hay *et al.*, 2012). Biswas and Gangwar (2021) reported that water supply in Delhi, India, varies from 29 LPCD in regions with poor service to 509 LPCD in the privileged residential zones.

With regard to per capita consumption in Zambia, surveys have been carried out in various towns where some areas in peri-urban areas are supplied through kiosks. Consumption at water kiosks and other public outlets varies primarily as a result of seasonal influences, availability of alternative sources, walking distance and water tariffs. The average LPCD is less than 20liters (NWASCO, 2022). A key determinant in these reported values is the extent of outdoor water use, which can vary significantly based upon a number of factors and building preferences, making it difficult to compare values from different areas and different studies. In the recent past, water usage has greatly increased at household level due to COVID 19 epidemic. The high hygiene standards that have come about due to COVID 19 have resulted in increased LPCD (UN, 2021).

Studies on water usage provides an opportunity to understand where and when the greatest amount of water is used. Water use data can be used to determine how an area's water use can be affected by weather and socioeconomic factors. Socio-economic factors that have been shown to impact water use in other studies include number of individuals per household, education level and income (Cheruseril, 2007; Fielding *et al*., 2012; Parandvash and Chang, 2016; Randolph and Troy, 2008;

Wentz & Gober, 2007). Water use patterns are often impacted by geographic location (Ahiablame *et al.*, 2012). Variables such as population growth, climate patterns, demographic factors and socioeconomic status may affect water consumption.

2.5 Household water conservation strategies

Safe water scarcity is a problem in many parts of the world. Most poor countries experience scarcity due to climate change and lack of water infrastructure. Industrialized countries experience conflicts among different uses, water quality - degradation and drought-quality degradation, and droughts (Maggioni, 2015). Water management organizations in most industrialized countries are facing increasing supply shortages of which conservation is one of their primary strategies to address water scarcity (Maggioni, 2015; Brainard, 2015). Water management and conservation efforts lead to efficient use of water (Adler, 2011) Adoption of water conservation practices (WCPs) is essential to save water. Water conservation may be as a result of both conscious effort of water agencies' policies and of individuals' behaviors (Inman & Jeffrey, 2006). Studies on water conservation adopt a range of different perspectives. Technical studies assess the effectiveness of individual conservation devices (Campbell *et al*., 2004).

In reference to conservation and adaptation strategies, Inman and Jeffrey (2006) adds that achieving effective and equitable adaptation outcomes will require encouraging or reinforcing social processes. Efforts by residents alone to adapt to shortage of water, water conservation methods and climate change will not be sufficient. There is need for a deliberate and systematic policy shift aimed at supporting and enhancing the effectiveness of various technical solutions in water conservation (Adler, 2011).

Water is among the natural resources that are important across Zambia. Water conservation include; less consumption of water, protection of leaking water pipe, taps, reserving water for future uses in containers and water reservoirs tank. Anything that disrupts the provision, and supply of water tend to disrupt the survival of humanity. Residential demand for water is growing rapidly in Zambia creating pressure for new sources of domestic water supplies. Even though Zambia is known of having adequate water resources in the region, many unplanned areas in cities such as Mtendere experience water shortages.

In an effort to ensure that residences have access to safe drinking water, Namuwelu, (2020) conducted a study on domestic water use and conservation practices among the households of Kansenshi and Ndeke residential areas of Ndola City in Zambia. Results show that domestic water use practices promoted water conservation as most respondents turned off the taps when not in use and advised members of their households to close the taps when not in use. The study by Namuwelu (2020) and others (Campbell *et al.*, 2004, Cooperation International Waters in Africa (CIWA), 2020; Oxfam, 2021), bring key issues that border on human survival where water usage is concerned.

2.6 Water supply indicators

Every water management project needs to be evaluated at the end of the cycle to check whether the objectives were met or not. There are a number of ways of evaluating a project depending on the set objectives (M and E framework 2020-2030)**.** If the objective of the project was to increase the population which can access safe water, increase the water supply coverage ratio and improve water supply infrastructure. Water supply is expected to increase due to the increase in water supply points. However, this is dependent on whether water is supplied all day or it is just supplied for two hours per day that is in the morning and also in the afternoon. When a pay-for-use system is not used, it is difficult to measure accurately the exact amount of water that the community or households are using (WHO/UNICEF, 2008; Musambo, 2017). Water supply can be evaluated by the increase or decrease in the amount of water that the community receives (Food and Nutrition Technical Assistance (FANTA), 1999; WHO, 2015; WHO/UNICEF, 2021). This can be done either through interviews with the residents or determining the number of hours in which water is supplied (WHO/UNICEF, 2019).

Water supply can also be assessed by the number of water- borne diseases in an area (Fewtrell *et al.*, 2005; UNICEF, 2008; United Nations, 2018; Oxfam, 2021). For example, areas like Kanyama and George townships in Lusaka district are prone to water borne diseases due low water supply. Percentage of children under 36 months with diarrhea in the last two weeks, where diarrhea is defined as more than three loose stools passed in a 24-hour period (FANTA, 1999, USAID, 2009). This is the most expected effect of the safe water supply, although the cause-and-effect relationship between the supplied water and the reduced number of people who contracted water-borne diseases

cannot be strictly proven epidemiologically (WHO, 2012). Improvements in water supply can also be assessed using the time spent in fetching water. A reduction in time spent to fetch water ultimately indicates a reduction in distances covered fetching water (Adler, 2011; Odunuga, 2010).

Another indicator that can be used to assess if there are any improvements in water supply is quantity of water used per capita per day. This is where all the water collected by or delivered to the household and used for personal purposes is considered (FANTA *et al*., 1999; WHO/UNICEF, 2021). This indicator includes all water collected by or delivered to the household and used for drinking, cooking, bathing, personal and household hygiene and sanitation by the inhabitants of the household (UNICEF, 2006; WHO/UNICEF, 2012; 2019).

2.7 Evaluation of water supply and sanitation projects.

2.7.1 Global evaluation of water supply and sanitation projects.

Global availability of freshwater remains relatively constant, the demand is growing (WHO, 2012; Shumilova *et al*., 2018). This increasing demand is linked to securing food and energy for a growing human population (UNESCO-WWAP, 2014; UNSD, 2018). The present status of water resources calls the need for improved water resources management (UN, 2021). In improving safe water supply, water management projects are implemented and evaluated. The first example is the study by Sternberg whose aim was to provide water for irrigation, domestic supply, energy production, and industrial development (Sternberg, 2016).

The second example is the World Bank's Global report of 2021 on external evaluation of the global water security and sanitation partnership (GWSP, 2021). It resulted from the integration of both the Water supply and Sanitation Program (WSP) and Water Partnership Program (WPP). The aim of this study was to address water sector challenges through a holistic approach (GWSP, 2021). Another example is the study done by Ermilio, *et al*., (2014), whose aim was to investigate the sustainability of community, managed water supply infrastructure in Nicaragua and Panama (Ermilio, *et al.*, 2014).

2.7.2 Regional evaluation of water and sanitation projects

In Africa, some studies conducted include the study by Mgoba and Kabote., (2020) in Tanzania whose aim was to determine the effectiveness of the participatory monitoring and evaluation on achievements of community-based water projects objectives which are the government and none governmental organization funded projects. The findings of the project were that the projects funded by non-governmental organization (NGO) recorded high achievements than the projects funded by the government (Mgoba & Kabote, 2020).

There is also a study done by United Nations Educational, Scientific and Cultural Organisation (UNESCO) in Ethiopia. The aim of this study was to gain an independent view of the performance of the project to draw lessons for future USAID financed similar projects and share the lessons for other partners. One of the main findings of the study was that the project was very effective in achieving its anticipated results in terms of providing access to improved water sources (UNESCO-WWA, 2014).

2.7.3 Evaluation of water supply and sanitation projects in Zambia

There are a number of studies that have been done in Zambia to evaluate water projects as outlined below. Vonk, (2021) evaluated 'Urban WASH' project implemented in George and Chawama townships of Lusaka by Oxfam and Village Water from 2013 to 2017. The purpose of the project was to improve the provision and sustainable management of WASH services. The findings on this project showed that households in Chawama did not have unimproved water sources and rate of piped water was at 53%. Households in George were using unimproved water sources at the rate of 15% and piped water at 19% (Vonk, 2021).

Japan International Cooperation Agency (JICA) evaluated a water project in Luapula, the Luapula Water and Sanitation project whose aim was to establish appropriate operation system of the commercial utilities and strengthen their own management capacity. One of the findings of this project was that more than 30 percent of installed major mechanical and electrical equipment were malfunctioning. This was attributed to budget constraints resulting in failure to replace equipment with new infrastructure as well as failing to maintain the existing ones (JICA, 2019).

Many projects on improving water supply and sanitation infrastructure have been implemented in areas where there is water scarcity. Evaluating the effectiveness of the projects helps in policy making. Therefore, the positive and negative effects (effectiveness) of the Millennium Challenge Corporation Compact water project on domestic water supply in Mtendere East remain unknown, hence the need to conduct the current study in Mtendere East.

2.8 Conceptual framework

The conceptual framework explains the expected relationship between variables, it serves as a guide to research (Kombo and Tromp, 2006; Ravitch & Riggan, 2016; Ravitch & Carl, 2021). It helps researchers to put together all aspects of a study through a process that explain their connections. The conceptual framework below shows activities that are key in water supply and how they are linked. The framework begins by highlighting the activities that have to be considered and put in place in order to achieve the desired outcomes. Activities such as improvement and provision of water supply and sanitation infrastructure in communities enable communities to have access to improved water supply

Furthermore, the framework shows how the outcomes such as increased percentage of people with access to improved water supply benefit and have better livelihood in the communities. Access to improved water supply reduce time to fetch water, and reduce diarrheal diseases (Fewtrell *et al.*, 2005; UNEP, 2005; Ahiablame *et al*., 2012). Additionally, adequate water supply increase productivity as community members will have sufficient water for domestic use even for economic purposes such as running salons. Improved water supply will also reduce time spent on fetching water ultimately increasing time residents spend in engaging themselves in other productive activities.

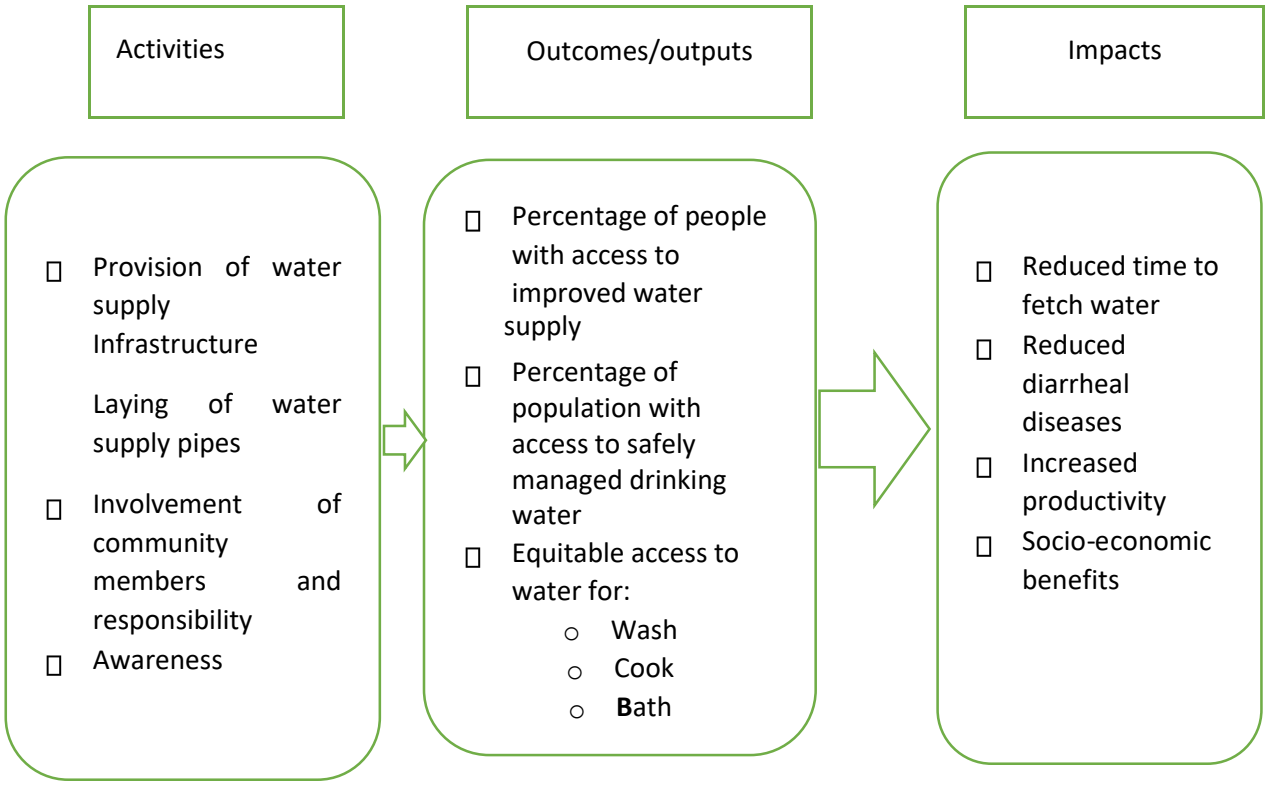

Figure 1: Conceptual framework of water supply indicators.

Source: Adapted from PATHs Safe Water Project (2011).

CHAPTER THREE

STUDY AREA

3.0 Introduction

This chapter presents the study area.

3.1 Description and justification of the study area

The study was conducted in Mtendere East of Lusaka district, as indicated in Figure 4. Mtendere East is divided into sections as shown in Figure 5. This study was conducted from section 5 to section 9. Mtendere East is on the eastern side of Old Mtendere compound. Mtendere East lies on the eastern part of Lusaka District about 12.0 km from the Central Business District (CBD). As of 2018, the population of Mtendere East was estimated at 50,000 people (Nkole, 2018). Mtendere East had a total of 3,953 household plots excluding section 10 which was not yet handed over to Lusaka water supply and Sanitation Company. Mtendere East was selected due to it being one of the high-density areas with persistent water shortage where the MCC Compact water supply and sanitation project was implemented.

Lusaka's population currently depend on groundwater and also supply from Kafue River. The main source of Mtendere East supply is the gravity line from stuart park reservoir to Chelstone tank. The tap – off line is a 300 mm steel pipe to Mtendere East. The other source of pipped water in Mtendere East come from LWSC boreholes located in Mtendere East.

Figure 2: Map of Zambia.

Source:University of Zambia, Cartographic Unit, 2023.

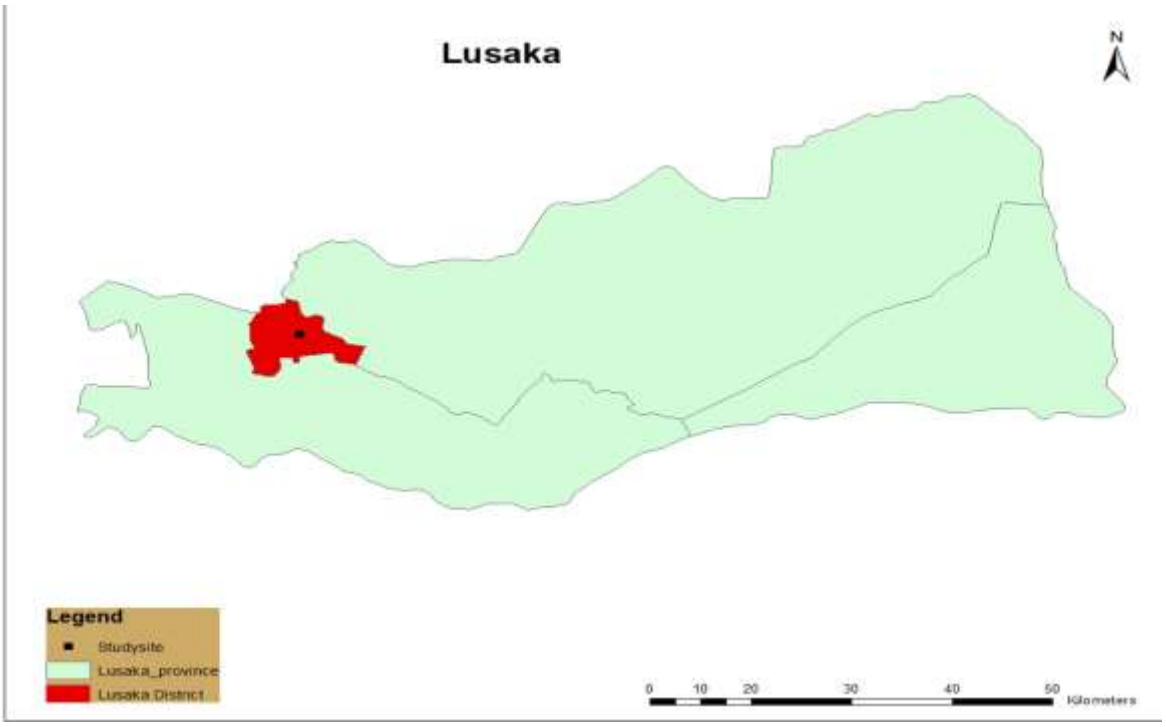

Figure 3: Lusaka province.

Source: University of Zambia, Cartographic Unit, 2023

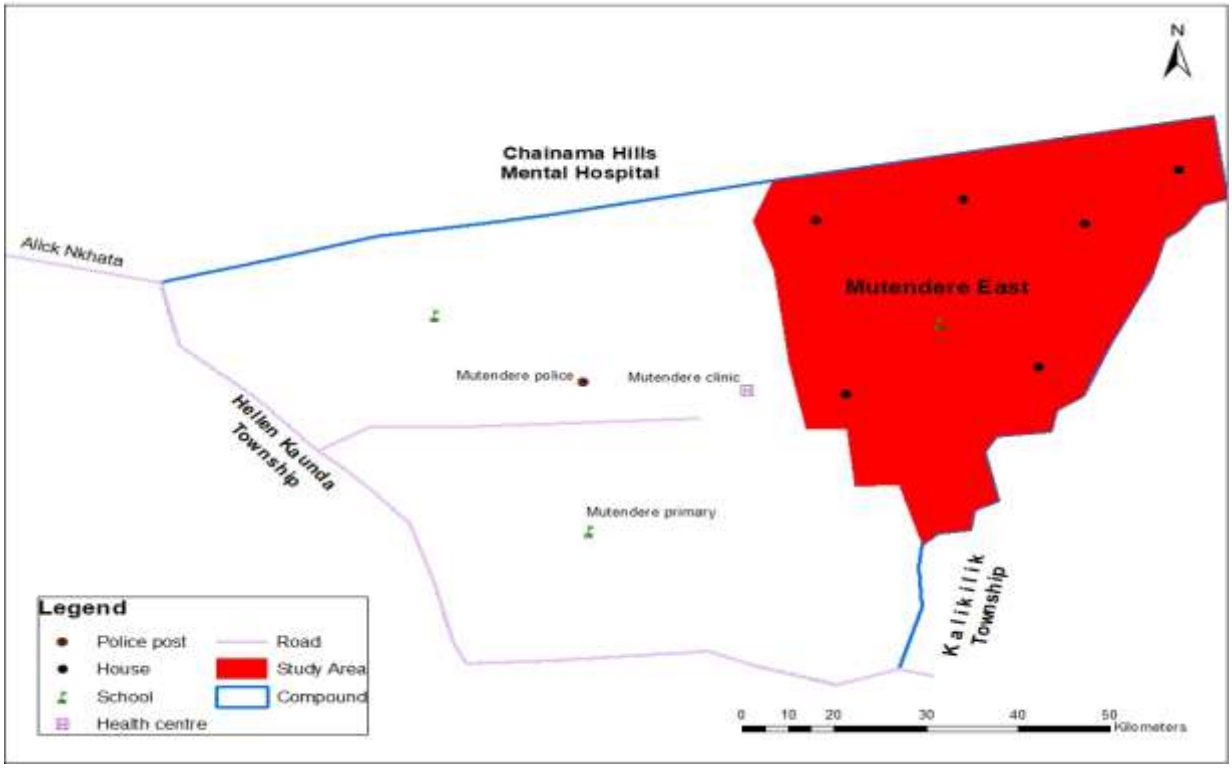

Figure 4: Mtendere East.

Source: University of Zambia, Cartographic Unit, 2023.

Figure 5: Mtendere sewer and water connection (water supply and sanitation infrastructure).

(Key: Green = Sewer lines; Blue = water lines)

Source: LWSC, (Mtendere branch), 2022.

3.2 Climate

The climate is sub – tropical, as most of the country lies on the central African high plateau at average altitude of 1200 m above sea level. The area is characterized by three seasons: a hot season, a rainy season and a cool dry season.

A hot season runs from mid – August to mid – November. Zambia has been experiencing temperature increase over the three last decades (World Bank, 2006; GRZ, 2007) (figure 2).

A rainy season runs from mid – November to April. Rainfall is strongly influenced by the movement of the Inter – Tropical Convergence Zone (ITCZ). The annual rainfall in Zambia averages between 600 mm in the South and 1,400 mm in the North (GRZ, 2002), and a cool dry season which runs from May to mid – August.

Lusaka province, a region in which the study area lies is located in central part of Zambia (region IIa) on the average maximum temperature measuring 31.2°c central African plateau, 1300 m above sea level to the North and gently drops to 1,200 m above sea level towards the East, South and West (World Bank, 2006). Lusaka receives about 800 mm to 1000 mm of rainfall annually (World Bank, 2006; Chabala L.M *et al.*, 2013).

3.3 Geology and vegetation

Dolomites, limestone, quartzites and schists of Katanga super group are distributed around Lusaka city and western part of Lusaka province. Gneisses and granitic gneisses of Basement complex are widely spread in the eastern, northern and the Lusaka city area. In Lusaka, hills mainly consist of quartzites are aligned East – West direction with 100 m – 200 m width and 50 m – 200 m height from plateau plane (Simpson J.G *et al*, 1963). Lusaka is covered by strongly folded overthrusted metasedimentary rocks of Katanga age which have been intruded by granitic and basic bodies. The rocks are part of the "Zambezi supracrustal sequence" (Simpson J.G *et al*, 1963; Johnston *et al.* 2008). The rocks are covered with soils, mainly composed of iron-oxide ooliths in a clayey matrix on dolomitic lithologies and sandy sediments on schists, gneisses and granites (Simpson J.G *et al*, 1963; Nkhuwa, 1996; Johnston *et al.* 2008). Lusaka soils are ferric, luvisols and Eutirc Nitosols are widly spread. Lithosols as well form a considerable unity in the area (Magai, 1985).

Natural vegetation is characterized by Miombo savannah-type woodlands, while in the North, along the Ngwerere and Chunga rivers, and to the South-west, along the road to Chilanga,

extensive farmlands and cultivated areas are situated. The natural forest reserves North and South of Lusaka have gradually been cut to leave space for newly growing townships. The clearing of forest for settlements, agriculture and charcoal production contributes to soil erosion (Sichingabula, 1997).

3.4 Socio-economic activities

Mtendere East is in Munali constituency, Kalikiliki ward. Mtendere East residents are both formal and informal employed. The majority of the residents are in informal employment such as; welding, solon business, barbing, small scale farming and buying and selling of goods. Some residents do their businesses at their homes where they have built stores or use tables. Many low-income households rely on house-based enterprise (Ezeadichie, 2012). Some are in formal employment such as; teachers, nurses, police officers and clerks. The study area only has private schools (Ministry of Education, 2013).

CHAPTER FOUR

RESEARCH METHODOLOGY

4.0 Introduction

This chapter discusses the methodology of the study. This includes; the research design, study population, sample size, sampling procedures, methods of data collection and data analysis.

4.1 Research Design

The study used constructivism philosophical stance, which is of the view that social phenomenon and their meaning are continually being accomplished by social actors, and that they are in constant construction (Denzin, 2011; Bryman, 2016). Constructionism or a constructivist grounded theory approach places priority on the phenomenon of study and sees both data and analysis as created from shared experiences and relationships with participants. The study is a mixed methods approach, combining both qualitative and quantitative with the use of convergent parallel research design (Mckim, 2017). This was arrived at because of the set objectives that needed both qualitative and quantitative ways of obtaining and analyzing data (Creswell, 2011; 2015; Tran 2016; Denzin and Lincoln, 2011; Kabir, 2016).

4.2 Population

In this study, the population was drawn from Mtendere East. The residential plots in Mtendere East are divided in sections; section 5 to section 10 by the Lusaka Water Supply and Sanitation Company. This study was from section 5 to section 9. The total number of households was as summarized in Table 1. Thus, there were a total of 3,953 household plots in the study, excluding section 10 which was not yet handed over to Lusaka water supply and Sanitation Company. Section 5 to section 9 had been chosen as the study area because that was where the MCC Compact project was implemented first in Mtendere.

Table 1: Approximated number of household plots with tap-water connected to LWSC in Mtendere East section 5 to 9.

Section 5	Section 6	Section 7	Section 8	Section 9	Total
483	1385	748	1044	293	3,953

Source: Field work, 2022.

4.3 Sample Size and Sampling procedure

4.3.1 Sample Size

From the 3,953 households, a sample of 270 was drawn, calculated using the proportion method as shown below. The study used Nighty percent confidence level (Z – value = 1.645) because it was not very stringent when it comes to inclusion criteria. However, due to logistical constraints, 170 households were interviewed including 4 key informants which composed of the councilor, two officials from LWSC (Lusaka Water Supply and Sanitation Manager for Asserts and Lusaka Water supply and Sanitation coordinator for Sanitation Connection Action Plan (A project under MPCA) Mtendere Branch) and one official (representative) from Millennium Project Completion Agency (MPCA). Sampling was stratified (disproportionate stratified random sampling) according to sections; 26 respondents from Section 5, 48 respondents from Section 6, 39 respondents from Section 7, 43 respondents from Section 8, and 14 respondents from Section 9 as given in Table 2. The head of the household or any senior member of the households available who was 18 years and above were allowed to participate in the study. Four key informants were selected using purposive sampling (Table 3).

Sample size = $((\text{Z-score}^2)$ X StdDev X (1- StdDev)) / ME^2

Where:

Z = Z value at 90% confidence level 1.645.

P = Standard deviation at 0.5

ME = Margin of error at 5%

Sample size = $((\text{Z-score}^2)$ X StdDev X (1- StdDev)) / ME^2
$= 1.645^2 \times \text{O.5} \times (1 - 0.5) / 0.05^2$
$= 270$

Therefore, calculated sample was 270.

Table 2: Number of respondents per section.

Section	**5**	**6**	**7**	**8**	**9**
Number of approximated household plots	483	1385	748	1044	293
Number of respondents	26	48	39	43	14
Total number of respondents					170

Source: Field Work, 2022.

Table 3: Sample size and sampling.

PARTICIPANTS	**SAMPLE SIZE**	**SAMPLING METHOD**
Key Informants ➢ Councilor ➢ Officials (LWSC) ➢ Official (MPCA)	 ➢ 1 ➢ 2 ➢ 1	➢ Purposive
Total	➢ 4	
Respondents ➢ Residents	 ➢ Section 5-26 ➢ Section 6-48 ➢ Section 7-39 ➢ Section 8-43 ➢ Section 9-14	➢ Disproportionate Stratified random sampling
TOTAL	170	

Source: Field work, 2022.

4.4 Data Collection Methods

In this study, interview guides with open ended questions were used to interview the key informants. A questionnaire with both open and closed ended questions was used to collect data

from each respondent. The interview guides and questionnaires were administered by the researcher. One to one interviews were conducted with some key informants that included two officials from LWSC in charge of water supply in Mtendere and one official from Millennium Project Completion Agency (MPCA). Information from the councilor was obtained via a phone interview.

4.5 Data Analysis

The study employed thematic analysis for qualitative data. In an effort to make sense of the data collected in terms of participants' explanations or definitions of the situation, noting patterns, themes, categories and regularities as explained by Cohen, *et al*., (2011). Data was organized, accounted for and explained according to participants' perceptions, values, feelings and experiences in an attempt to construct their understanding of the phenomenon. The analysed data was interpreted by identifying the emerging patterns, concepts and explanations from participants. Quantitative data was analysed using descriptive analysis. Thus, quantitative data was analyzed using STATA version 14 and Microsoft Excel spread sheets to bring out descriptive statistical representation of data in tables, and bar - graphs while the qualitative data was analyzed and presented thematically.

3.7 Validity and Reliability

Validity was achieved through the use of appropriate methods of sampling, data collection and data analysis. The population was well defined and enough sample was drawn. Semi-structured questionnaire and interview guides were constructed.

To achieve reliability, the research instruments were pre-tested through a pilot study in Kamanga compound. This was to evaluate if the instruments were able to give expected results. The research instruments were re-constructed. Kamanga was picked because it has similar settings to Mtendere.

3.8 Ethical Considerations

According to Cohen *et al*., (2007) "Ethics concern right and wrong, good and bad…" this is the question of norms and values. Research ethics seeks to protect human participants, serving the

interest of participants and examine specific activities for the ethical soundness and informed consent. The researcher observed every necessary ethical issue throughout the process of investigations. The researcher ensured that the study went through ethical clearance by the Natural Sciences Research Ethics (NASREC) committee based at Directorate of Research and Graduate Studies (DRGS) before data collection was conducted. Further, the participants were told the purpose and benefits of the study. The researcher had an introductory letter from the University of Zambia Institute of Distance Education (IDE) before embarking on collecting data. At the point of data collection, the researcher had to seek informed consent from the participants.

3.9 Health Considerations of the Participants

Data was collected during the post COVID-19 period in 2022. The researcher ensured that health measures were taken into considerations as advised by health experts such as maintaining social distance, wearing face masks and avoiding overcrowded places when conducting interviews.

CHAPTER FIVE

RESULTS

5.0 Introduction

This chapter presents the findings of the study. The findings were analysed in response to research objectives and were presented under the following headings; (i) background characteristics (ii) adequacy of domestic water supply (iii) perceptions on the success of the MCC Compact project (iv) perceptions on the effectiveness of the MCC Compact water project.

5.1 Background characteristics

The study revealed that the majority of the respondents were females, representing 74 percent and the rest were males, representing 26 percent as shown in table four. Sixty-two percent of the respondent were aged 18 to 40 years while 38 percent were aged 41 years and above. The results further show that the highest number of respondents were married representing 59 percent and the least where the divorced, widowed, or separated (Table 4). The study also revealed that 58 percent were employed.

The study further showed that the majority of respondents had junior secondary education status representing 38 percent and the least being those who have not been in school, representing two percent. In determining how long the respondents stayed in the area, the results showed that the majority of respondents had stayed in the area for 1 to 5 years, representing 42 percent, and the least being those who stayed less than a year, representing nine percent. The results further showed that the highest number of household sizes for respondents were those who had 5 – 7 people, representing 51 percent. The study also found that the majority of respondents earned between ZMW 500 – ZMW 2500 representing 52 percent and the least were those who earned above ZMW6501, representing one percent.

Table 4: Background characteristics.

	Frequency	Percent
Gender		
Male	45	26.47
Female	125	73.53
Age		
18 to 40	106	62.35
41 and above	64	37.65
Marital status		
Never married	47	27.65
Married	100	58.82
Divorced/Widowed/Separated/No response	23	13.53
Employment status		
Unemployed	72	42.35
Employed	98	57.65
Education status		
Not been in school	3	1.76
Primary	23	13.53
Junior secondary	65	38.24
Senior secondary	57	33.53
Tertiary	22	12.94
Period stayed in the area		
Less than a year	15	8.82
1 to 5 years	72	42.35
6 to 10 years	38	22.35
11 years and above	45	26.47
Household Size		
1-4	49	28.82
5-7	86	50.59
8 and above	35	20.59
Income level		
0ZMW	53	31.18
ZMW 500 to ZMW 2500	88	51.76
ZMW 2501 to ZMW 4500	17	10
ZMW 4501 to ZMW 6500	11	6.47
Above ZMW 65O1	1	0.59

Source: Field work, 2022.

5.2 Adequacy of domestic water supply

The section presents the source of domestic water before and after the MCC Compact project, the alternative sources of water and coping strategies used when there is no water supply. Further, results on the storage of water, approximated litres of water stored, approximated distance to the nearest source of water, strategies put in place by LWSC to improve water supply and other stakeholders involved in providing domestic water are also presented.

5.2.1 Source of domestic water before the MCC Compact project

Eighty – eight percent of the respondents said that their source of domestic water before the MCC Compact project was Borehole water. The least (4%) were those who said the source of domestic water was tap water, as shown in table 5.

In-depth interviews with LWSC Coordinator for Sanitation Connection Action Plan (A project under MPCA) also revealed that before the MCC Compact project, LWSC used to supply water to a few households of Mtendere East through Mtendere East water trust as the arm of the company. LWSC official said that the company did not supply tap water in Mtendere East, and so Mtendere East residents used to fetch water from Mtendere East water trust, Old Mtendere, kiosks, shallow wells and boreholes.

Table 5: Source of domestic water before MCC Compact project.

Variable	Yes		No	
Source of water before MCC project	Frequency	Percent	Frequency	Percent
Tap water	6	3.53	164	96.47
Borehole	149	87.65	21	12.35
Others	18	10.59	152	89.41

Source: Field work, 2022.

5.2.2 The current source of domestic water

Nighty – eight percent of respondents said that they used Tap water, while two percent of the respondents used boreholes and other sources like water trust and unprotected shallow wells as shown in table 6.

In-depth interviews with LWSC Coordinator for Sanitation Connection Action Plan revealed that the MCC Compact project improved the domestic tap water supply in Mtendere East. LWSC official said that;

> "*as of September 2022, the MCC compact project had improved the domestic water supply in Mtendere East. Most households connected with water infrastructure and water meter connected, have tap water supply".*

Table 6: Current source of domestic water supply.

Variable		
Current source of water	Frequency	Percent
Tap	167	98.24
Borehole/Others	3	1.76
Total	170	100

Source: Field work, 2022.

Figure 6: One of the current sources of water supply (Tap - water).

Source: Field work, 2022.

Figure 7: One of the current sources of water (Shallow well).

Source: Field work, 2022.

5.2.3 Alternative sources of domestic water when there is no water supply

Nighty – one percent of the respondents said that the alternative source of domestic water when there was no tap water supply was borehole water. Eleven percent of the respondents said that they used other alternative sources such as shallow wells and water they store as shown in Table 7.

Table 7: Alternative sources of domestic water.

Variable	Yes		NO	
Alternative sources of water	Frequency	Percent	Frequency	Percent
Borehole	154	90.59	16	9.41
Others	19	11.18	151	88.82

Source: Field work, 2022.

Figure 8: One of the alternative sources of water (Borehole).

Source: Field work, 2022.

5.2.4 Coping strategies used when there is no tap water supply

Seventy - six percent of the respondents said that the coping strategy they used when there was no tap water supply was storing water. Twenty - one percent said that they used borehole water while two percent of the respondents said they used shallow wells as shown in figure 9.

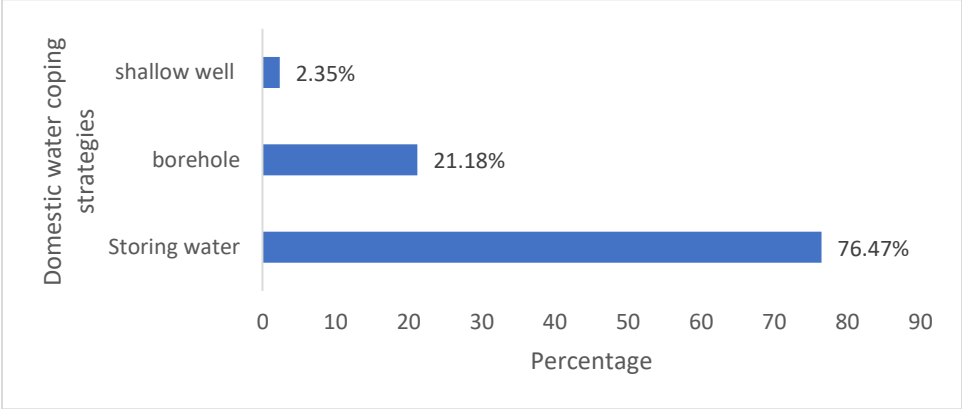

Figure 9: Coping strategies used when there is no Tap - water supply.

Source: Field work, 2022.

5.2.5 Storage of domestic water

Eighty – one percent of the respondents said that they used buckets as water storage. Twenty – six percent of respondents were those who said that they used 20 litre containers and the rest used other water storages like water basins as shown in table 8.

Table 8: Storage of domestic water.

Variable	Yes		No	
Storage of domestic water	Frequency	Percent	Frequency	Percent
2.5 litres container	11	6.45	159	93.53
5 litres container	7	4.12	163	95.88
10 litre container	19	11.18	151	88.82
20 litres container	45	26.47	125	73.53
Bucket	138	81.18	32	18.82
Drum	27	15.88	143	84.12
Others	6	3.53	164	96.47

Source: Field work, 2022.

5.2.6 Approximated litres of water stored for consumption

Thirty- nine percent of respondents said that they store 1 – 100 litres of water. Thirty-nine percent of the respondents said that they store 101-199 litres of water. Twenty-two percent of the respondents said that they store 200 litres and above (Table 9).

Table 9: Approximated litres of water stored for consumption.

Variable		
litres of water conserved for consumption by respondents	Frequency	Percent
1-100	66	38.82
101-199	67	39.41
200 and above	37	21.76
Total	170	100

Source: Field work, 2022.

5.2.7 Approximate distance to the nearest water source

Eighty - two percent of the respondents said that the approximate distance to the nearest water source was less than one kilometre. The least number of respondents said they walk one kilometre and above (Figure 10).

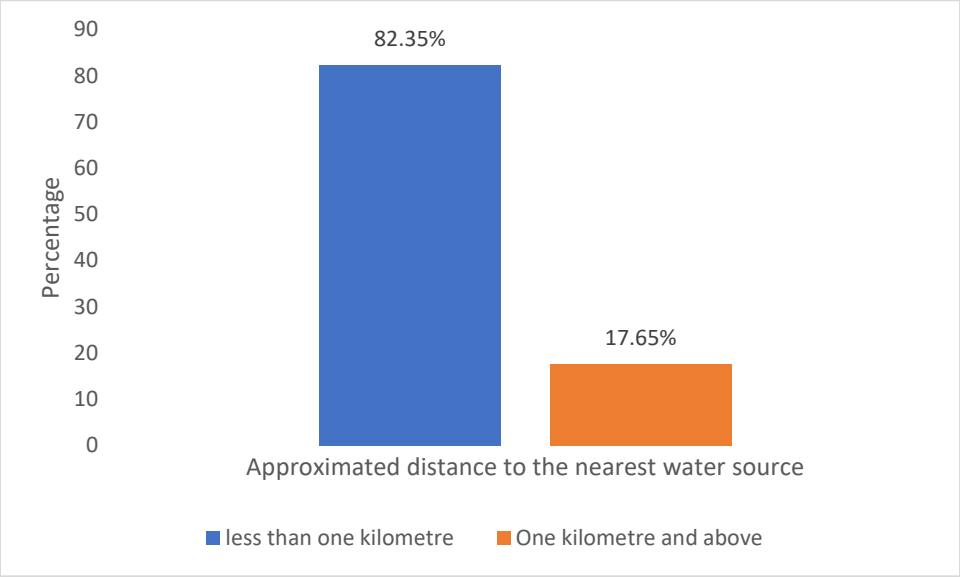

Figure 10: Approximated distance to the nearest water source.

Source: Field work, 2022.

5.2.8 Respondent's perceptions on strategies put in place by LWSC to improve water supply

Eighty - two percent of the respondents said that the strategy put in place by LWSC to improve water supply was providing water and sanitation services while 18 percent said that LWSC provide water infrastructure (table 10).

In-depth interviews with LWSC Manager for Assets also revealed that there were some strategies put in place by LWSC to improve water supply. The officials said that;

> *"The LWSC has put in places various strategies that are aimed at uplifting the goals of MCC Compact project and improve domestic water supply services such as; comprehensive water bills, installing water and sanitation infrastructure and sensitize the community on the dangers of infrastructure vandalism, sensitize residents to report any vandalized water infrastructure, sensitize residents on how to conserve water and how to take care of the water infrastructure".*

Table 10: Respondent's perceptions on strategies put in place by LWSC to improve water Supply.

Variable		
Strategies put in place by LWSC	Frequency	Percent
Provide water and sanitation services	140	82.35
Provide water infrastructure	30	17.65
Total	170	100

Source: Field work, 2022.

5.2.9 Other stakeholders involved in providing domestic water

Sixty-nine percent of the respondents said that other stakeholders involved in providing domestic water were borehole owners as shown in table 11. Twenty-eight percent of respondents said that there were no other stakeholders involved in providing domestic water. Three percent of respondents said that the other stakeholders involved in providing domestic water was water trust company.

In-depth interviews with LWSC Coordinator for Sanitation Connection Action Plan revealed that the borehole owners such as; the churches, individuals with boreholes, provide domestic water to some of Mtendere East residents.

Table 11: Other stakeholders involved in providing domestic water.

Variable		
Stakeholders involved in providing domestic water	Frequency	Percent
Borehole	118	69.41
No other stakeholders	47	27.65
water trust	5	2.94
Total	170	100

Sources: Field work, 2022.

5.3 Perception of the success of the MCC Compact project

This section looks at the respondent's perceptions on the purpose of the MCC Compact project, perceptions on water infrastructure, vandalism, cost of water and perceptions of the MCC Compact project by the respondents.

5.3.1 Respondents perception on the purpose of the MCC Compact project

Eighty-eight percent of the respondents said that the purpose of the MCC Compact project was to provide water infrastructure while 12 percent of respondents said that the purpose of the MCC Compact project was to improve water infrastructure as shown in table 12.

Table 12: Respondents perception on the purpose of the MCC Compact project.

Variable		
Purpose of the MCC Compact project	Frequency	Percent
Improve water infrastructure	20	11.76
Provide water infrastructure	150	88.24
Total	170	100

Source: Field work, 2022.

5.3.2 Perception on water infrastructure

Ninety - eight percent of respondents said that MCC Compact project had provided and improved water infrastructure. Thirty - six percent of the respondents said that they experienced vandalism. Ninety - five percent of respondents said that the provision of water was adequate. Ninety- nine percent of respondents said that they pay for tap water supply as shown in table 13.

In- depth interview with LWSC coordinator for Sanitation Connection Action Plan also revealed that residents paid water bills. The official said that;

> *"Most of Mtendere East residents paid water bills, as of September, 2022, all the designated plots in Mtendere East had meters but not all of them were connected with water supply, and about 3117 were connected and billed every month".*

Table 13: Perception of water infrastructure.

	Yes		No	
Variable	Frequency	Percent	Frequency	Percent
Provision and Improvement of water infrastructure	167	98.24	3	1.76
Experience of vandalism	61	35.88	109	64.12
Adequacy of water supply	162	95.29	8	4.71
Paying for tap water services	168	98.82	2	1.18

Source: Field work, 2022.

5.3.3 Vandalism of water infrastructure

Most of the respondents (64%) said that they never experience vandalism. While one percent of the respondents said that they experience vandalism once a month as shown in table 14.

In- depth interviews with LWSC Manager for Asserts and Coordinator for Sanitation Connection Action Plan revealed that LWSC received few cases of vandalism which were taken care of by the company.

Table 14: Frequency of vandalism

Variable		
Frequency of vandalism	Frequency	Percent
Once a week	7	4.12
Once a month	2	1.18
Every other month	12	7.06
Once a year	40	23.53
Never	109	64.12
Total	170	100

Source: Field work, 2022.

Figure 11: Vandalism of the pipe which takes water to the tap.

Source: Field work, 2022.

5.3.4 Cost of water

Eighty – one percent of respondents said that the water services are affordable while 19 percent of the respondents said that water services are not affordable. Findings are shown in table 15.

Table 15: Cost of water.

Variable	Frequency	Percent
Affordable	137	80.59
Not affordable	33	19.41
Total	170	100

Source: Field work, 2022.

5.3.5 Perception of the MCC Compact Project

Nighty – eight percent of the respondents said that the MCC Compact project was a good project, while two percent of the respondents said that the water services were not affordable as shown in table 16.

In-depth interviews with LWSC Coordinator for Sanitation Connection Action Plan also revealed that LWSC perceived MCC project as a good project. LWSC official said that;

> "*LWSC perceive the MCC Compact water and sanitation project as a good project that it has improved equitable domestic water supply in Mtendere East with a few challenges such as infrastructure vandalism and intermittent water supply. Since the project had yielded a huge success in Mtendere East, it should be replicated in other areas of the country".*

Equally, the representative for Millennium project completion Agency said that;

> "*The Agency perceived the MCC compact water and sanitation project for Mtendere as an important project and a complete success. Most residents of Mtendere East had no opportunity to running water but now they have water infrastructure in the area. Having tap water supply was a huge achievement for both the country and residents of Mtendere East"*

Table 16: Perception of the MCC Compact project.

Variable	Frequency	Percent
Good project	166	97.65
Not affordable services	4	2.35
Total	170	100

Source: Field work, 2022.

5.4 Effectiveness of the MCC Compact water project.

This section looks at the effectiveness of the MCC Compact water project. It presents findings on the availability of domestic water before and after the MCC Compact project, major causes of intermittent water supply, period for water shortage and effects of water shortage. Further, findings on effectiveness of domestic water supply and perception of the effectiveness of the MCC Compact project.

5.4.1 Availability of water before and after the MCC Compact project

Before the MCC project, tap water supply was at 23 percent. This is because a good number of respondents did not have water infrastructure. After the implementation of the MCC Compact project, 97 percent of the respondents said that they did receive tap - water supply. However, 89 percent said that they experienced intermittent water supply and water shortage. Twenty- seven percent of respondents walk long distances to fetch water as shown in table 17.

LWSC Coordinator for Sanitation Connection Action Plan also revealed that;

> *"the company do receive a number of intermittent water supply and water shortage complaints when there was water supply shutdown. LWSC communicate to the residents by giving a schedule for the water supply shutdown before water supply is shutdown".*

Table 17: Availability of water before and after MCC.

Variable	Yes		No	
	Frequency	Percent	Frequency	Percent
Adequacy of water supply before MCC	39	22.94	131	77.6
Adequacy of water supply after MCC	165	97.06	5	2.94
Experience of intermittent water supply and water shortage.	152	89.41	18	10.56
Distance covered to fetch water	46	27.06	124	72.94

Source: Field work, 2022.

5.4.2 Major causes of intermittent water supply and water shortage

Thirty-five percent of the respondents said that the major cause of intermittent water supply and water shortage was inadequate water infrastructure. Thirty-two percent of the respondents said that the major cause of intermittent water supply was a lack of good water infrastructure. Two percent of the respondents said the major cause of intermittent water supply was low water supply as shown in table 18.

In- depth interviews with respondents also revealed that;

> "the *other causes of water shortages are poor maintenance of water infrastructure and vandalism".*

Table 18: Major causes of intermittent water supply and water shortage.

Variable	Frequency	Percent
Lack of good water infrastructure	55	32.35
Inadequate water infrastructure	59	34.71
Vandalism of water infrastructure	21	12.35
High demand (others)	26	20.59
Leakages (others)	6	3.53
low water supply (others)	3	1.76
Total	170	100

Source: Field work, 2022.

5.4.3 Period for intermittent water supply and water shortage

Sixty - eight percent of the respondents said that they experience intermittent water supply for more than three hours, fifteen percent said that they experience water shortage for days and five percent of the respondents said that they experience water shortage on weekends as shown in figure 12.

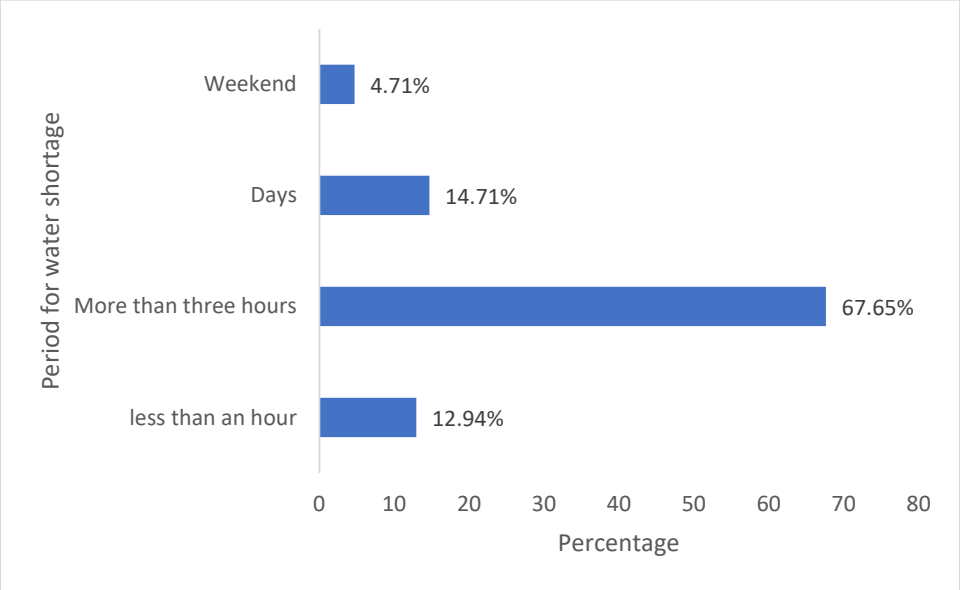

Figure 12: Period of water shortage.

Source: Field work, 2022.

5.4.4 Effects of domestic water shortages

Sixty - eight percent of the respondents said that they were not affected by water shortages because most of them conserve water for future use in buckets, drums and containers. Thirty - one percent of the respondents said that they had no water for domestic use and one percent of the respondents said that they had no water for business as shown in figure 13.

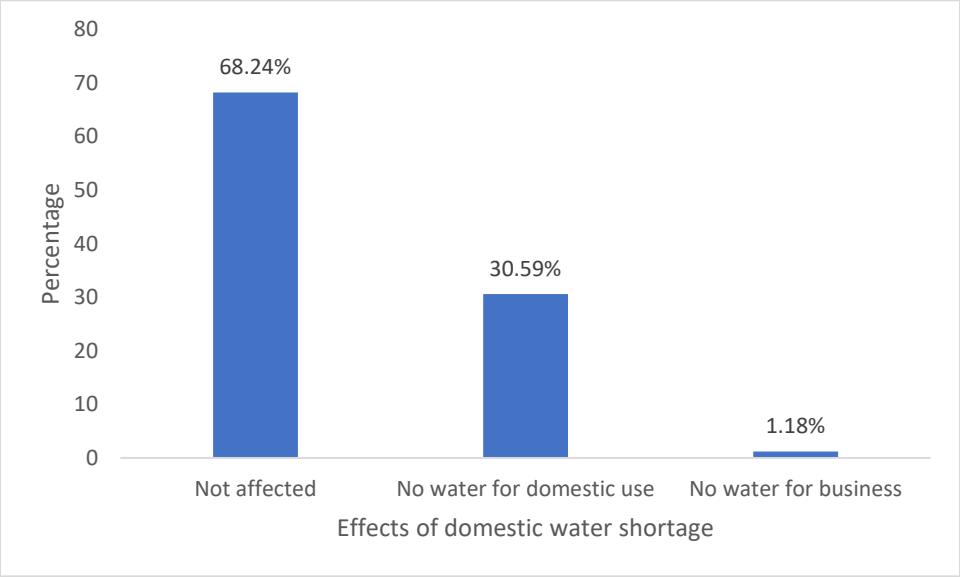

Figure 13: Effects of domestic water shortage.

Source: Field work, 2022.

5.4.5 Effectiveness of domestic water supply.

Nighty - nine percent of the respondents said that after the MCC Compact project, domestic water supply improved. Nighty – eight percent said that the hours of receiving domestic water increased, 95 percent said that the provision of water supply was adequate for domestic use as shown in table 19.

Table 19: Effectiveness of domestic water supply after the project.

Variable	Yes		No	
	Frequency	Percent	Frequency	Percent
Improvement of water supply after the MCC project.	168	98.82	2	1.18
Increased hours of receiving water supply	167	98.24	3	1.76
Adequacy of water for domestic use	162	95.29	8	4.71

Source: Field work, 2022.

5.4.6 Perception of the Effectiveness of the MCC Compact project

Nighty - five percent of the respondents said that the MCC Compact project was effective, while five percent of the respondents said that the MCC Compact project was not effective as shown in table 20.

In - depth interviews with the representative for the Millennium project completion Agency revealed that the MCC Compact water and sanitation project for Mtendere East had been effective. The representative said that;

> *"The MCC Compact water and sanitation project had been effective and the system was providing water to the residents and soon the sanitation infrastructure was going to be connected. The respondent added that there was an opportunity for the project since it's a contract to continue and reach the areas like section ten of Mtendere East".*

Table 20: Perception of the effectiveness of the MCC Compact project.

Variable		
Perception of the effectiveness of the MCC project.	Frequency	Percent
It is effective	162	95.29
It is not effective	8	4.71
Total	170	100

Source: Field work, 2022.

CHAPTER SIX

DISCUSSION OF RESEARCH RESULTS

6.0 Introduction

This chapter discusses the findings based on the objectives of the study.

6.1 Assessment of adequate domestic water supply in Mtendere East.

6.1.1 Source of domestic water before MCC Compact project

The study revealed that before the MCC Compact project, the highest number of respondents indicated that they used borehole water as their source of domestic water. Before the MCC Compact project, most households in Mtendere East hard no water and sanitation infrastructure. Four percent of respondents said that before the MCC Compact project, their source of domestic water supply was tap water. This is because only a few of the respondents had tap - water supply from Mtendere East water trust. Mtendere East water trust was a company which was given mandate to supply water to Mtendere East by LWSC. The study also indicated that some of the respondents used to fetch water from other water sources such as unprotected shallow wells. Similarly, other studies by United Nations, (2021) also observed that the present status of water resources calls for improved water resources management. A similar study by Odunuga, (2010) indicated that most of the poor households in Alajo and Sabon Zango of Accra (Ghana) lacked access to piped connections, these households bought water from households with piped connections.

6.1.2 Daily sources of domestic water

After the implementation of the MCC Compact project, the study revealed that the majority of the respondents used tap water as their source of domestic water supply. The study indicated that most of the respondents use tap water as their source of domestic water supply, this is because the majority of the respondents had water supply and sanitation infrastructure. The current study indicated that as of September 2022, most households connected with water infrastructure including water meters, had tap water supply. Similarly, the study by Musango, (2017) indicated

that 98 percent of households of Hillview south of Lusaka city were connected to LWSC water distribution network as others used personal boreholes. Also, the study by Namuwelu, (2020) indicated that 95 percent of respondents in Kansanshi and 82 percent of respondents in Ndeke had access to piped water. Vonk, (2021) also observed that households in Chawama compound of Lusaka did not have unimproved sources of water and had piped water connection with 53 percent, while 15 percent in George compound were using unimproved sources of water and 19 percent used piped water. One possible reason for the result might be because a good number of residents for Chawama compound had water and sanitation infrastructure while in George compound only a few had water and sanitation infrastructure.

The study also revealed that the majority of the respondents (Table 7) indicated that they used Borehole water as the alternative source of domestic water when there was no tap water supply. Residents get water from private borehole owner. These findings are supported by Musambo, (2017) who revealed that 39 percent of respondents from Hillview south used personal boreholes as alternative sources of water when there was no water supply. Thirty – two percent drew water at a fee from neighbours with personal boreholes and 29 percent indicated that they fetched water from water vendors. The study also indicated that 11 percent of respondents were those who use water they store and get water from unprotected shallow wells which are privately owned. Shallow wells are more prone to contamination and expose individuals to transmission of diseases such as typhoid, cholera, diarrhea and dysentery. Some residents were still using shallow wells because of reasons such as; vandalism of water infrastructure, low water supply, water shortages, intermittent water supply and high - water bills. Similarly, the report by UNICEF/WHO, (2019) also revealed that many people around the world are suffering from poor access to safe water.

6.1.3 Coping strategies used when there is no tap - water supply

The present study results indicated that the majority of the respondents said that the coping strategy they used when there was no tap - water supply was storing water. Respondents indicated that they store water before the water stop running as others get water they store from alternative sources like boreholes. Similarly, the study by Senna, (2021) revealed that in the absence of flowing tap - water, respondents depended on boreholes, wells and water from vendors.

6.1.4 Storage and approximated litres of domestic water

The study results indicated that the majority of respondents used buckets and containers as storage of domestic water. These results were supported by other studies by; Brainard, (2015); Maggioni, (2015) who revealed that water management organizations in most industrialized countries were facing increasing supply shortages of which conservation and storage of water for domestic use were some of the strategies to address water scarcity. The present study also revealed that 39 percent of the respondent store 1-100 litres of water and another 39 percent of respondents store 101-199 litres of water. Similarly, the study by Senna, (2021) revealed that participants in Madina study area used different kinds of containers ranging from small gallons, buckets, bows, drums and small tanks to large tanks, concrete overhead and under -ground tanks were used in storing water.

6.1.5 Approximated distance to the nearest water source

In the current study the majority (82 percent) of respondents said that the approximated distance to the nearest water source was less than one kilometre. The least number (18 percent) of respondents said that they walked one kilometre and above. Similarly, Odunuga, (2010) also indicated that people in Poor households of Accra traveled by foot at approximated distance of 3.22 km in search of water. The responses in the current study show that there was an improvement in water supply due to the reduced distances covered to fetch water.

6.1.6 Respondents perceptions on strategies put in place by LWSC to improve tap - water supply

The study revealed that the respondents said that the strategy put in place by LWSC to improve water supply was providing water and sanitation services. The study also revealed that LWSC had various strategies put in place that were aimed at uplifting the goals of MCC project and improved domestic water supply services such as; comprehensive water bills, installing water and sanitation infrastructure and sensitize the community on the dangers of infrastructure vandalism, sensitize residents to report any vandalized water infrastructure, sensitize residents on how to conserve water and how to take care of the water infrastructure. These findings are supported by Vonk, (2021) who revealed that LWSC had put in place strategies to improve water supply services such

as comprehensive water bills, installing water and sanitation infrastructure and community sensitization on the good use of water infrastructure.

6.1.7 Other stakeholders involved in providing domestic water

The study indicated that other stakeholders involved in providing domestic water were borehole owners. Individuals and churches who owned boreholes provided domestic water to the community. Similarly, study by Musambo, (2017) indicated that, apart from LWSC, other stakeholders involved in providing domestic water supply are borehole owner and water vendors.

6.2 Perception of the success of the MCC Compact project `

6.2.1 Respondents perception on the purpose of the MCC Compact project

According to the findings, 88 percent of respondents said that the purpose of the MCC Compact project was to provide water infrastructure. While the other group said that the purpose of the MCC Compact project was to improve water infrastructure. These findings are supported by Musambo, (2017); Mgoba and Kabote, (2020) who observed that the purpose of community-based water projects was meant to improve and provide water infrastructure.

6.2.2 Perception of water infrastructure, vandalism, adequacy of water and paying for water

The current study results revealed that the MCC Compact project had improved water infrastructure. Similarly, Mgoba and kabote, (2020) observed that both governmental and non-governmental funded projects improved water infrastructure in the study area. The present study results revealed that some of Mtendere East residents experienced vandalism of water infrastructure. Similarly, the study by Namuwelu, (2020) indicated that there was vandalism of water infrastructure in Kansenshi and Ndeke communities.

The present study results indicated that respondents said that the provision of water was adequate in Mtendere East. Similarly, the study by Mgoba and Kabote, (2020) revealed that non-governmental funded community- based water projects provided adequate domestic water supply in the study area.

The current study results revealed that respondents pay for tap - water supply services, most Mtendere East residents pay water bills, as of September, 2022, all the designated plots in Mtendere East had meters but not all of them were connected with water supply, and about 3117 were connected and billed every month. The current study also revealed that most respondents afford to pay for water services. These findings were supported by Musambo, (2017) who revealed that 41 percent of Hillview respondents pay for water services, they paid fixed monthly charge. Thirty – three percent of respondents were on pre- paid metering system while 24 percent of respondents were on a post – paid metering system. In addition, Vonk, (2021) also observed that both George and Chawama residents paid for water use which was fixed tariff for those who were not metered, communal taps billed per month and others per litres and individual connected payed per month.

6.2.3 Frequency of vandalism

The study revealed that some respondents never experienced vandalism, only a few respondents indicated to have been experiencing water and infrastructure vandalism, the cases are then reported to LWSC maintenance department and worked on. Similarly, the study by Musambo, (2017) indicated that few cases of water infrastructure vandalisim were experienced by respondents from Hillview south and were reported to LWSC maintenance team and were worked on. These results were also supported by Namuwelu, (2020); Vonk, (2021) who indicated that there was vandalisim of water infrastructure in some of their study areas which resulted into high level of non – revenue water and water contamination.

6.2.4 Perception of the MCC Compact Project

The study results indicated that the majority of the respondents said that the MCC Compact project was a good project (table 16). The study also revealed that LWSC and MPCA perceive the MCC Compact water and sanitation project as a good and a complete success project that had improved equitable domestic water supply in Mtendere East with a few challenges such as infrastructure vandalism and intermittent water supply. Most residents of Mtendere East had no opportunity to running water but now they had water infrastructure. Having tap water supply was a huge achievement for both the country and residents of Mtendere East. Similarly, the study by Musambo, (2017) indicated that the installed water distribution network of Hillview south

improved water supply in terms of supply hours in households of Hillview south with the few challenges of water leakages which made it difficult to account for the water used.

6.3 Effectiveness of the MCC Compact water project.

6.3.1 Availability of water before and after the MCC Compact project

The study indicated that, before the MCC project, most respondents indicated that they had no adequate water supply. This was because a good number of respondents did not have water and sanitation infrastructure. After the project, almost all of the respondents with water infrastructure did receive adequate water supply. Tap water supply in Mtendere East had improved after the implementation of the MCC Compact water project. Similarly, the study by Mgoba and Kabote, (2020) revealed that, both governmental and non- governmental funded projects achieved objectives on functionality of water points, by increasing water availability in the study area. The availability of water increased compared to the situation before establishment of the community-based governmental and non – governmental funded water projects.

However, the current study also revealed that majority of the respondents' experience intermittent water supply and water shortages. A few walked long distances to fetch water. The present study revealed that LWSC received a number of water supply shortage complaints when there was water supply shutdown. Therefore, LWSC mostly communicated to the residents by giving a schedule for the water supply shutdown before water supply is shut down for water infrastructure maintenance. These results were supported by Namuwelu, (2020) who asserts that Kitwe Water and Sanitation Company also received water challenge complaints from Kansenshi and Ndeke communities of which the company worked on the defects of water infrastructure.

6.3.2 Major causes of intermittent water supply and water shortages

The increase of the population and water demand causes water shortage in most urban area. Human dynamics have a great impact on water resources, how they are developed and used (Sternberg, 2016).

The study revealed that the major cause of intermittent water supply and water shortage was inadequate water infrastructure. Thirty-two percent of the respondents said that the major cause of

intermittent water supply and water shortage was lack of good water infrastructure. These findings are in line with the study by Odunuga, (2010) who observed that one of the causes of intermittent water supply in Alajo and Sabon Zango communities in Ghana was lacky of good water infrastructure.

The present study results indicated that 20 percent of respondents said that the cause of water shortage was high demand for water supply. Mtendere East is characterized by high population, hence high demand of water. These findings were also supported by, Sternberg, (2016); UN, (2018); Senna, (2021); Vonk, (2021); WHO/UNICEF, (2021) who observed that population growth and poor water infrastructure lead to insufficient safe water supply. The growing demand for water supply and sanitation lead to a growing challenge of providing adequate water supply.

6.3.3 Period for intermittent water supply and water shortage

The study results revealed that 13 percent of respondents experience intermittent water supply for less than an hour, 67 percent of respondents experienced intermittent water supply for more than three hours. Fifteen percent of respondents experience water shortage for a number of days and 5 percent experience water shortage on weekend. Similarly, the study by Musambo, (2017) revealed that 47 percent of respondents could go for a number of days without water service from LWSC water distribution network, 23 percent of the respondents indicated that they had water shortage at times and 28 percent mentioned as never experiencing water shortages. Also, the study by Vonk, (2021) revealed that residents of George compound experienced intermittent water supply and water shortages, they had water supply two hours in the morning and two hours in the evening while residents in Chawama did not indicate having water shortages, but only indicated having low water supply in some areas.

6.3.4 Effects of domestic water shortages

Water scarcity affects more than 40 percent of the people around the world (WHO/UNICEF, 2021).

Poor water and sanitation courses diseases like diarrhea. Diarrhea kills 4000 children every day around the world, making it the second leading cause of death among children under five years old globally and the fifth leading cause of death among all age groups (WHO/UNICEF, 2008).

The current study revealed that most of the respondents were not affected by water shortages. This was because most respondents said that they conserved water for domestic use. Thirty-one percent of the respondents had no water for domestic use such as washing and cooking. Inadequate water supply can lead to diarrheal diseases such as cholera and typhoid. One percent of the respondents had no water for home - based business like; vegetable selling, hair dressing of which they had no water for running home - based salon. Similarly, the study by Vonk, (2021) revealed that some residents from George and Chawama compound worried about not having enough domestic water for they did not have water for domestic use which caused school absenteeism as pupils were sent by their guardians to fetch water from alternative water sources. These results were also supported by Senna, (2021) who revealed that the effects of water scarcity in Madina peri- urban community of Accra included; lateness to school, low productivity and poor sanitation.

6.3.5 Effectiveness of domestic water supply.

The study results revealed that after the MCC Compact project, the majority of respondents said that water supply improved and the number of hours of receiving water increased. After the implementation of MCC Compact project, most households of Mtendere East had domestic tap water supply. Similarly, the study by Mgoba and Kabote, (2020) observed that 63 percent of the respondents showed high effectiveness of participatory monitoring and evaluation in enhancing water availability. This was attributed to non- governmental water projects in which participatory monitoring and evaluation was effective relative to government funded community- based water projects because of effective participation of the local communities.

6.3.6 Perception of the Effectiveness of the MCC Compact project

The present study revealed that the majority of the respondents said that the MCC Compact project was effective, (table 20). The study also revealed that MPCA indicated that the MCC Compact water and sanitation project had been effective and the system was providing water to the residents and soon the sanitation infrastructure was going to be connected. The respondent indicated that there was an opportunity for the project since it's a contract to continue and reach the areas like section ten of Mtendere East. The study revealed that the MCC Compact project improved equitable access to domestic water in Mtendere East.

The findings were supported by Ermilo, *et al.*, (2014) on identifying system failure of the Performance Evaluation of community managed water supply infrastructure in Nicaragua and Panama, the study revealed that the water levels for all sites studied were within the 85 percent to 95 percent tank-full conditions. This demonstrated that the systems studied were performing well. Similarly, the study by Mgoba and Kabote (2020) on determining the effectiveness of the participatory monitoring and evaluation on achievement of community – based water projects which were government and none governmental organization funded projects in Tanzania, the study revealed that non- governmental community- based water projects were more effective than governmental funded community- based water projects in terms of increasing water availability in the study area.

The study by Vonk, (2021) on 'Urban WASH' project, in George and Chawama townships of Lusaka showed that households in Chawama did not have unimproved water sources with 53 percent of pipe water connection. Households in George were using unimproved water sources at the rate of 15 percent and piped water at 19 percent. The project had a minimal impact in George compound for the sustainable water and sanitation while in Chawama the project had a positive impact on the access to piped water.

CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATIONS

7.0 Introduction

This chapter gives the conclusion of the research based on the objectives of the study. The recommendations are given based on the gaps observed.

7.1 Conclusions

The study investigated the role of the Millennium Challenge Corporation Compact project in improving the equitable access to domestic water supply in Mtendere East. Five sections that is section 5, 6, 7, 8, and 9 were taken under review and the study focused on; assessing the sources of domestic water supply before and after the MCC, assessing people's perceptions on the success of the MCC Compact water project in Mtendere East and evaluating the effectiveness of the MCC Compact water project in Mtendere East.

The transformative impact of the MCC Compact project in Mtendere East is evident in the significant improvement in water supply for households. Before the project, tap water was a rarity, and residents relied on sources such as boreholes and shallow wells. Post-implementation, a positive shift occurred, with the majority now enjoying ample tap water access.

The water storage practices adopted by residents, such as using buckets and containers, showcase their proactive coping strategies during periods of water scarcity. Despite challenges like infrastructure vandalism, the Lusaka Water Supply and Sanitation Company (LWSC) has implemented commendable strategies including; comprehensive water bills and infrastructure maintenance, to enhance water supply and sanitation services.

The study indicates a general satisfaction among respondents and key informants regarding the MCC Compact project. Despite occasional intermittent water supply and water shortages attributed to infrastructure issues, the overall perception is overwhelmingly positive. The success of the project is underscored by the improved water infrastructure and the impending connection of sanitation facilities.

While acknowledging the challenges faced, such as high demand, vandalism, and occasional intermittent water supply and water shortages, it is evident that the project significantly benefited the majority of Mtendere East residents. The positive impact on daily life, including household activities and home-based businesses, cannot be overstated.

The resounding support for the MCC Compact project from both residents and key informants, including LWSC officials, councillor, and MPCA, emphasizes its effectiveness. The call for an extension of the project to cover additional sections with water scarcity issues reflects a collective desire to address water-related challenges comprehensively.

In summary, the MCC Compact project had not only fulfilled its intended purpose of providing and enhancing water and sanitation infrastructure but also garnered widespread approval as a successful and impactful initiative. Its extension to other areas in need is advocated to further alleviate water scarcity and improve the overall quality of life for communities in the region.

7.2 Recommendations

Following the findings generated by the study, the following are recommendations;

- **The government**

  The Government of the Republic of Zambia should ensure that the water and sanitation projects are commenced, monitored, completed and implemented in most of the areas with domestic water supply challenges in the county. The projects that are aimed at both improving and providing water and sanitation infrastructure across the country should be given full resource capacity to ensure that they are complete and implemented in order to achieve intended goals as part of the SDGs number 6 of 2018. To increase the residents' access to safe, clean and adequate domestic water supply, water and sanitation projects have to be implemented in most of the part of the country with water scarcity.

- **Policies**

  Zambia's water policies should be targeted on environmental protection. The policies should create a comprehensive nationwide water management strategy such as implementing the efficient monitoring and evaluation policies on the underway water infrastructure projects and establishing adequate funding of various underway water infrastructure development projects.

- **Other stakeholders**

In collaboration with government, non – governmental organizations should be involved by funding water and sanitation projects to help address water scarcity in most of the parts of the country.

- **LWSC**

Lusaka Water supply and Sanitation Company should ensure that water and sanitation projects such as the MCC Compact project for Mtendere are completed, if there will be funds for water and sanitation projects, such a project may be replicated to other areas across the city and country. LWSC should ensure that the communities are trained (educated) with the optimal knowledge to help them take care of water and sanitation infrastructure and know the dangers of using unprotected water sources such as shallow – wells. Community education will help residents to minimize and report infrastructure vandalism. Involving the community in improving and providing water and sanitation services helps the community to value water and sanitation infrastructure. LWSC should consider that many residents in Mtendere East are in low-income generating category, the water bills charges should be designed with utmost consideration. LWSC should be getting information necessary to know what communities need in terms of improving and providing water and sanitation services. LWSC should be conducting periodic water and infrastructure maintenance to meet the demand of the communities.

7.3. Suggestions for future area of the study

Even though this study was sufficient in achieving its intended purpose as it met out all its set objectives and answered all the preliminary research questions, there is a need for the further study by the future academicians and scholars in the field. The future academician and scholars should focus on investigating the quality of domestic water supply after the implementation of the water and sanitation project.

7.4 Limitations to the study

The study was willing to cover other areas were the MCC Compact project was implemented but due to logistical constraints such as mobility, only Mtendere was covered.

REFERENCES

Adler, I., 2011. Domestic water demand management: implications for Mexico City. International Journal of Urban Sustainable Development 3, 93-105.

Ahiablame, L., Engel, B. and Venort, T., 2012. Improving water supply systems for domestic uses in urban Togo: The case of a suburb in Lomé. *Water*, *4*(1), pp.123-134.

Athuraliya, A., Roberts, P. and Brown, A., 2012. Residential Water Use Study. Yarra Valley Water, Mitcham, Australia.

Bigas, H. (Ed.), 2012. The Global Water Crisis: Addressing an Urgent Security Issue. Papers for the Inter Action Council, 2011-2012. Hamilton, Canada: UNU-INWEH.

Biswas, A. and Gangwar, D., 2021. Studying the water crisis in Delhi due to rapid urbanisation and land use transformation. International Journal of Urban Sustainable Development, 13(2), pp.199-213.

Brainard, L. K. 2015. An Evaluation of water needs in South Africa Communities. MSc Thesis-Texas A and M University. South Africa.

Browne, AL, Pullinger, M, Medd, W & Anderson, B. 2014, 'Patterns of practice: a reflection on the development of quantitative/mixed methodologies capturing everyday life related to water consumption in the UK', International Journal of Social Research Methodology, vol. 17, no. 1, pp. 27-43. https://doi.org/10.1080/13645579.2014.854012

Bryman, A., 2016. Social research methods. Oxford university press.

Campbell, H.E., Johnson, R.M. and Larson, E.H., 2004. Prices, devices, people, or rules: the relative effectiveness of policy instruments in water conservation. *Review of policy research*, *21*(5), pp.637-662.

Chanda, (2020); Water contamination in Lusaka's Mtendere Township. https://www.lusakatimes.com.

Chabala, L.M., Kuntashula, E. and Kaluba, P., 2013. Characterization of temporal changes in rainfall, temperature, flooding hazard and dry spells over Zambia. Universal Journal of Agricultural Research, 1(4), pp.134-144.

Cheruseril, J.J., 2007. Determining an urban water consumption model based on socio-demographic factors (Doctoral dissertation, RMIT University).

Citi GPS, 2017.Solutions for the global water crisis. The End of 'Free and Cheap' Water report. www.citi.com/citigps.

Cohen, L., Manion, L., & Morrison, K., 2011. Research Methods in Education (7th ed.). Routledge. https://doi.org/10.4324/9780203720967

Corcoran, E., 2010. Sick water: the central role of wastewater management in sustainable development: a rapid response assessment. UNEP/Earthprint.

Cooperation International Waters in Africa (CIWA) Annual Report, 2020. A snapshot. World bank.org.

Creswell, J.W., 2011. Controversies in mixed methods research. *The Sage handbook of qualitative research*, *4*(1), pp.269-284.

Creswell, J.W., 2015. *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. pearson.

Crouch, M. L. 2020. Stochastic Evaluation of per Capita Domestic Water Requirements in View of Various Lifestyles. MSc Thesis, Stellenbosch University, South Africa. Available from: https://scholar.sun.ac.za/handle/10019.1/107873.

Crouch, M.L., Jacobs, H.E. and Speight, V.L., 2021. Defining domestic water consumption based on personal water use activities. *AQUA—Water Infrastructure, Ecosystems and Society*, *70*(7), pp.1002-1011.

Denzin, N.K. and Lincoln, Y.S. eds., 2011. *The Sage handbook of qualitative research*. sage.

Dziedzic, R., Margerm, K., Evenson, J. and Karney, B.W., 2015. Building an integrated water–land use database for defining benchmarks, conservation targets, and user clusters. *Journal of Water Resources Planning and Management*, *141*(4), p.04014065.

Ermilio J. C., Pattison S., Cain D, Sohail M., 2014. *Performance Evaluation of Community Managed Water Supply Infrastructure*; Sustainable water and sanitation services for all in a fast-changing world. 37th WEDC international conference, Hanoi, Vietnam.

European Union, (2010), *Water Scarcity and Drought in the European Union*, [on line] Available from: http://ec.europa.eu/environment/water/quantity/pdf/brochure.pdf

External Evaluation of the Global Water Security & Sanitation Partnership (GWSP) (2021), ManagementGroup.https://thedocs.worldbank.org/en/doc/279f9a7ff51a5d3ef08913d13aadf90b-0320082021/original/

Ezeadichie, N (2012), "Home-Based Enterprises in Urban Space: Obligation for Strategic Planning?", Berkeley Planning Journal Vol 25, No 1. pages 44– 63.

Fewtrell, L., Kaufmann, R.B., Kay, D., Enanoria, W., Haller, L. and Colford, J.M., 2005. Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta-analysis. *The Lancet infectious diseases*, *5*(1), pp.42-52.

Fielding, K.S., Russell, S., Spinks, A. and Mankad, A., 2012. Determinants of household water conservation: The role of demographic, infrastructure, behavior, and psychosocial variables. *Water Resources Research*, *48*(10).

Food and Nutrition Technical Assistance (FANTA) project. 1999. Water and Sanitation Indicators Measurement Guide, Washington DC.

Government of The Republic of Zambia, (2002). Maize Production Guide, Public Service Capacity Building Project. Management Division, Soils and Crop Research Branch (SCRB) and Ministry of Agriculture and Cooperatives (MACO).

Government of The Republic of Zambia, (2007). The National Adaptation Programme on Action, Ministry of Tourism, Environment and Natural Resources.

Hay, E.R., Riemann, K., Van Zyl, G. and Thompson, I., 2012. Ensuring water supply for all towns and villages in the Eastern Cape and Western Cape Provinces of South Africa. *Water SA*, *38*(3), pp.437-444.

Heinrich M. 2008. 'Water Use in Auckland Households – Auckland Water Use Study (AWUS) – Final Report'. BRANZ Project Report EC1356. BRANZ Ltd, Judgeford, New Zealand.

Independent Development Evolution, 2015. African Development Bank Group: Water Supply and Sanitation in Africa: Findings, Lessons and Good Practices to Improve Delivery. Ad-hoc Publications.

Inman, D. and Jeffrey, P., 2006. A review of residential water conservation tool performance and influences on implementation effectiveness. *Urban Water Journal*, *3*(3), pp.127-143.

International Institute for Environment and Development Briefing, 2016. Policy pointers; why is water still unaffordable for sub-Saharan Africa's urban poor? http://pubs.iied.org/17353IIED.

Japan International Cooperation Agency, (2019). The project for strengthening capacity of urban water supply infrastructure in the republic of Zambia https: //www.jica.go.jp/project/english/zambia/014/materials/c8h0vm0000f3kvvz-att/briefnote.pdf

Johnston, D. and Strong, T., 2008. Reconciling voices in writing an autoethnographic thesis. *International Journal of Qualitative Methods*, *7*(3), pp.47-61.

Kabir, S.M.S., 2016. Basic guidelines for research. *An introductory approach for all disciplines*, *4*(2), pp.168-180.

Kombo, K.D. and Tromp, L.A.D. (2006) Proposal and Thesis Writing: An Introduction. Paulines Publishers, Nairobi, Kenya.

Lallana, C., Krinner, W., Estrela, T., Nixon, S., Leonard, J. and Berland, J.M., 2001. *Sustainable water use in Europe. Part 2: Demand management*. European Environment Agency.

Magai, R. (1985). The soils of Zambia. In: Proceedings of the XI the International Forum on soil Taxonomy and Agrotechnology Transfer, Zambia, July 15th to August 1st, 1985. Norwegian Agency for International Development. Pp136 – 140.

Mulwafu, W., Chavula, G., Chipeta, C., Ferguson, A., Chilima, G. and Nkhoma, B., 2002. The status of water demand management in Malawi and strategies for promoting it.

Maggioni, E., 2015. Water demand management in times of drought: What matters for water conservation. *Water Resources Research*, *51*(1), pp.125-139.

Makwiza, C. and Jacobs, H.E., 2016. Assessing the impact of property size on residential water use for selected neighbourhoods in Lilongwe, Malawi. *Journal of Water, Sanitation and Hygiene for Development*, *6*(2), pp.242-251.

Martínez-Santos, P., 2017. Does 91% of the world's population really have "sustainable access to safe drinking water"?. *International Journal of Water Resources Development*, *33*(4), pp.514-533.

Mayer, P.W., DeOreo, W.B., Opitz, E.M., Kiefer, J.C., Davis, W.Y., Dziegielewski, B. and Nelson, J.O., 1999. Residential end uses of water

McKim, C.A., 2017. The value of mixed methods research: A mixed methods study. *Journal of mixed methods research*, *11*(2), pp.202-222.

Mgoba, S.A. and Kabote, S.J., 2020. Effectiveness of participatory monitoring and evaluation on achievement of community-based water projects in Tanzania. *Applied Water Science*, *10*(8), p.200.

Millennium Challenge Corporation. Zambia Compact, 2019. https://www.mcc.gov/where-we-work/program/zambia-compact.

Millennium Challenge Corporation, 2020. Zambia Star Report.

Ministry of Education. (2013). Education Statistical Bulletin. Lusaka: MoE: Directorate of Planning and Information.

United Nations Department of Economic and Social Affairs (2008). Millenium Development Goals Report.

Molenaar D, M.S. 2018. Determinants of Household Water Use in the City of Kalamazoo. MSc Thesis. Western Michigan University. https://scholarworks.wmich.edu/masters_theses/3409

Monitoring and Evaluation framework, (2020-2030), Republic of Zambia ministry of water Development, Sanitation and Environmental Protection

Musambo, M. 2017. An Evaluation of performance of water Distribution Networks in Lusaka city: Hillview south water project. MSc dissertation. University of Zambia.

Namuwelu, V. 2020. Domestic water uses and conservation practices among the households of Kansenshi and Ndeke resdential areas of Ndola city of Zambia. MSc dissertation. University of Zambia.

National Planning Commission (2012). *National Development Plan 2030*: Our future – make it work, 2012, Pretoria, South Africa.

Nkhuwa, D.C.W. 2006 Ground water quality Assessments in the John Laing and Misisi areas of Lusaka. MSc Dissertation. university of Zambia.

Nkole, N. 2018. Mtendere township: The place of peace. Retrieved from http://www.dailymail.co.zm/mtendere-township-the-place-of-peace

National Water and Supply Council, 2022. Annual report. https://www.nwasco.org.zm/index.php/media-center/publications/annual-reports/category/6-annual-reports.

Odunuga, K. 2010. Analysis of Domestic water use for Commercial activities among the poor in Alajo and Sabon Zango communities of Accra Ghana. MSc Thesis, University of Manitoba, Canada.

Oxfam, 2021. Sustainable Water and Sanitation in Zambia: Impact evaluation of the 'Urban WASH'project Effectiveness Review series 2018/19

Parandvash, G.H. and Chang, H., 2016. Analysis of long-term climate change on per capita water demand in urban versus suburban areas in the Portland metropolitan area, USA. *Journal of Hydrology*, *538*, pp.574-586.

Program for Appropriate Technology and Health, 2011. Safe water project's monitoring and evaluation framework: Testing market-based solutions in four countries. www.path.org.

Randolph, B. and Troy, P., 2008. Attitudes to conservation and water consumption. *Environmental science & policy*, *11*(5), pp.441-455.

Ravitch, S.M. and Riggan, M., 2016. *Reason & rigor: How conceptual frameworks guide research*. Sage Publications.

Ravitch S. M. & Carl, M. N. (2021). Qualitative Research: Bridging the Conceptual, Theoretical, and Methodological. (2nd Ed.). Sage Publications.

Schleich, J. and Hillenbrand, T., 2009. Determinants of residential water demand in Germany. *Ecological economics*, *68*(6), pp.1756-1769.

Senna, R., 2021. Household coping strategies of water scarcity: The Case of Madina, A suburb of the La-Nkwantanang District in the Greater Accra Region. *Journal of Resources Development and Management*, *76*, pp.62-70.

Shumilova, O., Tockner, K., Thieme, M., Koska, A. and Zarfl, C., 2018. Global water transfer megaprojects: A potential solution for the water-food-energy nexus?. *Frontiers in Environmental Science*, *6*, p.150.

Sichingabula, H. M. (1997). Problems of sedimentation in small dams in Zamia. In: D. E walling and J – L Probst (ends) Human Impact on Erosion and sedimentation. IAHS PubI. No 245, pp 251 – 259.

Simpson, A., 1963. The stratigraphy and tectonics of the Manx Slate Series, Isle of Man. *Quarterly Journal of the Geological Society*, *119*(1-4), pp.367-400.

Sternberg, T., 2016. Water megaprojects in deserts and drylands. *International Journal of Water Resources Development*, *32*(2), pp.301-320.

Tran, B., 2016. The nature of research methodologies: Terms and usage within quantitative, qualitative, and mixed methods. In *Mixed methods research for improved scientific study* (pp. 1-27). IGI Global.

United Nations 2021. United Nations World Water Development Report 2021 https://www.unwater.org/publications/un-world-water-development-2008report-2021/

United Nations 2018. Sustainable Development Goal number six Synthesis Report 2018 on Water and Sanitation; https://www.unwater.org/publication_categories/sdg-6-synthesis-report-2018-onwater-and-sanitation/

United Nations Committee on Economic, Social and Cultural Rights (UNCESCR), 2003. United Nations; New York, NY, USA: 2003. General Comment No. 15: The Right to Water (Arts. 11 and 12 of the Covenant) http:// www.unhchr. ch/tbs/doc.

United Nations Children's Fund (UNICEF), 2008. UNICEF Handbook on Water Quality. 3 UN Plaza, New York, NY 10017.

United Nations Development Programme, 2015. Human Development Report 2015. https://www.undp.org/sites/g/files/zskgke326/files/migration/dk/UNDP_Denmark_2015_human_development_report.pdf.

United Nations Economic and Social Council (2005) *UNICEF water, sanitation and hygiene strategies for 2006-2015 E/ICEF/2006/6*. United Nations. http://www.unicef.org/about/execboard/files/06-6_WASH_final_ODS.pdf

United Nations Educational, Scientific and Cultural Organization -WWA 2014. The United Nations World Water Development Report: Water and Energy. http://unesdoc.unesco.org/images/0022/ 002257/225741E.pdf

United Nations Environment Programme, (2005) *Water policy and strategies*. United Nations Environment Programme. http://www.unep.org/dpdl/water/

United Nations Children Fund, 2006. Meeting the MDG drinking water and sanitation target: the urban and rural challenge of the decade. In *Meeting the MDG drinking water and sanitation target: the urban and rural challenge of the decade* (pp. 41-41).

United Nations, 2010. *Resolution on Human Right to Water and Sanitation, UN General Assembly Research A/64/292*. United Nations; New York, NY, USA

United States Agency for International Development, 2009. Addressing Water Challenges in the Developing World: A Framework for Action Report.

Vonk, J., 2021. Sustainable Water and Sanitation in Zambia: Impact evaluation of the 'Urban WASH' project.

Water Resources Management Act, 2011. Act Number**:** No. 21 of 2011 of the laws of Zambia. https://www.parliament.gov.zm/node/6544.

Wentz, E.A. and Gober, P., 2007. Determinants of small-area water consumption for the city of Phoenix, Arizona. *Water Resources Management*, *21*, pp.1849-1863.

Willis, R.M., Stewart, R.A., Panuwatwanich, K., Williams, P.R. and Hollingsworth, A.L., 2011. Quantifying the influence of environmental and water conservation attitudes on household end use water consumption. *Journal of environmental management*, *92*(8), pp.1996-2009.

World Health Organization and United Nations Children's Fund Joint Monitoring Programme for Water Supply and Sanitation (JMP) 2008. *Progress on Drinking Water and Sanitation: Special Focus on Sanitation*. UNICEF, New York and WHO, Geneva.

World Health Organisation and United Nations Children Fund Joint Monitoring Programme for Water Supply and Sanitation, 2012. Progress on Drinking Water and Sanitation: 2012 Update. World Health Organisation

World Health Organisation and United Nations Children Fund Joint Water Supply and Sanitation Monitoring Programme, 2015. *Progress on sanitation and drinking water: 2015 update and MDG assessment*. World Health Organization.

World Health Organization, 2015. *Water, sanitation and hygiene in health care facilities: status in low and middle income countries and way forward*. World Health Organization.

World Health Organisation and United Nations Children Fund Joint Monitoring Programme, 2019. Progress on household drinking water, sanitation hygiene: 2000 – 2017: Special focus on inequalities.

World Health Organization and United Nations Children's Fund (2021). The measurement and monitoring of water supply, sanitation and hygiene (WASH) affordability: a missing element of monitoring of Sustainable Development Goal (SDG) Targets 6.1 and 6.2. New York, NY 10017 USA www.unicef.org/wash

World Health Organization and United Nations Children's Fund Joint Water Supply and Sanitation Monitoring Programme, 2014. *Progress on drinking water and sanitation: 2014 Update*. World Health Organization.

World Health Organization, (2012) Global costs and benefits of drinking-water supply and sanitation interventions to reach the MDG target and universal coverage. Geneva

APPENDICES

Appendix 1: Work schedule

Activity	**Person responsible**	**Dec**	**Jan**	**Feb**	**May**	**Jun**	**Jul**	Aug	Sep	Oct
Proposal writing	Researcher									
Proposal presentation	Researcher									
Ethical approval	Researcher									
Pre-test of instruments	Researcher									
Data collection	Researcher									
Data cleaning	Researcher									
Data analysis	Researcher									
Report writing	Researcher									
Presentation of findings	Researcher									
Submission of report	Researcher									

Appendix 2: Budget

Item	**Quantity**	**Unity price**	**Total**
Pencils	20	ZMW 50	ZMW 50
Rubber	20	ZMW 50	ZMW 50
Plain papers	1 ream	ZMW 100	ZMW 100
Notepad	4	ZMW 100	ZMW 400
Transport		ZMW 2000	ZMW 2000
Research assistants		ZMW 10,000	ZMW 10000
Printing		ZMW 1000	ZMW 1000
Binding		ZMW 3000	ZMW 3000
Miscellaneous		ZMW 5 000	ZMW 5, 000
UNZABREC Ethics		ZMW 2000	ZMW 2000
Accommodation		ZMW 17 000	ZMW 17000
Total		**ZMW 40,600**	**ZMW 40,600**

Appendix 3: Questionnaire to be used to collect data from (participants) residents of Mtendere East.

Introduction

My name is Majory Dimuna.

I am a student at the University of Zambia pursuing a Master of Science degree in Geography. I am conducting a research entitled ***"The role of the Millennium Challenge Corporation Compact project in improving equitable access to Domestic water in Mtendere, Lusaka.***"

The purpose of my visit is to find out if the Millennium Challenge Corporation Compact project has improved equitable access to domestic water in Mtendere East.

The information that you will provide will be treated with utmost care and confidentiality.

Part A: Socio-economic demographic data for the participant

a. Gender: 1. Male [ ] 2. Female [ ]

b. Age: 1. 18 to 40 years [ ] 2. 41 and above [ ]

c. Current marital status

1. Never married [ ] 2. Married [ ] 3. Divorced [ ] 4. Widowed [ ]
5. Separated [ ] 6. Not saying anything [ ].

d. Kindly state your employment status
1. Unemployed [ ] 2. Employed [ ] 3. Self-employed [ ] 4. Other [

e. Education status
1. Not been in school [ ] 2. Primary [ ] 3. Junior secondary [ ] 4. Senior secondary [ ] 5. Tertiary [ ]

f. How long have you stayed in this area?
1. Less than a year [ ] 2. 1 to 5 years [ ] 3. 6 to 10 years [ ] 4. 11 years and above [ ]

g. How many people live in this house?
. ……

h. How many children are (0 to 5 years) ……. How many children are (6 to18 years) ……. How many adults are (older than 19 years) ……

i. Income level……
1. None [ ] 2. ZMW 500 to ZMW 2500 [ ] 3. ZMW 2501 to ZMW 4500 [ ] 4. ZMW 4501 to ZMW 6500 [ ] 5. Above ZMW 6501 [ ]

PART B: Water supply and accessibility by households in the study area

1. What is the source of your domestic water uses?
   1. Tap [ ] 2. Borehole [ ] 3. Others [ ]

If the answer is others
specify……
……

2. What is your understanding of the purpose of the MCC Compact project?.....
   .....
   .....
   .

3. Before the MCC Compact water project, what was your source of domestic water?
   1. [ ] Tap [ ] 2. Tank water [ ] 3. Borehole [ ] 4. Others [ ] If the answer is others, please
   specify…….
   ……
   ……

4. Before the MCC Compact water project, did you receive adequate domestic tap water supply?
   1. Yes [ ] 2. No [ ]

5. After the MCC, are you receiving adequate domestic tap water supply in Mtendere East?
   1. Yes [ ] 2. No [ ]

6. Please state the reason of your answer in question 5
   ……
   ……

7. Have the hours of receiving water been increased?
   1. Yes [ ] 2. No [ ] if the answer in question 7 is No, please state the reason……
   ……

8. After the MCC project, has the amount of domestic tap water supply been improved?
   1. Yes [ ] 2. No [ ] If the answer is no, please state the reason……
   ……..

9. Is the provision of water in your area adequate for domestic use?
   1. Yes [ ] 2. No [ ]

10. Have you been experiencing water shortage?
    1. Yes [ ] 2. No [ ]

11. If the answer is yes for question 10, how long do you experience water shortage?
    1. less than an hour [ ]
    2. More than three hours [ ]
    3. Days [ ]

4. Weekend [ ]

12. What cause water shortages?
    1. High demand for water [ ] 2 .L ow water supply [ ] 3. Leakages [ ]
13. In your view, is the shortage of water related to inadequate water supply?
1. Yes [ ] 2. No [ ]
If the answer is yes, state other factors that contribute to inadequate water supply in your area
……
……
……
14. How have you been affected by water shortages?
    1. Not affected [ ]
    2. No water for domestic use [ ]
    3. No water for business [ ]
15. Where do you get water from when there is no water supply?
    1. Borehole [ ]
    2. Tank water [ ]
    3. Other [ ] Please specify……
……
…
16. Do you walk long distance when fetching domestic water?
    1. Yes [ ] 2. No [ ]
17. Approximately how long is the distance to your nearest water source?
    1. Less than one kilometre [ ]
    2. One to two kilometres [ ]
    3. Three kilometres and above [ ]
18. Where do you store domestic water when there is no water?
    1. 2.5 litres containers [ ] 2. 5 litres containers [ ] 3. 10 litres containers [ ]
    4. 20 liters containers [ ] 5. Buckets [ ] 6. Drums [ ] 7. Others [ ]
    If the answer is others, indicate the type, size and number of water storage you use.
    ……
    ……
    ……
19. If the answer is from 1 to 6, specify the size and number of containers, buckets and drum you use……
    ……

20. Approximately, how much water do you store in your household? Kindly list the various types, sizes and number of water storage you use such as;

containers, buckets, drums and water tank……
……

21. What do you think is the major cause of intermittent supply of tap water in Mtendere East?

1. Lack of water infrastructure [ ] 2. Inadequate water infrastructure [ ]
3. Vandalism of existing water infrastructure [ ] 4.
Others [ ]
If the answer is others, please
specify……
……

22. Do you experience vandalism of water infrastructure in your area?

1. Yes [ ] 2. No [ ]

23. How frequently do you experience vandalism? 1. Once a week [ ] 2. Once a month
[ ] 3. Every other month [ ] 4. Once a year [ ] 5. Never [ ]

24. Has the MCC water project improved water infrastructure in Mtendere East?

1. Yes [ ] 2. No [ ]

25. Do you pay for water services in your area?

1. Yes [ ] 2. No [ ]

26. What is your perception on the cost of water in your area?

1. Affordable [ ] 2. Not affordable [ ].

27. What other coping strategies do you use when there is no domestic water supply?

……
……
……
……

28. What strategies have the LWSC put in place to improve water supply in Mtendere East?

……
……
……
……

29. Which other stakeholders if any, are involved in providing domestic water supply in Mtendere East?

……
……
……

30. How do you perceive the MCC Compact water project in your area?

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

31. How do you perceive the effectiveness of the MCC Compact water project in improving water supply in Mtendere East?

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

Appendix 4: Interview guide - Lusaka Water supply and Sanitation Company

(LWSC)Interview guide to be used to collect data from a representative from LWSC

My name is Majory Dimuna.

I am a student at the University of Zambia pursuing a Master of Science degree in Geography. I am conducting a study titled "***The role of the Millennium Challenge corporation Compact project in improving equitable access to Domestic water in Mtendere, Lusaka.***"

The purpose of my visit is to find out if the Millennium Challenge Corporation Compact project has improved equitable access to domestic water in Mtendere East.

The information that you will provide will be treated with utmost care and confidentiality.

1. When was the MCC Compact water project for Mtendere East handed over to LWSC?

……
……

2. At what percent was it when it was handed over to LWSC?

……
……

3. When was the MCC Compact water project implemented in Mtendere East?

……
……

4. How many sections are in Mtendere East which are under the MCC Compact?

……
……

5. Are all section for Mtendere East connected to domestic tap water?

……
…….

6. What is the total number of customers served by LWSC in Mtendere East?

……
…….....

7. How many connections are metered in Mtendere East?

……
……

8. How many connections are billed every month?

……

9. Do you receive inadequate water supply complaints by Mtendere East residents?

……
……

10. Do you receive water infrastructure vandalism complaints by Mtendere East residents?

……
……
…

……
11. How often do you receive water infrastructure vandalism complaints by Mtendere East residents?.....
12. Before the MCC Compact water project, what where the sources of domestic water for Mtendere East residents?
.....
.....
.
.....
.
.....

13. Was LWSC supplying water to Mtendere East before the MCC Compact water project?
……
……
…
……
……
14. How has the MCC Compact water project improved domestic water supply service in Mtendere East?
……
……
…
……
……
……
……
15. What measures has the LWSC put in place to ensure sustainability in the provision of water supply in Mtendere East?
……
……
……
……
16. What strategies have the LWSC put in place to improve water supply in Mtendere East?
……
……
……
……
17. Which other stakeholders if any, are involved in providing water supply in Mtendere East?
……

……
……
……
18. How has the MCC Compact improved water infrastructure in Mtendere East?
……
……
…
……
……
19. What support is the LWSC providing to safeguard MCC Compact infrastructure?
……
……
…
……
…
……
20. How does the LWSC perceive the MCC Compact water project?
……
……
……
……
21. How does the LWSC perceive the effectiveness of the MCC Compact water project in improving water supply in Mtendere East?
……
……
……
……
…
22. Do you as LWSC think this approach can be replicated in other areas of the city?.....
.....
23. If not, why do you think this should not be replicated.
……
……
…
……
24. If yes why should it be replicated?
……
……

Appendix 5: Interview guide - Mtendere East area councilor.

Interview guide to be used to collect data from the area councilor in Mtendere East

My name is Majory Dimuna.
I am a student at the University of Zambia pursuing a Master of Science degree in Geography. I am conducting a study entitled ***"The role of the Millennium Challenge Corporation Compact project in improving equitable access to Domestic water in Mtendere, Lusaka."***
The purpose of my visit is to find out if the Millennium Challenge Corporation Compact project has improved equitable access to domestic water in Mtendere East.
The information that you will provide will be treated with utmost care and confidentiality.

1. What is the source of domestic water in Mtendere East?

……
……

2. How many sections are in Mtendere East?

……
……

3. Are all sections of Mtendere East connected to tap water?

……
……

4. Before the MCC Compact water project, did the residents experience domestic water shortage?

……
……
……
……

5. What is the current situation on the domestic tap water supply in Mtendere East?

……
……
……
……
……
……

6. Are there other stakeholders involved in providing water supply apart from the LWSC in Mtendere East?

……
……
……
……

7. Which coping strategies do the residents use when there is a water shortage?

……
……
……
……

8. What measures has the LWSC put in place to ensure sustainability in the provision of water supply in Mtendere East?

……
……
……
……
……

9. How has the MCC Compact water project improved water infrastructure in Mtendere East?

……
……
……

10. How do you perceive the MCC Compact water project?

……
……
……
……

11. How do you perceive the effectiveness of the MCC Compact water project in improving water supply in Mtendere East?

……
……
……
……
……

Appendix 6: Interview guide - Millennium project completion Agency.

Interview guide to be used to collect data from a representative of the Millennium project completion agency.

My name is Majory Dimuna.
I am a student at the University of Zambia pursuing a Master of Science degree in Geography. I am conducting a study entitled "***The role of the Millennium Challenge Corporation Compact project in improving equitable access to Domestic water in Mtendere, Lusaka***."
The purpose of my visit is to find out if the Millennium Challenge Corporation Compact project has improved equitable access to domestic water in Mtendere East.
The information that you will provide will be treated with utmost care and confidentiality.

1. Why was Mtendere selected for the project?
.....
.....
2. When was the MCC Compact water project for Mtendere East handed over to LWSC?
……
……
3. At what percent in terms of infrastructure development was it by the time it was handed over to LWSC?
……
……
4. Was there tap water before the MCC Compact was implemented in Mtendere East?
……
……
……
.
5. How has MCC Compact improved water infrastructure in Mtendere East?
……
……
……
……
6. How does the Millennium project completion Agency perceive the MCC compact water project for Mtendere?
……
……
……
……

7. How does the Millennium project completion Agency perceive the effectiveness of the MCC Compact water project in improving water supply in Mtendere East?
……
……
……
……
……

8. Is there an opportunity for continuation of the project to ensure 100% coverage of Mtendere in
Future?.....
.
.....
.....

End of the interview, thank you for your participation.

Appendix 7: Approval of the study

THE UNIVERSITY OF ZAMBIA
DIRECTORATE OF RESEARCH AND GRADUATE STUDIES

Great East Road Campus | P.O. Box 32379 | Lusaka10101 | Tel: +260-211-290 258/291 777
Fax: (+260)-211-290 258/253 952 | E-**mail**: director.drgs@unza.zm | Website: www.unza.zm

APPROVAL OF STUDY

IORG No. 0005376
NASREC IRB No. 00006465

4th November, 2022

REF NO. NASREC-2022-OCT.009

Ms. Majory Dimuna,
The University of Zambia,
School of Engineering,
P.O. Box 32379
LUSAKA

Dear Ms. Dimuna,

RE: "THE ROLE OF MILLENNIUM CHALLENGE CORPORATION COMPACT PROJECT IN IMPROVING EQUITABLE ACCESS TO DOMESTIC WATER IN MTENDERE, LUSAKA"

Reference is made to your protocol dated as captioned above. NASREC resolved to approve this study and your participation as Principal Investigator for a period of one year.

REVIEW TYPE	ORDINARY REVIEW	APPROVAL NO. NASREC-2022-OCT. 009
Approval and Expiry Date	Approval Date: 4th November,, 2022	Expiry Date: 3rd November, 2023
Protocol Version and Date	Version - Nil.	3rd November, , 2023
Information Sheet, Consent Forms and Dates	• English.	To be provided

Consent form ID and Date	Version - Nil	To be provided
Recruitment Materials	Nil	Nil
Other Study Documents	Questionnaire.	

Specific conditions will apply to this approval. As Principal Investigator it is your responsibility to ensure that the contents of this letter are adhered to. If these are not adhered to, the approval may be suspended. Should the study be suspended, study sponsors and other regulatory authorities will be informed.

CONDITIONS OF APPROVAL

- No participant may be involved in any study procedure prior to the study approval or after the expiration date.

- All unanticipated or Serious Adverse Events (SAEs) must be reported to NASREC within 5 days.

- All protocol modifications must be approved by NASREC prior to implementation unless they are intended to reduce risk (but must still be reported for approval). Modifications will include any change of investigator/s or site address.

- All protocol deviations must be reported to NASREC within 5 working days.
- All recruitment materials must be approved by NASREC prior to being used.

- Principal investigators are responsible for initiating Continuing Review proceedings. NASREC will only approve a study for a period of 12 months.

- It is the responsibility of the PI to renew his/her ethics approval through a renewal application to NASREC.

- Where the PI desires to extend the study after expiry of the study period, documents for study extension must be received by NASREC at least 30 days before the expiry date. This is for the purpose of facilitating the review process. Documents received within 30 days after expiry will be labelled “late submissions” and will incur a penalty fee of K500.00. No study shall be renewed whose documents are submitted for renewal 30 days after expiry of the certificate.

- Every 6 (six) months a progress report form supplied by The University of Zambia Natural and Applied Sciences Research Ethics Committee as an IRB must be filled in and submitted to us. There is a penalty of K500.00 for failure to submit the report.

- When closing a project, the PI is responsible for notifying, in writing or using the Research Ethics and Management Online (REMO),both NASREC

- and the National Health Research Authority (NHRA) when ethics certification is no longer required for a project.

- In order to close an approved study, a Closing Report must be submitted in writing or through the REMO system. A Closing Report should be filed when data collection has ended and the study team will no longer be using human participants or animals or secondary data or have any direct or indirect contact with the research participants or animals for the study.

- Filing a closing report (rather than just letting your approval lapse) is important as it assists NASREC in efficiently tracking and reporting on projects. Note that some funding agencies and sponsors require a notice of closure from the IRB which had approved the study and can only be generated after the Closing Report has been filed.

- A reprint of this letter shall be done at a fee.

- All protocol modifications must be approved by NASREC by way of an application for an amendment prior to implementation unless they are intended to reduce risk (but must still be reported for approval). Modifications will include any change of investigator/s or site address or methodology and methods. Many modifications entail minimal risk adjustments to a protocol and/or consent form and can be made on an Expedited basis (via the IRB Chair). Some examples are: format changes, correcting spelling errors, adding key personnel, minor changes to questionnaires, recruiting and changes, and so forth. Other, more substantive changes, especially those that may alter the risk-benefit ratio, may require Full Board review. In all cases, except where noted above regarding subject safety, any changes to any protocol document or procedure must first be approved by NASREC before they can be implemented.

Should you have any questions regarding anything indicated in this letter, please do not hesitate to get in touch with us at the above indicated address.

On behalf of NASREC, we would like to wish you all the success as you carry out your study.

Yours faithfully,

Dr. Mususu Kaonda

VICE-CHAIRPERSON
THE UNIVERSITY OF ZAMBIA NATURAL AND APPLIED SCIENCES RESEARCH ETHICS COMMITTEE - IRB

CC: Director, Directorate of Research and Graduate Studies
Assistant Director (Research), Directorate of Research and Graduate Studies
Assistant Registrar (Research), Directorate of Research and Graduate Studies