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FACULTY OF SCIENCE

DEPARTMENT OF SUSTAINABLE DEVELOPMENT

THE EFFECTS OF WASTE POLLUTION ON COMMUNITY HEALTH IN KUWADZANA RESIDENTIAL AREA IN HARARE, ZIMBABWE

BY

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A DISSERTATION SUBMITTED TO BINDURA UNIVERSITY OF SCIENCE EDUCATION IN PARTIAL FUFILMENT OF THE REQUIREMENTS FOR THE BACHELOR OF SCIENCE DEGREE IN DEVELOPMENT STUDIES

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JUNE 2026

DECLARATION

I Tivonge Romilah Chindika declare that this dissertation titled, “The Effects of Waste Pollution on Community Health in Kuwadzana Residential Area in Harare, Zimbabwe is my original work and has not been submitted before. It has been done in accordance with ethical guidelines.

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APPROVAL FORM

This is to certify that the dissertation entitled, “The Effects of Waste Pollution on Community Health in the Residential area of Kuwadzana in Harare, Zimbabwe.” Submitted by Tivonge R Chindika in partial fulfilment of the requirements for the award of the Bachelor of Science Honours Degree in Development Studies has been completed under supervision and is approved for submission and examination.

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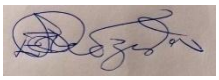
Signature:  Date: 18/08/2026

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DEDICATION

This dissertation is dedicated to my grandmother, mother and aunt Grace for their unlimited support which contributed to this study. To the Kuwadzana community including nurses who helped with relevant information of this study.

ABSTRACT

Due to urban expansion Zimbabwe's high-density residential regions continue to suffer severe waste pollution issues that endanger public health. The purpose of this study is to examine how waste pollution in Kuwadzana, Harare affects community well-being. It is located approximately 15 kilometres west of the Harare Central Business District and most densely populated suburbs in Harare. The study used a Case study as research design. Questionnaires were included to consult community views regarding the waste pollution problem. Key informant interviews were conducted with nurses at Kuwadzana Polyclinic, field observations with the aid of GPS spatial tracking and photographic documentation. Buffer zone mapping, spatial proximity analysis and hydrological vulnerability overlays were used to model the spatial extent of pollution using QGIS. Results of the study identified the major sources of pollution namely household (40%), commercial waste (30%) failure of sewage infrastructure (20%), electronic (5%) and industrial waste from workshop areas (5%). These sources are associated with the high occurrence of diarrhoea, typhoid, cholera, malaria and respiratory disease. The community views the problem as a result of Harare City Council's chronic service delivery issues which is making residents normalise illegal dumping due to the continued neglect. GIS spatial analysis showed that hazardous substance remains of waste pollution are common around households, informal markets and community water sources and that a large percentage of boreholes and shallow wells are located within contamination buffer zones. Therefore, the results illustrate the crisis as a systemic issue, arising from institutional failures, spatial planning and weakened civic accountability. Communities continue to pay the price for governance failure in health unless action is taken now for structural reform. The study thus recommends that the Harare City Council have to decentralised waste transfer points, formalise municipal bins in areas it cannot access. Awareness campaigns are also important to minimise waste and educate the community on waste pollution.

CONTENTS PAGE

DECLARATION ..... **i**
APPROVAL FORM ..... **ii**
ACKNOWLEDGEMENTS ..... **iii**
DEDICATION ..... **iv**
ABSTRACT ..... **v**
LIST OF TABLES ..... **x**
LIST OF FIGURES ..... **xi**
LIST OF PLATES ..... **xii**
LIST OF APPENDICES ..... **xiii**
LIST OF ACRONYMS ..... **xiv**
CHAPTER ONE: INTRODUCTION OF THE STUDY **1**
1.1Introduction 1
1.2 Background of the Study 1
1.3 Problem Statement 2
1.3 Justification of the Study 2
1.4 Aim of the Study 3
1.5 Specific Objectives 3
1.6 Research Questions 3
1.7 Significance of the Study 3
1.8 Delimitations of the Study 4
1.9 Definition of Key Terms 4
1.10 Chapter outline 4
CHAPTER TWO: LITERATURE REVIEW **5**
2.1 Introduction 5
2.2 Understanding Waste Pollution and Community Health 5
2.3 Theoretical Framework 6
2.3.1 Conceptual Framework **7**
2.4 Waste Pollution Sources 8
2.4.1 Household and Commercial Solid Waste Accumulation 8
2.4.2 Sewage Infrastructure and Liquid Waste Failures 9
2.4.3 Electronic and Industrial Waste Accumulation 10
2.5 Health Impact of Waste Pollution in Urban Areas 11

2.5.1 Vector borne diseases 11
2.5.2 Water borne diseases 11
2.5.3 Respiratory 12
2.5.4 Contact Diseases 12
2.6 Community Perceptions on Waste Pollution and Health Risks 12
2.6.1 Perceived Severity of Waste-Related Health Risks 12
2.6.2 Attribution of Responsibility and Accountability for Urban Pollution 13
2.6.4 Public Attitudes Towards Waste Mitigation and Enforcement Strategies 14
2.7 Waste Pollution Hotspots and Spatial Dynamics 15
2.7.1 Spatial Proximity of Waste Hotspots to Residential and Commercial Structures 15
2.7.2 Contamination Risks and Buffer Zones Around Urban Water Sources 16
2.8 Research Gap 18
2.9 Chapter Summary 18
CHAPTER 3: RESEARCH METHODOLOGY **20**
3.1 Introduction 20
3.2 Study Area 20
3.3 Research Design 21
3.4 Target Population 21
3.5 Sampling 22
3.5.1 Sample Size Determination 22
3.5.2 Sampling Method 22
3.6 Data Collection Instruments 23
3.6.1 Questionnaire 23
3.6.2 Interview Guide 24
3.6.3 Field Observation Checklist 24
3.6.4 Data Collection Methods 25
3.7 Data Collection Procedures 26
3.8 Data Analysis 26
3.8.1 Quantitative Data Analysis 26
3.8.2 Qualitative Data Analysis 27
3.9 Data Quality Control 28
3.9.1 Validity and reliability of the Study 28

3.10 Limitations of the Study 29
3.11 Ethical Considerations 29
3.12 Chapter Summary 29
CHAPTER 4: RESULTS AND DISCUSSION **31**
4.1 Introduction 31
4.2 Response Rate 31
4.3 Demographic Characteristics 31
4.4 Waste Pollution Sources and their Effects on Community Health 33
4.4.1 Household and Commercial Solid Waste Accumulation 33
4.4.2 Sewage Infrastructure and Liquid Waste Failures 36
4.4.3 Electronic and Industrial Waste Accumulation 38
4.4.4 Diseases Caused by Waste Pollution 40
4.5 Community Perceptions on Waste Pollution and Health Risks 42
4.5.1 Perceived Severity of Waste-Related Health Risks 42
4.5.2 Attribution of Responsibility and Accountability for Urban Pollution 43
4.5.3 Public Attitudes Towards Waste Mitigation and Enforcement Strategies 46
4.6 Hotspots of Waste Polluted Areas in Kuwadzana 47
4.6.1 Spatial Proximity of Waste Hotspots to Residential and Commercial Structures 49
4.6.2 Contamination Risks and Buffer Zones Around Urban Water Sources 52
4.6.3 Spatial Factors Influencing Waste Concentration in High-Density Zones 54
4.7 Discussion of Findings 56
4.7.1 Comparative Analysis of Waste Pollution Sources 56
4.7.2 Community Perceptions, Accountability Loops, and Enforcement Realities 58
4.7.3 Spatial Analysis of Pollution Hotspots and Geographic Dynamics 59
4.8 Chapter Summary 61
CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS **62**
5.1 Introduction 62
5.2 Summary of Findings 62
5.2.1 Pollution sources and waste related diseases 62
5.2.2 Community perceptions on waste pollution 63
5.2.3 Kuwadzana waste hotspot areas 64
5.3 Conclusions 65

5.4 Recommendations 65
5.5 Further Research 66
REFERENCES **67**
APPENDICES **79**

LIST OF TABLES

Table 2.1 Impact of waste pollution on health ..... **Error! Bookmark not defined.**
Table 4.1 Demographic profile of sampled residents ..... **Error! Bookmark not defined.**
Table 4.2 Perceived Frequency of sewage overflows and liquid waste failures..... **Error! Bookmark not defined.**
Table 4.3 Community attributes of primary responsibility of waste pollution ..... **Error! Bookmark not defined.**
Table 4.5 Waste classification of legal and illegal hotspots..... **Error! Bookmark not defined.**
Table 4.5 Measured proximity of residents to the nearest pollution hotspots ..... **Error! Bookmark not defined.**
Table 4.6 Spatial and structural drivers of waste concentration ..... **Error! Bookmark not defined.**

LIST OF FIGURES

Figure 2.1 Risks of waste mismanagement..... **Error! Bookmark not defined.**
Figure 3.1 Kuwadzana Study area map ..... **Error! Bookmark not defined.**
Figure 4.1 Primary pollution sources in Kuwadzana..... **Error! Bookmark not defined.**
Figure 4.4 Electronic and industrial waste..... **Error! Bookmark not defined.**
Figure 4.5 Waste related diseases in Kuwadzana ..... **Error! Bookmark not defined.**
Figure 4.6 Perceived severity of local health risks ..... **Error! Bookmark not defined.**
Figure 4.7 Public policy preferences using horizontal bar graph ..... **Error! Bookmark not defined.**
Figure 4.8 Illegal and legal dumpsites in Kuwadzana ..... **Error! Bookmark not defined.**
Figure 4.9 Proximity Map Kuwadzana..... **Error! Bookmark not defined.**
Figure 4.10 Spatial proximity pie chart near water sources..... **Error! Bookmark not defined.**
Figure 4.11 Hydrological Vulnerability overlay analysis map Kuwadzana . **Error! Bookmark not defined.**

LIST OF PLATES

Plate 4.1 Refuse near Kuwadzana main roads ..... **Error! Bookmark not defined.**
Plate 4.2 Flowing sewage near roads ..... **Error! Bookmark not defined.**
Plate 4.3 Unmaanaged dumpsite near Kuwadzana 5 shops ..... **Error! Bookmark not defined.**
Plate 4.4 Dump site near households ..... **Error! Bookmark not defined.**

LIST OF APPENDICES

APPENDIX 1 INTERVIEW GUIDE ..... **Error! Bookmark not defined.**
APPENDIX 2 QUESTIONNAIRE GUIDE ..... **Error! Bookmark not defined.**
APPENDIX 3 FIELWORK CHECKLIST ..... **Error! Bookmark not defined.**
APPENDIX 4 BINDURA RESEACH LETTER..... **Error! Bookmark not defined.**
APPENDIX 5 RESEACH LETTER FROM HARARE CITY COUNCIL LETTER FROM HARARE CITY COUNCIL 89
APPENDIX 6 PLAGGERISM REPORT ..... **Error! Bookmark not defined.**

LIST OF ACRONYMS

CBO	Community Based Organisation
EMA	Environment Management Agency
GIS	Geographical Information Systems
MSW	Municipal solid Waste
WHO	World Health Organization
WMP	Waste Management Practises
ZIMSTATS	Zimbabwe National Statistics Agency

CHAPTER ONE: INTRODUCTION OF THE STUDY

1.1 Introduction

In the globe, the increasing volume of urban waste production and ineffective municipal solid waste management are becoming key factors of poor urban community health. But the failure of urban local governments to manage wastes efficiently safely and effectively puts the environment directly at risk of infectious and chronic diseases as populations grow worldwide. The chapter offers a detailed introduction to the study and lays the foundations for the investigation of these dynamics in the high-density suburb of Kuwadzana found in Harare. The structural organization of the chapter presents background of the study, statement of the problem, aim of the study, research objectives and guiding research questions. Moreover, it marks the importance and bounds of the research, copies definitions for significant terms and ends with a structural outline of the whole dissertation.

1.2 Background of the Study

According to Masimba and Walnycki (2024) industrialisation is the reason why waste pollution challenge is increasing causing negative implications on health. Strengthened by poor land ownership ever since colonial era which resulted to informal settlements. Residents and industries are dumping litter in open spaces and this practise has been on for some time. Waste pollution has also increased as a result to global trade of different commodities in attempt to diversify economies (Agboola et al., 2025). Ever since 2019 there reported massive deaths as a result of waste pollution. Many lives were lost due to waste pollution (WHO, 2019).

In low to medium income countries due to open dumping and landfills pollution has become unbearable. This is due to the unsustainable economic activities like agriculture, industrialisation informal markets (Agboola et al. 2025). In African regions, Southern Africa there has been overpopulation in cities due to the developing urban areas which has contributed overtime in the generation of waste. Dumping in open areas non-collection of waste has resulted in health complications (Njewa et al., 2025). Over the past decades waste pollution is having implications on the health sector and its largely impacting the lives of communities socially and economically (Khan et al., 2025).

In Zimbabwe the economic activities which rely on several communities like commercial businesses, industries have increased contamination in both water and soil sources increasing waste sources (Nkosi et al., 2025). Urban areas linked Harare struggled over a long period to

manage solid waste as the city is developing in terms of urbanisation (Kwenda et al., 2022). In urban cities like Kwekwe non-collection of waste for some time is increasing the risk of open littering and burning of waste which affecting residents (Amato et al., 2024). Areas like Masvingo are at risk as flood is common therefore solid waste affects proper drainage systems (Chireshe et al., 2023).

Locally in Harare the accumulation of open waste dumping areas affects normal supply of basic services like water as waste pollute water sources like Lake Chivero and impacts on supply of clean water (Nhubu et al., 2019). Due to the development of housing cooperative many households have been built such that waste collection has reduced targeting minimum coverage of households. Some households are resorting to burning waste which affects residents with air pollution. Although waste has been a problem in some areas where plastics are being recycled (Mutsindikwa and Muchato, 2022).

1.3 Problem Statement

This high-density suburb, Kuwadzana, in Harare, Zimbabwe that faces a significant challenge in waste disposal resulting in the rapid increase of waste-affected areas. This has resulted in the growth of large open dump sites in the residential areas, green spaces and recreational areas (Kasimba et al., 2023). When residents cannot safely dispose of the waste, they often burn mixed solid waste outdoors creating long-lasting toxic smoke emissions. The disposal of trash into local water pathways and drainage system is also common (Mutsindikwa and Muchato, 2022). All these environmental unsafe practices have directly affected the local ecosystem causing the contamination of nearby water sources blockage of urban drainage systems and production of highly unsanitary living condition. This puts at risk the most vulnerable groups, such as women and children. Toxic emissions from localized waste burning will lead to an increase in chronic respiratory illnesses and uncollected waste will increase breeding vectors for infectious diseases. This creates a huge, unsustainable burden on the local health-care system and reducing the quality of its residents' lives for generations to come.

1.3 Justification of the Study

This study is important for the community of Kuwadzana community to be aware of the dangers of waste pollution and improve on waste management practises. The relationship between waste pollution and health challenges is also shown on study (Masimba and Walnycki 2024). It is essential to inform policy makers that minimizing waste pollution, regular waste collection covering all areas including developing cooperative areas in Kuwadzana, strengthen

waste reduction and the community to engage in clean up campaigns. Through clean-up campaigns local residents acquire knowledge as to how waste management is important and reduce informal vending practises as they result to rapid dumping areas. For academics and health officials it will provide evidence-based policy improvements on improved waste management practises to promote health.

1.4 Aim of the Study

The aim of the study is to assess the impact of waste pollution on community health in Kuwadzana.

1.5 Specific Objectives

1. To describe waste pollution sources in Kuwadzana.
2. To examine perceptions in waste pollution on health in Kuwadzana.
3. To model pollution hotspots within the Kuwadzana community.

1.6 Research Questions

1. Which health risks relates to which sources of waste pollution in Kuwadzana?
2. How do community members perceive waste pollution challenge on health in Kuwadzana?
3. Which locations in Kuwadzana residential area mainly pollution hotspots?

1.7 Significance of the Study

This study is essential as it gives clear evidence of the direct effect of waste pollution on the health of residents in high density suburbs such as Kuwadzana. This research does not focus on the city of Harare but rather on the actual experiences of the everyday lives of the residents of Kuwadzana. The findings will assist the community to gain insight into the direct connection between waste that is and diseases. Local leaders and residents can utilise this information to plan clean-up events to enhance their local health education and to halt illegal dumping activities in open spaces. The study will also be beneficial to municipal planners, Harare City Council and Environmental Management Agency (EMA). This research also demonstrates the location of waste and through mapping identifies the worst dumping site. This aids the council to establish regular refuse collection and to clean up unsafe refuse disposal sites to prevent any major outbreaks of water and vector-borne diseases. This study makes a local to global link. It contributes to the achievement of the United Nations Sustainable Development Goal (SDG) 3

good health and well-being, and SDG 11 make cities safe and sustainable. This study demonstrates how waste is a local problem and offers the first step towards a healthy and productive nation, namely a clean environment.

1.8 Delimitations of the Study

This study is limited to analyse the relationship between waste pollution and health with more emphasis on the sources of pollution. This study does not include other types of pollution like air, nose pollution. The time frame of the study is limited to 6 years from 2019 to 2025 focusing on the years like 2024 when cholera outbreak was common. Geographically the selected study area Kuwadzana Harare Zimbabwe where data will be gathered from different relevant stakeholders. This study only focuses on how residents are being affected by diseases, their views and perceptions on this topic.

1.9 Definition of Key Terms

Community health

Community health is a state of wellness physically, mentally and emotionally within a number of a population living in the same geographical area (Ravaghi et al., 2023).

Waste pollution

Can be defined as the unwanted material discarded in open dumping areas on land and in water in form of paper, plastics, electronic waste and other (Al- Taai, 2022).

1.10 Chapter outline

This study consists of five chapters. Chapter one introduces the study. The second chapter outlines the literature review of the study, the third chapter is all about the methods used to collect data, the fourth data collected will be presented. Lastly the fifth concludes the study and giving recommendation and summary of the study.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This literature review is critically examining in detail, the current body of research on the impacts of waste pollution on the health of urban residents. This chapter provides a context for the research and establishes a foundation for the research by reading and summarizing previous research on the topic. The first part of this chapter identifies the key concepts of waste pollution and community health. It then summarises the primary theory underlying the study and provides a conceptual framework table to outline the human health impacts of waste. Following this, the chapter summarises the previously conducted research, categorizing it by specific themes directly related to the aims of this study: sources of waste, community perceptions and pollution hotspot mapping. Lastly the chapter highlights the research gaps that this research addresses.

2.2 Understanding Waste Pollution and Community Health

Waste pollution refers to the build-up of solid, liquid and hazardous materials in the environment beyond what nature can safely handle (Afolalu et al., 2022). Community health refers to the general wellbeing of people living in a particular area, not only the absence of disease (Awino et al., 2020). These two ideas are closely connected because poor waste management can directly affect the health and living conditions of communities.

Across Africa, waste pollution is mainly caused by rapid urban growth, poor planning and weak municipal waste collection systems (Agbola et al., 2025). Many African cities have large uncontrolled dumpsites that pollute the air, water and soil, putting vulnerable people at risk. Mahar et al. (2023) explain that community health in this context is linked to how exposed people are to unsafe environmental conditions. In high-density areas, poor sanitation and uncollected waste create breeding places for diseases that could have been prevented (Awuchi et al., 2020).

In Harare, waste pollution is seen through illegal dumpsites, sewer bursts and smoke from the burning of household waste. Mutsindikwa and Muchato (2022) found that housing cooperatives and household activities have increased solid and liquid waste pollution in open spaces because municipal service delivery has not kept up with urban growth. Although the Constitution gives citizens the right to a clean and safe environment, people in high-density suburbs continue to face daily health risks caused by waste pollution.

2.3 Theoretical Framework

This study was guided by the Theory of Waste Management developed by Pongracz (2002). The theory helps to explain how the way waste is produced, handled, stored and disposed of can affect the environment and community health. It was useful in this study because it helped the researcher to examine how failures in municipal waste collection and storage contribute to health risks in urban residential areas. Pongracz (2002) argued that waste is not just a natural problem, but a result of human actions and poor resource management. The theory explains that materials become harmful waste when society fails to collect, process or reuse them properly. Amasuomo and Baird (2016) also support the view that waste can either become an environmental danger or a reusable resource depending on how it is managed. Therefore, waste management depends on local laws, municipal systems and people's daily practices. When these systems fail, ordinary household waste can build up in unsafe places and threaten community hygiene (Elsaid and Aghezzaf, 2015).

Several studies have used this theory to explain waste problems in developing urban areas. Uche (2023) used Pongracz's model to study waste management in urban slums and found that illegal dumping was not only caused by careless residents, but also by weak waste management systems. Similarly, Pande and Makonye (2023) applied the theory in Zimbabwe and found that poor solid waste disposal contributed to diseases such as typhoid and cholera in Gweru. This shows that the theory is useful in explaining waste management challenges in fast-growing urban communities.

The Theory of Waste Management has important strengths because it looks at the whole waste process, from waste generation to final disposal. Wikurenda et al. (2022) explain that this makes it useful for identifying where policies, institutions and human actions fail to prevent environmental harm. However, the theory also has limitations. Kotsiuba et al. (2023) note that it was developed in a context where councils are assumed to have enough money, strong laws and proper recycling technology, which is often not the case in developing countries.

Despite these limitations, the theory is suitable for this study because the waste crisis in Kuwadzana is strongly linked to human behaviour and weak municipal systems. It helps to explain how poor refuse collection forces residents to use open spaces as dumping sites. The theory also helps the study to show how poor waste handling can contribute to diseases such as cholera, typhoid and malaria in the suburb.

2.3.1 Conceptual Framework

A conceptual framework shows the relationship between the main ideas in a study. It can be presented in writing or through a diagram. In this study, the conceptual framework explains the link between waste pollution and community health (Abila, Abila and Kantola, 2023). Luft et al. (2022) states that a conceptual framework is important because it guides the research and helps the researcher understand the problem clearly. In this study, the framework helps to show how pollution affects health and how the community is exposed to different environmental risks. Table 2.1 below will be addressing on the impact of pollution on human health.

Table 2.1 Impact of waste pollution on health

Waste pollution risk	**Health effects**	**Affected community**
Contaminated water	Infectious diseases like cholera malaria typhoid	Children, women
Contaminated soil	Toxic chemicals in soil cause cancer, organ damage and skin infections	Children, farmers and residents
Contaminated air	Respiratory diseases like asthma, pneumonia, tuberculosis and lung cancer.	Households using fuels and some who discard waste through fire

(Source: Egemba et al., 2024)

Risks of Waste mismanagement

Waste mismanagement is a growing environmental and public health problem in many urban areas. Improper waste disposal practises results to pollution of land, water and air creating favourable conditions for the spread of diseases. Figure 2.1 describes the main risks of waste management.

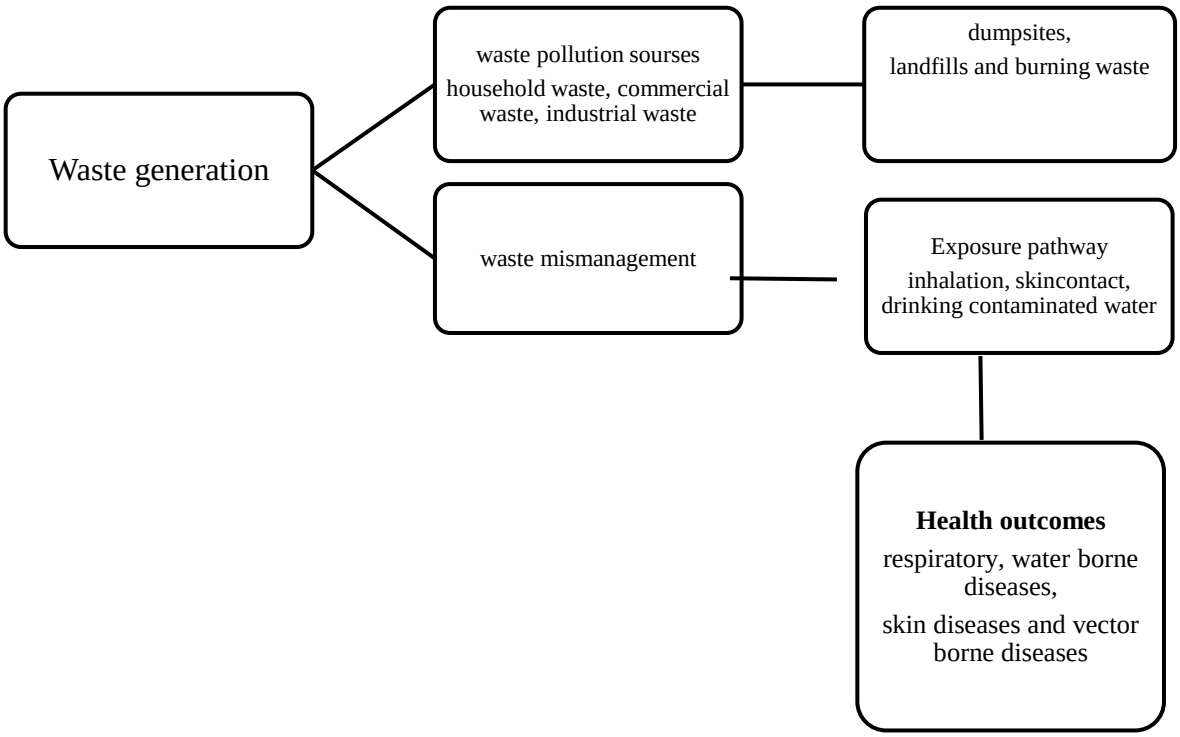

Figure 2.1: Risks of waste management (Source: Awino et al., 2020)

2.4 Waste Pollution Sources

This section discusses the main sources of waste pollution found in urban residential areas. Identifying the sources of pollution is important because different types of waste require different methods of management and create different health risks. The discussion is divided into three main areas, namely household and commercial solid waste, sewage and liquid waste failures and electronic waste.

2.4.1 Household and Commercial Solid Waste Accumulation

Globally, waste from households and businesses forms a large part of municipal waste. The increased use of single-use packaging has changed the nature of domestic waste with plastics, glass bottles and tins now commonly found in open dumpsites (Abubakar et al., 2022). In cities with strong recycling systems these materials are collected and reused safely. In poorly serviced urban areas they often pile up in yards, streets and open spaces. Kwun et al. (2021) explain that when food waste and business refuse are left uncollected, they rot quickly and attract rats, flies and other disease-carrying pests. This makes uncollected household and commercial waste a serious threat to public health.

In Africa the accumulation of household and commercial waste is mainly linked to poor municipal service delivery and rapid urban growth (Raman et al., 2024). Many councils do not have enough money, working refuse trucks or staff to provide regular waste collection. In cities such as Harare, Soweto and Lagos the absence of proper bins has caused markets and street vendors to dump waste along roadsides and into drainage systems (Nyati, 2025). Mandal et al. (2025) also note that in parts of East Africa residents sometimes go for months without reliable refuse collection, forcing them to create illegal dumps near homes or burn waste in their yards. This shows that weak municipal systems force communities to live close to harmful waste.

In Harare's high-density suburbs, household and commercial waste has reached serious levels because of poor council waste collection. Mutsindikwa and Muchato (2022) found that Harare City Council's collection system has declined from regular weekly collection to irregular monthly visits and in some outer areas collection has stopped completely. As a result residents in overcrowded suburbs such as Kuwadzana dump plastics, bottles and food waste on open school grounds wetlands and street corners. Maphosa (2024) also notes that informal tuckshops and vendors worsen the problem because they sell packaged goods but often have no proper waste disposal systems. This has left many high-density areas surrounded by illegal dumpsites that expose families to serious health risks.

2.4.2 Sewage Infrastructure and Liquid Waste Failures

Globally, the failure of sewage systems and liquid waste infrastructure is a serious environmental and health problem. As urban populations grow old sewer and drainage systems become overloaded and begin to break down (Agboola, 2025). In many developing cities, broken pipes release raw sewage into streets, open spaces and shallow groundwater sources. Lin et al. (2022) explain that untreated sewage creates easy pathways for the spread of bacteria and viruses when it flows close to people's homes. Poor liquid waste management therefore contributes greatly to poor sanitation and environmental pollution in urban areas.

In Africa, sewage failure and liquid waste pollution are common because of limited funding, poor planning and old infrastructure (Njewa et al., 2025). Many urban councils struggle to maintain sewer systems and wastewater treatment plants. In some newer settlements, residents do not have access to proper sewer systems and rely on poorly built pit latrines, which may overflow during heavy rains. Raman (2024) explains that this exposes residents to raw human waste and unsafe living conditions. This shows that when liquid waste systems are ignored, they become a long-term health danger for communities.

Locally, sewage infrastructure failure is a major problem in high-density suburbs such as Kuwadzana. Jerie et al. (2024) found that the local authority has failed to repair broken sewer lines, leading to repeated sewage bursts in yards, roads and footpaths. In crowded areas raw sewage often flows near homes play areas and vending sites. Chivenge et al. (2024) also note that during the rainy season, blocked stormwater drains mix with domestic waste and sewage creating dangerous pools of contaminated water. This places families at risk by threatening household hygiene and the safety of local water sources.

2.4.3 Electronic and Industrial Waste Accumulation

Electronic and industrial waste is becoming a serious environmental problem across the world. The increased use of electronic devices such as phones, computers and appliances has led to large amounts of e-waste entering dump sites (Murthy and Ramakrishna, 2022). In developed cities this type of waste is usually handled through regulated recycling systems. In many developing cities, electronic waste is mixed with ordinary household waste. Liu et al. (2023) explain that when electronic parts are left in open dumps, they can release dangerous heavy metals such as lead, mercury and cadmium into the soil.

In Africa, electronic and industrial waste is mainly caused by weak regulation and the growth of informal recycling activities. Many Sub-Saharan countries receive large amounts of second-hand electronics and some of these items are already broken when they arrive (Maes et al., 2022). Informal repairers and backyard recyclers often dismantle electronics or burn cables to recover metals such as copper. This releases harmful smoke and chemicals into residential areas. As a result, electronic and industrial waste creates both environmental pollution and health risks for people living close to informal workshops and dumpsites.

The presence of electronic and industrial waste has emerged as a distinct environmental challenge within high-density urban suburbs due to the expansion of unregulated informal industries. In an assessment of light industrial activity and urban zoning, (Jerie et al., 2024) supports that the economic shift towards informal home-based workshops and backyard electronics repairs has brought specialized waste directly into residential spaces. In crowded environments like Kuwadzana, this structural shift means that discarded television sets, computer monitors and dead automotive batteries are frequently abandoned on open land, roadside verges and communal areas alongside standard domestic waste (Ferdous et al.,2025). Furthermore, local home-grown enterprises, such as metal fabrication shops and informal vehicle garages operating within the suburbs, regularly discard scrap metals, chemical paints

and spent oils into the local environment without any institutional oversight. Consequently, local families are exposed to an increasingly complex pollution profile where traditional organic waste is heavily compounded by non-biodegradable technological and chemical hazards (Ferdous et al., 2025)

2.5 Health Impact of Waste Pollution in Urban Areas

According to Fuller et al., (2022) waste pollution of wastes is one of the greatest threats to public health in urban areas. Badly handled waste can be a breeding ground for disease-carrying organisms and pollute water, soil and air. The residents near waste dumps are exposed to harmful pollutants which can cause respiratory infections, skin diseases, gastrointestinal and other health issues. Waste buildup also draws pests like flies, rats and mosquitoes which may transmit disease (Ferdous, 2025). This consequently results in pollution of waste which affects the quality of life and imposes heavy pressure on the health care systems of the cities.

2.5.1 Vector borne diseases

This is a type of illness caused by pathogens which breed in waste and other open spaces with litter and wastewater (Martins et al., 2024). Open waste dumpsites are causing pathogens to breed in waste and visit households which increases the spread of malaria (Nawal 2025). Even the flies the breed in dirty waste imposing a higher risk of cholera (Chireshe et al., 2023). Mostly in urban areas when residents discard waste in open areas and stagnant water it gives rise to flies and mosquitoes (Egemba et al., 2024). In Harare, many areas affected include Glenview, Kuwadzana and Budiriro by open waste and most residents in those areas suffer from diseases like malaria (Matengo et al., 2025). Poor waste disposal and stagnant water provide breeding conditions for disease vectors. High population density of residential areas makes them vulnerable to waste related diseases.

2.5.2 Water borne diseases

Water borne diseases can be defined as the type of illness caused by lack of proper sanitation, water contamination and water scarcity. Polluted water cause diseases like typhoid, dysentery and cholera (Njewa et al., 2025). The presence of open dump sites and sewage pipe bursts are harmful to both the environment and human health (Goto et al., 2020). For instance, the 2008 to 2009 the cholera pandemic claimed huge lives of people in Zimbabwe due to poor sanitation and water pollution (Chimusoro et al., 2018). The recent outbreak of cholera during the year

2023 also claimed huge lives in areas like Chegutu. This affects the delivery of health services such that women and children are largely at risk.

2.5.3 Respiratory

These types of diseases are caused by contagious air particles from industries and smoke from fire. Most households in urban areas are disposing their waste and burning it is affecting the Ozone layer increasing greenhouse gases causing climate change effects like global warming (Chireshe et al., 2023). In industries methane and carbon dioxide is affecting the environment. Respiratory diseases like cardiovascular illness, lung cancer and bronchitis are affecting the community

2.5.4 Contact Diseases

These are types of diseases caused by contracting waste or touching infected substances. Infectious diseases are contracted as a result to hospital waste and healthcare workers are largely at risk of blood borne pathogens (Chireshe et al., 2023). These are common if hospital waste is mishandled the diseases include Human Immunodeficiency Virus (HIV) and Hepatitis B and C (Ibanez Cruz et al., 2025). Skin diseases are also caused by open dumpsites usually those who collect waste are at risk of contracting bacteria, rushes which result to skin itching

2.6 Community Perceptions on Waste Pollution and Health Risks

This section presented how urban populations and healthcare practitioners perceive the severity of environmental refuse and the distribution of institutional accountability. Public attitudes, risk awareness and institutional friction dictate how communities react to sanitary crises and whether local mitigation strategies succeed. For a comprehensive overview, this analysis categorizes the reviewed literature into three core thematic areas. The perceived severity of waste-related health risks, the attribution of responsibility for urban pollution and public attitudes towards mitigation and enforcement strategies.

2.6.1 Perceived Severity of Waste-Related Health Risks

According to Okoji et al. (2023) the community perceives that irregular collection of waste has led to pollution hotspots. Whereas the growing population has led to failures in controlling waste. On another view waste burning has been a solution to the residents since waste is not regularly collected causing respiratory diseases like asthma and bronchitis among others. Nahar et al (2023). Community awareness promoting waste taxes and recycling programs have been helpful since resident can be educated, these efforts have been successful in areas like United Stated of America and London (Izichukwu and Zino, 2025). Nahar et al. (2023) also note that

the reason for failure of waste pollution control owes to the unequal industrialisation levels in developed countries like United States and developing African states. In these areas there is lack of adequate and consistency waste collection and disposal resources. Brotosusilo et al. (2022) notes that it is important to promote awareness programs as waste accumulation is caused by peer influence.

Nations across Africa are engaging in clean-up programs to minimise all types of waste pollution for example South Africa Zimbabwe and Nigeria African local communities engage in knowledge sharing regarding keeping the environment secure from waste pollution and on Green Remediation the process of using sustainable methods to reduce waste environment harm from waste pollution. The method of the process is making use of renewable energy conservation resources (Otunola and Mhangara, 2025). Water conservation methods are also another way to enhance water conservation water harvesting, purifying which prevent water related illness. To avert industrial emissions making use of renewable is important than non-reliance on fossil fuels (Awuchi et al., 2020).

Awareness Campaigns have been helpful due to the irregular collection of refuse in urban areas. Since waste pollution results in health problems cleanup campaign have been helpful as it involves communities they come together and share knowledge on waste dangers (Poshai and Intauno, 2024). According to Nyakudya et al. (2022) the environment Management Act impose regulations which help protect and avoid environment damage through landfills and open dumping. The legislative policy framework helps promote law and policy observation which helps protect the environment

2.6.2 Attribution of Responsibility and Accountability for Urban Pollution

Globally, the debate surrounding who is to blame for the degradation of the urban environment reveals a deep structural tension between civil society and municipal institutions (Okoji et al., 2023). Local authorities often attempt to shift the blame onto residents by accusing them of a lack of civic discipline and persistent illegal dumping. Conversely urban communities argue that their actions are a direct reaction to systemic structural abandonment as they are left with no choice but to discard refuse in open spaces when municipal collections cease entirely (Nahar et al., 2023). In absence of basic public bins or collection schedules, informal enterprises and residents learn to dispose of their waste in ways that are not monitored by the authorities. Global governance researchers argue then that environmental blame is rarely equitable, and

that institutional actors often blame vulnerable groups for their survival strategies to hide fiscal and operational mismanagement (Izuchukwu and Zino, 2025).

The blame for urban sanitation problems is very politicized and polarized on the bases of institutions at regional level. Local municipal councils are overwhelmingly blamed by sub-Saharan urban dwellers for environmental pollution, which includes embezzlement of public rates, and the complete absence of refuse collection trucks (Nyati, 2025). Business owners both formal and informal are unwilling to pay taxes to the municipality telling the municipality that it offers them very little in terms of environmental maintenance. On the other hand, in East African municipalities the municipal administration often relies on state media to attribute the situation of obstruction of stormwater drains in the city to communities, as a justification for not holding them accountable structurally (Njewa et al., 2025). This regional pattern is a clear sign of a lack of trust among both the municipal councils and the local populations and it also highlights a lack of action to improve environmental conditions and ensure the development of sustainable cities.

The responsibility for waste pollution has led to a sour relationship between Harare City Council and the people of high-density suburbs locally (Tongesayi et al., 2018). The residents of the densely populated suburbs blame the local authority completely. For the escalation of health risks citing decades of failure to collect municipal rates and a complete breakdown in basic services. This institutional failure has resulted in communities dumping waste in illegal open spaces and local council officials accusing them of being lawless and unhygienic because of their waste disposal practices (Mutsindikwa and Muchato, 2022) in highly populated areas like Kuwadzana. The mushrooming of unregulated informal businesses and backyard mechanics has compounded the situation. With these operations contaminating the environment with significant amounts of commercial waste that includes a large amount of highly toxic material and not paying municipal taxes or being held to account under the law (Zhongove et al., 2024).

2.6.4 Public Attitudes Towards Waste Mitigation and Enforcement Strategies

Globally, people's willingness to take part in environmental clean-up activities is strongly influenced by the support systems provided by local authorities, Izuchukwu and Zino (2025) argue that awareness campaigns have limited impact when councils do not provide sorting bins or accessible recycling points. In developed cities, residents are more willing to separate waste at source because they trust that recyclable materials will be properly processed by the state

(Zhang et al., 2024). This shows that although communities may support clean-up goals, they are likely to reject fines and arrests where legal and reliable waste disposal options are not available.

In Africa, public attitudes towards waste reduction are shaped by community survival strategies and mistrust of government enforcement. Kubanza and Simatele (2022) note that many urban communities in Sub-Saharan Africa prefer community-led recycling and informal waste-picking because state enforcement is often viewed as corrupt or mainly focused on collecting fines. Similarly, Kiwanuka (2022) notes that residents in some west African trade zones organise their own weekend clean-up groups to clear blocked drains when municipal services fail.

In Zimbabwe, community attitudes towards waste management are mixed. Residents support recycling source separation and the clearing of blocked drains but they have little confidence in council enforcement systems. Awuchi et al. (2020) found that high-density residents in Harare support environmental by-laws, although they doubt the capacity of local authorities to implement them effectively. In areas such as Kuwadzana residents may support action against illegal dumping and industrial pollution, but still view council policing as inconsistent, corrupt and unfair (Otunola and Mhangara, 2025). Therefore, community support depends on transparency and reliable service delivery rather than punishment alone (Poshai and Inatuno, 2024).

2.7 Waste Pollution Hotspots and Spatial Dynamics

This section examines the spatial patterns of refuse accumulation in urban residential areas. Identifying where waste is located is important because the distance between uncollected waste and human activity determines the level of environmental and health risk. The discussion is organised into three main areas the closeness of waste hotspots to homes and businesses, contamination risks near urban water sources and the spatial factors that increase waste concentration in high-density suburbs.

2.7.1 Spatial Proximity of Waste Hotspots to Residential and Commercial Structures

Globally, the distance between dumpsites and human settlements is a major measure of environmental risk. Tsui et al., (2022) explain that refuse dumped close to homes and food markets creates continuous exposure to biological hazards. In well-planned cities, zoning laws create buffer zones between waste facilities and residential areas. However, in congested

developing cities, these boundaries are often absent. This is why spatial mapping of refuse sites is important in assessing daily health risks faced by urban households (Medina Medina, 2024).

Regionally, illegal dumping near homes and shops reflects rapid urban growth and weak landuse planning. In high-density Sub-Saharan suburbs, the absence of designated waste drop-off points forces residents to dump waste close to homes or behind market stalls (Georgiou, 2023). Mvula et al. (2025) also show that in some West African coastal settlements, many informal food vendors operate very close to decomposing solid waste. Arfasa et al. (2026) add that tightly packed housing and commercial blocks allow waste to collect in narrow spaces, increasing bad odours, pests and health risks.

Locally, illegal waste hotspots close to homes, kitchens and shopping centres have become a serious problem in Harare's high-density suburbs. Yeukai and Kharlamova (2014) link this to weak planning enforcement. Kwenda et al., (2022) further note that poor municipal bin collection has caused dumpsites to appear near residential windows and informal tuck shops. In Kuwadzana waste such as plastics, bottles and organic refuse often gathers along roads and footpaths used daily by residents. Masimba and Walnycki (2024) argue that when council bins are not cleared legal collection points overflow and become expanding waste hotspots. As a result, the boundary between household living areas and decomposing refuse becomes unclear, exposing residents to serious sanitary risks.

2.7.2 Contamination Risks and Buffer Zones Around Urban Water Sources

Internationally, open refuse dumps near streams, wetlands and underground water sources create serious risks to water safety. Marchiori et al. (2020) explain that when waste is not properly contained, rainwater can carry chemical and biological pollutants into nearby water systems. Developed countries often use buffer zones to protect rivers, wetlands and drainage channels from contamination. However, Frigo et al. (2025) note that in many congested developing cities, these areas are used as informal dumping spaces because they are open and poorly monitored.

Regionally, weak protection of streams and shallow aquifers has increased water contamination in many African urban areas. Hakorimana and Ndokoye (2025) observe that high-density suburbs are often located near wetlands and open streams, which become dumping sites when councils fail to provide fencing and proper waste services. Oyedele et al. (2022) shows that plastic waste and organic refuse dumped in drainage channels block water flow, creating stagnant and polluted pools. In Southern African cities, households sometimes dig shallow

wells near areas where refuse and sewage gather, especially when municipal water supplies are unreliable (Martins and Mafimisembi, 2024). This increases the risk of water-borne diseases.

Locally, refuse accumulation near wetlands and communal water sources has become a serious concern in Harare. Zhongove et al. (2024) state that poor municipal waste collection has pushed residents to dump household and commercial waste into wetlands and open streams. In Kuwadzana, illegal dumpsites may develop near boreholes and shallow wells, allowing toxic liquids from decomposing waste to seep into groundwater. Masimba and Walnycki (2024) also note that blocked stormwater drains can overflow during the rainy season, carrying solid waste and sewage towards community water points. This exposes local families to major health risks because the separation between waste areas and drinking water sources has been weakened.

Globally, the layout and physical features of high-density urban areas influence where illegal dumping takes place. In poorly managed cities, residents often use open communal spaces when waste bins are broken, removed or not collected on time. Such places are usually chosen because people can dump waste without being easily noticed by authorities (Gergiou, 2025). Graham (2024) also argues that waste concentration does not happen by chance but is caused by weaknesses in urban planning and waste management systems.

In Africa, waste often builds up in urban spaces because of poor infrastructure and the difficult layout of crowded settlements. Mvula et al. (2025) found that open stormwater drains, road edges and low-lying areas are among the most polluted places in countries such as Malawi. Grangxabe (2023) adds that where roads are narrow, muddy or not paved, refuse trucks fail to reach some areas, forcing residents to dump waste at main road intersections. In Southern Africa, places such as open grounds and areas near schools are also used for illegal dumping because they are poorly managed and do not have clear boundaries, as seen in South Africa (Jakeni et al., 2024). This shows that when open spaces are not properly controlled and roads are difficult to access, they can easily become permanent dumpsites.

Locally, illegal dumpsites are commonly found around schools, wetlands and public road corners (Bandauko and Arku, 2024). In crowded suburbs such as Kuwadzana, this problem is worsened by the failure of Harare City Council to provide secure and fenced waste collection points. As a result, residents dump plastic, food waste and commercial refuse on open community spaces, including areas where children play. Masimba and Walnycki (2024) also note that poorly maintained stormwater drains become easy dumping areas, causing rubbish to

block the movement of water. Therefore, waste concentration in Kuwadzana is mainly caused by poor municipal maintenance, weak planning control and limited waste collection facilities.

2.8 Research Gap

Although there is a huge amount of literature on urban environmental management, a critical review shows that there is still a lot of empirical and geographical void that this thesis can fill. Existing research is much fragmented although it has been well documented by scholars around the world and in the region that the government of local authorities collapsed at the macro level. Public health research is bound to be statistical in tracking epidemics and the clinical burden of water-borne diseases. On the one hand, public health research is heavily focused on the statistical monitoring of epidemiological outbreaks and the clinical burden of water-borne diseases. They always ignore the localised physical layouts and spatial factors which have formed these environments. Traditional geographic and urban planning literature, on the other hand, heavily depends on the use of remote sensing to map environmental decay over whole metropolitan areas. Geographically, one of the major limitations of existing literature is that the studies have been carried out in relatively older high-density suburbs in Harare which located in the central part of the city such as Mbare and Highfield. The researches have entirely been different infrastructural designs and historical planning frameworks. While there is a lack of micro-level studies that have focused specifically on Kuwadzana. It is important to note that there are no empirical studies that have done so. Kuwadzana has some geographical characteristics that make it distinct its peripheral location in the west of the city. The high dependence on localised groundwater sources its close spatial proximity to sensitive wetland ecosystems and its swift up to date growth of informal backyard businesses without regulation. The main literature void is the lack of an integrated analysis that directly links the physical identification of the sources of waste pollution with local community and clinical perception. Health risks are modelled using the connection of geographical coordinates within this particular under-researched landscape. Previous research addresses waste as a purely logistical problem and a stand-alone health emergency. This study fills that gap by showcasing a multi-dimensional assessment of the extent of institutional service failure, public attitude and how localised geographical features intersect in the local context of Kuwadzana to form localised public health risks.

2.9 Chapter Summary

This chapter has provided a comprehensive review of the theoretical, empirical, and geographical literature surrounding urban waste accumulation and its associated public health

risks, structured directly around the core objectives of the study. By establishing a robust academic foundation through the lens of political ecology and the treadmill of production theory, the discussion systematically analysed the sources of waste pollution, community and clinical risk perceptions, and the spatial dynamics of environmental hotspots on a global, continental, and national scale. Crucially, this review contextualized these thematic areas within the specific, under-researched geographical terrain of Kuwadzana, explicitly highlighting the empirical gaps in integrated spatial and public health literature. Ultimately, the insights synthesized throughout this chapter lay a firm theoretical and conceptual foundation for the empirical investigations and research design detailed in the following chapter.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

Chapter 3 outlines the research methodology that was used in this study to understand the implications of waste pollution on health and to model pollution hotspots within the Kuwadzana community. This research methodology has various components including the study area, research design, target population, sampling procedures, data collection instruments, data collection procedures, data quality control, data presentation, spatial analysis and ethical considerations. Each of these components was carefully detailed to provide clarity and justification for each chosen method, ensuring the validity and reliability of the study outcomes. By setting out this clear structure, the chapter shows exactly how the fieldwork was carried out to meet each of the three research objectives.

3.2 Study Area

Kuwadzana is a high-density, large scale residential suburb situated at the west peripheral area of Harare, about 15 km from the Central Business District (CBD) along Harare-Bulawayo major transport corridor. Geographically, the suburb consists of low-lying flat land with clay soils and a shallow water table which naturally meets fragile local wetland networks (Mutsindikwa and Muchato, 2022). The area is characterized by strong informal commercial activities such as street vending, tuck shops, small-scale local street food markets, urban farming, and often, cooperative housing projects that grow faster than formal facilities (Matengo et al., 2025). The Zimbabwe National Statistics Agency (ZIMSTAT, 2022) indicated that Kuwadzana has a dense population more than of 60 000 individuals in 42 670 households. This particular locality was chosen as a critical case example of extremely high population density where basic municipal services are totally absent, with chronic water shortages coupled with frequent sewage burst and absolute lack of any solid waste collection, providing an ideal geographical setting to examine the interaction of institutional failure and spatial dynamics in creating localized public health hazards (Chikukwa, 2023; Matengo et al., 2025). Figure 3.1 below shows Kuwadzana study area map which was created by the researcher using QGIS. Layers with shapefiles including roads, buildings and administrative boundaries were digitized using data from the internet sources such as Google Earth and DivaGIS.

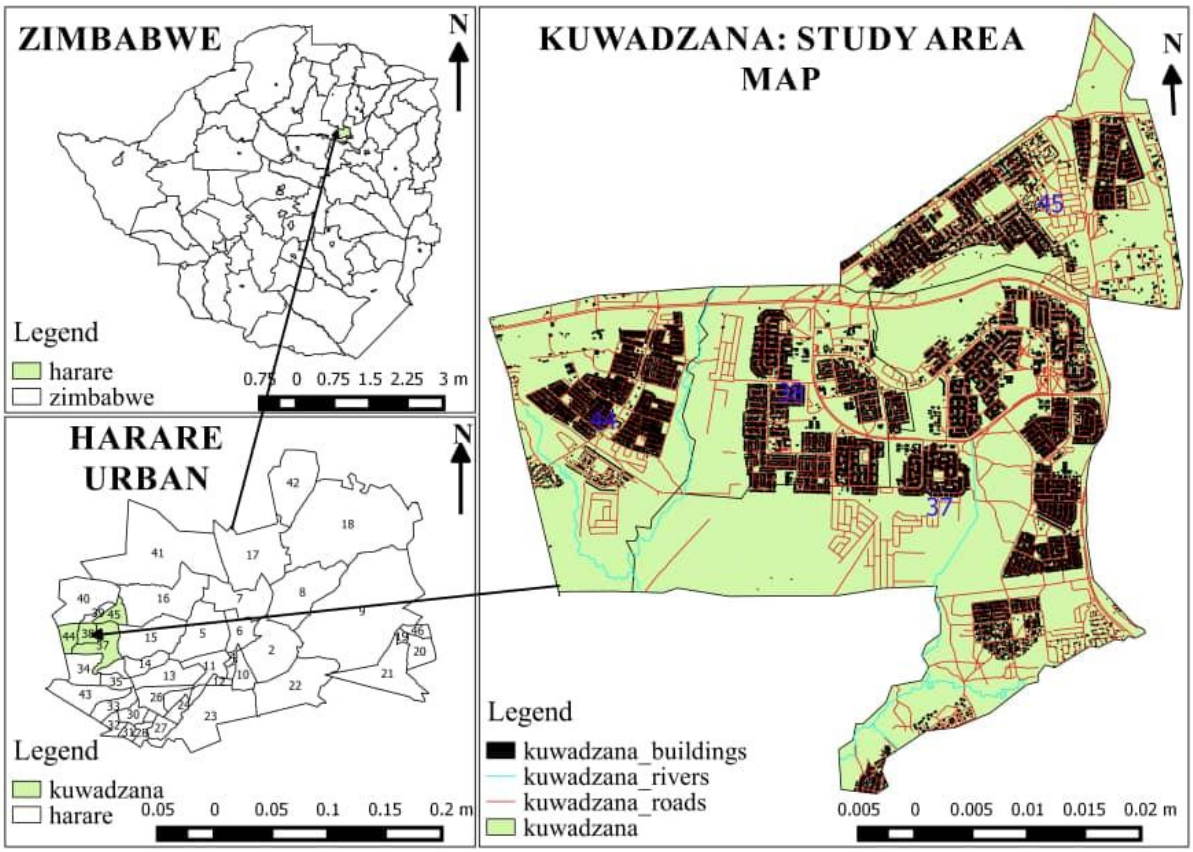

Figure 3.1: Kuwadzana Study Area Map (Source Quantum Geographic Information Systems Software)

3.3 Research Design

A research design is a plan of the research that guides the research and a pathway of how the research will compile data aligning to the topic (Takona, 2024). A case study was employed in this study. It is important that a case study is included because it highlights the connection between the concepts of this case, namely waste pollution and community health. The research also employed used both qualitative and qualitative methods. Case studies are helpful in this study as they will bring out information from various sources not only focusing on one source (Mangara and Dorrasamy, 2026). Case studies are flexible as they allow the researcher to use both qualitative and quantitative data not focusing one aspect.

3.4 Target Population

Target population is the specific complete group of people that have the attributes necessary to provide data on which an academic investigation can be conducted (Willie, 2023). For this

study the target population includes local informal market vendors, commercial business owners and frontline healthcare professionals. It was appropriate to include these separate groups as they each have an operational perspective with respect to the waste crisis (Willie, 2024). The main population of concern for the written questionnaire is the household residents, local vendors and commercial business owners. Household members especially women and children who use open spaces during the day suffer the direct impact of the environment. Local vendors and commercial business owners supply key information on the amount of waste produced in the public markets and commercial areas how the waste is disposed of at the local level. Finally, the Kuwadzana Polyclinic nurses who attend to the patients in the clinic are an important population for the structured interviews since they have direct, clinical information about the occurrence of water-borne or vector borne disease outbreaks in the community and their monitoring and treatment.

3.5 Sampling

A sampling procedure is a systematic procedure for selecting an adequate sample of participants from the larger target population of Kuwadzana. Identifying purposive sampling framework in empirical research is crucial to make sure the data collected is statistically manageable, free from bias and contain valid generalizable information (Ahmed et al., 2025). This section explains the mathematical calculation for determining the actual size for the study and describes the sampling techniques employed in selecting the respondents for the survey and the key informants for the key interviews.

3.5.1 Sample Size Determination

This study used Proportionate sampling since Kuwadzana has a vast population to capture different information in each ward, from residents residing at the centre of the location Kuwadzana 4 shopping centre and surrounding areas. It is located in Ward 38, the shopping centre and surrounding areas has roughly 1000 population. The researcher took 10% of the population surrounding Kuwadzana 4 shopping complex as the centre of Kuwadzana. Different Kuwadzana locals come to Kuwadzana 4 to buy and sell their goods.

3.5.2 Sampling Method

In this study, the participants were selected from the target population using proportionate and purposive sampling, which is a method to eliminate the data that do not have any meaning. A total of 100 questionnaires were distributed to the various participants in Kuwadzana. The selected population covered information of the 8 phases of Kuwadzana since some of the

workers resides in these areas surrounding Kuwadzana. This technique ensured that no part of the suburb was over-represented in the quantitative survey, and a geographically representative sample of the waste conditions was achieved for all 8 phases.

The Kuwadzana Polyclinic was then purposively sampled to find the qualitative key informants, which were clinic nurses at the frontline of service delivery. Purposive sampling involves the researcher carefully choosing information rich participants to include in the study because they possess specialised professional knowledge and are on the frontlines of the environmental health crisis. The number of key informant interviews was not pre-determined with a mathematical formula but rather the principle of data saturation was used. The saturation point is when new interviews show no new thematic information patterns or insights in waste-related health trends. During the fieldwork 7 intensive interviews have been conducted with Clinic nurses and information collected was completely repetitive, thus indicating data saturation.

3.6 Data Collection Instruments

The term data collection instruments are the collection tools, devices and systematic frameworks that a researcher uses to collect the empirical data from the people that have been targeted (Khoa et al., 2023). In this study there were several data collection instruments to meet the requirement of the concurrent triangulation mixed methods design used. The multi-instrumental approach enabled the researcher to collect quantitative information as well as rich qualitative accounts. The investigation into the environmental health crisis in Kuwadzana was balanced and cross verified. It describes the design structure and implementation of the specific tools that were used such as structured questionnaires and interview guide together with a field observation checklist including the spatial tracking.

3.6.1 Questionnaire

The researcher designed and interviewed a highly structured questionnaire to collect primary quantitative data on the practices of disposing household waste frequency of localized dumping and environmental health symptoms observed throughout Kuwadzana. The questionnaire is referred to in Appendix 2 addressed to the community members. The instrument was developed using simple, unambiguous language to suit different levels of literacy and was a blend of closed ended multiple choice questions. Likert scales and short open-ended questions for specific nuances in the community. In the fieldwork stage, the researcher personally handed out a total of 100 questionnaires to the people residing in Kuwadzana 4. To the informal market

vendors and other areas surrounding Kuwadzana and gives information which covers all eight administrative phases of the suburb. Of these spread instruments, questionnaires were returned filled in 80%, 80 questionnaires. This remarkably high return rate is a solid and stable base for statistical analysis and far surpasses the 80% rate considered excellent for external research studies of urban communities. According to Sharma (2022) a questionnaire is a formal tool, it contains certain number of items, is structured and aims at collecting specific and measurable information from the respondents about their knowledge, attitudes and behaviours. The questionnaire provided a standardized approach to gathering data from the 80 respondents by giving them the same questions, which means that a researcher's interpretation of the data was not a factor in the results, and that it was possible to compare the data objectively when conducting statistical analysis of the responses (Synder, 2019).

3.6.2 Interview Guide

Interview guide is a qualitative research instrument that refers to a collection of open-ended questions that are presented in a flexible, thematic manner to gain insight into the expertise, perspectives and experiences of individuals with significant vantage points in a target system (Khoa et al., 2023). The interview guide is places in Appendix 1 which was used to interview nurses. A semi-structured key informant interview guide was used to elicit in-depth qualitative information on the immediate public health impacts of the current waste problem in Kuwadzana. This instrument was developed specifically with open ended and flexible questions that gave the researcher the opportunity to go into greater depth to learn about health trends. Tracking and professional observations were made which were not measured through the household questionnaires. This instrument was used to carry out seven intensive face to face interviews with the frontline nurses in Kuwadzana Polyclinic. The selected healthcare workers were selected due to their direct exposure to the medical realities of the environmental breakdown in their everyday clinical work. The researcher was able to capture detailed clinical information about the seasonal surge along with medical treatment information for water-borne diseases (e.g. cholera, typhoid) and vector-borne diseases in the community by interacting with them through conversation. The use of this instrument proved to be of great benefit in the study as it allowed for the interactive nature to reveal the underlying operational issues that local clinics face, complementing the quantitative survey results (Knott et al., 2022).

3.6.3 Field Observation Checklist

The researcher used a structured field observation checklist which was coupled with mobile Global Positioning System (GPS) spatial tracking to gather firsthand unmediated empirical

data on the physical realities of the waste situation in Kuwadzana. The researcher used this tool to record environmental information systematically rather than just basing on the opinions of the respondents to the questionnaire and the interviewees themselves. The checklist was employed during the physical walkthrough of the field by the researcher in all eight administrative phases to document and compare the situation of legal collection points and scattered illegal dump sites. The sites were assessed with the checklist for each specific site, concerning its closeness to residential doorstep, water and open drainage systems fly or rat presence and hazardous practices like open burning of waste. The checklist was used for documenting frequency of collection and overruns in collection capacity along with efficiency of municipal management for the designated legal collection sites. At the same time, a GPS logging application was developed for mobile use that recorded GPS coordinates of the exact location of both legal and illegal waste piles. The researcher was able to record the precise coordinates of environmental. Importantly the researcher also took raw captures of photographs in these physical walks to visually record the structural reality of the waste situation. The field photographs are taken to document the size, nature and setting of the many dumpsites found throughout the study area both legal and illegal. These visual materials provide an essential source of primary empirical evidence that is a vehicle to directly include the physical condition of the environment with the quantitative surveys and qualitative transcriptions of the interviews. In doing so strict ethical care was adhered to and no face of a person, private residential property and identifying feature were included in the photos, which is necessary to ensure the total anonymity of the local community whilst capturing the essential empirical evidence (King et al., 2023). The observation guide used to collect information was placed in Appendix 3.

3.6.4 Data Collection Methods

Data collection methods are essential for every study since they are the evidence and ways in which the researcher collected information (Khoa et al., 2023). The study used interviews, questionnaire and fieldwork. An interview is a guideline which consists of a list of questions which are used to ask questions which can dig deep information of the study. Interviews are reliable and allow the researcher to ask participants to elaborate (Knott et al., 2022). An interview does not provide information written by the participant that's when the questionnaire comes in providing written information right from the participants. A questionnaire is a combination of questions which seeks to bring more information regarding the study to the community. The questionnaire will also bring out perceptions regarding the problem being

researched on (Sharma, 2022). The questionnaire targeted 100 participants who will give accurate answers meaningful for the research. For more visual evidence the researcher used fieldwork to capture areas where waste pollution is affecting the community. Fieldwork is important as it provide both visual and written information helpful to this study. Observations enhance the researcher to obtain direct information from the site reducing bias which is important for the research (King et al., 2023).

3.7 Data Collection Procedures

The researcher was able to get a research letter from the University and went to Harare City Council to present my research proposal after a couple of days of review. The researcher was given an opportunity to have a research allowance to interview at Kuwadzana Polyclinic. After this she went to and conducted the interview. Following that, the researcher evaluated the community and took photographs in the 5 pollution hot spots and engaged community members in random questions about the reality of open dumping. Finally, questionnaires were distributed online, as well as in person, with some members of the community, such as nurses and commercial business owners, vendors, being able to submit written data. In fact, a special alphanumeric coding system was used for each questionnaire at the data entry stage in the Microsoft Excel program. (King et al., 2023).

3.8 Data Analysis

Data analysis and presentation are systemic processes that turn raw empirical data gathered in the field into meaningful, organized evidence to answer the research core objectives (Ahmed, 2025). Mixed methods were used here the quantitative and qualitative data streams were cleaned and analysed separately and then combined in the interpretation process. The statistical information obtained from the 80 household questionnaires and the narrative information derived from the 7 key informant interviews, plus the visual information gathered from the field and through photographs, were processed, analysed and then visually structured for presentation.

3.8.1 Quantitative Data Analysis

Microsoft Excel software was used to process and analyse the main quantitative data collected from the 80 completed household and vendor questionnaires. Data analysis was carried out systematically. The researcher did data cleaning and screening within the spreadsheets to ensure that there were no missing data or inexplicable and duplicate outliers. Closed ended variables, Likert scale and categorical response items were coded in a comprehensive coding

framework that was developed within the excel worksheet to enable systematic computation. After coding and data entry was completed, the data was processed using data formatting tools so as to ensure the security of data matrix.

The researcher used spatial analysis by taking easting and northing coordinates through observations to capture the points of areas affected by waste pollution. The software QGIS was used to visualise these points using a map. The researcher went on further analyse areas close to water sources used in homes.

The statistical analysis mainly comprised descriptive statistics that summarised and described the characteristics of the sample (Nardi, 2024). To measure the prevalence of specific solid waste management practices, frequency distributions and percentages were calculated using Excel. To measure the frequency of municipal garbage collection failures in the 8 phases, Excel formulas and data analysis functions were used. For the distribution of reported health conditions, frequency distributions and percentages were calculated using Excel. Pivot tables and cross tabulations were created to analyze patterns and relationships between selected geographical areas (illegal areas vs. legal dumping areas) and the frequency of open burning and dumping waste.

3.8.2 Qualitative Data Analysis

The qualitative data collected from the seven face-to-face interviews with clinic nurses was analysed using thematic analysis, following Braun and Clarke's six-phase framework as supported by Hole (2024). This method helped the researcher to identify, organise and explain repeated ideas and patterns from the interview responses. The process started by transcribing the recorded interviews word for word and reading the transcripts several times to gain a clear understanding of the nurses' views. The researcher then coded the transcripts line by line, focusing on important ideas related to environmental health trends seasonal disease increases and challenges faced by the clinic. After coding, similar ideas were grouped into broader themes that matched the objectives of the study. These themes were reviewed against the original data to make sure they were clear, accurate and meaningful. Finally, the themes were named and presented in Chapter 4, supported by direct quotations from the nurses to show their real experiences and professional views.

3.9 Data Quality Control

Data quality control refers to the steps taken by the researcher to make sure that the information collected was accurate, reliable and free from major errors (Wayant, 2022). Since this study used a mixed methods approach, it was important to ensure that both the quantitative and qualitative data were trustworthy. For this reason, the researcher focused on checking the validity and reliability of the research instruments used during data collection. This helped to maintain consistency, clarity and accuracy throughout the study.

3.9.1 Validity and reliability of the Study

Validity refers to the extent to which research instruments measure what they are intended to measure (Coleman, 2022). In this study the validity of the household and vendor questionnaires was improved through review by the research supervisor and a peer review panel. This helped to ensure that the questions were clear, relevant and linked to the study objectives such as measuring waste dumping practices and health-related effects. The researcher also improved construct validity by adapting some questions from previous environmental health studies (Synder, 2019). For the qualitative part, validity was strengthened by comparing the nurses' interview responses with questionnaire results and field observation evidence. Member checking was also done by summarising key points to the nurses at the end of each interview to confirm that their views had been correctly understood. The researcher also gave detailed descriptions of the Kuwadzana context so that the findings could be clearly understood by the reader.

Reliability refers to the consistency and dependability of the research process, meaning that similar results would be obtained if the study were repeated under the same conditions (Coleman, 2022). To improve quantitative reliability, the researcher first carried out a pilot study using 10 household residents from a nearby suburb Kuwadzana 5 with similar characteristics to Kuwadzana. These participants were not included in the final study. The pilot study helped the researcher to identify unclear wording, remove confusing terms and improve the response options in the questionnaire. For the qualitative data, reliability was maintained by keeping a clear audit trail, including audio recordings, full interview transcripts and fieldwork notes (Wayant, 2022). The researcher also used the same interview guide for all seven nurses and applied the same observation checklist across all eight phases of Kuwadzana. This helped to reduce personal bias and ensured that the data collection process was consistent.

3.10 Limitations of the Study

The study faced some limitations during data collection. Firstly, the researcher was not given access to some secondary data from Kuwadzana Polyclinic because the information was private. However, the researcher managed to collect useful information through interviews with clinic nurses. Secondly, interviewing nurses was time-consuming because they had to attend to patients and could not always be available immediately. The researcher struggled to cover the vast population in all the 4 wards but decided to select different participants in all the wards. The researcher therefore had to be patient and flexible in order to collect the required information. Lastly, some responses from community members may have been biased, but the researcher carefully reviewed the responses and used only the information that was relevant and meaningful to the study.

3.11 Ethical Considerations

Ethical considerations were important in this study because the researcher worked with household residents and medical professionals on issues related to environmental health. Ethics help to protect the rights, dignity and safety of participants during the research process (McGregor, 2023). Before collecting data, the researcher obtained ethical approval from the Bindura University of Science Education research ethics committee. Permission was also obtained from the Harare City Council to distribute questionnaires in Kuwadzana and to approach health workers at the local polyclinic. The researcher also followed the principle of informed consent as explained by Creswell and Creswell (2018). Before giving questionnaires or conducting interviews, participants were given clear information about the purpose of the study, how the data would be used, and the fact that the research was for academic purposes only.

3.12 Chapter Summary

This chapter explained the research methods used to study the waste crisis in Kuwadzana. The study used a concurrent triangulation mixed methods design capturing information Kuwadzana 4. Multi-stage sampling was used to select 80 household and vendor respondents for questionnaires, while purposive sampling was used to choose 7 clinic nurses as key informants. Data was collected using structured questionnaires, semi-structured interviews, field observation checklists with GPS points, and photographic evidence. The quality of the data was improved through pilot testing, validity and reliability checks, and triangulation of different data sources. Quantitative data was analysed using descriptive statistics in Microsoft Excel, while qualitative data was analysed thematically. Ethical approval was also obtained

from Bindura University of Science Education and Harare City Council to protect the rights and safety of the participants.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Introduction

The chapter presents, interprets and discusses the empirical results collected from the study area on the impacts of waste pollution on the health of the community in Kuwadzana. The content is organized systematically and directly to the three specified research objectives for this research. The presentation starts by providing an overview of the final response rate and profile of the participants' demographic characteristics. The empirical data is then presented sequentially in subsections and under headings relating to each research objective. To conclude the chapter an in-depth academic analysis brings all these findings together with the existing literature. It also draws the necessary conclusions to provide context and meaning for each finding and its connection to the literature.

4.2 Response Rate

The response rates for each data stream (quantitative and qualitative) were monitored and validated to ensure a strong foundation of mixed methods data. For the quantitative survey, 100 structured questionnaires were administered in Kuwadzana 4 shopping centre and commercial workers. Of these distributed research instruments, 80 questionnaires were returned and confirmed for statistical analysis and yielded a response rate of 80%. In the qualitative aspect, semi-structured interviews with key informants were conducted with the medical and institutional personnel at the local polyclinic. Together these response rates offer an unprecedented high degree of empirical validity and full scope of local waste problems.

4.3 Demographic Characteristics

This section illustrates more on the demographic characteristics of the participants obtained during the surveys done in Kuwadzana 4. Table 4.1 provides an overview of the study sample including age, gender and employment status.

Table 4.1: Demographic Profile of the Sampled Community Residents [Source: Primary Data]

Demographic variable	**Category Options**	**Frequency (N=80)**	**Percentage (%)**
Gender Distribution	Male	30	37.5
	Female	50	62.5
Age Range (Years)	11 to 20	8	10

	21 to 30	16	20
	31 to 40	32	40
	50 and above	24	30
Employment Status	Formally Employed	15	19
	Informal Job	33	41
	Not Employed	22	27.5
	Other	10	12.5
Period of Settlement	Below 5 Years	24	30
	5 to 10 Years	32	40
	Above 10 Years	24	30

[Source: Primary data]

When viewed within the statistical distribution in the consolidated table, it shows significant insights into the socio-economic structure of the Kuwadzana community. There is an asymmetric distribution with many female participants, accounting for almost two-thirds of the total sample as indicated in the gender matrix. This means women continue to be the main actors of the household. They are involved in the local informal vending spaces as such it is the most exposed social group to domestic waste storage and disposal problems. The age profile of the respondents is concentrated in the economically active age group (31-40) closely followed by adults over 50 years. Thus, the sample is dominated by mature adults who have been aware of the changes to the environment over a long time.

The settlement status demonstrates that the respondents have been residing permanently in the high-density suburb for 5 years or longer. Supporting this deep environmental awareness, which is mathematically supported. Long-term residency will mean that the data collected will be legit as they would have much experience of the area. They give helpful responses as they would have noticed the gradual decay of public waste facilities over time. From an economic perspective only a small proportion of the population has formal jobs. The largest single group is engaged in informal livelihoods including road-side street food vendors, second-hand clothing vendors and convenience vendors. This informal dominance is one of the biggest

structural influencers of local waste. The vast amount of daily waste materials produced by the unregulated commercial activities do not have institutional access to formal systems of waste disposal for the municipality.

4.4 Waste Pollution Sources and their Effects on Community Health

This section presents the results on the first specific objective on main sources of waste pollution found in Kuwadzana and their effects on community health. To clearly understand the causes of the waste crisis the study looks at the different forms of pollution affecting the area. These include household and commercial solid waste, sewage and liquid waste problems, as well as electronic and industrial waste. By examining these sources separately, the study shows how different types of waste expose residents to biological, chemical and physical health risks.

4.4.1 Household and Commercial Solid Waste Accumulation

This section discusses the findings on the build-up of household and commercial solid waste in Kuwadzana and how it affects the health of residents. It focuses on waste from homes and businesses especially uncollected domestic refuse and commercial waste that create visible environmental hazards. During the survey respondents were asked to identify the main source of waste pollution affecting their homes and trading areas. This helped the researcher to understand the major causes of surface waste in the community. Figure 4.1 presents the responses from the sampled residents on the main sources of pollution.

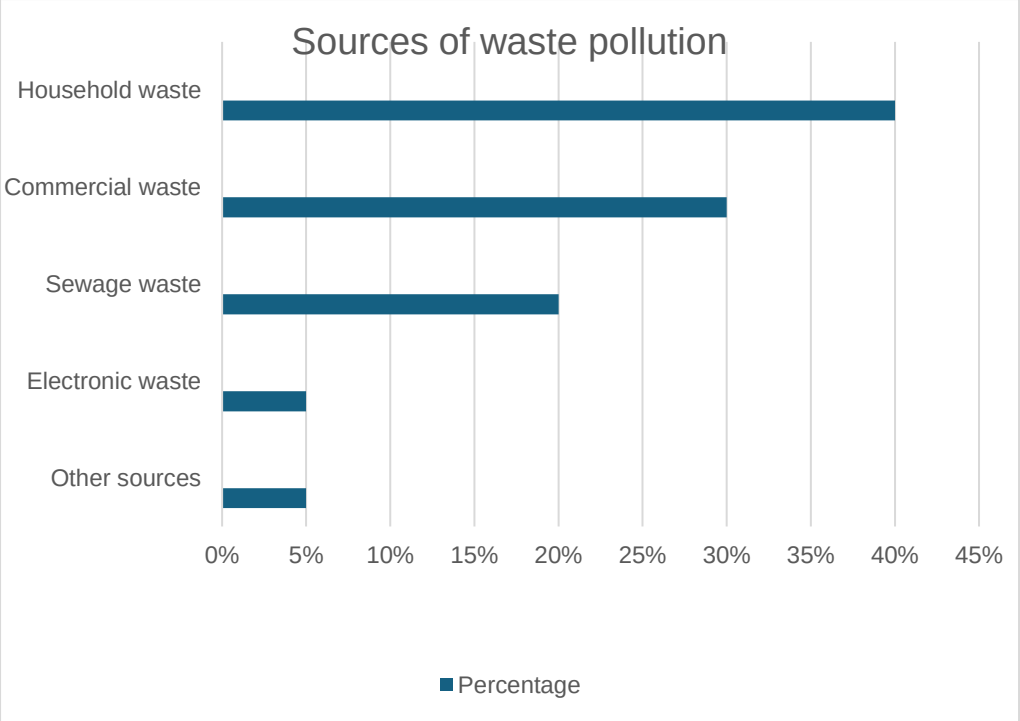

Figure 4.1: Sources of waste pollution [Source Primary data]

The statistics show that municipal solid waste is the most significant environmental problem in the region. Household and commercial waste is the biggest category of responses. These findings reveal that the problems that are affecting the environment are mainly domestic rather than from large industries in the community. It stresses that there is a failure to maintain a regular collection for the refuse. The accumulation of daily consumer waste is left within the pathways and spaces that people live and do business in.

Participants highlighted these specific municipal and commercial sources in their interviews that lead to this surface accumulation. Nurse A said that:

> *"The origin of the household waste is completely domestic, as a continuous supply of organic kitchen waste, a single-use plastic and a heavy packaging waste. It accumulates in the residential yards, are not collected by the formal municipal waste collection."*

This was supported by Nurse D who used to say that:

"There are no local commercial waste bins in areas close to informal marketplaces and road-side vegetable stalls. This is making commercial sellers commonly along roadsides dump rubbish everywhere."

The researcher observed during the observations that open dumpsite has become a common sight in Kuwadzana 4, especially in the commercial area. It is also a common problem in Kuwadzana 8, particularly in the expanding blocks along the main transport routes. In boundary paths and open dumpsites are extensive unauthorised. A significant amount of domestic solid waste mostly high-density plastics was seen tumbling on public gravel roads and in the open drainage channels. This spatial reality is captured in Plate 1 which represents a primary roadside domestic dump encroaching into a domestic path leading to houses.



Plate 4.1: Waste near major Road [Source: Primary Data]

A closer look at Plate 4.1 shows that household and commercial solid waste is one of the main causes of health problems in the community. When waste collection services fail, rotting food waste, plastics and other refuse remain close to people's homes, creating breeding places for flies, rats and other disease-carrying pests. The situation becomes worse when residents burn the uncollected waste in open spaces as a way of reducing it. This produces harmful smoke, which can lead to chest infections, breathing problems and asthma, especially among young children. Therefore, the findings show that poor urban waste management directly exposes the community to physical and biological health risks, affecting the safety and wellbeing of residents.

4.4.2 Sewage Infrastructure and Liquid Waste Failures

This section presents and discusses the findings on the poor condition of the sewage system in Kuwadzana and the health risks caused by liquid waste problems. It focuses on how damaged sewer pipes, blocked drains and sewage overflows expose residents to unsafe wastewater. During the survey, respondents were asked how often sewage bursts and liquid waste overflows occurred in their residential areas. This helped the researcher to assess the condition and performance of the local wastewater system. Table 4.2 shows the responses from community members on the frequency of sewage overflows and liquid waste failures.

Table 4.2: Perceived Frequency of Sewage Overflows and Liquid Waste Failures

Perceived Frequency	**Frequency (N=80)**	**Percentage (%)**
Continuous / Daily Overflows	40	50
Weekly Recurrence	24	30
Monthly Intermittent Failures	12	15
Rare / Only During Rainy Season	4	5
Total	**80**	**100**

[Source: Primary Data]

Table 4.2 show that the sewage and liquid waste system in Kuwadzana is seriously failing. Most respondents reported that sewage overflows occur either weekly or daily meaning that contact with raw sewage has become a regular problem rather than an occasional breakdown. This suggests that the local sewer system no longer has the capacity to safely carry wastewater away from homes and public spaces.

The interviews also helped to explain the causes of this problem. Nurse B stated;

> *The crisis is mainly caused by old and overloaded underground sewer pipes, especially in the older parts of Kuwadzana. These pipes often break under pressure and release untreated sewage onto roads and into residential yards.*

Nurse F also explained that;

> *Poor municipal maintenance worsens the situation as blocked sewer lines are sometimes left unrepaired for long periods. As a result, wastewater flows back*

through toilets, inspection points and manholes, spilling into pathways used by residents.

Field observations confirmed these concerns. The field observations noted several sewages burst points, especially in Kuwadzana 4 and the developing areas of Kuwadzana 8. Raw sewage was seen flowing across dusty roads and public spaces. Greenish stagnant wastewater collected in shallow roadside drains. These pools produced strong unpleasant smells and attracted many flies close to people's homes. Plate 2 shows raw sewage flowing across a main pedestrian crossing used by residents which is close to a junior school namely Kuwadzana 7 primary which affects children's health.



Plate 4.2: Flowing sewage near roads Kuwadzana 7 primary [Source: Primary Data]

A closer look at Plate 4.2 shows that sewage and liquid waste problems pose a serious health risk to residents in Kuwadzana. Raw sewage is often found in open spaces where people live, walk and children play creating a dangerous environment for the community. The problem becomes worse because municipal tap water supplies are unreliable. This forces some residents to depend on shallow wells and other alternative water sources. When sewage flows openly near these water points. There is a high chance that the water becomes contaminated with harmful germs. This connects directly to the main research problem as the failure of public

sanitation systems exposes residents to unsafe waste and increases the risk of waterborne diseases and adds pressure on local health facilities.

4.4.3 Electronic and Industrial Waste Accumulation

This section presents and discusses the findings on electronic and industrial waste found in Kuwadzana and how it affects the local environment. It focuses on waste such as broken household appliances, old mechanical parts, scrap metal and waste from small-scale manufacturing activities. These types of waste are difficult to decompose and may create long-term environmental risks when they are dumped in residential areas. During the survey, respondents were asked to identify the main places where electronic and mechanical scrap waste is commonly found in their communities. Figure 4.4 shows the distribution of Electronic and Industrial waste using a pie chart.

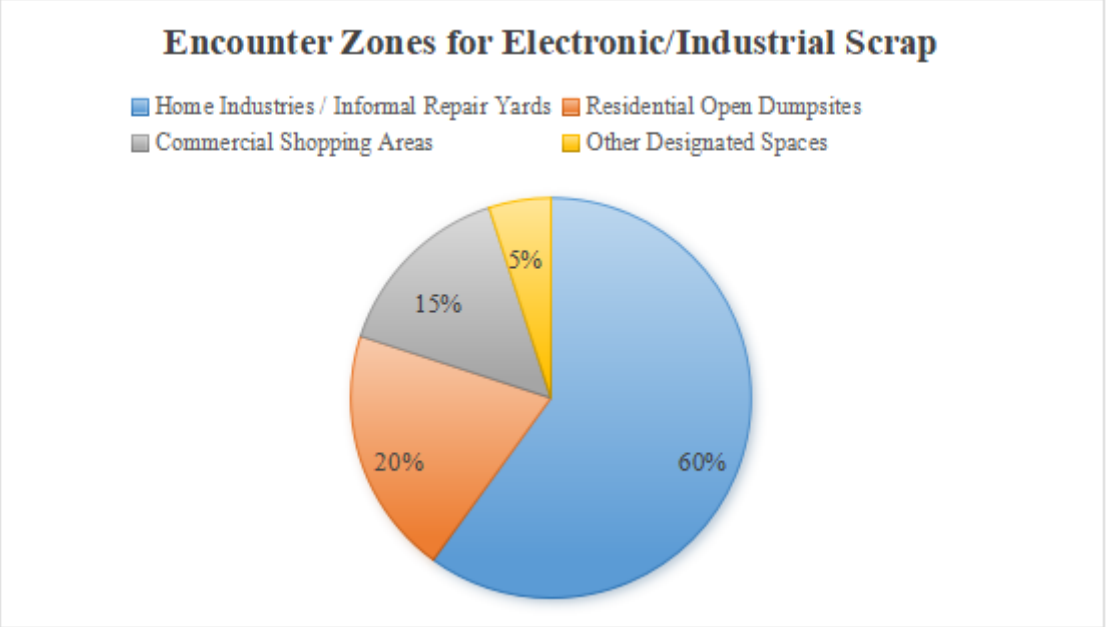

Figure 4.4: Primary Encounter Zones for Electronic and Industrial Waste [Source: Primary Data]

Figure 4.4 shows that electronic and mechanical waste is not spread evenly across Kuwadzana, it is mainly concentrated around informal home industries and backyard workshops. Although this type of waste may not make up the largest amount of waste in the suburb. It creates serious local environmental risks where it is dumped. This is because items such as broken electronics, scrap metal, copper wires, circuit boards and old machinery parts do not decompose easily and are often handled in unsafe places where people work and live.

Interview responses helped to explain the causes of this problem. Nurse C explained that electronic waste mainly comes from backyard repair businesses that fix phones, televisions and computers. These operators often remove plastic covers, circuit boards and wires inside residential yards. As there is no formal place for sorting or disposing of hazardous electronic waste. Residents also note that industrial scrap comes from informal welders, metal workers and vehicle repairers who leave sharp metal pieces, old vehicle parts and used battery cells on open communal land because there are no proper small-business zones for such activities.

Field observations also showed differences between the older and newer parts of Kuwadzana. In areas such as Kuwadzana 1 and 4, electronic and mechanical waste was mostly found behind shopping centres and around backyard workshops, where rusted metal and broken plastic parts were seen blocking pathways. In Kuwadzana 8 the situation was different because poor planning and lack of regular refuse collection. This has caused residents to mix broken appliances and small electronic waste with ordinary household rubbish in large open dumpsites. Plate 4.3 shows this problem through an unmanaged dumpsite in Kuwadzana 8 filled with broken plastics and consumer metal waste.



Plate 4.3: Unmanaged dumpsite near Kuwadzana 5 shops [Primary source]

A closer look at Plate 4.3 shows that electronic and industrial waste creates special physical and chemical dangers in the community. This problem is linked to the growth of informal recycling and repair activities in residential areas. Although these activities help people earn a

living and recover useful materials such as metals. The absence of proper industrial zones and safe disposal systems makes these areas risky. Over time scrap metal, broken glass, old batteries, wires and plastic casings build up around homes and pathways. This creates dangers such as injuries, blocked movement and possible chemical contamination. This links directly to the main research problem because informal survival activities. Weak urban planning and poor waste management services bring harmful materials into residential spaces and reduce community safety.

4.4.4 Diseases Caused by Waste Pollution

Waste pollution leads to several diseases and health complications some diseases develop overtime such as respiratory diseases and become chronic illnesses such as asthma. In Kuwadzana high density areas with many population residents suffer from diseases like cholera and becomes contagious such that control can be difficult. Figure 4.5 illustrates waste related diseases in 3 classes namely respiratory, vector borne and water borne diseases.

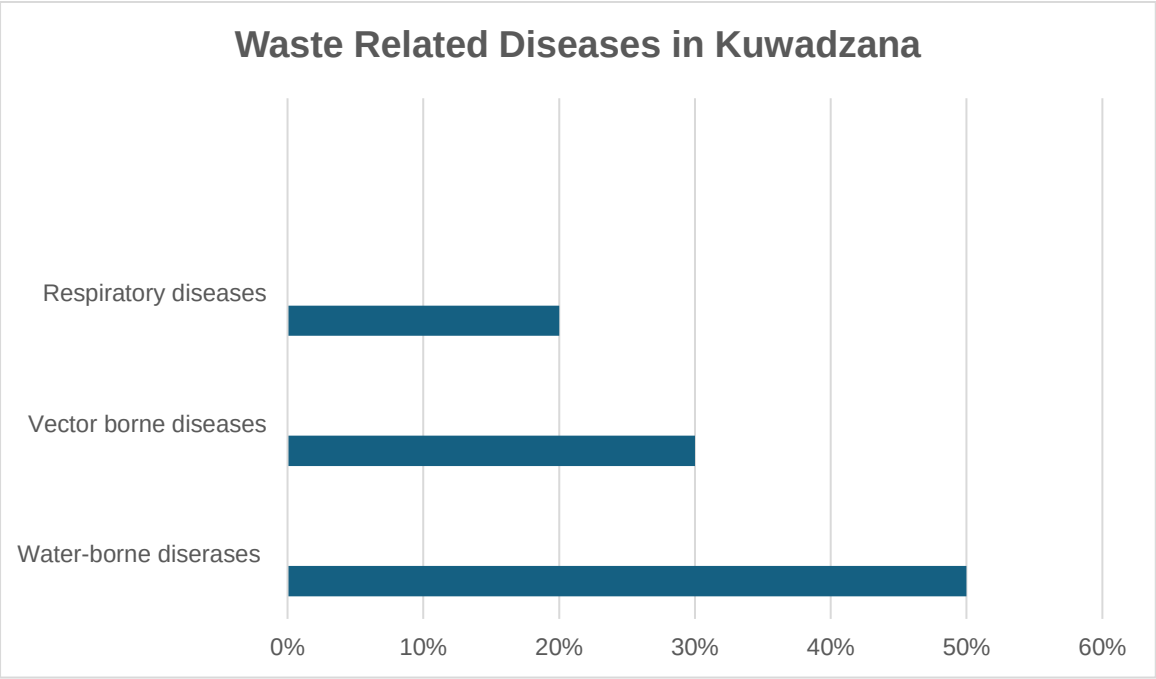

Figure 4.5: waste related diseases experienced in Kuwadzana [Source primary data]

4.4.6 Water Borne Diseases

According to Figure 4.5 water borne diseases are largely affecting residents in Kuwadzana mainly caused by household waste and sewage waste which dumped in open areas. In questionnaires and interviews the majority classified that waste pollution is causing cholera,

diarrhoea and typhoid. Kuwadzana is affected by shortage of water such that Harare city council water has limited days it runs on taps so that residents can use. Therefore, residents start looking for solutions to fix the water challenge and end digging shallow wells and ends up drinking contaminated sewage water. When sewage water mixes with water in shallow wells it causes bacteria which increases the risk of cholera, typhoid as the residents use the water to drink cook and engage in other normal activities. This is the main reason why if there is cholera outbreak the rate of infection worsens as hygiene is low if open dumping hotspots are common in various areas. The other health worker commented

> *During 2024 cholera outbreak the impact worsened as there is lack of hygiene in households and commercial areas. People tend to resort to dumping waste everywhere which makes it difficult to control disease prevalence. Even if the problem of cholera seems to have ceased some patients are still coming and seeking treatment, affected by typhoid and cholera due to less control of waste. The Harare City council waste is making efforts to collect waste regularly but still some residents are throwing waste in open areas.*

This shows that personal hygiene is important and should be practised in households through disposing waste to City Council waste collectors should and not to dump in open areas. Those open dumping areas can become breeding ground for flies and they can carry the bacteria in households.

4.4.7 Vector Borne Diseases

Vector borne disease is reported to have a 30% effect according to the questionnaire and interview responses. Household waste dumped in open areas is becoming a challenge by increasing the breeding ground of mosquitoes. The challenge worsens during rainy seasons when people dump in dirty stagnant water mostly those who stay close to the dumping areas are mostly affected like in Kuwadzana 8 and 4 paddock areas. Poor waste management skills like dumping everywhere increases the breeding of mosquitoes causing vector borne diseases like malaria.

4.4.8 Respiratory diseases

These diseases are triggered by poor waste disposal practises like burning waste. The Kuwadzana residents note that the effective solution if waste collection delays is burning waste and also in newly constructed areas with no roads yet like Kuwadzana 8 they resort to burning

waste as it is not frequently collected and it becomes a challenge. The dangers of respiratory diseases is that they can be detectable over time and not instantly. The diseases are asthma, chest infections, breathing difficulties, bronchitis.

4.5 Community Perceptions on Waste Pollution and Health Risks

This section presents and discusses the findings on how Kuwadzana residents understand and experience the health risks caused by waste pollution. Community perceptions are important because they show how people connect the dirty environment around them with possible illness, injury and poor living conditions. The section focuses on how residents rate the seriousness of waste-related health risks who they believe is responsible for the pollution problem and how they view possible waste management and enforcement measures. By examining these views, the study shows how daily exposure to uncollected solid waste and sewage shapes residents' fears concerns and expectations from local authorities.

4.5.1 Perceived Severity of Waste-Related Health Risks

This section discusses how serious residents believe waste pollution is to their health and the wellbeing of their families. It focuses on community concerns about diseases, injuries and other health problems caused by living close to dumped refuse, blocked drains and flowing sewage. During the survey respondents were asked to rate the level of danger that environmental pollution poses to their households. Figure 4.6 presents these responses using a bar graph.

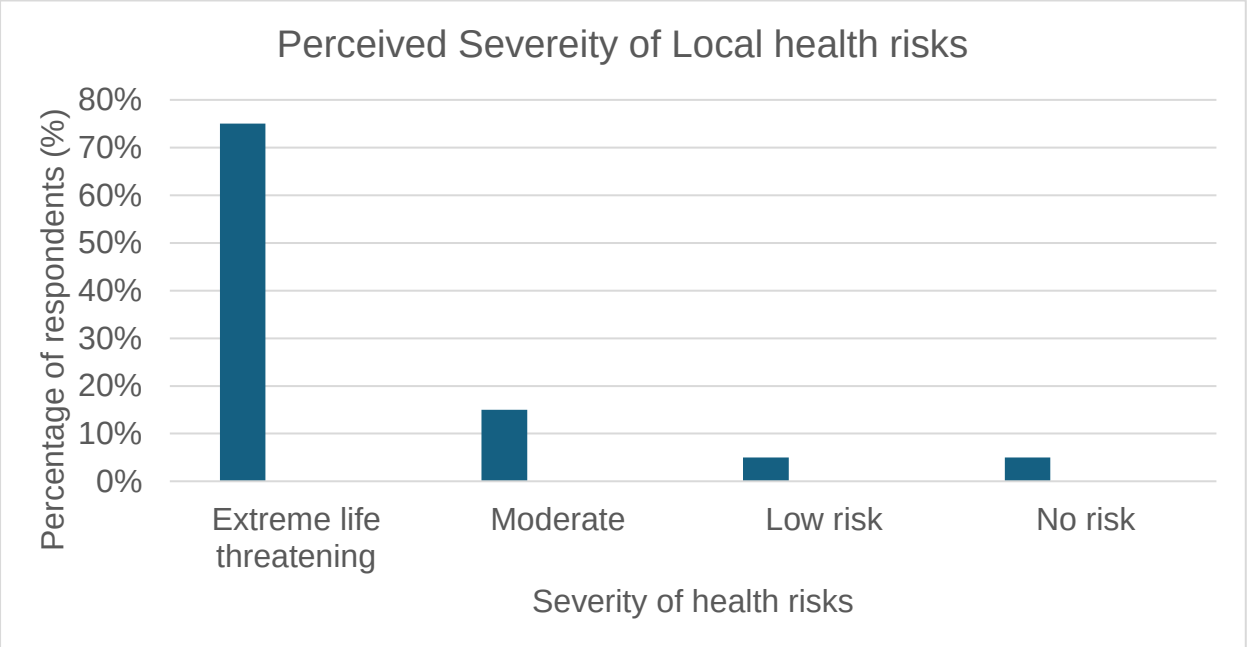

Figure 4.6: Resident Ratings of Waste-Related Public Health Severity [Source: Primary Data]

Figure 4.6 shows that many residents in Kuwadzana are seriously worried about the health risks caused by waste pollution. Three-quarters of the respondents described the waste crisis as a severe and life-threatening problem. This shows that residents do not view uncollected rubbish and sewage overflows as just unpleasant sights or minor inconveniences. Instead, they understand them as serious health dangers that can cause disease and threaten the wellbeing of their families.

Interview responses supported these concerns. Nurse A mentioned that:

> *"...he community's high-risk perception is completely justified by our daily clinic admissions, as mothers frequently arrive in tears expressing deep anxiety over their children playing next to open dumpsites where bloody diarrhoea and typhoid are actively caught."*

Nurse E supported this view and noted that:

> *"...the problem of living next to continuous pollution has worsened public health fear of uncontrollable cholera outbreak spreading through their blocks."*

Field observations also confirmed why residents feel unsafe. In areas such as Kuwadzana 1 and 4, children were seen playing near waste piles and crossing sewage streams on their way to school. This exposes them to both disease and physical injury. In Kuwadzana 8, the problem was even more serious because some houses were located very close to large, unmanaged dumpsites due to poor municipal planning and limited waste services.

Overall, the findings show that residents' fear of waste-related health risks reflects the real environmental conditions they face every day. Uncollected rubbish, blocked sewer pipes and open sewage flows have created a constant sense of danger in the community. This links directly to the main research problem as the failure of urban waste management services has left residents exposed to health risks while also affecting their sense of safety and wellbeing.

4.5.2 Attribution of Responsibility and Accountability for Urban Pollution

This section presents and discusses the findings on who Kuwadzana residents believe is responsible for the continuous pollution in their area. It focuses on how the community assigns blame for the poor sanitary conditions, especially between the duties of the municipality and the role of residents themselves. During the survey respondents were asked to identify the main party responsible for the ongoing accumulation of solid waste and liquid waste in their

neighbourhoods. Table 4.3 presents the responses from the sampled residents on who they believe should be held accountable for the pollution problem.

Table 4.3: Community Attribution of Primary Responsibility for Waste Pollution

Designated Accountable Entity	**Frequency (N=80)**	**Percentage (%)**
Local Municipality / City Council	48	60
Local Kuwadzana Residents	16	20
Informal Businesses	12	15
Formal businesses	4	4
Total	**80**	**100**

[Source: Primary Data]

Table 4.3 shows that most residents blame the local authority for the waste pollution problem rather than blaming individual households or businesses. A huge percentage of respondents pointed to municipal failure as the main cause of the crisis. This shows that although residents understand that everyone has a role to play in keeping the environment clean. They still believe that proper waste collection and sanitation are mainly the responsibility of the council. In this sense, the waste crisis is viewed less because of poor community behaviour and more as a failure of public service delivery.

Interview responses also supported this view. Nurse B mentioned that:

> *"...the community holds the local city council completely accountable because residents continue to pay their monthly rate bills for water and sanitation, yet the local authority routinely fails to provide the basic public skips and refuse trucks needed to fulfill their legal obligations."*

Nurse F supported this view and noted that:

> *"...while many residents blame the municipality for the broader system breakdown, there is a growing and vocal group within the clinic committees that points out the lack of accountability among residents themselves, who frequently resort to illegal dumping under the cover of darkness rather than organizing community cleanups."*

Field observations also showed this shared responsibility problem across different parts of Kuwadzana. In the older areas such as Kuwadzana 5 municipal failure was clearly visible through broken concrete bins, rusting collection points and overflowing garbage left unattended in public spaces. In the newer area of Kuwadzana 8, the problem also reflected weak community accountability. Since the municipality does not regularly collect waste there some households were observed dumping rubbish behind neighbours' walls and along open pathways. Plate 4 shows this problem, where a large dumpsite had developed directly against a residential boundary wall in Kuwadzana 8.



Plate 4.4: Dump site near households [Source: Primary Data]

A closer look at Plate 4.4 shows that responsibility for urban pollution in Kuwadzana is closely linked to the weakening relationship between the local authority and residents. The community expects the municipality to provide proper waste collection and sanitation services because residents pay rates and service charges. The continued absence of these services has also weakened community discipline as some residents now dump waste illegally as a way of coping with the situation. This means that a council service failure has created wider problems within the community where residents begin to blame both the municipality and one another. This links directly to the main research problem, as poor institutional accountability has

removed the basic systems needed to maintain hygiene, leading to conflict, blame and increasing environmental health risks.

4.5.3 Public Attitudes Towards Waste Mitigation and Enforcement Strategies

This section presents and discusses the findings on residents' views towards waste control measures and stricter anti-littering laws in Kuwadzana. It focuses on whether the community is willing to take part in clean-up campaigns and whether residents support stronger municipal enforcement against illegal dumping. The section also examines whether people prefer punishment-based approaches, such as fines or cooperative solutions involving both the council and the community. During the survey, respondents were asked to identify the most effective action needed to reduce the waste crisis in Kuwadzana. Figure 4.7 outlines the quantitative distribution of these public policy preferences using a horizontal bar graph layout.

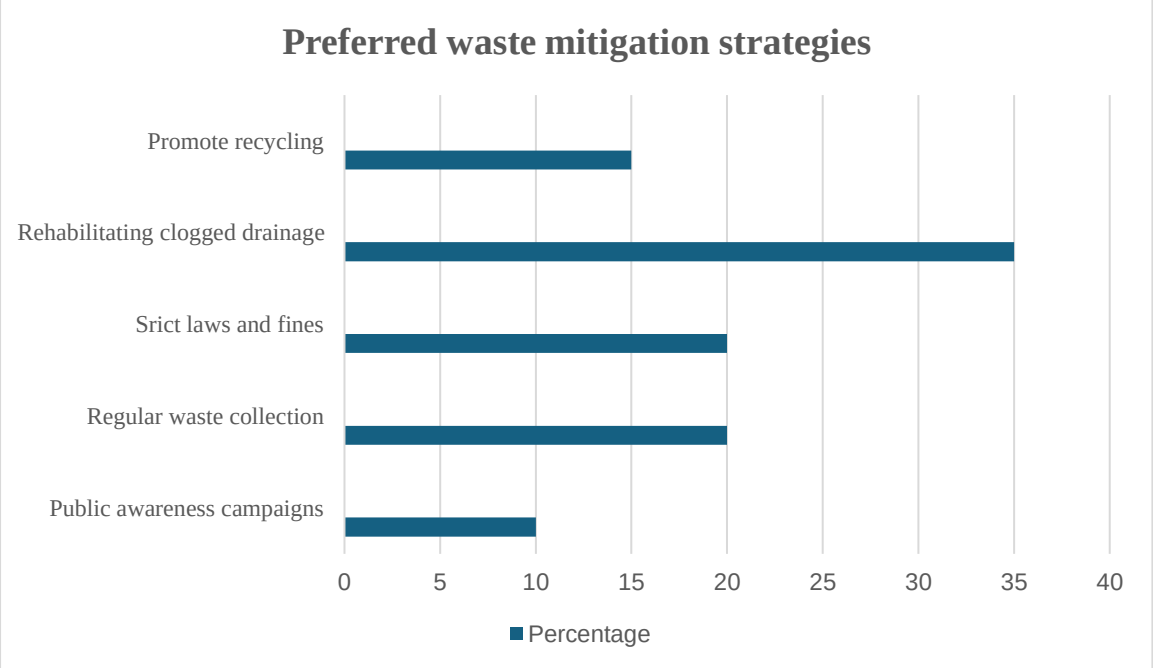

Figure 4.7: Public Preferences for Environmental Enforcement and Mitigation Strategies [Source: Primary Data]

Results on Figure 4.7 show that many residents in Kuwadzana want stronger action from the local authority to control the waste problem. A large percentage of the respondents supported that there should be rehabilitation and development of drainage systems followed by regular collection and imposing strict laws to those violating waste management laws. This shows that

awareness Campaigns and recycling alone are not enough to solve the crisis. They believe the municipality should monitor public spaces more closely and punish people who dump waste illegally.

During interviews, participants explained that community attitudes are changing, with many residents now supporting stricter rules. Nurse D mentioned that:

> *"...the prevailing consensus among local health committees is that public education has run its course, and residents now actively support the strict enforcement of municipal bylaws to correct the commercial vegetable vendors and landlords who repeatedly turn common green spaces into illegal dumpsites."*

Nurse H supported this view and noted that:

> *"The local authority should help rehabilitating clogged drainage systems and regular waste collection to reduce waste accumulation. Resource community-led cleanup clubs, are also helpful as many young people are eager to volunteer if given basic tools like gloves, wheelbarrows, and plastic collection sacks."*

In older commercial areas such as Kuwadzana 2 and 7 there was very little official monitoring. Informal traders were seen throwing packaging waste into public pathways without fear of being fined or punished by the municipality. Overall, the findings show that residents want both strict municipal enforcement and practical community support. While they support fines and legal action against illegal dumpers, poor service delivery has also forced them to depend on their own efforts, such as local clean-up groups.

4.6 Hotspots of Waste Polluted Areas in Kuwadzana

The mismanagement of waste has created pollution hotspots in Kuwadzana. These hotspots are important for understanding the spatial distribution of waste. Figure 4.8 map shows that the waste pollution hotspots in Kuwadzana are the areas where waste accumulates in larger quantities. The map gives insight into the spatial temporal extent of waste pollution and helps identify sites that need to be prioritised for interventions by local authorities.

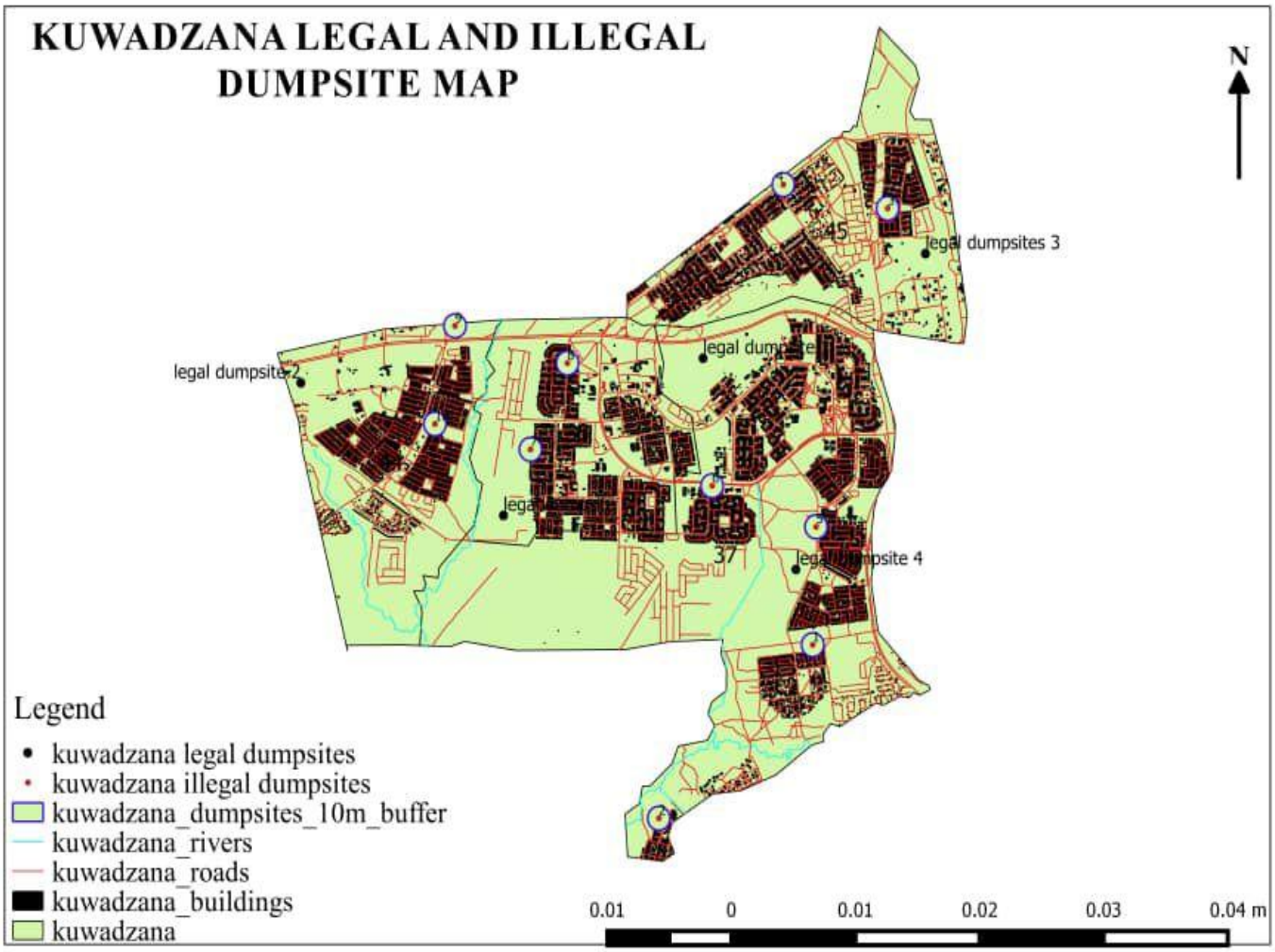

Figure 4.8 Map show legal and illegal dumpsites in Kuwadzana [Source Primary data]

The researcher conducted a field observation of which areas are mostly affected by pollution and came up with the following areas represented by blue dots as illegal dump sites and legal dumpsites are clearly labelled. This map shows that waste is visible in the areas mainly along roadsides in drains. Most areas affected are in ward 38 along roadsides in Kuwadzana 6, ward 37 in areas covering areas in Kuwadzana 3, 4 and 6 areas affected by waste pollution are in roadsides close to households as illegal dumpsites. In ward 44 Kuwadzana extension covering areas which have recently developed like Kuwadzana area 8 is mostly affected by open disposed areas close to households as some areas have no roads yet. Ward 37 is not mostly affected, as the researcher have noticed few waste polluted hotspots. Legal dumpsites are just a few as only 5 were observed and covering at least each ward but there are still visible illegal open dumps despite of visible dumpsites. The table below illustrates types of waste discovered from legal and illegal hotspots

Waste classification from each site	Percentage
Plastic	40%
Bottle	25%
Biogradable	20%
Electronic	10%
Metal	5%
Total	**100%**

Table 4.4 Type of waste visible in waste polluted hotspots

[Source: Primary data]

The findings also show that in these areas mostly affected by waste has a higher rate of plastic waste which is even evident in Plate 4.4 which visualises household waste. This can be an opportunity for recycling since plastic material is useful for recycling. Residents are failing to discard bottles which can also be a harmful risk as they can hurt children who pass through the dumping areas. Biodegradable waste is also visible in these areas especially close to Kuwadzana 4 and 5 shops where vendors sell their products. Electronic waste is also visible but not a higher percentage an observation was done by the researcher that there are people who move in most local areas collecting metal and electronic waste that is why there is no higher percentage.

4.6.1 Spatial Proximity of Waste Hotspots to Residential and Commercial Structures

This section presents and discusses the field findings regarding the physical distance between unauthorized waste accumulation points and active living or trading spaces in Kuwadzana. This section assesses how the uncontrolled growth of dumpsites encroaches onto domestic spaces exposing residents to continuous contamination. The researcher asked respondents to estimate the physical distance from their front doors or business counters to the nearest unauthorized

solid waste dumpsite or open sewage flow. Table 4.5 presents the quantitative distribution of these spatial proximity measurements across the sampled community.

Table 4.5: Measured Proximity of Residents to Nearest Pollution Hotspot

Physical Distance Interval	**Frequency (N=80)**	**Percentage (%)**
Immediate Proximity (Less than 10 Metres)	36	45
Close Proximity (10 to 50 Metres)	28	35
Moderate Proximity (51 to 100 Metres)	12	15
Distant Proximity (Greater than 100 Metres)	4	5
Total	**80**	**100**

[Source: Primary Data]

Table 4.5 shows that majority of the residents in Kuwadzana live very close to within 10m of pollution points. More respondents indicated that they live or work less than 50 metres from an active dumpsite or sewage flow. This means that there is very little distance between people's homes, businesses and harmful waste. As a result exposure to rotting garbage and sewage has become part of everyday life for many residents.

During interviews, participants explained that this closeness increases the risk of illness. Nurse A mentioned that:

> *"...the physical proximity is the main driver of infection, as multiple family houses have informal dumpsites growing directly against their kitchen walls, allowing flies and cockroaches to migrate straight from the rotting waste onto dining tables within seconds."*

Nurse G supported this view and noted that:

> *"...the roadside commercial markets are crowded directly alongside overflowing sewage lines, food vendors are forced to serve clients in spaces*

where windblown dust contaminated with dried waste regularly settles onto fresh produce."

Field observations also confirmed this problem. In older high-density areas such as Kuwadzana 3 illegal dumpsites were found in narrow footpaths between houses. In some places, residents had to step over waste when leaving their homes. Figure 4.9 shows illegal dumpsites with 10-metre buffer zones clearly indicating that many households are affected by nearby waste hotspots.

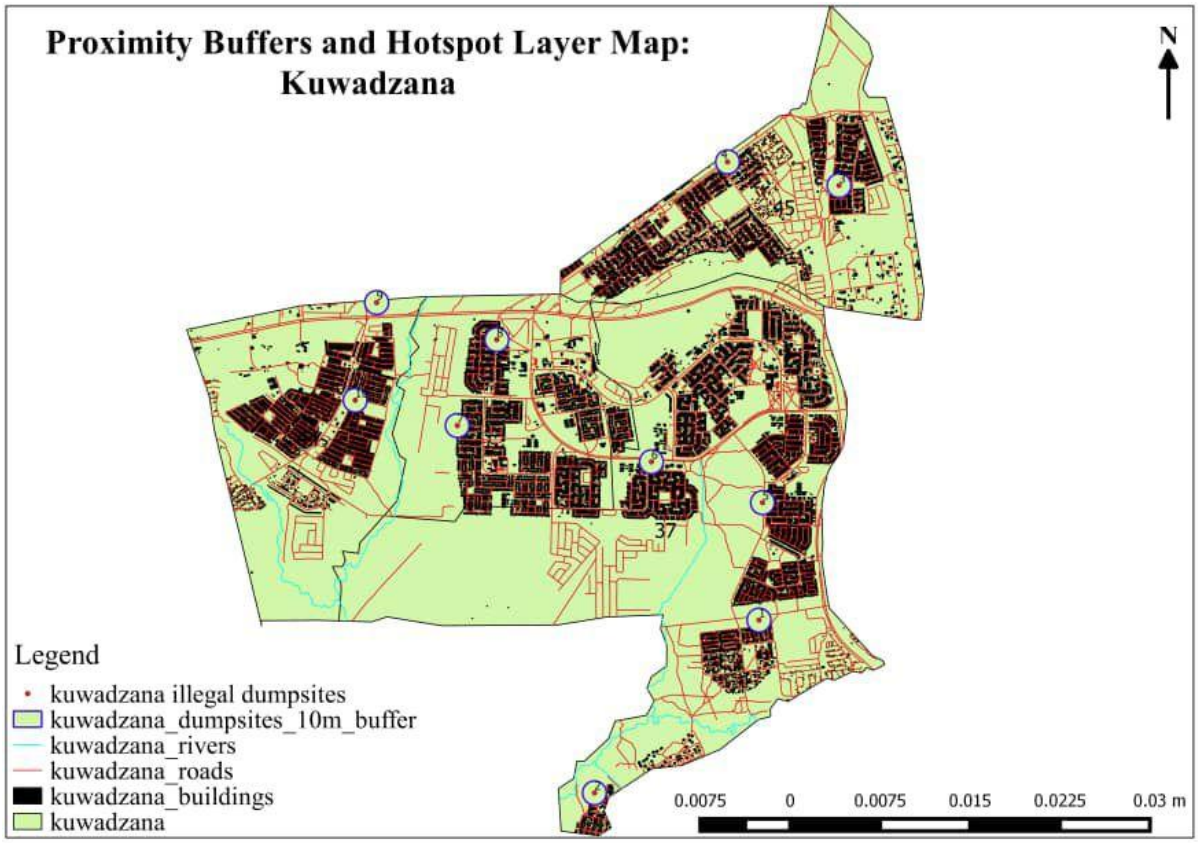

Figure 4.9: Proximity Map Kuwadzana [Source: Primary Data]

Figure 4.9 shows that pollution hotspots are dangerously close to homes and business places in Kuwadzana. This closeness removes the basic safety distance that should exist between people and harmful waste. When rubbish and sewage are found near doorsteps, kitchens, shops and pathways, flies, cockroaches and germs can easily move into people's living spaces. This makes it difficult for families to protect themselves from disease. The situation links directly to the main research problem because poor urban planning and weak municipal waste services have allowed hazardous waste to become part of everyday life, creating serious risks to public health.

4.6.2 Contamination Risks and Buffer Zones Around Urban Water Sources

This section presents and discusses the findings on the risks faced by water sources in Kuwadzana due to nearby waste pollution. It focuses on how boreholes, shallow wells and other alternative water sources are exposed to contamination when they are located close to dumpsites or sewage overflows. The section also looks at the lack of proper buffer zones that should separate drinking water points from harmful waste. Respondents were asked to estimate the distance between their main alternative water source such as a community borehole or backyard well and the nearest illegal dumpsite or sewage overflow. Figure 4.10 shows these findings using a pie chart.

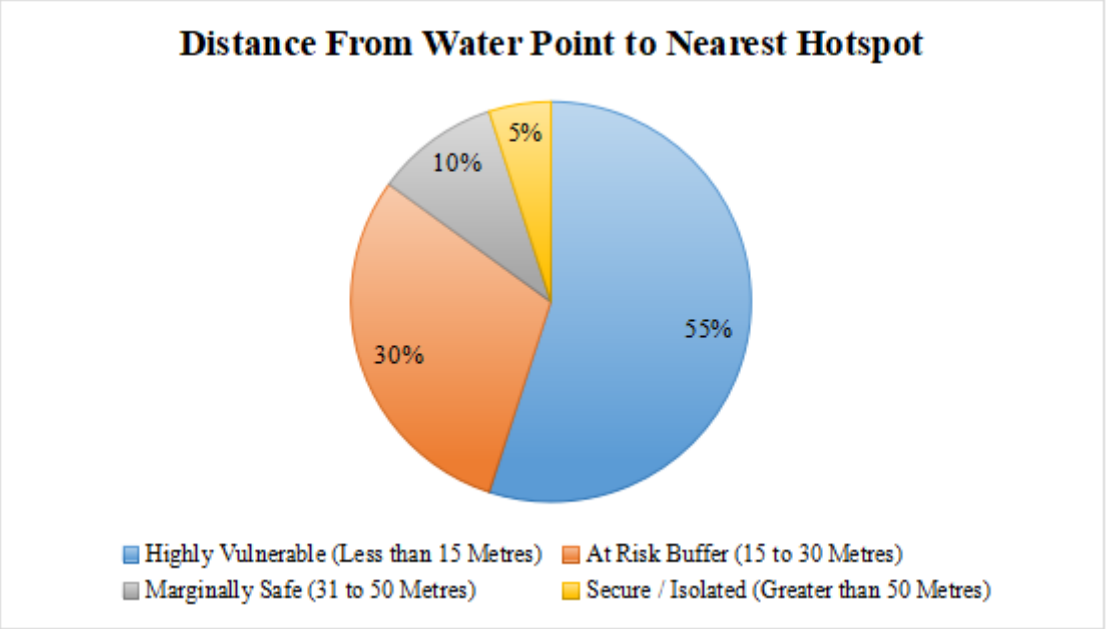

Figure 4.10 Spatial Proximity Intersecting Public Water Sources and Waste Hotspots [Source: Primary Data]

The spatial findings show that many alternative water sources in Kuwadzana are highly exposed to pollution. More than half of these water points are located less than 15 metres from major pollution sources such as illegal dumpsites and sewage leaks. This means that there is not enough physical distance to protect boreholes and shallow wells from contaminated water, sewage and toxic liquids from waste. As a result, the safety of domestic water is directly threatened by poorly located dumpsites and damaged sewer systems.

During interviews, participants explained how this contamination happens and how it affects community health. Nurse A mentioned that:

> *"...the lack of physical buffer zones is a major environmental failure, as heavy rain regularly washes rotting organic matter and raw sewage from nearby roads directly over the unsealed concrete aprons of our community boreholes, allowing pathogens to seep straight into the underground water table."*

Nurse D supported this view and noted that:

> *"...the risk is worst around shallow, hand-dug backyard wells, where residents frequently store domestic waste pits or encounter bursting sewers within a few steps of their water buckets, causing continuous water contamination that keeps local families trapped in a cycle of recurrent stomach infections."*

Field observations also confirmed these risks across different parts of Kuwadzana. In Kuwadzana 6 sewage leaks were seen flowing through public drains and collecting near water points, creating a direct route for bacteria to enter the water supply. Figure 4.10 presents the Hydrological Vulnerability and Overlay Analysis Map. The map shows the relationship between water points, illegal dumpsites and sewage leakages observed in Kuwadzana. It also shows that some water points are located close to illegal dumpsites, while many sewage leaks are near rivers, dumpsites and water sources. This indicates poor drainage, weak sanitation management and serious risks to public health. Figure 4.11 illustrates the hydrological vulnerability and overlay analysis map of Kuwadzana.

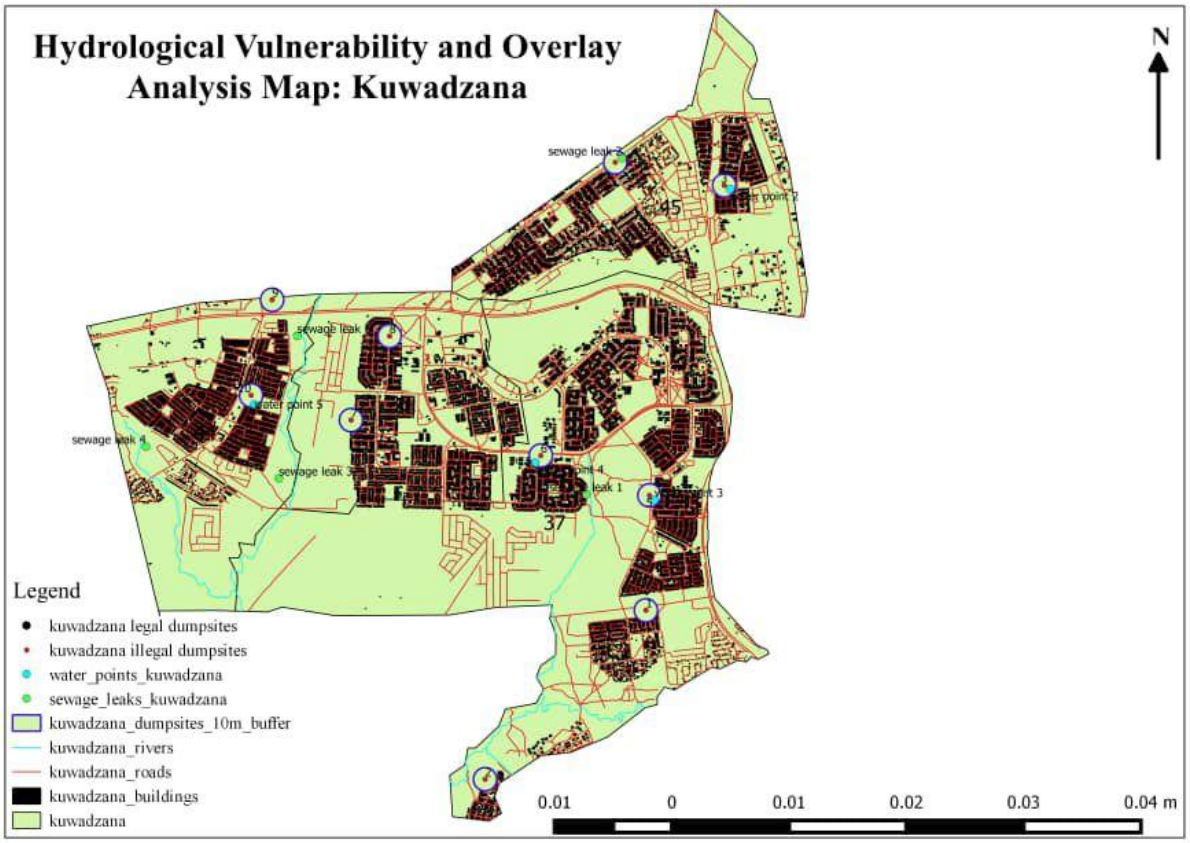

Figure 4.11: Hydrological Vulnerability and Overlay Analysis Map Kuwadzana. [Source: Primary Data]

Figure 4.11 shows that the loss of safe buffer zones around water sources is a serious health threat in Kuwadzana. When solid waste and sewage collect close to boreholes shallow wells the soil can no longer safely filter out harmful germs before they reach underground water. This means that residents may unknowingly use contaminated water for drinking, cooking and other household needs. This links directly to the main research problem because poor urban planning and weak municipal services have allowed dangerous waste to affect important water sources, creating a serious risk to community health.

4.6.3 Spatial Factors Influencing Waste Concentration in High-Density Zones

This section presents and discusses the findings on the physical and structural factors that cause waste to build up in different parts of Kuwadzana. It looks at how narrow spaces between houses, unpaved roads, poor drainage, uneven land and unclear administrative boundaries contribute to waste accumulation. These factors make it difficult for refuse trucks to reach some areas and also create open spaces where residents dump waste. During the survey respondents were asked to identify the main spatial or structural reason why waste collects heavily in their

areas. Table 4.6 presents the responses from the sampled residents on the key factors influencing waste concentration in Kuwadzana.

Table 4.6: Spatial and Structural Drivers of Waste Concentration

Primary Spatial/Architectural Driver	**Frequency (N=80)**	**Percentage (%)**
High Housing Density and Narrow Access Passages	32	40
Unpaved Roads and Impassable Topographic Terrain	24	30
Lack of Formal Zoning and Unplanned Land Use	16	20
Location Near Open Drainage Culverts or Boundaries	8	10
Total	**80**	**100**

[Source: Primary Data]

The findings show that the way Kuwadzana is physically built plays a major role in the build-up of waste. Housing density narrow pathways and unpaved roads accounted for 70% of the responses, meaning that most residents believe waste accumulation is strongly linked to the layout of the suburb. This shows that the waste crisis is not only caused by poor behaviour but also by structural problems that make normal refuse collection difficult. In many areas, the design of the neighbourhood prevents waste trucks from reaching households easily, which leads to illegal dumping in open spaces.

During interviews, participants explained how these physical barriers affect waste collection and increase pollution. Nurse C mentioned that:

> *"...the physical layout of the older high-density blocks leaves almost no space between household structures, creating narrow, interconnected residential alleys where modern municipal compactor trucks cannot physically fit, forcing residents to carry their waste out to distant main roads or drop it in the nearest open space."*

Nurse G supported this view and noted that:

> *"...the spatial crisis is completely different but equally severe in the newly expanded perimeter of Kuwadzana 8, where a lack of basic road grading and*

terrain levelling means that heavy rains turn unpaved streets into muddy, eroded gullies that completely isolate households from service vehicle access."

Field observations also confirmed that waste builds up differently across the suburb depending on the physical layout of each area. In older sections such as Kuwadzana 1 and 4, the houses are closely packed together leaving very little open space. As a result, waste was found collecting in narrow walkways and between boundary walls. In Kuwadzana 8. The situation was different because the area lacks proper planning, roads and public infrastructure. Large dumpsites were seen forming on slopes, wetlands and low-lying areas where rainwater carries loose waste into stagnant pools.

Overally the findings show that spatial and structural problems in Kuwadzana have turned ordinary layout challenges into serious health risks. High housing density narrow walkways and poor road access make it difficult for municipal vehicles to collect waste leaving residents with few safe disposal options. This forces waste to accumulate close to homes and pathways, exposing families to pollution and disease. The findings therefore link directly to the main research problem, as poor urban planning, weak infrastructure and lack of proper zoning have allowed waste to become a permanent danger to community health and safety.

4.7 Discussion of Findings

This section discusses the main findings from the fieldwork carried out in Kuwadzana and compares them with the literature reviewed earlier. The discussion helps to show how the waste and health problems in Kuwadzana are similar to wider global and African experiences and where they are different because of local conditions. It also explains how factors such as poor service delivery, informal trading, settlement layout, weak infrastructure and economic hardship have contributed to the waste crisis in the suburb. The discussion is organised into three main areas sources of waste pollution, community views on health risks and responsibility, and the spatial location of pollution hotspots.

4.7.1 Comparative Analysis of Waste Pollution Sources

The findings on household and commercial waste show that Kuwadzana is facing problems similar to those discussed by Abubakar et al. (2022), who argued that modern urban waste is increasingly made up of plastics, packaging materials and other non-biodegradable items. In Kuwadzana, plastic containers, bottles, cans and packaging waste were common in open dumpsites. However, unlike wealthier areas where waste increases because of higher incomes

and changing lifestyles, the situation in Kuwadzana is mainly caused by economic survival activities. The growth of informal tuckshops, roadside fruit stalls and unlicensed trading spaces has increased commercial waste in public areas. This supports Maphosa (2024), who found that informal businesses in Harare often dump packaging waste without proper regulation.

The findings also show that waste collection services in Kuwadzana have seriously declined. This agrees with Raman et al. (2024), who found that many councils in Sub-Saharan Africa struggle with limited money, few working refuse trucks and shortage of staff. In Kuwadzana, poor collection services have forced residents and vendors to live near piles of rotting waste. These conditions create breeding places for flies, rats and other disease-carrying pests, which supports the concerns raised by Kwun et al. (2021). The sewage situation is even more serious, as many residents reported daily exposure to raw sewage. While Agboola (2025) and Raman et al. (2024) link sewer problems to population growth and ageing infrastructure, the situation in Kuwadzana appears more severe because of old clay pipes, frequent blockages and slow council response.

The breakdown of the sewer system in Kuwadzana is not only caused by population pressure, but also by poor maintenance and municipal neglect. Field findings showed that old underground pipes easily break under pressure, while blocked sewer lines are often left unrepaired for long periods. This supports Jerie et al. (2024), who found that Harare City Council has failed to properly maintain and repair sewer infrastructure. As a result, raw sewage flows openly along roads and pathways, creating a serious health risk that is more constant than the occasional sewer bursts reported in some wider African studies.

The findings on electronic and industrial waste showed both similarities and differences across Kuwadzana. In older areas such as Kuwadzana 1 and 4, electronic waste was mainly found around backyard workshops and behind shopping centres. This is similar to the findings of Moyen and Archodoulaki (2023), who explained that informal electronics repairs and small-scale welding bring hazardous materials into residential spaces. However, Kuwadzana 8 presents a different situation. Because refuse collection services are almost absent there, residents mix broken televisions, computer parts, batteries and other electronic waste with ordinary household waste in open fields. This creates risks of heavy metal contamination, as warned by Ferdous et al. (2025). This shows that lack of municipal services can turn residential areas into dangerous zones where different types of waste are mixed together.

4.7.2 Community Perceptions, Accountability Loops, and Enforcement Realities

The survey findings showed that most residents view the waste crisis as a serious threat to their health and survival. About three quarters of the respondents saw the problem as life threatening rather than just an unpleasant environmental issue. This agrees with Okoji et al. (2023), who found that people living in high-density areas often see waste pollution as a direct health crisis. In Kuwadzana, this fear is linked to real experiences of illness, especially outbreaks such as cholera and dysentery. These findings are also supported by Goto et al. (2020) and Chimusoro et al. (2018). However, Kuwadzana has an additional challenge because residents also fear that local clinics may not have enough medicines or resources to treat waste-related illnesses. This supports Chireshe et al. (2023), who noted that shortages in clinics increase public fear during disease outbreaks.

On the issue of responsibility, most residents blamed the local authority for the waste crisis. Nyati (2025), also found that urban residents expect councils to provide waste collection because they pay monthly rates and service charges. However, the findings also showed that poor service delivery has weakened community discipline. In areas such as Kuwadzana 8, where council refuse collection is almost absent, some residents now dump waste near neighbours' walls and open spaces. This shows that when institutions fail for a long time, residents may adopt harmful survival practices that worsen the problem. This creates a cycle of blame between the council, residents, traders and landlords, as also noted by Zhongove et al. (2024).

The findings also showed that 40% of respondents supported strict fines and law enforcement, while 30% supported community clean-up programmes. This differs from some African studies, such as Kubanza and Simatele (2022), which suggest that many communities resist strict environmental laws because they view them as unfair or corrupt. In Kuwadzana, residents appear tired of awareness campaigns and now want stronger action against illegal dumping. This supports Precious and Zino (2025), who argued that education alone is not enough when proper waste facilities are not provided. At the same time, residents have also started organising their own clean-up activities, especially in areas where council services are weak. This agrees with Kiwanuka (2022) and Poshai and Inatuno (2024), who found that communities often combine demands for government action with self-help efforts.

4.7.3 Spatial Analysis of Pollution Hotspots and Geographic Dynamics

The spatial findings showed that many residents live or work very close to pollution hotspots. Nearly half of the respondents were less than 10 metres from a dumpsite or sewage flow, while 80% were within 50 metres. This confirms the warning by Tsui et al. (2022), who stated that waste located close to homes and markets creates constant biological exposure. In older areas such as Kuwadzana 1 and 4 dumpsites were found in narrow walkways between closely packed houses. This supports Arfasa et al. (2026), who found that overcrowded housing areas trap bad smells, pests and waste close to family living spaces. In Kuwadzana 8, the problem was different, as large open-field dumpsites were found close to residential gates. This shows a serious failure in land-use planning and supports the concerns raised by Kwenda et al. (2022).

Map 1: Legal and illegal dumpsites in Kuwadzana

Waste was clearly concentrated in locations with inadequate official waste disposal facilities and poor infrastructure, according to the mapping of pollution hotspots throughout the study wards. Household solid trash, including as plastic bags, food scraps, and abandoned packaging materials dominated roadside dumping along Kuwadzana 6 in Ward 38. This reflects the daily disposal pressures of a densely populated residential zone with inadequate collection stations. At its open disposal sites, Ward 44 (Kuwadzana Extension) displayed a more complicated waste composition, with organic matter, household garbage, and construction debris found mixed together close to residences. This pattern was especially noticeable in the less developed areas of Kuwadzana Area 8. Locals turn to the closest open space when formal alternatives are either non-existent or inaccessible, the existence of such mixed waste streams at informal dumping sites is a clear symptom of the lack of legally approved disposal infrastructure. Even relatively better-served wards are susceptible to the effects of an overburdened and geographically unequal trash collection system, as Ward 37 demonstrated roadside accumulations of domestic waste despite recording fewer hotspots.

The variety and quantity of waste types found in all three wards strongly suggest that one of the main causes of environmental contamination in the research area is the severe lack of authorised disposal sites. Illegal dumping constitutes a reasonable, if environmentally harmful solution to an unmet basic service need when communities lack sufficient access to officially designated garbage transfer stations or collection locations within reasonable proximity to residential zones. In recently constructed places like Kuwadzana Area 8, where urban growth

has overtaken the supply of waste management infrastructure, inhabitants lack a legally approved disposal outlet, making this scarcity more severe. Therefore, in order to close the infrastructure gap that currently causes contamination. Addressing the pollution hotspot issue requires not only enforcement against illegal dumping but more importantly a significant expansion of accessible. Legally designated waste disposal facilities distributed equitably across all wards.

Map Explanation 2: Proximity buffers hotspot layer map

The Kuwadzana Waste Hotspot and Residential Proximity Map clearly show how close illegal dumpsites are to people's homes. The map uses 10-metre buffer zones around GPS-recorded dumpsites. In older areas such as Kuwadzana 1 and 4, the buffer zones overlap with many closely packed houses, showing that residents are exposed to waste at very close range. In Kuwadzana 8, the map shows large dumpsites located directly opposite residential gates, confirming the lack of proper buffer zones and weak land-use control, as warned by Kwenda et al. (2022).

The findings on water contamination showed that more than half of the alternative water sources were located less than 15 metres from pollution sources. This creates a serious threat to water safety and supports Hakorimana and Ndokoye (2025), who warned that water sources in high-density areas are often exposed to pollution. Oyedele et al. (2022) also emphasised the need for safe buffer zones around water points to prevent bacteria from entering groundwater. In Kuwadzana, these buffer zones have broken down because many residents depend on boreholes and shallow wells due to unreliable tap water. In older phases, sewage leaks were found close to public hand-pumps, while in Kuwadzana 8, shallow wells were located downhill from large dumpsites. This allows contaminated water to enter groundwater sources and supports the concerns raised by Zhongove et al. (2024).

Map Explanation 2: Hydrological Vulnerability and Overlay Analysis

The Kuwadzana Hydrological Contamination Vulnerability Map shows the relationship between sewage leaks, illegal dumpsites and community water points. The map shows that some public hand-pumps are located close to sewage leaks, especially in older areas. In Kuwadzana 8, shallow wells are found downhill from large waste dumps, meaning rainwater

can carry polluted material from dumpsites into the water sources. This shows that residents are at high risk of using contaminated water.

The study also found that waste accumulation is strongly influenced by the physical layout of Kuwadzana. Housing density, narrow pathways, unpaved roads and poor drainage were major causes of waste build-up. This supports Gergiou (2025), who found that waste often collects in areas where poor layout and open spaces encourage illegal dumping. In older areas such as Kuwadzana 1 and 4, houses are tightly packed, leaving little space for refuse trucks to pass. This forces waste to collect in small walkways and stormwater channels. In Kuwadzana 8, the problem is caused by unpaved roads, slopes and wetlands. During the rainy season, roads become muddy and inaccessible, making it difficult for refuse trucks to enter. This agrees with Mvula et al. (2025) and Bandauko and Arku (2024), who found that poor road access and low-lying land increase dumping in African urban settlements.

Overall, the spatial findings show that the waste crisis in Kuwadzana is not accidental. It is caused by overcrowded housing, poor road networks, weak land-use planning and poor council maintenance. These problems force residents to live close to waste, sewage and polluted water sources, increasing the risk of disease and reducing community safety.

4.8 Chapter Summary

This chapter presented and discussed the main findings of the study. It focused on the sources of waste pollution, community views on health risks, responsibility for pollution and the spatial location of waste hotspots in Kuwadzana. The findings showed that poor waste collection, sewer breakdowns and weak municipal services have created serious health risks, especially in unserviced areas such as Kuwadzana 8. By combining survey results, interviews with healthcare workers and field observations, the chapter showed that residents are exposed to solid waste, sewage and contaminated water sources daily. These findings provide the basis for Chapter 5, which presents the conclusions and recommendations of the study.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary, conclusions and recommendations of the study based on the findings discussed in Chapter 4. The main aim of the study was to examine the causes of waste management problems in Kuwadzana and how these problems affect the health of people living in the high-density suburb. This chapter brings together the major findings from the research objectives, draws conclusions on the failure of waste collection and sanitation services, and gives practical recommendations that can help reduce the waste crisis. The chapter also suggests areas that future researchers may study further.

5.2 Summary of Findings

This section gives summary on the findings of the research, conclusions and areas for further research. Focusing on the link between the polluted sources discovered in Kuwadzana with the diseases caused. The community insights will also be presented and the hotspot areas affected by pollution will be summarised and concluded.

5.2.1 Pollution sources and waste related diseases

The study showed that Kuwadzana is facing a serious and complex waste pollution problem which is mainly attributed by irregular refuse collection and sanitation services in Harare City Council. The most common and noticeable sources of pollution in the suburb were found to be household and commercial solid waste. Most respondents to the survey indicated that the council refuse collection is very irregular or not present at all in their neighbourhoods. The rapid expansion of informal tuckshops and roadside food vendors, which do not have facilities for disposing of packaging waste, has exacerbated this situation, with packaging waste being left directly on public roads, open drains and communal spaces.

Failure of sewage infrastructure was identified as a critical pervasive issue across the suburb with 50% of respondents reporting that sewage overflows occurred on a daily basis and a further 30% reporting sewage bursts occurred weekly. The cause of these overflows is mainly poor pipe maintenance due to ageing infrastructure, frequent blockages and the council's slow and inefficient response time in fixing damaged pipes. Open flows of raw sewage along roads and footpaths pose a direct risk to residents and leave pools of stagnant water which can become breeding grounds for disease vectors. Another source of pollution was also found to be the unregulated use of electronic and industrial waste in backyard workshops, especially in

Kuwadzana 8 where the lack of refuse collection is resulting in the mixing of broken electronic appliances and hazardous materials from the workshops with domestic waste in the open fields.

These sources of pollution were identified to directly contribute to various pollution-related diseases in the community. The Kuwadzana Polyclinic's nurses confirmed that patients presenting to the clinic frequently suffered from diarrhoea, typhoid, cholera, malaria, respiratory diseases and skin infections. It was determined that disease incidence significantly increased during the rainy season when stormwater drains became clogged and raw sewage and solid waste flow into the water sources of the community. The community's most vulnerable and exposed groups were identified as children and women.

5.2.2 Community perceptions on waste pollution

The findings also showed that residents are deeply worried about the health risks caused by waste pollution. Most respondents viewed the waste crisis as a serious threat to their families health and safety. Clinic nurses confirmed that waste-related illnesses such as diarrhoea and typhoid are common in the area. On the issue of responsibility, most residents blamed Harare City Council because they continue to pay council rates but do not receive proper waste collection and sanitation services. However, poor service delivery has also weakened community discipline as some residents now dump waste near neighbours' walls and in open spaces. The study also found that many residents support strict fines and law enforcement against illegal dumping, while others take part in weekend clean-up activities because they cannot wait for council services. The study found that Kuwadzana residents are deeply concerned and largely unanimous in their view of the waste pollution crisis as a serious and immediate threat to the health and safety of their families. Most respondents described the health effects of waste pollution as being serious or very serious and this perception was strongly supported by clinical evidence given by the nurses who were interviewed at Kuwadzana Polyclinic. Healthcare workers confirmed that waste-related conditions are not isolated events, but a recurring and increasing burden on the clinic's limited resources and capacity.

On the issue of institutional responsibility, most residents blamed mainly the Harare City Council as they are still paying council rates but are not getting the waste collection and sanitation services they deserve. This continuous institutional failure was found to have eroded community discipline thus creating a cycle where lack of formal disposal infrastructure has

forced residents to resort to illegal dumping as a survival response. However, the study also found a large proportion of residents actively in support of stricter enforcement of environmental by-laws and fines against illegal dumpers, while others have taken it upon themselves to organise community-led weekend clean-up activities in areas where council services have completely broken down. This double effect speaks to a community frustrated with institutional

5.2.3 Kuwadzana waste hotspot areas

The study's spatial analysis confirmed that pollution hotspots are within dangerous proximity to residential homes, informal commercial sites and critical water sources in all eight phases of Kuwadzana. Field measurements revealed that 45% of the sampled residents live or work within 10 metres of an active dumpsite or sewage overflow and 80% within 50 metres. This near-total removal of the safe distance between humans and harmful waste means that pests, polluted air and surface water pollution are incorporated into everyday domestic and commercial environments.

Community water sources, such as boreholes and shallow wells, on which residents depend due to unreliable municipal water supply, were found to be at acute risk of contamination. The majority located well within the internationally recognised minimum safe distance from active dumpsites and sewage overflow points. GIS-based overlay analysis of hydrological vulnerability confirmed the direct pathways of contaminated surface runoff and sewage leakages to the groundwater table particularly during the rainy season. The spatial situation was found to be most severe in Kuwadzana 4,5 and 8 where tightly packed housing and narrow access lanes physically preclude refuse trucks from entering and in Kuwadzana 8 where completely unpaved roads, unlevelled terrain and the absence of formal planning infrastructure. This area becomes inaccessible to conventional municipal waste collection services.

The study further found that pollution hotspots are very close to people's homes, shops and water sources. Many residents live or work within a short distance of dumpsites or sewage overflows. This increases the risk of disease because pests, bad smells and contaminated water are close to people's daily living spaces. Water sources such as boreholes and shallow wells are also at risk because some are located near dumpsites and sewage leaks. The problem is worse in older areas such as Kuwadzana 1 and 4, where houses are closely packed and refuse

trucks cannot easily pass. In Kuwadzana 8, the situation is caused by poor planning, unpaved roads and muddy gullies that prevent waste collection vehicles from reaching households.

5.3 Conclusions

The study also concludes that poor service delivery has affected community behaviour. Although residents expect the council to provide waste collection because they pay rates, the absence of proper services has forced some people to use illegal dumping as a survival response. This has created tension between residents, businesses and the local authority. Therefore, the waste problem in Kuwadzana should not be viewed only as a lack of awareness among residents, but because of poor service systems and lack of proper disposal options.

The physical layout of Kuwadzana worsens the waste crisis. In older areas, narrow roads and crowded housing make it difficult for refuse trucks to access some places. In Kuwadzana 8, poor road development and lack of proper planning have made the area difficult to service. The closeness of homes, dumpsites, sewage leaks and water sources creates a continuous risk of disease. This means that clean-up campaigns alone cannot solve the problem. There is need for proper planning, infrastructure development and stronger accountability from the responsible authorities.

5.4 Recommendations

To reduce waste pollution, Harare City Council should improve local waste collection services in Kuwadzana. The council should establish local waste sorting and transfer points in high-density areas so that waste does not remain in open spaces for long periods. Since large refuse trucks may fail to reach narrow roads, the council should also work with smaller private waste collectors who can access tight spaces. Informal tuckshops and roadside vendors should be registered and required to keep their business areas clean as part of their operating conditions.

To improve accountability and enforcement, the municipality should deploy active and honest environmental officers to monitor illegal dumping and enforce by-laws fairly. Commercial dumpers should face penalties when they pollute public spaces. However, the money collected from waste management rates in Kuwadzana should be used directly to improve refuse collection, fuel availability and vehicle maintenance in the same community. The council should also support community clean-up groups by providing gloves, wheelbarrows, refuse bags and other protective equipment.

To address spatial and water contamination risks, further residential development in Kuwadzana 8 should be controlled until roads, drainage and sanitation services are properly provided. The council and urban planners should make sure that refuse trucks can access all residential areas. Boreholes and public water points should be protected by creating safe buffer zones of at least 30 metres from dumpsites and sewage flows. These water points should also be fenced and protected with proper drainage channels to prevent contaminated runoff from entering them. In areas where residents use shallow wells, health committees should provide water treatment tablets and encourage safe well protection methods.

5.5 Further Research

Future researchers may carry out a long-term study on groundwater quality in Kuwadzana 8 to check how waste and sewage affect boreholes and shallow wells during different seasons. Another study may examine whether public-private partnerships can improve waste collection in high-density suburbs by using small community-based waste collection companies. Further research may also compare how fuel shortages, economic instability and foreign currency challenges affect waste management services in urban councils across Southern Africa

REFERENCES

Abila, B., Abila, N., & Kantola, J. (2023). Knowledge management approach for sustainable waste management: Evolving a conceptual framework. *International Journal of Environment and Waste Management*, 31(2), 231-257.

Abubakar, I. R., Maniruzzaman, K. M., Dano, U. L., AlShihri, F. S., AlShammari, M. S.,Ahmed, S. M. S., ... & Alrawaf, T. I. (2022). Environmental sustainability impacts of solid waste management practices in the global South. *International journal of environmental research and public health*, *19*(19), 12717.

Afolalu, S. A., Ikumapayi, O. M., Ogedengbe, T. S., Kazeem, R. A., & Ogundipe, A. T. (2022). Waste pollution, wastewater and effluent treatment methods-an overview. Materials Today: Proceedings, 62, 3282-3288.

Agboola, S. O., Inetabor, G. M., Bello, O. O., & Bello, O. S. (2025). Waste pollution and management: Current challenges and future perspectives. In Smart Waste and Wastewater Management by Biotechnological Approaches (pp. 3-20). Singapore: Springer Nature Singapore.

Agboola, S. O., Inetabor, G. M., Bello, O. O., & Bello, O. S. (2025). Waste pollution and management: Current challenges and future perspectives. In Smart Waste and Wastewater Management by Biotechnological Approaches (pp. 3-20). Singapore: Springer Nature Singapore.

Ahmed, S. K., Mohammed, R. A., Nashwan, A. J., Ibrahim, R. H., Abdalla, A. Q., Ameen, B. M. M., & Khdhir, R. M. (2025). Using thematic analysis in qualitative research. *Journal of Medicine, Surgery, and Public Health*, 6, 100198.

Ahmed, S. M. S., ... & Alrawaf, T. I. (2022). Environmental sustainability impacts of solid waste management practices in the global South. *International journal of environmental research and public health*, *19*(19), 12717.

Ajibade, F. O., Adelodun, B., Lasisi, K. H., Fadare, O. O., Ajibade, T. F., Nwogwu, N. A., ... & Wang, A. (2021). Environmental pollution and their socioeconomic impacts. In *Microbe mediated remediation of environmental contaminants* (pp. 321-354). Woodhead Publishing.

Al-Taai, S. H. H. (2022, March). Solid waste: A study of its concept, management methods, and environmental impacts. *In IOP Conference Series: Earth and Environmental Science* (Vol. 1002, (1), p.; 012007). 1OP Publishing

Amasuomo, E., & Baird, J. (2016). The concept of waste and waste management. *J. Mgmt & Sustainability*, 6, 88.

Amato, C., Jerie S., Mutekwa, T., and & Tafadzwa, M. (2024). Impacts of solid waste management strategies in urban high-density suburbs: a case of Amaveni suburb Kwekwe, Zimbabwe. *Discover Environment* 2(1), 97.

Arfasa, G. F., Tilahun, Z. A., & Kejela, M. D. (2026). Towards zero-waste cities: Leveraging circular economy strategies for municipal solid waste management and pollution mitigation in East Africa-A systematic review. Next Sustainability, 7, 100228.

Awino, F. B., Maher, W. A., Krikowa, F., & Lynch, A. J. J. (2020). Occurrence of trace metals in food crops grown on the Mbale dumpsite, Uganda, and human health risks. *Integrated environmental assessment and management*, 16(3), 362-377.

Awuchi, C. G., Awuchi, C. G., Amagwula, I. O., & Igwe, V. S. (2020). Industrial and community waste management: global perspective. American Journal of Physical Sciences, 1(1), 1-16.

Bandauko, E., & Arku, G. (2024). "It is no longer the sunshine city, it is now a dump site city": Discursive construction of urban space and street trading in Harare, Zimbabwe. *Cities, 155,* 105488.

Brotosusilo, A., Utari, D., Negoro, H. A., Firdaus, A., & Velentina, R. A. (2022). Community empowerment of waste management in the urban environment: More attention on waste issues through formal and informal educations. *Global Journal of Environmental Science and Management, 8*(2), 209-224.

CHIKUKWA, M. R. (2023). Implications of water crisis on genders and policy in Kuwadzana high density suburb Harare, Zimbabwe. *GSAR Journal of Economics, Business and Management.*

Chimusoro, A., Maphosa, S., Manangazira, P., Phiri, Nhende, T., Danda, S., Tapfumanei, O., Munyaradzi Midzi, S. & Nabyonga-Orem, J. (2018) Responding to cholera

outbreaks in Zimbabwe: building resilience over time, In: D. Claborn (Ed.) Current Issues in Global Health, IntechOpen, pp. 45-64. DOI: 10.5772/intechopen.79794.

Chireshe, A., Shabani, T., & Shabani, T. (2023). Safety and health risks associated with illegal municipal solid waste disposal in urban Zimbabwe. "A case of Masvingo City". Safety in Extreme Environments, 5(3), 243-252.

Chireshe, A., Shabani, T., & Shabani, T. (2023). Safety and health risks associated with illegal municipal solid waste disposal in urban Zimbabwe. "A case of Masvingo City". *Safety in Extreme Environments, 5*(3), 243-252.

Coleman, P. (2022). Validity and reliability within qualitative research for the caring sciences. *International journal of caring sciences*, 14(3), 2041-2045.

Ditia, S. (2024). The effect of industrial waste on air pollution and water pollution causes climate change. Journal of Waste and Sustainable Consumption,1(1), 18-26. Chicago

Dong, W. L. (2025). 5R Principles for Sustainable Household Waste Management. *Asia Pacific Journal of Religions and Cultures, 9*(1), 264-274.

Egemba, M., Ajayi, S. A. O., Aderibigbe-Saba, C., & Anthony, P. (2024). Environmental health and disease prevention: Conceptual frameworks linking pollution exposure, climate change, and public health outcomes. *International Journal of Multidisciplinary Research and Growth Evaluation, 5*(3), 1133-1153. Environmental Health Insights, 18, 11786302241289681.

Elsaid, S., & Aghezzaf, E. H. (2015). A framework for sustainable waste management: challenges and opportunities. *Management research review*, 32(10), 1086-1097.

Ferdous, J. (2025). Historical, Theoretical, and Epidemiological Approaches to Environmental Health Research. In: Roy, A., Rahaman, M., Chouhan, P., Ahmed, F. (eds) Environment and Public Health. Sustainability Solutions. Springer, Cham. https://doi.org/10.1007/978-3-031-99770-9.

Folarin, O. S. (2021). Achieving sustainable solid waste management in Sub-Saharan Africa: The option of valorisation and circular economy model. In *Waste*

management, processing and valorisation (pp. 285-300). Singapore: Springer Singapore 6246.

Frigo, Giulia, et al. "The geography of waste: Explaining the spatial variation of litter and dumpsites in Indonesia." Environmental Challenges (2025): 101345.

Fuller, R., Landrigan, P. J., Balakrishnan, K., Bathan, G., Bose-O'Reilly, S., Brauer, M., ... & Yan, C. (2022). Pollution and health: a progress update. *The Lancet planetary health,* 6(6), e535-e547.

Georgiou, G., & Karayannis, V. (2023). GIS-based approach for solid waste disposal site mapping and environmental rehabilitation. *Euro-Mediterranean Journal for Environmental Integration, 8*(3), 601-611.

Goto, T., Shiripinda, I., Phiri, A., & Tagwira, F. (2020). An analysis of alternative water sources in Budiriro Suburb Harare. *International Journal of Scientific Research & Engineering Trends*, 6(5), 2395-566X.

Graham, R. E. (2024). A study of illegal dumping near coastal zones and waterways in Grenada: advancing waste management solutions and reducing marine litter. *PLoS Water, 3*(4), e0000175.

Grangxabe, X. S., Maphanga, T., & Madonsela, B. S. (2023). Public participation on waste management between nature reserves and surrounding informal settlement: A review. *Journal of the Air & Waste Management Association, 73*(8), 589-599.

Hakorimana, F., & Ndokoye, P. (2025). Assessing the Appropriateness of Waste Disposal Locations and the Environmental Effects in the Expanding Satellite City of Muhanga in Muhanga District, Rwanda. *Journal of Agriculture & Environmental Sciences*, 9(2), 126-168.

Hole, L. (2024). Handle with care; considerations of Braun and Clarke's approach to thematic analysis. *Qualitative research journal, 24*(4), 371-383.

Izuchukwu Precious, O., & Zino, I. O. (2025). From Cities to Villages a Comparative Study of Waste Management Policies. *World of Semantics: Journal of Philosophy and Linguistics, 3*(2), 1-31. y

Jakeni, Y., Maphanga, T., Madonsela, B. S., & Malakane, K. C. (2024). Identification of illegal dumping and community views in informal settlements, Cape Town: South Africa. Sustainability,16(4), 1429.

Jerie, S., Mutekwa, T. V., Mudyazhezha, O. C., Shabani, T., & Shabani, T. (2024). Environmental wastewater management and human health problems associated with hospital Zimbabwe. *Current Environmental Health Reports*, 11(3), 380-389.

Kasimba, R., Choguya, N. Z., & Mugayi, S. (2023). Women and solid waste management in high density: the case of Hatecliffe, Harare, Zimbabwe. African Journal of Gender, Society & Development,12(1), 209.

Khoa, B. T., Hung, B. P., & Hejsalem-Brahmi, M. (2023). Qualitative research in social sciences: data collection, data analysis and report writing. *International Journal of Public Sector Performance Management*, 12(1-2), 187-209.

King, R. B., Sheldon, J. K., & Long, G. M. (2023). Practical environmental bioremediation: the field guide. CRC Press.

Kiwanuka, E. N. (2022). COMMUNITY-LED SOLUTIONS: STRATEGIES AND CHALLENGES IN PROMOTING PARTICIPATORY SOLID WASTE MANAGEMENT. *Research Journal of Education and Development*, *10*(1), 29-38.

Knott, E., Rao, A. H., Summers, K., & Teeger, C. (2022). Interviews in the *social* sciences. Nature Reviews Methods Primers, 2(1), 73.

Kotsiuba, I., Herasymchuk, O., Shamrai, V., Lukianova, V., Anpilova, Y., Rybak, O., & Lefter, I. (2023). A strategic analysis of the prerequisites for the implementation of waste management at the regional level. *Ecological Engineering & Environmental Technology*, 24, 55-66.

Kubanza, N. S., & Simatele, M. D. (2022, February). Sustainable solid waste management in developing countries: a study of institutional strengthening for solid waste management in Johannesburg, South Africa. In *Journal of Planning Literature* (Vol. 37, No. 1, Pp. 118-119). 2455 Teller Rd, Thousand Oaks, Ca 91320 Usa: Sage Publications Inc.

Kwenda, P. R., Lagerwall, G., Eker, S., & van Ruijven, B. (2022). Identifying the leverage points in the household solid waste management system for Harare, Zimbabwe, using network analysis techniques. Sustainability, 14(19), 12405. Materials of the V International Conference, pp. 236-242. 2014.

Kwenda, P. R., Lagerwall, G., Eker, S., & Van Ruijven, B. (2022). A mini-review on household solid waste management systems in low-income developing countries: A case study of urban Harare City, Zimbabwe. Waste Management & Research, 40(2), 139-153.

Kwun Omang, D. I., John, G. E., Inah, S. A., & Bisong, J. O. (2021). Public health implication of solid waste generated by households in Bekwarra Local Government area. African Health Sciences, 21(3), 1467-1473.

Lin, L., Yang, H., & Xu, X. (2022). "Effects of water pollution on human health and disease heterogeneity: a review." *Frontiers in the environment science,*10 (2022): 880246.

Liu, K., Tan, Q., Yu, v., & Wang, M. (2023). A global perspective on e-waste recycling. Circular Economy,2 (1), 100028.

Luft, J. A., Jeong, S., Idsardi, R., & Gardner, G. (2022). Literature reviews, theoretical frameworks, and conceptual frameworks: An introduction for new biology education researchers. CBE-Life Sciences Education, 21(3), rm33.

Maes, T., & Preston-Whyte, F. (2022). E-waste it wisely: lessons from Africa. *SN Applied Sciences*, *4*(3), 72.

Mandal, M., Roy, A., Binha, S. K., Popek, R., Przybysz, A., Koczoń, P., ... & Sarkar, A. (2025). Waste dumps as microplastic hotspots: a comparative investigation at urban, suburban, and rural areas of Eastern India and associated risk assessment. *Environmental Toxicology and Chemistry*, *44*(7), 1869-1882.

Mandal, M., Roy, A., Binha, S. K., Popek, R., Przybysz, A., Koczon, P., … & Sarkar, A. (2025). Waste dumps as microplastic hotspots: a comperatived investigation at urban, suburban, and rural areas of Eastern India and associated risk assessment. Environment Toxicology and Chemistry,44(7), 1869-1882

Mangara, F., & Dorasamy, N. (2026). Case Studies in Urban Planning and Disaster Risk Reduction in Southern Africa. In Sustainable Urban Development in Southern Africa: Disaster Risk Reduction and Economic Resilience (pp. 269-281). Cham: Springer Nature Switzerland.

Maphosa, M., & Maphosa, V. (2022). A bibliometric analysis of the effects of electronic waste on the environment. *Global Journal of Environmental Science and Management, 8*(4), 589-606.

Marchiori, L., Albuquerque, A., & Cavaleiro, V.(2020, November). Critical review of industrial solid wastes as barrier material for impermeabilization of storage waste facilities. In Proceedings of 5th Symposium on Urban Mining and Circular Economy-SUM2020 (pp. 18-20).

Martins, G., & Mafimisebi, P. (2024). Impacts of sewage wastewater on groundwater quality and health risk in makoko, lagos, Nigeria. Asian Journal of Basic Science & Research, 6(3), 100-110.

Masimba Nyama, G., & Walnycki, A. (2024). Harare: City report. *Anna, Harare: City report (August 26, 2024)*.

Matengo, T., Mwedzi, T., & Mbetu, J. (2025). Spatial and temporal patterns in water quality analysis near effluent dump-sites in Harare, Zimbabwe. *Journal of Water, Sanitation and Hygiene for Development*, 15(3), 206-214.

McGregor, S. L. (2023). Ethical considerations in research about organizations: Compendium of strategies. Ethics in Progress, 14(2), 4-23.

Medina-Medina, A. J., López, R. S., Barboza, E., Tuesta-Trauco, K. M., Zabaleta-Santiesteban, J. A., Guzman, B. K., ... & Rojas-Briceño, N. B. (2024). Participation GIS for the monitoring of areas contaminated by municipal solid waste: A case study in the City of Pedro Ruiz Gallo (Peru). *Case Studies in Chemical and Environmental Engineering, 10*, 100941.

Mishra, S. B., & Alok, S. (2022). Handbook of research methodology. Educreation publishing Starbuck, C. (2023). Research design. In The fundamentals of people analytics: With applications in R (pp. 51-57). Cham: Springer International Publishing.

Moyen Massa, G., & Archodoulaki, V. M. (2023). Electrical and electronic waste management problems in Africa: Deficits and solution approach.Environments, 10(3), 44.

Mutsindikwa, N., & Muchato, M. (2022). Housing Developments by Co operatives in Harare: An Evaluation of Kuwadzana. *Journal of Urban Systems and Innovations for Resilience in Zimbabwe-JUSIRZ, 4*(1), 240-262.

Mvula, R. L. S., Banda, Y. M., Njunju, M. A., Tholo, H. M., Chisemga, C., Nyengere, J., … & Kadewa, W. 2025. Mapping illegal dumping sites in a low resource region using GIS and remote sensing: the case study of Blantyre City Malawi. *Urban Science*, 9(7), 254.

Nahar, N., Hossain, Z., & Mahiuddin, S. (2023). Assessment of the environmental perceptions, attitudes, and awareness of city dwellers regarding sustainable urban environmental management: a case study of Dhaka, Bangladesh. *Environment, Development and Sustainability*, *25*(8), 7503-7531.

Nawal, P. (2025). Examining Clean Water and Health Infrastructure for Sustainable Global Well-being under SDG 3 and SDG 6. *International Journal of SDG's Prospects and Breakthroughs*, 24-31.

Nhubu, T., Mbohwa, C., Muzenda, E., & Patel, B. (2019). Impacts of waste management practices on water resources in Harare. In *wastes: Solutions, treatments and opportunities III* (pp. 531-536). CRC Press.

Njewa, J. B., Mweta, G., Sumani, J., & Biswick, T. (2025). The impact of dumping sites on air, soil and water pollution in selected Southern African countries: challenges and recommendations. *Water Emerging Contaminants & Nanoplastics*, 4(1), N-A.

Njewa, J. B., Mweta, G., Sumani, J., & Biswick, T. (2025). The impact of dumping sites on air, soil and water pollution in selected Southern African countries: challenges and recommendations. *Water Emerging Contaminants & Nanoplastics*, 4(1), N-A.

Nkosi, M. S., Idowu, G., Madzivanzira, T. C., Masina, F., Dondofema, F., Khanyile, N., ... & Dalu, T. (2025). Emerging freshwater contamination in two subtropical austral river systems of Zimbabwe. *Water, Air, & Soil Pollution*, *236*(12), 794.

Nkosi, M. S., Idowu, G., Madzivanzira, T. C., Masina, F., Dondofema, F., Khanyile, N., ... & Dalu, T. (2025). Emerging freshwater contamination in two subtropical austral river systems of Zimbabwe. *Water, Air, & Soil Pollution*, *236*(12), 794.

Nyathi, B. (2025). Solid waste management in informal settlements in Harare, Soweto, Egypt, Accra, Kinshasa, and Lagos: a review of challenges, impacts, and measures for improvement. *Discover Sustainability*.

Obilor, E. I. (2023). Convenience and purposive sampling techniques: Are they the same. *International Journal of Innovative Social & Science Education Research*, 11(1), 1-7.

Okoji, O. O., Adeyemi, T. O., & Olawuni, O. A. (2023). Assessment of community perception on waste management practice in Ilorin metropolis, Kwara State, Nigeria. *Reality of Politics*, (25), 114-132.

Okoji, O. O., Adeyemi, T. O., & Olawuni, O. A. (2023). Assessment of community perception on waste management practice in Ilorin metropolis, Kwara State, Nigeria. *Reality of Politics*, (25), 114-132.

Oluwagbayide, S. D., Abulude, F. O., Akinnusotu, A., & Arifalo, K. M. (2024). The relationship between waste management practices and human health: new perspective and consequences. *Indonesian Journal of Innovation and Applied Sciences (IJIAS)*, *4*(1), 19-34.

Otunola, B. O., & Mhangara, P. (2025). Green Remediation of Environmental Pollution in Africa: Challenges and Opportunities. *Remediation Journal*, *35*(3), e70019.

Pande, G., & Makonye, F. (2023). Analysing the impact of solid waste improper disposal practices: The case of a suburb in Gweru City, Zimbabwe. *African Journal of Public Administration and Environmental Studies (AJOPAES)*, *2*(2), 75.

Pongracz, E. (2002). Re-defining the concepts of waste and waste management: *Evolving the Theory of Waste Management*. University of Oulu.

Poshai, L., & Intauno, K. (2024). Evaluating the efficacy of social capital in facilitating sustainable municipal waste management: Reflections from Harare, Zimbabwe. *Journal of Education, Management and Development Studies*, 4(1), 80-93.

Raman, A. P. S., Aslam, M., Singh, P., Pandey, G., Jain, P., & Kumari, K. (2024). Solid and liquid waste management in urban and rural areas: current practices and future perspectives. In Integrated Waste Management: A Sustainable Approach from Waste to Wealth (pp. 141-157). Singapore: Springer Nature Singapore.

Ravaghi, H., Abdi, Z., Elfeky, S., El-Adawy, M., Lega, F., & Mataria, A. (2025). Role of community health needs and assets assessment in promoting PHC-oriented models of care. *Health Services Management Research*, *38*(4), 228-231.

Ray, R., & Fellow, D. M. R. (2020). The importance of collecting demographic data. *The Brookings Institute*.

Sharma, H. (2022). How short or long should be a questionnaire for any research? Researchers dilemma in deciding the appropriate questionnaire length. *Saudi journal of anaesthesia*, 16(1), 65-68.

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of business research*, 104, 333-339.

Sukmawati, S. (2023). Development of quality instruments and data collection techniques. *Journal Pendidikan Dan Pengajaran Guru Sekolah Dasar (JPPGuseda*), 6(1), 119-124.

Sukmto, P., & Kusuma, F. D. P. (2026). Student satisfaction survey at XYZ Campus using the Slovin formula method and mwater application. Teknosains*: Jurnal Sains, Teknologi dan Informatika*, 13(1), 107-116

Tajik, O., Golzar, J., & Noor, S. (2025). Purposive sampling. *International Journal of Education & Language Studies*, 1-9.

Takona, J. P. (2024). Research design: qualitative, quantitative, and mixed methods approaches. Quality & Quantity, 58(1), 1011-1013.

Takona, J. P. (2024). Research design: qualitative, quantitative, and mixed methods approaches. *Quality & Quantity*, *58*(1), 1011-1013

Tongesayi, T., Kugara, J., & Tongesayi, S. (2018). Waste dumpsites and public health: a case for lead exposure in Zimbabwe and potential global implications. *Environmental geochemistry and health*, 40(1), 375-381.

Uche, O. L. (2023). Theoretical Approaches to Plastic Waste Regulation in *Nigeria. Beijing L. Rev.,14, 2136.*

Weyant, E. (2022). Research design: Qualitative, quantitative, and mixed methods approaches: by john W. Creswell and J. David Creswell, Los Angeles, CA: SAGE, 2018, $38.34, 304pp., ISBN: 978-1506386706.

Wikurendra, E. A., Ferto, I., Nagy, I., & Nurika, G. (2022). Strengths, weaknesses, opportunities, and threats of waste management with circular economy principles in developing countries: A systematic review. Environmental Quality Management, 32(1),87-94.

Willie, M. M. (2024). Population and target population in research methodology. Golden Ratio of Social Science and Education, 4(1), 75-79.

World Bank. (2020). Solid waste management in urban environments: A guide to sustainable practices for households. World Bank. https://www.worldbank.org/en/topic/urbandevelopment.

World Health Organization. (2025). *Progress on household drinking water, sanitation and hygiene 2000-2024: special focus on inequalities*. World Health Organization.

World Health Organization. (2025). *Progress on household drinking water, sanitation and hygiene 2000-2024: special focus on inequalities*. World Health Organization.

Yeukai, Mada Sharon, and M. Kharlamova. "An assessment of the relationship between the spatial distribution of undesignated dumpsites and disease occurrence in Budiriro, Harare, Zimbabwe." In Science, Technology and Higher Education.

Zhongove, B., Cheleka, A., Chipfunde, F., Nhedzi, E., & Mapira, J. (2024). Challenges and prospects of solid waste management in the city of Masvingo, Zimbabwe. *European Journal of Social Sciences Studies*, 9(5).

Zimbabwe National Statistical Agency (ZimStats) (2022). 2022 Census Report. Government Printers, Harare.

APPENDICES

APPENDIX 1: INTERVIEW GUIDE FOR NURSES AT KUWADZANA POLYCLINIC

My name is Tivonge Romilah Chindika, a research student at Bindura University of Science Education studying towards a Bachelor of Science Honours Degree in Development Studies. The purpose of this research is to examine on **The Effects of Waste Pollution on Community Health in Kuwadzana Residential Area in Harare, Zimbabwe**. This interview guide has been designed to collect information and views from participants. No identity will not be recorded, and all responses will be anonymised. I am respectfully requesting for your consent to participate which is of vital assistance and will significantly contribute to this study. Feel free to discontinue if you feel uncomfortable or no longer wish to participate. The findings of the study will be shared when the research is completed. The interview is expected to last only 30 minutes.

Health Sources and Waste Pollution (Objective 1)

1. What are the sources of waste pollution affecting community health?
2. Which are the resulting health effects of pollution in Kuwadzana residential suburbs?
3. Which diseases are specifically a result of waste pollution in Kuwadzana?
4. What common health conditions do residents frequently report?
5. How do illegal dumping sites affect the community?

Perceptions on waste pollution on health (Objective 2)

6. What challenges do you encounter when dealing with illness linking to wate pollution?
7. What are the main causes of waste pollution in Kuwadzana community?
8. What role does the Kuwadzana council play in addressing waste pollution?
9. In which ways do you respond to waste pollution?
10. To what extent is waste pollution a problem to the community health in Kuwadzana?

Kuwadzana Hotspots affected by waste pollution (Objective 3)

11. Describe any specific places where waste tends to accumulate?
12. How close are waste polluted areas to households, shops and water sources?
13. Which diseases are commonly reported in pollution hotspot areas?
14. Which factors contribute to the concentration of waste pollution in certain locations in Kuwadzana

Thank you for your cooperation. I reassure you that all responses will remain anonymous and all findings would be shared upon the completion of the study

APPENDIX 2: QUESTIONNAIRE GUIDE FOR THE COMMUNITY MEMBERS

My name is Tivonge Romilah Chindika, a research student at Bindura University of Science Education studying towards a Bachelor of Science Honours Degree in Development Studies. The purpose of this research is to examine on **The Effects of Waste Pollution on Community Health in Kuwadzana Residential Area in Harare, Zimbabwe**. This questionnaire guide has been planned to collect information from participants. I kindly seek for your consent and your participation is voluntary. The information provided will be treated with strict confidentiality, identity will not be disclosed and responses will be anonymised and I am willing to share the findings of this research upon completion of this study. It will only last for about 20 minutes to respond to the following questions.

Instructions to Responding the Following Questions

- Please **do not write your name** or any other details that may review your identity on this questionnaire.
- Please tick where applicable in the given box (☐) with relevant answers in the blank space (……) and provide information on the spaces ere necessary.
- Some questions require for you to rate tick the applicable on the scale provided.

SECTION A: BACKGROUND INFORMATION

1. Gender

Female	
Male	

2. Age (years)

11-20	
20-30	
30-40	
50+	

3. Highest education attained

Primary	
Secondary	
Tertiary	
None	

4. Are you a resident in Kuwadzana

Yes	
No	

5. Indicate when was your last visit to Kuwadzana Polyclinic?

…….

6. Visit purpose (Tick one reason)

Self	
Escorting spouse	
Escorting child	
Escorting friend	
Other reasons	

7. What is your current employment status

Formerly employed	
Non- formal job	
Not employed	
Other	

8. Period staying in Kuwadzana

Below 5 years	
Above 5 years	

SECTION B: HEALTH PROBLEMS ASSOCIATED WITH WASTE POLLUTION

9. Which pollution source is common in Kuwadzana? (tick one)

Industrial waste	
Solid waste	
sewage waste	
Electronic waste	
Other	

10. Explain how the specific source you chose is affecting health in Kuwadzana?

……

……

11. How often is waste collected?

Weekly	
Monthly	

12. How serious are the health effects of waste pollution in Kuwadzana? (Tick one)

Very serious	
Serious	
Moderate	
Not serious	
Not very serious	

13. List five diseases that commonly affects Kuwadzana residents caused by waste pollution?

i…….

ii……

iii……...

iv……...

v……

SECTION C: COMMUNITY PERCEPTIONS ON WASTE POLLUTION

14. Which methods do you normally use to discard waste?

……

……..

15. Who do you think is responsible for waste pollution resulting to health problems? (Tick one)

Local Kuwadzana Residents	
Local authority	
Formal businesses	
Informal businesses	

Answer the following questions 16-20 on the table below using Linkert scale rating defined with; 1-strongly disagree, 2-disagree, 3-neutral, 4-agree and 5-strongly agree (tick one on each question)

Item	**Method of waste management**	**Rating**				
		1	2	3	4	5
16	Public health education and awareness campaign are important					
17	Promote recycling will reduce pollution					
18	Rehabilitating clogged drainage systems is important					
19	Promote separation of waste at source					
20	Arrest anyone or company found polluting					

SECTION D: WASTE POLLUTION HOTSPOTS

21. Which locations are commonly affected with waste pollution?

……

……

22. What do you think should be done to reduce to reduce waste polluted locations?

……

……

23. In your own words which suggestions those who litter and increase pollution hotspots?

……

……

Thank you for your time and l assure that your personal information will remain anonymised. Your response will help so much in my research.

APPENDIX 3: FIELDWORK CHECKLIST

SECTION A: Legal dump sites

Dump site ID	Location		Classification of waste observed from each site				
1	Easting	Northing	biodegradable	plastic	Bottle	Metal	Electronic
2							
3							
4							
5							
6							
7							
8							
9							
10							

Section B Illegal dumping sites

Dump site ID	Location		Classification of waste observed from the site				
	Eastings	Northings	Biodegradable	Plastic	Bottle	Metal	electronic
1							
2							
3							
4							
5							
6							

7							
8							
9							
10							

SECTION C: HEALTH AND WASTE POLLUTION

Location	Type of pollution observed	Possible disease/ health effects	Affected Population

APPENDIX 4: BINDURA RESEARCH APPROVAL LETTER



Bindura University of Science Education

SUSTAINABLE DEVELOPMENT DEPARTMENT

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BINDURA UNIVERSITY OF SCIENCE EDUCATION

CHAIRPERSON'S OFFICE

Friday, 17 October 2025

TO WHOM IT MAY CONCERN

Dear Sir/Madam

RE: RESEARCH SUPPORT LETTER FOR SUSTAINABLE DEVELOPMENT STUDENT

This is to confirm that **CHINDIKA TIVONGE ROMILAH** Registration Number **B213623B** is our fourth-year student doing Bachelor of Science (Honours) Degree in Development Studies (HBSc.DG) at Bindura University of Science Education in the Sustainable Development Department.

In the fourth-year, students are required to do field research which require them to do data collection for their research purposes from various sources as part of their degree programme.

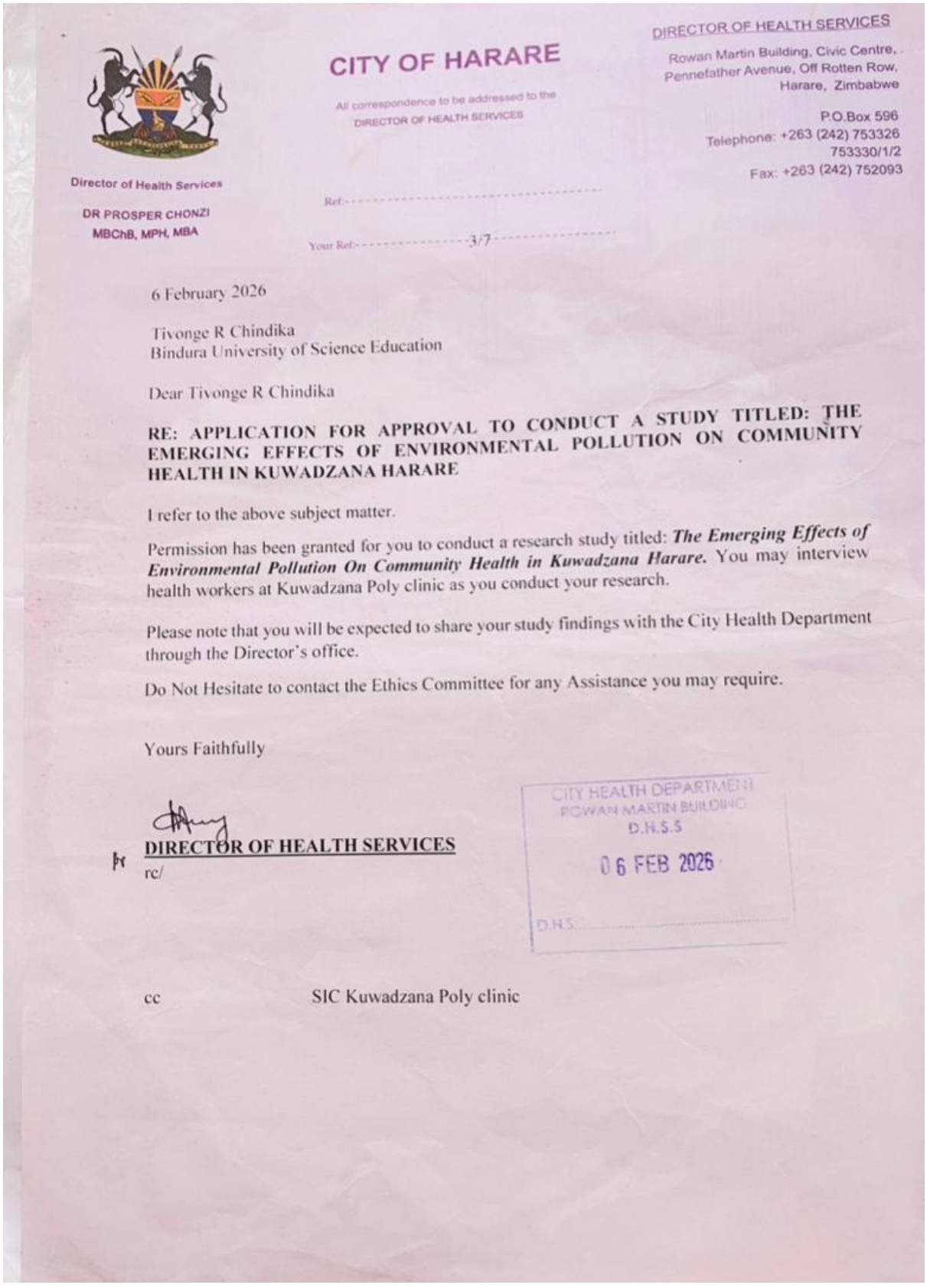
Kindly accord him/her the due cooperation the student truly deserves.

Yours faithfully,

CHAIRMAN
GEOGRAPHY DEPARTMENT
FACULTY OF SCIENCE

Dr. J. Bowora (PhD)
(Chairperson)

APPENDIX 5 RESEACH LETTER FROM HARARE CITY COUNCIL



CITY OF HARARE

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Director of Health Services
DR PROSPER CHONZI
MBChB, MPH, MBA

Ref:-----

Your Ref:----------3/7----------

6 February 2026

Tivonge R Chindika
Bindura University of Science Education

Dear Tivonge R Chindika

RE: APPLICATION FOR APPROVAL TO CONDUCT A STUDY TITLED: THE EMERGING EFFECTS OF ENVIRONMENTAL POLLUTION ON COMMUNITY HEALTH IN KUWADZANA HARARE

I refer to the above subject matter.

Permission has been granted for you to conduct a research study titled: ***The Emerging Effects of Environmental Pollution On Community Health in Kuwadzana Harare.*** You may interview health workers at Kuwadzana Poly clinic as you conduct your research.

Please note that you will be expected to share your study findings with the City Health Department through the Director's office.

Do Not Hesitate to contact the Ethics Committee for any Assistance you may require.

Yours Faithfully

DIRECTOR OF HEALTH SERVICES
rc/

CITY HEALTH DEPARTMENT
ROWAN MARTIN BUILDING
D.H.S.S
06 FEB 2026
D.H.S.

cc SIC Kuwadzana Poly clinic