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BARRIERS LIMITING FLOOD RISK MANAGEMENT IN WARD 10 OF KANYAMA COMPOUND, LUSAKA DISTRICT, ZAMBIA

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This study investigated the barriers limiting flood risk management in Ward 10 of Kanyama Compound, Lusaka District, Zambia. The primary objective was to establish the infrastructural, governance, and socio-economic barriers impeding effective flood management. Framed by General Systems Theory and the Input-Process-Output model, the research utilised a pragmatic convergent parallel mixed-methods design. Data were collected between January and March 2026 through structured questionnaires administered to 68 households (selected via stratified cluster sampling) and semi-structured interviews with five key informants (purposively sampled from the Disaster Management and Mitigation Unit, Lusaka City Council, an NGO, the Ward Councillor, and the Ward Development Committee). Quantitative data were analysed using descriptive statistics, while qualitative data were analysed using inductive thematic analysis. The findings indicate that flood risk management is constrained by interconnected barriers. These included infrastructural deficits such as the absence of proper drainage (94.1%) and blocked drains (76.5%); governance failures characterised by weak enforcement of regulations (82.4%) and insufficient funding (77.9%); and socio-economic constraints driven by poverty (79.4%) and poor housing conditions (70.6%). Key informants revealed that institutional fragmentation, inadequate technical capacity, and a reactive rather than proactive approach to flood management perpetuate the problem. The study concludes that these barriers act as a reinforcing cycle, trapping residents in vulnerability. Key recommendations include designing a catchment-wide drainage master plan, enforcing land-use regulations, and establishing a multi-stakeholder flood risk management committee. This paper is the first in a series and focuses exclusively on establishing the barriers; subsequent papers will examine how these barriers influence flood risk management practices and evaluate existing practices.

Keywords: Flood risk management; Barriers; Drainage infrastructure; Governance; Informal settlements; Urban flooding; Kanyama; Lusaka; Zambia.

ABBREVIATIONS
DMMU – Disaster Management and Mitigation Unit
LCC – Lusaka City Council
NGO – Non-Governmental Organisation
WDC – Ward Development Committee
CDF – Constituency Development Fund
RDA – Road Development Agency
SDG – Sustainable Development Goal
GST – General Systems Theory
IPO – Input-Process-Output

INTRODUCTION

Urban flooding is a growing global challenge, particularly in rapidly expanding informal settlements where poor infrastructure and high population density intersect. In Sub-Saharan Africa, drainage networks in many cities are either non-existent or designed for outdated rainfall patterns, leaving poor communities highly vulnerable (Douglas et al., 2008). In Lusaka, Zambia, recurrent flooding has become a chronic crisis. Ward 10 of Kanyama Compound serves as a critical example of this issue. Over the past decade, flood depths in the ward have escalated from 0.1 metres in 2015 to 1.2 metres in 2025 (DMMU, 2024). During the most recent floods of February–March 2025, approximately 80,000 residents required emergency water aid, and frequent outbreaks of waterborne diseases severely threatened public health (*Resilience Framework for Action, 2023; One Love Radio, 2025).*

The core problem is a persistent gap between policy design and practical implementation. Although Zambia has enacted the Disaster Management Act (2010) and the National Disaster Management Policy (2015) and has aligned its strategy with the Sendai Framework for Disaster Risk Reduction 2015–2030 (UNDRR, 2015), these frameworks have not translated into long-term resilience for Ward 10. Current responses remain temporary and reactive, such as seasonal clean-up campaigns and makeshift drains, rather than proactive prevention (Satterthwaite et al., 2020). This failure occurs because the specific, localised barriers limiting effective flood risk management in Ward 10 have not been systematically identified

and addressed.

Existing research highlights that Zambia's disaster management framework remains fragmented (Chitondo et al., 2024), and poor solid waste management directly exacerbates flooding in Kanyama (Mukuma, 2022). However, previous studies have examined Kanyama Compound as a whole or Lusaka District broadly. They have not generated the granular, ward-specific data necessary to identify the specific, interacting barriers operating in Ward 10. Without localised evidence, interventions remain generic and fail to address the root causes of vulnerability in this specific community.

To address this knowledge gap, this study adopted a pragmatic, mixed-methods approach. By combining quantitative household surveys with qualitative interviews from key informants, the research captures both statistical patterns and the lived experiences of residents. The study is guided by General Systems Theory (von Bertalanffy, 1968), which provides a lens to examine how infrastructural, governance, and socio-economic factors interact to create a cycle of vulnerability, and by the Input-Process-Output model (Katz & Kahn, 1966), which frames flood risk management as a systemic process.

The primary aim of this study was to systematically establish the barriers limiting flood risk management in Ward 10 of Kanyama Compound, Lusaka District. The specific objective addressed in this paper is:

Specific Objective

i. Barriers limiting flood risk management in Ward 10 of Kanyama Compound.

By providing empirical evidence of these specific barriers, this study offers actionable solutions for policy reform. Identifying these barriers is a necessary step toward achieving Sustainable Development Goal 11 (Sustainable Cities and Communities) and Goal 13 (Climate Action) in Zambia. This paper is the first in a series; subsequent papers will examine how these barriers influence flood risk management practices and evaluate existing practices.

LITERATURE REVIEW

Global Perspectives on Barriers to Flood Risk Management

Flood risk management across the world continues to face significant barriers that undermine resilience and adaptation, particularly in informal urban settlements. At the global level, institutional fragmentation and weak governance structures remain persistent challenges. Agencies responsible for disaster management often operate in isolation, leading to duplication of efforts and gaps in coordination (Grigg, 2024). Conventional top-down approaches fail to integrate community knowledge, producing strategies that are poorly aligned with vulnerable populations. Weak enforcement of land-use regulations further allows settlements to expand into flood-prone zones, undermining resilience (Bhanye et al., 2025).

Infrastructural deficits remain a critical global barrier. In developed countries, aging flood control systems such as levees and dams are increasingly unable to withstand extreme weather events. In developing nations, stormwater infrastructure is either absent or poorly maintained, leaving urban populations exposed. Mudenda et al. (2022) highlight that inadequate drainage systems and poor waste management exacerbate flood vulnerability, particularly in informal settlements. Globally, the lack of technical capacity to design, maintain, and upgrade drainage networks remains a pressing issue (Ran et al., 2022).

Socio-economic inequalities also shape global flood risk management outcomes. Marginalised populations often lack the resources to invest in protective measures, leaving them dependent on overstretched public systems. Awah et al. (2024) argue that socio-economic disparities amplify vulnerability, as recurrent floods erode livelihoods and deepen poverty. Bhanye et al. (2025) similarly emphasise that these inequalities reinforce cycles of vulnerability. This global pattern of inequality resonates strongly in Sub-Saharan Africa, where poverty and insecure tenure prevent residents from investing in flood-resistant housing, thereby intensifying regional exposure.

Regional Perspectives: Sub-Saharan Africa

In Sub-Saharan Africa, institutional weaknesses are compounded by limited regional cooperation. Disaster management agencies often lack coordination across borders, despite shared river basins and climatic risks. The UNDRR (2022) notes that fragmented governance structures hinder integrated flood management strategies. This regional fragmentation reflects the global challenge of institutional incoherence, but with added complexity due to transboundary water systems such as the Zambezi and Niger basins.

Infrastructure deficits are particularly acute in African cities. Rapid urbanisation has outpaced investment in stormwater systems, leaving informal settlements vulnerable. Lumbroso (2020) highlights that poor drainage and inadequate waste disposal systems exacerbate flooding in peri-urban areas. These infrastructural weaknesses are not isolated but are linked to socio-economic inequalities, as poverty prevents residents from investing in flood-resistant housing.

Socio-economic inequalities are stark across the region. Informal settlements are characterised by insecure tenure, poverty, and limited access to basic services. Residents often lack the resources to relocate or invest in flood-resistant housing. The Global Center on Adaptation (2021) stresses that poverty and inequality are key drivers of vulnerability to floods in Africa, reinforcing cycles of exposure and loss. These inequalities at the regional level directly connect to national realities in Zambia, where poverty in peri-urban settlements such as Kanyama Compound intensifies vulnerability.

National Perspectives: Zambia

At the national level, Zambia faces significant institutional weaknesses. Disaster management agencies often operate in isolation, leading to duplication of efforts and gaps in coordination. Chitondo et al. (2024) argue that Zambia's disaster management framework remains fragmented, with limited integration of flood risk management into urban planning and housing policies. This national fragmentation mirrors both global and regional patterns, showing how institutional

weaknesses cascade across scales.

Infrastructure deficits are a major barrier in Zambia. Poor drainage systems and inadequate waste management exacerbate flooding in peri-urban areas. The IFRC (2023) highlights that stormwater drains are either absent or clogged, resulting in recurrent flooding even during moderate rainfall. These infrastructural weaknesses are compounded by socio-economic inequalities, as residents of informal settlements often lack the resources to invest in protective measures.

Socio-economic inequalities further hinder flood risk management in Zambia. Residents of informal settlements such as Kanyama Compound often lack the resources to invest in protective measures. Poverty and limited access to formal flood protection reinforce cycles of vulnerability (Chitondo et al., 2024). This national reality connects directly to the local level, where residents of Ward 10 face heightened exposure due to poverty and inadequate services.

Governance challenges and policy gaps persist in Zambia. Although frameworks such as the Sendai Framework provide guiding principles, Zambia struggles to translate these into actionable local policies. Weak accountability mechanisms and corruption further undermine resilience (GFDRR, 2025). These governance failures at the national level are mirrored locally, where authorities struggle to implement effective flood risk management strategies.

Empirical evidence from other African informal settlements. Studies across the region identify a consistent triad of barriers. In Kibera, Nairobi, Mulligan (2017) found that drainage maintenance failures and uncoordinated upgrading projects, rather than the total absence of drains, produced the most severe localised flooding, while Di Caprio (2018) and Odunsi and Momodu (2024) show that in Makoko and Lagos respectively, community-driven adaptation has substituted for absent municipal investment without reducing underlying exposure. Across the region, Lumbroso (2020) and the Global Center on Adaptation (2021) attribute persistent vulnerability to the interaction of rapid urbanisation, insecure tenure and poverty, which prevents households from investing in flood-resistant housing. Awah et al. (2024) and Bhanye et al. (2025) reach similar conclusions at the global level, arguing that socio-economic inequality, rather than hazard magnitude alone, determines outcomes. These findings parallel the present study's identification of blocked drains (76.5%), weak enforcement (82.4%) and poverty (79.4%) as dominant barriers, but they also show that Ward 10 differs in one important respect: its flat terrain and shallow substrate make infiltration almost impossible, so engineered solutions are unavoidable and community-level coping alone cannot be sufficient.

Flooding and waterborne disease in Zambia. Within Zambia, evidence on flood-related health risk is concentrated in Lusaka's peri-urban settlements. The IFRC (2023) reports that recurrent flooding in these areas repeatedly triggers waterborne disease outbreaks, and the Resilience Framework for Action (2023) links flood exposure in Kanyama to contaminated water sources and recurrent public-health emergencies; the 2025 floods alone left approximately 80,000 residents dependent on emergency water aid (One Love Radio, 2025). Chitondo et al. (2024) and Silumbwe (2025) show that municipal responses remain fragmented and reactive, while Mukuma (2022) demonstrates that solid waste accumulation is the proximate cause of drainage failure in Kanyama. Mulekwa et al. (2022) add that coordination gaps in disaster management extend to water, sanitation and hygiene provision. The present study extends this literature by disaggregating these national and settlement-level findings to ward level, showing how infrastructural, governance and socio-economic barriers interact within a single flood-exposed ward.

Local Perspectives: Kanyama Compound and Ward 10

At the local level, Ward 10 in Kanyama Compound illustrates how these barriers converge. Institutional weaknesses are evident in the limited capacity of local authorities to manage flood risks. Mulekwa et al. (2022) argue that local institutions lack coordination and resources, leaving communities to rely on improvised coping mechanisms.

Infrastructure deficits are particularly acute in Ward 10. Mukuma (2022) highlights that poor drainage systems and inadequate waste management exacerbate flooding. Solid waste accumulation blocks drainage channels, intensifying flood risks during heavy rainfall. These infrastructural challenges are inseparable from socio-economic inequalities, as residents of Ward 10 often lack the resources to invest in protective measures such as flood-resistant housing.

Governance challenges and policy gaps persist at the local level. Local authorities struggle to translate national policies into actionable interventions. Weak accountability mechanisms and corruption further undermine resilience, as resources allocated for flood mitigation are often mismanaged. Knowledge gaps and limited community participation are evident in Ward 10. Residents rely on improvised drainage channels and community-based early warning systems, yet these practices are rarely incorporated into formal planning. This exclusion perpetuates ineffective strategies, leaving interventions disconnected from community priorities (Mulekwa et al., 2022).

Theoretical Framework

This study is anchored in two complementary theoretical frameworks that together provide a comprehensive lens for understanding flood risk management in Ward 10: General Systems Theory and the Input-Process-Output model.

General Systems Theory (GST) , developed by Ludwig von Bertalanffy (1968), posits that complex problems must be understood as the product of interactions among multiple subsystems rather than isolated components. Bertalanffy argued that "the whole is more than the sum of its parts," emphasising that systems whether biological, social, or environmental function through dynamic interdependence. The theory identifies key concepts including inputs (resources, information, and energy entering the system), interdependence (the mutual reliance of system components), feedback loops (mechanisms by which system outputs influence future inputs), and emergent properties (characteristics that arise from interactions rather than individual components). In the context of flood risk management in Ward 10, this theory provides a lens to examine how institutional, infrastructural, socio-economic, environmental, and financial barriers interact to shape vulnerability and resilience. Flooding in Ward 10 is not merely a result of extreme rainfall, but a systemic outcome of weak governance, poor drainage infrastructure, informal settlement patterns, and limited access to basic services. By applying Systems Theory, the study conceptualises flood risk management as a multi-layered process influenced by the coordination, or lack thereof, among various actors and systems.

The Input-Process-Output (IPO) Model, rooted in open systems theory as formalised by Katz and Kahn (1966), provides

a structured framework for analysing how barriers limit outcomes. In the context of flood risk management in Ward 10, the INPUTS (independent variables) include poor drainage systems, inadequate funding, weak institutional support, poor waste management, limited community awareness, lack of warning systems, weak enforcement, and poor coordination. These inputs interact with PROCESSES (intervening variables), namely community participation, environmental conditions, availability of resources, and local government policies, which shape the OUTPUTS (dependent variable). The output flood risk management effectiveness reflects how well the system functions under the influence of both barriers and mediating factors. Katz and Kahn's perspective strengthens the IPO framework by emphasising the importance of environmental exchanges and institutional responsiveness.

Research Gap

Although flooding in Kanyama Compound has been widely studied, important gaps remain for Ward 10 that this study seeks to address. Most research on flooding in Kanyama Compound has focused on the entire settlement or on Lusaka District as a whole, leaving Ward 10 under-researched despite being one of the most severely affected areas. Mukuma (2022) conducted spatial analysis of solid waste and flooding in Kanyama, but the analysis was not disaggregated at ward level. Similarly, Chitondo et al. (2024) examined disaster management in Zambia at national and provincial levels but did not generate ward-specific evidence. This absence of localised data has made it difficult to design effective drainage systems or provide accurate early warnings, resulting in interventions that do not meet the real needs of the most vulnerable residents. This study addresses this gap by generating primary data specifically from Ward 10, providing a granular evidence base for intervention planning.

MATERIALS AND METHODS

Description of the Study Area

Ward 10 is located in Kanyama Compound, approximately 7 kilometres west of Lusaka's Central Business District. The ward lies in a low-lying, flat terrain that makes natural water drainage difficult. It is densely populated, with 86,828 residents across 18,023 households (Zambia Statistics Agency [ZamStats], *2022, 2022 Census of Population and Housing: Lusaka District Report)*. Ward 10 is officially known as Garden Park Ward; for context, Kanyama Ward has 130,842 residents and Kanyama Constituency has 526,418 residents (ZamStats, 2022). The Sandy loam generally drains freely, so soil texture alone does not explain the drainage problem. Field observations during this study, together with residents' accounts, indicate that a shallow impermeable substrate and a high water table restrict infiltration across much of the ward, making engineered drainage systems essential. The ward experiences a humid subtropical climate with approximately 756 mm of rainfall annually, concentrated between November and March (*Climate-Data.org, 2023; Weather Atlas, 2023).* The location of Ward 10 is shown in Fig. 1.

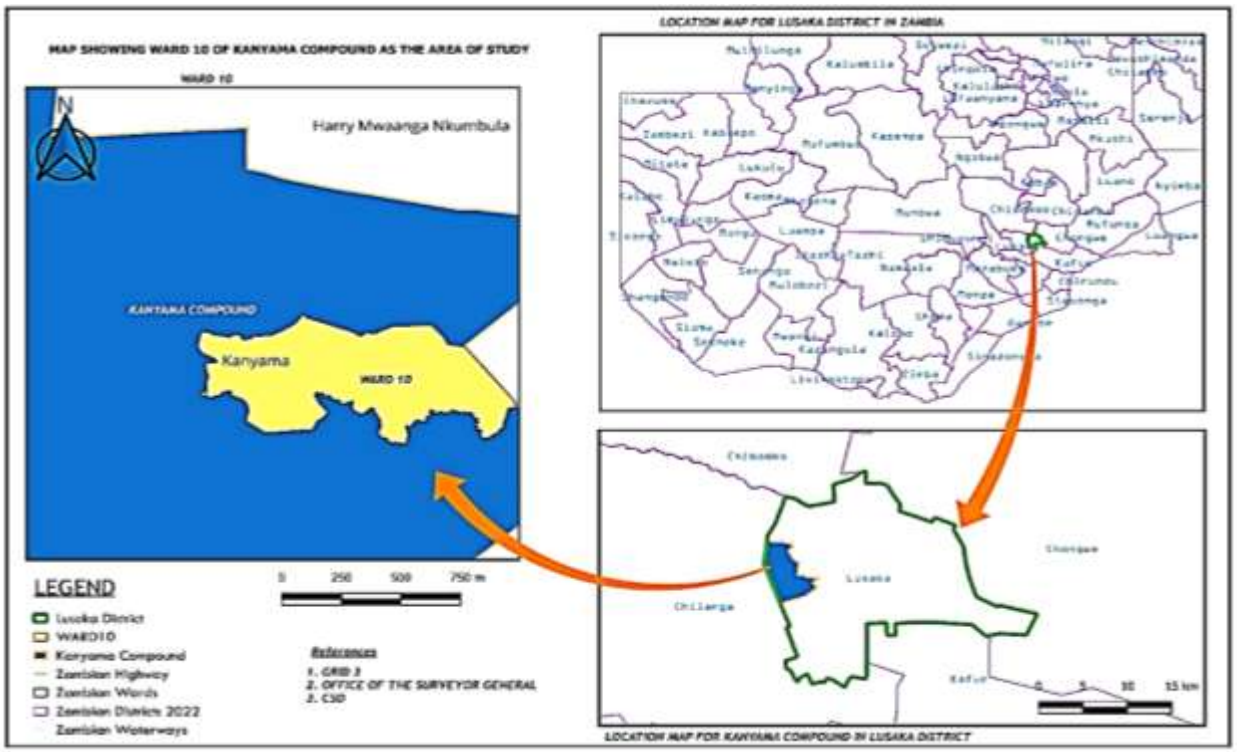


Fig. 1. Map showing the location of Ward 10 in Kanyama Compound, Lusaka District, Zambia.

Research Paradigm and Design

The study was guided by a pragmatic paradigm, using a convergent parallel mixed-methods design (Creswell, 2014). This paradigm was appropriate as the research aimed to combine measurable statistical data with the lived experiences of residents to provide a complete picture of the barriers limiting flood management. In this design, quantitative and qualitative data were collected simultaneously, analysed separately, and then merged during interpretation. Integration of the two strands was achieved through a joint display table comparing survey results with interview themes, enabling triangulation

and cross-verification of findings.

Population and Sampling

The target population consisted of 4,750 households classified as highly or moderately vulnerable to flooding in Ward 10, identified using historical flood records, topographical analysis, and a household vulnerability assessment conducted by the University of Zambia (2022), which classified the ward's 18,023 households (ZamStats, 2022) into three categories: highly vulnerable (3,500 households), moderately vulnerable (1,250 households), and low vulnerability (13,273 households, derived as the residual of the 18,023 total). Together, the highly and moderately vulnerable categories account for 4,750 households, and this group was deliberately isolated from the total ward household population to ensure that data collection focused exclusively on households with direct, recurring flood exposure.
Sample Size Calculation: Using Yamane's (1967) formula with a 12% margin of error, the sample size was calculated as follows:

$n = N / [1 + N(e)^2]$
$n = 4,750 / [1 + 4,750(0.12)^2]$
$n = 4,750 / [1 + 68.4]$
$n = 4,750 / 69.4$
n = 68 households

A 12% margin of error was chosen due to time and resource constraints, and this is acknowledged as a limitation of the study. To account for potential non-response, the researcher over-sampled by 10%, administering questionnaires to 75 households. An anticipated response rate of 85% was expected, based on similar studies conducted in informal settlements in Lusaka (Mulekwa et al., 2022; Mukuma, 2022). Non-response was managed by revisiting households up to three times on different days and times; if a household remained unavailable, the next household on the sampling interval was substituted to maintain the required sample size. Ultimately, 68 completed questionnaires were obtained.

Sampling Procedure

Stratified cluster sampling was used to select household heads for the quantitative survey. The ward was divided into six clusters based on natural boundaries, drainage patterns and community-defined blocks. Each cluster was then stratified into a high-risk or moderate-risk flood zone using local knowledge, historical flood data and environmental characteristics. Four clusters were randomly selected from the high-risk stratum and two from the moderate-risk stratum, proportionate to the relative distribution of flood impacts. Within each selected cluster, the number of households was estimated through transect walks, participatory mapping and consultations with local leaders, including members of the Ward Development Committee. From a randomly chosen starting point in each cluster, households were selected at a regular interval of $K = N/n = 4,750 \div 68 \approx 70$, meaning every 70th household was included. Table 1 summarises the number of households selected per cluster.

Table 1: Households Selected per Cluster

Stratum	Cluster	Estimated households	Households selected
High risk	Cluster 1	1,100	16
High risk	Cluster 2	950	14
High risk	Cluster 3	900	13
High risk	Cluster 4	850	12
Moderate risk	Cluster 5	600	8
Moderate risk	Cluster 6	350	5
Total		**4,750**	**68**

Source: Field Data, 2026.

For the qualitative component, expert purposive sampling was used to select five key informants. These included a representative from the Disaster Management and Mitigation Unit (DMMU) (C1), a Senior Planner from Lusaka City Council (C2), an NGO officer (C3), the Ward Councillor (C4), and a Ward Development Committee (WDC) Chairperson (C5). This sample size falls within the recommended range of four to twelve participants for homogeneous qualitative groups (Saunders, 2012). In total, the study involved 73 participants (68 households and 5 key informants), providing both statistical breadth and contextual depth.

Data Collection

Primary data were collected between January and March 2026 (the rainy season) using structured questionnaires, semi-structured interview guides, and an observation checklist. The questionnaire was designed to capture demographic data and specific barriers to flood management. Respondents were presented with a pre-set list of barriers (closed, multiple-response format) derived from the literature review and pilot study, and they were asked to identify all that applied. This format was chosen to facilitate statistical analysis and comparability, though it is acknowledged that it may constrain responses and introduce response bias. Open-ended questions were included to allow respondents to elaborate on their experiences and provide contextual detail.

Instrument Design and Pilot Testing: Content validity was ensured by designing all instruments in direct alignment with the study objectives and conceptual framework. Each question addressed the research problem, ensuring that all

independent variables (poor drainage, inadequate funding, weak institutional support, poor waste management, limited community awareness, lack of warning systems, weak enforcement, and poor coordination) were adequately measured. A pilot study was conducted in Ward 11 of Kanyama Compound, involving 10 households. The pilot assessed clarity, comprehension, time required (average 35 minutes), and cultural appropriateness. Feedback led to the rewording of five questions, the addition of three response options, and the reorganisation of question order.

Reliability: Cronbach's alpha test was used to check internal consistency. The pilot study yielded alpha values of 0.82 (Demographics), 0.88 (Barriers), 0.85 (Influencing Factors), and 0.79 (Practices Evaluation). All sections exceeded the acceptable threshold of 0.70 (Nunnally, 1978), confirming reliability. Test-retest reliability was applied to 10 respondents; the same questionnaire was administered two weeks apart, and high consistency was observed.

Data Collection Procedures

The researcher and trained assistants administered questionnaires and conducted interviews uniformly, using consistent instructions to reduce bias. Interviews were audio-recorded with consent and transcribed verbatim. The observation checklist was used during site visits to record physical and environmental conditions, including the presence, functionality, and condition of drainage channels, waste accumulation, housing quality, and evidence of flooding. Quotations from household respondents are labelled M1-1 to M1-31 (male respondents) and F2-1 to F2-37 (female respondents) and are drawn from open-ended questionnaire items. Key informant quotations are labelled Disaster Management and Mitigation Unit (DMMU) (C1-1), a Senior Planner from Lusaka City Council (C1-2), an NGO officer (C1-3), the Ward Councillor (C1-4), and a Ward Development Committee (WDC) Chairperson (C1-5). Verbatim spelling has been retained in direct quotations.

Data Analysis

Quantitative data were analysed using the Statistical Package for the Social Sciences (SPSS) version 26.0. Descriptive statistics, including frequencies and percentages, were used to summarise the identified barriers. Qualitative data from key informant interviews and open-ended questionnaire responses were analysed using inductive thematic analysis (Braun & Clarke, 2006). This involved transcribing responses, systematically coding the data, and grouping similar ideas into themes. The analysis followed six steps: familiarisation with the data, generation of initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report. To enhance credibility, the identified themes were validated through repeated review and comparison across different respondent groups.

Integration of Quantitative and Qualitative Findings: A joint display table was constructed to compare survey results with interview themes, enabling the identification of convergences and divergences. This integration allowed the study to determine whether findings confirmed, complemented, or contradicted each other, thereby strengthening validity and credibility through triangulation.

Trustworthiness and Ethical Considerations

To ensure robustness of qualitative findings, the study applied the four criteria of trustworthiness proposed by Lincoln and Guba (1985). Credibility was established through prolonged engagement in the field (three months), triangulation of data sources (questionnaires, interviews, observations), and member checking with key informants. Transferability was addressed by providing comprehensive descriptions of the study area, population characteristics, infrastructure, housing conditions, and participants' flood experiences. Dependability was maintained through systematic documentation of all research activities, including data collection procedures, coding frameworks, and analytical steps, supported by an audit trail. Confirmability was ensured through reflexivity and the use of direct quotations from participants.

Ethical clearance was obtained from Kwame Nkrumah University (dated 15 December 2025). Prior to data collection, participants were fully informed about the study's objectives, procedures, and their right to voluntary participation, including the option to withdraw at any stage without penalty. Written consent was obtained, and for those with limited literacy, the process was explained verbally in a language they understood, with signatures or thumbprints used to confirm agreement. Confidentiality was safeguarded by removing personal identifiers and securing all data, while results were presented in aggregated form to prevent individual identification.

Limitations

Several limitations should be considered when interpreting the findings. First, the sample size of 68 households with a 12% margin of error is considerably wider than the conventional 5%, limiting the generalisability of the findings. This was necessitated by time and resource constraints. Second, the study was confined to a single ward, which limits the applicability of findings to other wards or settlements. Third, the cross-sectional design captures a snapshot at a single point in time and cannot establish causal relationships. Fourth, the use of a pre-listed set of barriers may have introduced response bias by constraining respondents' answers to predetermined categories. Fifth, some respondents displayed resistance and were unwilling to share information freely, while others demanded payment before participating, which posed ethical and logistical challenges. Sixth, language barriers required the use of research assistants, potentially introducing minor interpretation errors. Seventh, although the Ward Councillor (C1-4) was interviewed, his views largely echoed those of C1-1, C1-2 and C1-5 and are therefore not quoted separately.

PRESENTATION OF RESULTS

Socio-Demographic Profile of Respondents

The study involved 68 household respondents, comprising 37 females (F2-1 to F2-37; 54.4%) and 31 males (M1-1 to M1-

31; 45.6%). The largest age group was 26–35 years (51.5%, n = 35), representing the prime working-age population. This was followed by respondents aged 36–45 (22.1%, n = 15), while the youngest group (18–25) accounted for 13.2% (n = 9). Respondents aged 46–55 and 56+ constituted 8.8% (n = 6) and 4.4% (n = 3), respectively.

Table 2: Socio-Demographic Profile of Respondents (N = 68)

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	31	45.6
	Female	37	54.4
Age Group	18–25	9	13.2
	26–35	35	51.5
	36–45	15	22.1
	46–55	6	8.8
	56+	3	4.4
Education	None	5	7.4
	Primary	7	10.3
	Secondary	8	11.8
	Tertiary	48	70.6
Employment	Formal	30	44.1
	Informal	11	16.2
	Unemployed	14	20.6
	Farming	6	8.8
	Student	5	7.4
	Other	2	2.9

Source: Field Data, 2026.

Educational attainment was relatively high, with 70.6% (n = 48) holding a college or university qualification. Tertiary education includes college, diploma and university qualifications. Formal employment refers to a paid job with a registered employer or regular salaried work. These figures should be interpreted with caution because the sample was drawn from highly and moderately flood-vulnerable households and may not represent the entire ward.

Objective i: Barriers Limiting Flood Risk Management in Ward 10

The findings established three distinct categories of barriers: infrastructural, governance, and socio-economic. Table 3 presents the infrastructural barriers

Table 3: Infrastructural Barriers Limiting Flood Risk Management

Specific Barrier	Frequency (n)	Percentage (%)
Absence of proper drainage	64	94.1
Blocked drains	52	76.5
Unplanned settlements	46	67.6
Poor waste management	9	13.2

Source: Field Data, 2026.
Note: N = 68. Percentages do not sum to 100% because respondents could identify multiple barriers.

The absence of proper drainage was the most frequently cited barrier (94.1%). *F2-9 lamented, "No drainages in the ward."* M1-2 further observed*: "Lack of proper drainage systems and people built in places where water should pass through."* M1-4 elaborated: "The major issue is lack of passage because water does not seep and sits on the rocks. When it rains, the water has nowhere to go." While Figure 2 shows a concrete-lined drainage channel, the barrier identified by respondents is the inadequacy, poor connectivity, and poor maintenance of existing drains rather than their complete absence in all areas.



Fig. 2. A drainage channel in Ward 10 completely blocked by solid waste and gravel.

Blocked drains were cited by 76.5% of respondents. M1-8 explained: *"Residents often dump waste in drains, with limited enforcement by council officers."* M1-12 described the cycle: "*Gravel roads wash away during rains, and the gravel covers and blocks the drains."* Unplanned settlements were identified by 67.6% of respondents. M1-5 observed: *"People are building unwanted structures where the drainage system should pass."*

Key Informant Perspectives on Infrastructural Barriers

The qualitative findings from key informants corroborated and elaborated on the survey results. C1-2 explained: *"Inadequate drainage infrastructure silted-up and undersized channels cannot cope with heavy rainfall. Ward 10 is rocky for drainages; the size of drainages is too small to accommodate heavy floods. It is difficult to construct drainage channels in the built-up areas."* C1-5 added: *"Garden Park is an unplanned settlement; hence people-built houses in waterways, creating barriers for the passage of water and causing floods."*

Observation Findings

Field observations confirmed the presence of severe drainage blockages. At one location, a concrete-lined drainage channel was completely filled with solid waste, including plastic bottles, bags, and construction debris, rendering it non-functional (**see Figure 2**). Observations also revealed stagnant water in residential areas following heavy rainfall, with water pooling around housing structures and creating conditions conducive to disease transmission **(see Figure 3)**.



Fig. 3. Stagnant water in a residential area of Ward 10 following heavy rainfall.

Governance Barriers Limiting Flood Risk Management

Table 4: Governance Barriers Limiting Flood Risk Management

Barrier	Frequency (n)	Percentage (%)
Weak enforcement	56	82.4
Lack of funding	53	77.9
Limited community participation	50	73.5
Poor coordination among stakeholders	48	70.6

Source: Field Data, 2026.

Note: N = 68. Percentages do not sum to 100% because respondents could identify multiple barriers.
Weak enforcement was identified by 82.4% of respondents. F2-1 remarked: *"Leaders are not strict enough to punish the rule breakers."* M1-11 added: *"There is no one to enforce whatever rules are there."* F2-22 further explained: *"Delays in approving projects and lack of seriousness from some partners undermine enforcement. People throw garbage in drains because there are no consequences."*

Lack of funding was cited by 77.9% of respondents. C1-2 explained: *"CDF is far less for drainage projects. Ward 10 is rocky; digging proper drainage needs a lot of money and proper machinery."* M1-29 recommended: *"Drainage should be funded by central government through RDA as a capital project."*
Limited community participation (73.5%) was linked to survival needs. M1-6 observed: *"People are not participating because we need money to get rid of floods."* C1-5 explained: *"Through participation in making drainages and reporting incidents, the community tries, but lack of proper tools makes it difficult."*
Poor coordination (70.6%) was highlighted by F2-22: *"Uncoordinated efforts between council, NGOs, and residents."* C1-3 provided a more nuanced view: *"The government has been relocating people who built in drainages. NGOs like JICA are the most reliable; they helped with the drainage master plan and funding. We work with councils, WDC, and the community."* However, C1-3 noted failures: *"Delays in approving projects and lack of seriousness from some partners."*

Key Informant Perspectives on Governance Barriers:

C1-2 confirmed: *"No much engagement between Government, NGOs, and community. But they have worked and collaborated with donors such as JICA. With locals, they work hand in hand with councillors, residents, and the Ward Development Committee."* On enforcement, C1-1 stated: *"The Government has been relocating or paying off those people who built where the drainages pass. Sensitisation has been conducted through megaphones and leaflets and through meetings organised by the Ward Development Committees to educate people on the dangers of blocking the flow of water and building on the waterways."*

Socio-Economic Barriers Limiting Flood Risk Management

Table 5: Socio-Economic Barriers Limiting Flood Risk Management

Barrier	Frequency (n)	Percentage (%)
Poverty	54	79.4
Poor housing conditions	48	70.6
Unemployment	45	66.2

Source: Field Data, 2026.

Note: N = 68. Percentages do not sum to 100% because respondents could identify multiple barriers.

Poverty was a dominant theme (79.4%). M1-4 explained: *"Poverty affects flood management as people put up structures even in flood-prone areas."* M1-11 stated: *"Poor households cannot register for garbage collection and prefer to dispose garbage anyhow."* C1-5 added: *"Poverty forces people to live in low-income, high-risk areas because land is cheaper there. The area is already built; displacing people is a huge challenge."*

Poor housing conditions (70.6%) were cited by a majority of respondents. M1-2 stated*: "Poorly built housing, lack of drainage, and poor waste management worsen flood impact."* M1-22 added: *"Houses made of weak materials collapse or allow water entry during floods."* F2-34 observed: *"This is a direct result of poverty; there is no money for flood-resistant materials."*

Unemployment (66.2%) was highlighted by respondents. M1-14 stated: *"Unemployment means people are starved and living in frustration. They can't participate in flood management."* F2-34 added: *"Unemployment reduces both financial capacity and time for community initiatives."*

Integration of Quantitative and Qualitative Findings

Table 6: Display of Survey Results and Interview Them

Barrier	Survey Findings	Key Informants	Convergence/Divergence
Infrastructural	Absence of proper drainage (94.1%); blocked drains (76.5%)	Inadequate, silted-up, undersized channels; rocky terrain prevents infiltration (C1-2, C1-5)	Convergent: both confirm drainage deficit as critical
Governance	Weak enforcement (82.4%); lack of funding (77.9%)	Institutional fragmentation; CDF insufficient; delays in project approval (C1-1, C1-2, C1-3)	Convergent: both highlight governance failures
Socio-economic	Poverty (79.4%); poor housing (70.6%)	Households cannot afford flood-resistant materials; displacement challenging (C1-5)	Convergent: both confirm poverty as a major underlying factor

Source: Field Data, 2026.

The joint display table demonstrates that the quantitative and qualitative findings converge on all major themes. The survey data and key informant interviews both identify drainage deficits, governance failures, and socio-economic constraints as the primary barriers. The observation findings provide visual confirmation of these barriers, particularly the severe blockage of drainage channels and the presence of stagnant water in residential areas.

DISCUSSION OF RESULTS
Infrastructural Barriers

The study's finding that the absence of proper drainage is the most frequently cited barrier (94.1%) highlights a fundamental failure in urban planning and public works. Ward 10's physical geography exacerbates this deficiency. Because the area sits on flat, rocky terrain with sandy loam soils, natural water infiltration is nearly impossible. Without engineered channels to create artificial gradients, rainwater has nowhere to go but into residential areas. This situation mirrors the broader African context described by Douglas et al. (2008), who noted that drainage networks in many cities are either non-existent or designed for historical rainfall patterns that no longer apply.

Furthermore, the finding that 76.5% of respondents cite blocked drains demonstrates that even the minimal infrastructure that does exist is poorly maintained. This creates a direct link between solid waste management and flood risk. When households reported limited access to municipal waste collection, they resorted to dumping garbage in open spaces and drainage channels. As Mukuma (2022) observed in Kanyama, this accumulation of solid waste acts as a physical dam, reducing the capacity of drains to carry water. The presence of unplanned settlements (67.6%) compounds this issue, as structures are often built directly over natural waterways or drainage reserves (Fig. 4). This physical encroachment not only blocks water flow but also makes retrofitting proper drainage systems logistically difficult and expensive.



Fig. 4. An unplanned settlement in Ward 10 where structures block natural water pathways.

The observation findings which documented a concrete-lined drainage channel completely filled with solid waste provide visual confirmation of these survey results. This aligns with C1-2, who noted that "drainages are there but not enough to channel water" and "drainages are constructed but not in all danger spots for water."

Governance Barriers

The governance barriers identified in this study reveal a significant disconnect between national policies and local realities. Weak enforcement of rules was cited by 82.4% of respondents, reflecting a phenomenon that institutional theorists describe as "institutional thinning" (Béné et al., 2012). This occurs when the presence and effectiveness of state institutions diminish as one moves from formal city centres to informal peripheries. Although laws exist to prevent construction on drainage reserves and illegal dumping, the local council lacks the staff, resources, and political backing to enforce them. This creates an environment of impunity where residents feel compelled to break rules for survival because they see no consequences for others doing the same.

The lack of funding (77.9%) is a structural barrier that cannot be resolved at the local level. Residents recognise that the Constituency Development Fund (CDF) and local municipal budgets are insufficient to construct the large-scale, capital-intensive drainage networks required. This financial deficit forces communities to rely on temporary, reactive measures like seasonal clean-up campaigns, which Satterthwaite et al. (2020, p. 149) characterise as "incremental, often small-scale, and sometimes cosmetic" interventions that create an illusion of progress without altering underlying risks. Poor coordination among stakeholders (70.6%) further undermines governance. When the council, NGOs, and community leaders do not coordinate their efforts, resources are duplicated, and critical maintenance tasks fall through the cracks, leaving the community vulnerable year after year.

Socio-Economic Barriers

The socio-economic barriers, particularly poverty (79.4%), appear to be a major underlying factor in the cycle of vulnerability. Poverty limits the choices available to households. It is associated with families living in low-cost, high-risk areas because they cannot afford safer land. It prevents households from investing in flood-resistant housing materials, such as elevated foundations or concrete walls, which is why 70.6% of respondents identified poor housing conditions as a significant barrier. When floods occur**,** poorly constructed homes made of weak materials collapse easily, leading to displacement and asset loss.

Unemployment (66.2%) is intrinsically linked to this vulnerability. With high unemployment rates, residents are primarily focused on daily survival. This economic precarity leaves little time, energy, or financial resources for community-level flood management activities. As M1-14 noted, people cannot participate in flood management when they are *"starved and living in frustration."* Consequently, the very people who are most affected by flooding are often the least equipped to participate in mitigation efforts, creating a self-perpetuating cycle of risk.

The finding that 70.6% of respondents held college or university qualifications is notable for an informal settlement. This suggests that education alone does not translate into flood resilience. F2-34 captured this paradox: *"I have a degree, but I cannot afford to move. Poverty forces even us educated people to live in high-risk zones."* This indicates that structural constraints lack of drains, weak enforcement, poverty are the real issues, not lack of awareness.

Systemic Interaction of Barriers

The findings of this study strongly support the application of General Systems Theory (von Bertalanffy, 1968) to urban flood risk. The barriers identified are not isolated variables; they are deeply interconnected components of a complex system. Poverty contributes to unplanned settlements, which obstruct drainage and complicate waste management. The resulting blockages cause floods, which destroy the weak housing of the poor, thereby deepening their poverty. Simultaneously, governance failures such as weak enforcement and lack of funding allow this cycle to continue by failing to provide the necessary infrastructure and regulatory oversight.

This systemic interaction means that isolated technical interventions, such as digging a single drain or running a one-off clean-up campaign, are destined to fail. They do not address the structural roots of the problem. To build genuine resilience in Ward 10, interventions must be multi-faceted and coordinated. Addressing the infrastructure deficit requires addressing the governance failures that prevent funding and enforcement. Similarly, improving infrastructure must go hand-in-hand with socio-economic interventions that alleviate poverty, ensuring that residents have the capacity to maintain the systems and recover from future shocks.

The Input-Process-Output (IPO) framework (Katz & Kahn, 1966) further illuminates this dynamic. The inputs (barriers) interact with processes (community participation, environmental conditions, resources, policies) to shape outputs (flood risk management effectiveness). The study found that current processes temporary drain digging (83.8%), clean-up campaigns (77.9%) are not sufficient to transform the serious inputs into positive outputs. As F2-6 stated: *"We make simple paths for the floods,"* while M1-31 noted: *"They only do seasonal maintenance which is not sustainable."* C1-2 confirmed: "*Everything is washed away when the rains come."* These processes are reactive, periodic, and labour-intensive, lacking formal support and sustainability.

Comparison with Other Studies

The findings of this study align with research from other African informal settlements. In Kibera, Nairobi, residents face similar challenges of inadequate drainage, weak enforcement, and poverty (Mulligan, 2017). In Makoko, Lagos, community-driven adaptation strategies have enabled residents to cope with recurrent flooding despite limited formal support (Di Caprio, 2018; Odunsi & Momodu, 2024). However, important differences distinguish Ward 10. First, topographical constraints rocky terrain preventing water infiltration require localised solutions, unlike Khayelitsha's wetland encroachment or Kibera's river proximity (Birkmann et al., 2013; Mulligan, 2017). Second, flood management in Ward 10 remains top-down, contrasting with community-responsive models in Kibera where participatory projects integrate community input (Kounkuey Design Initiative, 2024). Third, gender dynamics differ: in Makoko, women play active roles in community flood governance using traditional knowledge (Di Caprio, 2018), while Ward 10 women's coping remains largely

domestic. Fourth, stakeholder coordination is weaker in Ward 10 (70.6% cited fragmentation) compared to Nairobi and Lagos, where diverse actors collaborate effectively (Mulligan, 2017; Silumbwe, 2025).

CONCLUSION AND RECOMMENDATIONS

Conclusion

The study concludes that flood risk management in Ward 10 is fundamentally limited by a tripartite failure: infrastructure failure, characterised by the absence of permanent drainage (94.1%), blocked drains (76.5%), and unplanned settlements (67.6%); governance failure, manifested through weak enforcement (82.4%), chronic underfunding (77.9%), and poor coordination (70.6%); and socio-economic failure, arising from poverty (79.4%), unemployment (66.2%), and poor housing (70.6%). These barriers are not isolated but are deeply interconnected, acting as a continuous cycle that prevents effective flood management and leaves residents vulnerable.

The high education level (70.6% tertiary) has not reduced vulnerability because structural deficits nullify individual knowledge. Without a systemic shift from temporary measures to permanent infrastructure, from weak to consistent enforcement, and from reactive relief to proactive risk reduction, flooding will continue to devastate Ward 10. This paper has focused exclusively on establishing these barriers; subsequent papers will examine how they influence flood risk management practices and evaluate existing practices.

Recommendations

Based on the findings, the following measures are recommended:

Catchment-wide drainage master plan: The absence/inadequacy of proper drainage was cited by 94.1% of respondents, and blocked drains by 76.5%. The Lusaka City Council, in collaboration with the Road Development Agency and development partners, should develop and implement a catchment-wide drainage master plan for Ward 10. The RDA should be involved because stormwater drainage requires capital-project funding and engineering capacity beyond the local CDF allocation.

Strengthen enforcement of land-use and waste-disposal regulations: Weak enforcement was cited by 82.4% of respondents. The Lusaka City Council should allocate enforcement staff and resources to prevent construction on drainage reserves and illegal dumping in drains.

Establish a multi-stakeholder flood risk management committee: Poor coordination was cited by 70.6% of respondents. A committee comprising the council, DMMU, NGOs, the Ward Councillor, the WDC and community representatives should coordinate planning, implementation and maintenance.

Increase and ring-fence funding for drainage: Lack of funding was cited by 77.9% of respondents. Central government, through the RDA and CDF, should provide dedicated funding for drainage construction and maintenance.

Community participation and waste management: Limited community participation was cited by 73.5% of respondents. Community sensitisation, waste-collection services and participatory drain maintenance should be strengthened.

Future research: Future studies should consider hydrological modelling of the Ward 10 catchment, longitudinal monitoring of flood risk, and comparison across wards in Lusaka.

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