MAKERERE UNIVERSITY

COLLEGE OF ENGINEERING, DESIGN, ART AND TECHNOLOGY

SCHOOL OF THE BUILT ENVIRONMENT

DEPARTMENT OF ARCHITECTURE AND PHYSICAL PLANNING

RESEARCH TOPIC:

THE IMPACT OF POOR MANAGEMENT OF EXCESS STORM WATER ON HOUSING IN KAMPALA CAPITAL CITY:

A Case Study of Nalukolongo Zone, Lubaga Division, Kampala Capital City.

BY

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A DISSERTATION SUBMITTED TO THE DEPARTMENT OF ARCHITECTURE AND PHYSICAL PLANNING IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF BACHELORS OF URBAN AND REGIONAL PLANNING OF MAKERERE UNIVERSITY

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DEDICATION

I dedicate this research to everyone who will find it purposeful for academic reasons. Furthermore, I dedicate this research to my beloved parents and relatives who have rendered tremendously in the accomplishment of the research project through their support given to me of all kind whether financial or words of encouragement and also dedicate it to my lecturer/supervisor Mr. Derek A. B. Muhwezi.

DECLARATION

I MUGANYI IVAN, solemnly declare to the best of my knowledge that I am the author of this research and any assistance I received in its preparation is fully acknowledged and disclosed in the report. I have cited the sources from which I used the data and it has never been submitted to any institution for the award of a degree in my course. I also certify that this report was prepared by me specifically for the partial fulfillment of the bachelor's degree of Urban and Regional Planning at Makerere University.

MUGANYI IVAN

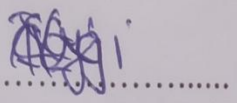
Registration Number

17/U/18849

Date

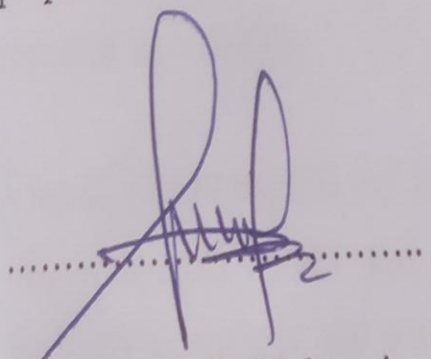
21ST/OCT/2021

Signature



APPROVAL

This is to certify that MUGANYI IVAN has submitted his dissertation for the partial fulfillment for the award of the bachelor's degree of Urban and Regional Planning at Makerere University and he was under proper and close supervision by the academic supervisor.



29/3/2022

Mr. Derek A. B. Muhwezi

Date

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For the purpose of finishing this report and the research activity at large, I would like to extend my sincere gratitude to those who contributed directly and indirectly to my undertaking for their so doing.

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ABSTRACT

The purpose of this study is to explore the ways in which the poorly managed excess storm water affects the housing conditions in Nalukolongo zone, Lubaga division, Kampala capital city. The study seeks to answer the research questions; which areas are prone to excess storm water in Nalukolongo? What are the means by which storm water is managed in Nalukolongo? What is the impact of excess storm water on housing? And then suggest possible solutions/ recommendations to those impacts on housing in Nalukolongo zone.

The research is engulfed in five chapters and each chapter details a specific theme based on the research objectives. The chapters stand on their own though intertwined to give a chronological flow of the research findings, recommendations as well as conclusion

In chapter one, it explains the general introduction for the research study containing the topic of study, study objectives, research questions, scope of the study, statement of the problem, significance of the study and justification of the study.

In chapter two, it explains the existing literature written by different scholars prior the research study on different aspects related to the objectives of study in line with different objectives.

Chapter three outlined and justified the research methodology implemented in this research study and its validity. Because of the nature of the research, the author opted for the qualitative strategy, bound by interpretivist approach. The key research tools were questionnaire, supplemented by interviews with severe groups of participants*;* Community members (general and specific), Government officials (technical and politician), Others (NGO's and institutions). The participants are carefully targeted and recruited through stratified sampling technique. The results will be analyzed manually, due to the small sample of participants.

In chapter four, it shows the findings obtained from the study after the various field visits, conversations with the concerned stake holders and table work to analyze data to come up with the representative data that is ought to be useful to all who will come across this research.

In chapter five, it is about the recommendations made to the different stakeholders regarding poor management of excess storm water and its effects on housing in Nalukolongo such as the central government(Ugandan government), Urban authorities(KCCA and Lubaga division) and the entire community so as the problem is managed. And then conclusion of the research study.

ACRONYMS AND ABBREVIATIONS

% - Percentage

CDR – Carbon Disclosure Report

EIA – Environmental Impact Assessment

GIS – Geographical Information System

GKMA – Greater Kampala Metropolitan Area

Ha – Hectares

ICT – Information Communication Technology

KCCA – Kampala Capital City Authority

KIIDP – Kampala Institutional and Industrial Project

KM^2 – Square kilometers

M – Meters

m^3 – Cubic meters

mm – Millimeters

MoWE – Ministry of Water and Environment management

NEMA – National Environmental Management Authority

NGOs – Non Government Organisations

NWSC – National Water and Sewerage Corporation

^oC – Degrees Celicius

^oF – Degrees farhnite

STW – Sewerage Treatment Works

TVs – Televisions

U.K – United Kingdom

U.S – United States

UN – United Nations

DEFINITION OF KEY TERMS

Bronze Age – Period between 3,300 – 1,200 BC.

Climate change – Variation in the generation weather conditions of a place for a long period of time between 10 – 35 years.

Development – Any construction/ improvement made on land such as buildings.

Drainage channel – Trough/ basin through which storm/waste water flows.

Dredging – Scooping out mud, rubbish and weed from a bed.

Enforcement – Ensuring compliance with laws, regulation, rules and standards.

Flooding – Overflow of a body of water especially onto normally dry land.

Housing – The construction and assigned usage of houses or building collectively for the purpose of sheltering people.

Liquid waste – liquids such as waste water, fats, oils, sludge and other hazardous household liquids.

Low-lying area – Area at, near or below sea level.

Population – All the inhabitants of a particular place.

Solid waste – range of garbage materials both human and animal influence.

Storm water – Water that comes from precipitation and snow melt.

Stratified sampling – Form of sampling which involves grouping of sample population into groups.

Temperature range – Difference/ variation in temperature.

Water volume – Amount of water per cubic meter.

Wetland – Area where water covers the soil, or is present either at or near the surface of soil for varying periods of time.

TABLE OF CONTENT

CHAPTER ONE

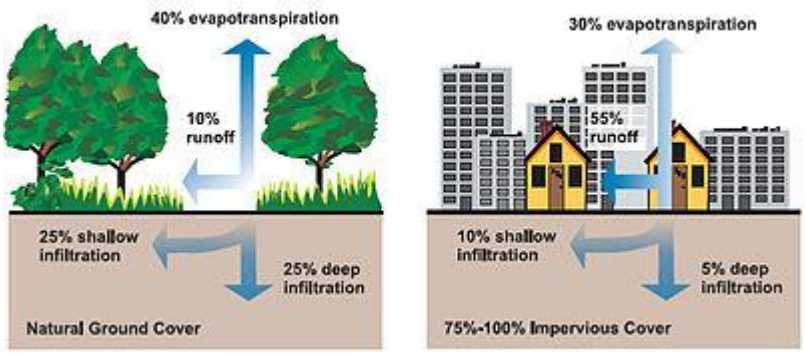
GENERAL INTRODUCTION

This research undertaking is intended to tackle the continuous challenges brought by poor management of excess storm water within Nalukolongo, one of the areas along Nalukolongo drainage channel in Rubaga division which is prone to flooding due to overflow of this channel and its location in lowland/ swampy urban area and it is this excess storm water that is poorly managed and affects housing and people's standards of living within this locality which prompted this research study.

1.1 BACKGROUND OF THE RESEARCH STUDY

Storm water, also spelled storm water, is water that originates from rain, including snow and ice melt. Storm water can soak into the soil (infiltrate), be stored on the land surface in ponds and puddles, evaporate, or contribute to surface runoff. Most runoff is conveyed directly to nearby streams, rivers, or other water bodies (surface water) without treatment according to ***Baltimore (2016)***.

In natural landscapes, such as forests, soil absorbs much of the storm water. Plants also reduce storm water by improving infiltration, intercepting precipitation as it falls, and by taking up water through their roots. In developed environments like Nalukolongo, unmanaged/ poorly managed storm water can create two major issues; one related to the volume and timing of runoff (flooding) and the other related to potential contaminants the water is carrying (water pollution).



With less vegetation and more impervious surfaces (parking lots, roads, buildings, compacted soil), developed areas allow less rain to infiltrate into the ground, and more runoff is generated than in the undeveloped condition. Additionally, conveyances such as drainage channels and storm sewers quickly transport runoff away from commercial and residential areas into nearby water bodies. This greatly increases the volume of water in waterways and the discharge of those waterways, leading to erosion and flooding. Because the water is flushed out of the watershed during the storm event, little infiltrates the soil, replenishes groundwater, or supplies stream base flow in dry weather.

Storm water is a major cause of flooding. Flooding is the inundation of land or property in a built-up environment caused by storm water overwhelming the capacity of drainage systems, such as storm sewers/drainage channels. Although triggered by single events such as flash flooding or snow melt, flooding is a condition, characterized by its repetitive, costly and systemic impacts on communities. In areas susceptible to flooding, backwater valves and other infrastructure may be installed to mitigate losses.

Where properties are built with basements, flooding is the primary cause of basement and sewer backups. Although the number of casualties from flooding is usually limited, the economic, social and environmental consequences can be considerable: in addition to direct damage to property like houses and infrastructure (highways, utilities and services), chronically wet houses are linked to an increase in respiratory problems and other illnesses according to *Schueler, Thomas R.* Sewer backups are often from the sanitary sewer system, which takes on some storm water as a result of Infiltration/Inflow.

Flooding has significant economic implications. In the U.S, industry experts estimate that wet basements can lower property values by 10 to 25 percent and are cited among the top reasons for not purchasing a home. According to the Federal Emergency Management Agency almost 40 percent of small businesses never reopen their doors following a flooding disaster. In the UK, urban flooding is estimated to cost £270 million a year (as of 2007) in England and Wales; 80,000 homes are at risk.

Since humans began living in concentrated village or urban settings, storm water runoff has been an issue. During the Bronze Age, housing took a more concentrated form, and impervious surfaces emerged as a factor in the design of

early human settlements. Some of the early incorporation of storm water engineering is evidenced in Ancient Greece.

A specific example of an early storm water runoff system design is found in the archaeological recovery at Minoan Phaistos on Crete.

For the case of Nalukolongo, is located in a lowland and swampy urban area with Mutundwe and Kabowa in its neighborhood where water flows from during drop offs towards Nalukolongo drainage channel through its tributaries and its storm water in large amount that is poorly managed and overwhelms the drainage system hence flooding and it causes a great impact on housing and according to , Minister of State for Kampala Benny Namugwanya Bugembe, In her state of flooding in Kampala report to Parliament in June 2019 explained that the hilly terrain of the city implies that water quickly flows from the catchment areas into primary and secondary channels located at the lowest points. And this running water is what has become a nightmare for city dwellers.

1.2 STATEMENT OF THE PROBLEM

Nalukolongo zone is one of the areas in Kampala city which experiences excess storm water during heavy downpour and this storm water has posed a big threat to human living conditions on several occasions whereby it brings about flooding due to poor management of this excess storm water hence it enters into people's houses bringing various challenges, according to Daily monitor, 2020, "Reports of people dying in collapsed buildings and drowning in storm water are expected usually between September to November and March to May" and it has also claimed lives of many city dwellers for example last year, a one Cissy Namukasa(56) downed in floods/storm water in Kampala city according to Patrick Onyango, Police spokesperson.

The number of people drowning due to flooding is projected to increase as Kampala city (Nalukolongo inclusive) faces a shocking rise in climate change-related risks. This is according to a report; ***"The water risk scenarios estimate research"*** conducted by the World Wide Fund for Nature and launched ahead of the World Cities' Day 2020, the reports puts Kampala on the list of 100 other cities that are expected to suffer the greatest rise in water risk problems by 2050. The risks include flooding, drowning, prolonged hot seasons and water scarcity, among others. The report further reveals that Kampala faces the 7th

highest increase in the water risks above for cities across Africa with a 10% rise by the year 2050.

1.3 PURPOSE OF THE RESEARCH STUDY

To study the impact of poorly managed excess storm water on housing in Nalukolongo and provide solutions to this problem so as to improve the housing and living conditions of people live in Nalukolongo.

1.4 OBJECTIVES OF THE RESEARCH STUDY

1. To identify the areas which are prone to excess storm water in Nalukolongo.
2. To assess the causes why excess storm water stays longer in Nalukolongo.
3. To examine the means by which storm water is managed in Nalukolongo.
4. To examine the impact of excess storm water on housing.
5. To suggest possible solutions/recommendations to problems caused by excess storm water on housing.

1.5 RESEARCH QUESTIONS TO GUIDE IN THE RESEARCH STUDY

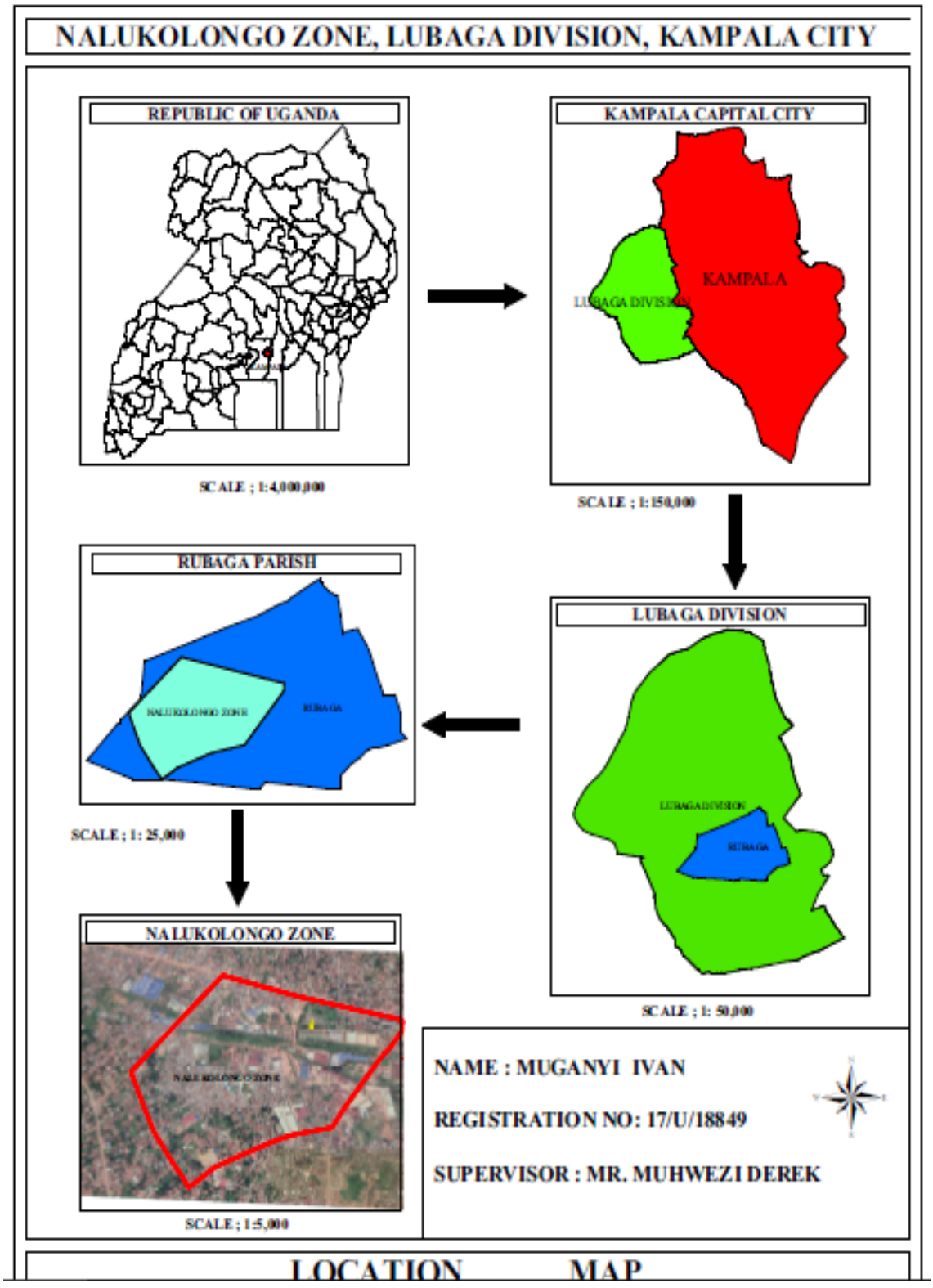
During my research undertaking in Nalukolongo area in regard with the stated topic above, the following research question will be very vital in guiding me at the different stages of research;

a) Which areas are prone to excess storm water in Nalukolongo?
b) What are the causes why excess storm water stays longer in Nalukolongo?
c) What are the means by which storm water is managed in Nalukolongo?
d) What is the impact of excess storm water on housing?

1.6 SCOPE OF WORK

The research study is to be carried out spatially covering Nalukolongo cell, Rubaga parish, Lubaga division, Kampala capital city particularly concerning with the poor management of excess storm water as the contextual study topic and how this has affected the housing conditions of the dwellers with the involvement of the residents of the area of study and their local leaders. Below is the location map of Nalukolongo;

Map 1: Location of Nalukolongo Zone within Lubaga division, Kampala Capital City.



Source: Digitalization 2021

1.7 SIGNIFICANCE OF THE RESEARCH STUDY

The research study will be relevant firstly, to Makerere University particularly the department of Architecture and Physical Planning in that it will be used for reference purposes by fellow students and academia in the same program since it is a supplement to earlier knowledge/research that was carried out in line to storm water management and housing aspect and consideration of storm water management as a major aspect of planning for housing and living standards.

The research study will also be of much relevant to the community of Nalukolongo and neighboring communities experiencing the same problem like Nateete and others whereby through and after the study, possible solutions will be generated and recommendations made which will help improve the housing and living conditions in the area particularly Nalukolongo.

This research study will also be of great value to Kampala Capital City Authority which is the governing body of Kampala Capital City and Lubaga division inclusive where Nalukolongo is a subordinate in that after the study, recommendations made will guide it in the best way to manage the excess storm water that is generated so as to mitigate the likely negative impact on housing.

1.8 JUSTIFICATION OF THE STUDY

The research study on the impact of excess storm water on housing in Nalukolongo, Kampala city is motivated by the fact that during heavy downpours, excess storm water is a nightmare to the residents of Nalukolongo and nearby areas of Nateete, Ndeeba and Wankulukuku whereby during rainy seasons, those areas experience floods which affect housing standards of people and it also pose threats to human life in those areas which has prompted me as a scholar to carryout research in this area since it's my locality where have experienced all the challenges of storm water myself and also the need to create a positive impact in the development of this area of study.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION TO LITERATURE REVIEW

Kampala city (Nalukolongo) has experienced a lot of excess storm water that have adversely affected the housing conditions. The arrival of thousands of in-migrants year after year has overwhelmed the area's ability to deliver adequate, quality and standard housing. Unplanned, densely populated informal settlements that lack basic water, sewer, and waste services now cover much of Nalukolongo land area. Climate change is placing further strains on Nalukolongo ability to manage the excess storm water. Increasing levels of rainfall from climate change contribute to excess storm runoff levels that exceed the capacity of the area's drainage infrastructure, causing flooding and the spread of pollution. Such conditions have degraded the housing standards in the area by depleting the houses.

The Urban Environmental Profile for Kampala has been prepared as the first component of the assignment "Promoting Green Urban Development in Africa: Enhancing the Relationship Between Urbanization, Environmental Assets and Ecosystem Services," a project being conducted under the leadership of the World Bank. An overall objective of this project is to link the study of urban environmental issues with the advancement of more sustainable urban growth. The Profile summarizes the existing quality of the wetlands and other aquatic and terrestrial environmental assets, identifies the key drivers that are the cause of their vulnerability, and describes the key institutional challenges and constraining factors that limit the city's ability to address environmental management challenges.

There have been various studies carried earlier by different scholars and researchers about different environmental aspects that are adversely affecting the living conditions of people in Kampala such as adaptation of Kampala to climate change given the large population of urban poor, the un-serviced informal settlements, and inadequate urban services in general (Lwasa, 2010), drainage and transportation, urban green environment, slum development in Kampala suburbs and others but one thing has not been studies and that the impact of poorly managed excess storm water on housing in Nalukolongo as a case in point.

This study is going to extensively look into areas which are prone to excess storm water, the factors responsible for the generation of excess storm water in Nalukolongo, the means by which storm water is managed, the impact of excess storm water on housing in Nalukolongo, Kampala city and after suggest possible solutions.

2.2 HAZARD PRONE AREAS TO EXCESS STORM WATER IN NALUKOLONGO

The city of Kampala developed on hills linked by wide valleys of wetlands and river channels that flow into the Murchison Bay on Lake Victoria. Kampala has grown outward from the urban center along upland corridors, with development spreading down the slopes of the city's 24 hills into the low-lying wetland areas. This growth has led to an increasingly inefficient pattern of development that encroaches into wetland areas. This pattern has furthermore presented difficulties for provision of drainage, flood control, adequate sanitation and environmental asset protection in addition to proving costly for the government to service (KCCA, 2013; Fichtner, 2014).

About 23% of the Greater Kampala Metropolitan Area (GKMA) is fully urbanized, a significant portion (60%) is semi-urbanized, and the remainder consists of rural settlements. By contrast, the KCCA is almost entirely developed, with less than 10% of the land mass vacant. Approximately 7% of the GKMA area is wetlands (KCCA, 2012). A consequence of rapid urbanization has been the overall decline in the quality of the urban natural environment. The impacts of climate change have exacerbated the rate and extent of environmental degradation and have made the city's efforts toward environmental management all the more challenging.

Kampala spatial development from 1989 to 2010 and prior to 1989, most development occurred within upland areas of the urban core and along major transportation corridors, which represented 27% of KCCA's total land area (Abebe, 2013). With the increase in population, particularly the in-migration of the rural poor, development spread to unplanned areas on the lower slopes and low-lying drainage corridors and marginal areas: areas are often prone to flooding and are environmentally vulnerable.

From 1989 to 2010, the area of developed land increased from 27% to 78% (Abebe, 2013). The majority of Kampala's urban development has been

residential, which covers approximately 23% of the GKMA landmass (over 60% of the total developed areas in the GKMA) and approximately 64% of the KCCA land area. Employment associated land uses account for 3% of the GKMA land area and 10% of the KCCA. Public services and facilities land uses are 2% of the GKMA and 6% of the KCCA (KCCA, 2012).

A recent survey estimated that 40% of the city population, and much of the recent migration, live in informal settlements and/or slums like Nalukolongo which lack basic infrastructure services for the provision of water, storm drainage, sewage treatment, and solid waste collection (KCCA, 2012). While an array of practical and social factors have driven informality, the demand for affordable and accessible housing has been key. Planning scenario projections indicate that the demand for land could vary between 200,000 ha in the worst case scenario to around 100,000 ha in the best case scenario by 2040. The dense informal settlements predominate at the edges of the wetland corridors throughout the city and, have become one of the key drivers of environmental degradation of the water quality in wetlands and drainage courses.

2.3 CAUSES WHY EXCESS STORM WATER STAYS LONGER IN NALUKOLONGO

As Kampala is located near the equator, there is little fluctuation in the average temperature throughout the year. Temperatures range from average lows in the mid-60s ^{o}F to average highs in the low 80s ^{o}F. However, the tropical rainforest climate provides variation, with two annual wet seasons. There is a long rainy season from August to December and a short rainy season from February to June that has substantially heavier rainfall per month. The average annual rainfall is between 1,750mm and 2,000 mm, with monthly rainfall ranging from approximately 50mm to 260mm (World Meteorological Organization, 2013 in UN Habitat 2013)

Recent climate projections for Uganda conclude that while overall rainfall totals for the country may remain similar to the present, and Kampala's total rainfall may decrease, the seasonality of rainfall may see a longer wet season that extends from September through to the start of the February rainy season (Baastel, 2014, Baastel, 2014b). "*Projected climate change impacts for Kampala anticipate an increase in temperature and decrease in overall precipitation, threatening water supplies" (Baastel, 2014).*

Recent analysis focused on Kampala suggests a temperature increase of 1.5ºC to 3.0ºC by 2095 and a 20 mm decrease in precipitation by 2095 under a moderate greenhouse gas emissions projection. (Baastel, 2014). Furthermore, a rise in mean annual temperatures could intensify an urban heat island effect that where built-up areas absorb and generate more heat than nearby rural areas. This combination of higher temperatures could strain water resources by reducing flows and degrading quality.

Kampala City has already experienced an increase in rainfall during extreme climate events. Rainfall data being developed at a weather station installed at Kampala's Makerere University as part of a flood modeling program. While there is limited modeling and few weather stations, the analysis indicates an increase in intensity of rainfall and greater likelihood of extreme weather effects that can cause harm to human settlement and natural systems (UN-Habitat, 2013).

The increase in rainfall has already exacerbated existing chronic urban environmental management conditions due to rapid urbanization without corresponding development of urban services. The City of Kampala's Carbon Disclosure Report (CDR) 2013 Report notes that changes in the seasonality of rainfall are already a serious risk, affecting the predictability of planting and harvesting and increasing already-chronic flooding (CDR, 2013). Low-lying areas of informal settlements like Nalukolongo will continue to be the most vulnerable as they are already located in hazard prone areas and are subject to flooding and or high storm runoff from the adjacent hills (UN-Habitat, 2012). During heavy rains in June and November, 2014, there were news reports of trees uprooted and latrine slabs lifted and carried by floodwaters, polluting waters with human waste (Daily Monitor, June 10, 2014; UGO News, 2014). Public health challenges from increased flooding include the rise of cholera outbreaks during the rainy season (Lwasa, 2010).

Although new information about climate change specific to Kampala is underdevelopment (Baastel, 2014), the city's efforts to address climate change mitigation and adaptation actions have been limited. There is a Climate Change unit within the Ministry of Water and Environment, but a national policy on climate change has yet to be produced. However, there is no local adaptation policy to comprehensively address climate change issues in an integrated and strategic manner. There is an inherently low capacity to adapt to climate change

given the large population of urban poor, the un-serviced informal settlements, and inadequate urban services in general (Lwasa, 2010).

2.3.1 Storm water runoff in Nalukolongo.

Expansion of the city's drainage system has not kept up with the rapid urban growth and development of informal settlements. As previously stated, Kampala has seen a 197% increase in the number of buildings constructed in the city from 2004-2010. The extent of impervious surfaces and compacted land area, the higher rates of precipitation and increasing storm events, and poor maintenance of the existing drainage system collectively have caused an increase in the volume and coefficient of runoff. This lack of an adequate drainage system required to manage storm water runoff and flooding is a key driver of Kampala's environmental asset degradation. A reduction in pervious land creates greater storm water runoff volumes, leading to increased flooding and increased pollution of waterways as storm water collects solid and liquid waste from settlement areas and roads, transporting pollutants into the city's wetlands.

Between 2004 and 2010, Kampala's amount of impervious roof area has grown 262% across the city with substantial increases in each drainage area. Also, the buildings have generally increased in size, leading to an even higher rate of increase in roof area. These conditions have increased the frequency and severity of flooding problems throughout the city. A detailed case study analysis as part of the Kampala Flood Risk Management Report 2013 shows that the amount of impervious surfaces in a catchment is a major determinant of the volume and speed of surface water runoff and therefore flooding (UNHabitat, 2013).

Inadequate storm water management facilities threaten to degrade the quality of Kampala's remaining high quality wetlands. Drainages such as the Kinawataka, Walufumbe, Nalubaga, Nalukolongo and Mayanja that have received the largest growth in impervious coverage between 2004 and 2010, also contain the city's least degraded wetlands. However, this staggering growth in impervious surface coverage suggests that these peri-urban wetland assets could be considered highly threatened due to increasing runoff velocities and volumes, erosion and sedimentation, nutrient enrichment, and pollutant-heavy non-point source runoff.

2.3.2 Wetlands mismanagement in Nalukolongo

Wetlands have traditionally been marginalized as “wasteland” or “no-man’s land”, open to exploitation. Up until 1988 when Uganda acceded to the Ramsar Convention, the legal regimes over wetlands have been unclear. With the establishment of the National Wetlands Conservation and Management Programme in 1989, the process of policy and legislative review began. However, adoption of the National Wetlands Policy only took place in 1995 after rounds of revisions.

The National Wetlands Policy has clearly laid down the guiding principles and strategies which supports the conservation and sustainable management of wetlands. Those of particular importance include:

• Government is not supposed to lease land or give land tenure in wetlands. “All wetlands are a public resource to be controlled by the Government on behalf of the public. There shall be no leasing of any wetland to any person or organisation in Uganda at any given moment and for whatever reason.” “All future land tenure documents including maps and layouts will indicate whether the area contains a wetland and will accordingly exclude these wetlands from tenure.”

• Any development in the wetland is subjected to EIAs and the continuous monitoring of their impacts. “… all proposed modifications and restorations on wetlands be subject to an EIA, the result of which will determine whether such restoration or modification should proceed and if so to what extent.” “All planned new wetland developments will be subjected to an EIA process to determine the required environmental controls.” “Those, which have been subjected to ElAs, will continuously be monitored to assess their impact on the environment and where the impact is detrimental; Government will require that such a development be halted.”

• There are varying categories of wetlands, including fully protected wetland areas and those for partial use. “Government will establish fully “Protected Wetlands Areas” of important biological diversity.” “Any wetland serving as a source of water supply or receiving effluent, as part of a designated service to any human settlement shall be declared a fully protected wetland from any encroachment, drainage or modification.” “Government may also establish certain wetlands, which will be used for partial exploitation such as research.”

• Government may permit the use of wetlands only for certain non-destructive functions and in a sustainable manner. “Wetlands may be utilized in such a way that they do not lose traditional benefits presently obtained from them.” “Any decision to use wetlands must consider the requirements of all other users in the community.” “Only those uses that have been proved to be non-destructive to wetlands and their surroundings will be allowed and/or encouraged. These include water supply, fisheries, wetland edge gardens and grazing.”

In addition, the management of wetlands has been regarded as an integral part of environmental management. The National Environment Statute of 1995 included specific provisions on wetlands, in addition to pollution, environmental restoration orders, environmental easements, public awareness and enforcement of the law. The statute thus set in place a framework but the various provisions would need to be further developed in regulations to be applicable as law on the ground.

2.4 STORM WATER MANAGEMENT IN NALUKOLONGO

Kampala’s key storm water management is predominantly done by KCCA through the directorate of water and environmental management and Central government through ministry of water and environmental management and this is facilitated through the network of wetland waterways that course throughout the city and there is Nalukolongo wetland as the major wetland in the area of study, delivering a suite of ecological services, including flood attenuation, water purification, and storm water treatment. The quality and function of the city’s aquatic system has been significantly degraded. The city’s terrestrial assets are composed of hills, open spaces, and trees. These areas are being rapidly developed by informal settlements and lack formal protection and environmental management. The management of storm water consists of the following aspects;

2.4.1 Wetland management system in Nalukolongo

The Kampala City has relied on Kampala’s wetlands throughout the settlement’s history to provide numerous ecological services that support the City;

• The wetland system has also served as the city's primary sponge for absorbing storm waters, slowly releasing and cleansing waters by discharging into Lake Victoria or recharging groundwater flows through the Murchison bay.

• Wetlands have served as the city's primary infrastructure for physically and biologically cleansing water, filtering out sediments and nutrients that enable the raw drinking water to be cost-effectively treated for human consumption.

• Wetlands have provided the city's predominant human waste processing function by receiving raw sewage and mechanically treated waste water, processing nutrient loads, and releasing waste water downstream with a higher degree of treatment (KCCA, 2014).

However, the steady decrease in wetland area due to influence of human activities is driving overall wetland system decline. Once a large and vital ecosystem, the remaining area of wetlands constitutes approximately 9% of the total Kampala City surface area, according to recent spatial analysis based on satellite imagery (KCCA, 2012).

Unfortunately, the city's wetland resources are now mostly characterized by their state of degradation. Urbanization; encroachment; indiscriminate disposal of wastewater from the settlements, industries, and commercial establishments; and the illegal dumping of solid waste have led to degradation of almost all of Kampala's wetlands to some extent in past decades and the mismanagement of storm water in the city has relied on throughout its history. Wetland conversion to developed land has progressed quickly over the past few decades. Wetlands within the GKMA have been consistently encroached upon by development, causing a steady decrease in wetland area, a direct indicator of overall wetland system decline.

The amount of wetland area that has been converted to development between 1989 and 2010, indicating a significant growth in area of wetland encroachment. While the change in percentage of wetland encroached during each time period has decreased from 2003 to 2010, it is important to note that as the area of wetlands that are available to be encroached decreases, the percent of change in encroached area will also decrease. The extent of encroachment in the past decade also indicates limited enforcement and monitoring activities in the wetlands despite the development of environmental regulations protecting wetlands from encroachment.

Analysis of wetland encroachment reveals that most of the encroachment is occurring within the KCCA. Known encroachment of permanent and seasonal wetlands is illustrated in the purple and blue areas, while the built-up areas at the edges of wetlands are shown in red. Most of the major permanent wetlands have settlement that is approaching the wetland edges. Compared to the wetland area of early Kampala settlement, the degradation of wetlands is significant.

By 1993, 8 km^2 or 25% of the original wetland area was converted for development, and by 1999, 46 % of the original wetland areas of Kampala had been converted for urban development. Of the remaining wetland area, only about 8% remains highly functioning (KCCA, 2014b). Due to the expanse of urbanization and increased storm water runoff, there has been increasing pressure to develop in low-lying flood prone areas (i.e. within the 1 in 10 year flood line) with substantial amounts of construction occurring inside this flood line between 2004 and 2010 (UN-Habitat, 2013).

The wetlands are used by the residents of informal settlements and slums for domestic and small-scale income-generation uses. Yam, sugarcane, cassava, sweet potatoes, mixed vegetables and matooke are grown; papyrus is harvested and brick-making and fish farming also occur (Emerton, 1998). While this local use of wetland goods and services is an important source of livelihoods for the residents, these activities also directly contribute to degradation of the wetland and its functions.

2.4.2 Drainage management system in Nalukolongo

The Nalukolongo is drained with several drainage channels both major and minor with Nalukolongo drainage channel as the major drainage channel which is attached to Nalukolongo wetland which is connected to the Lubigi Wetland system, is located in Lubaga Division and generally runs alongside and south of Masaka Road. Unlike the Nakivubo and the Kinawataka, which flow into Lake Victoria, the Nalukolongo drainage channel feeds Lake Kigoya to the north of Kampala. It comprises both permanent and seasonal wetland stretching along the Nalukolongo and Mayanja rivers. Most of the original vegetation has been modified through agricultural activity and settlements, but there is still some papyrus and sedge habitat. The area floods excessively during peak rains, affecting many homes and industries.

The wetland is gazetted as an industrial area by the Kampala City Council in its Urban Planning Structure Plan. A large part (the Mayanja to the south) of this wetland falls outside the Kampala District. Although approximately 50% modified, the lower part is in relatively good condition (MoWE, 2014).

Kampala's wetlands have been further modified and compromised by drainage enhancements, cultivation, and extraction of natural resources. The city has numerous wetlands that serve as tributaries within broader wetland systems. The general status of the city's major drainages and associated wetlands.

The Kampala Drainage Master Plan designates 8 major wetland systems. The steady decrease in wetland area is driving overall system decline. Between 2002 and 2010, the area of wetlands declined from 18% to 9% of city surface area. Only one (Nalubaga and Nakelere/Nalubaga drainage) of the city's eight major wetland systems is generally observed to be in good condition (KCCA, 2014b).

2.4.3 Flooding in Nalukolongo

Poor quality and maintenance of the existing drainage system contributes to flooding. Storm water runoff from upland and overland flow discharges into drainage channels and then flows to the wetlands where, under environmentally healthy conditions, runoff would be stored and flood peaks would be attenuated. Drainage systems and wetlands are frequently overtopped, however, and flooded when they are impeded by solid waste, filled by sediment/siltation, and overwhelmed by the volume of flow. Channelization of some of Kampala's wetlands has occurred in an effort to reduce the negative effects of flooding (UN-Habitat, 2013).

Most drainage systems in the built areas of the city flow in open culverts along the roadside. The open culverts are frequently used as dumping grounds for waste disposal, which clogs the systems and causes flooding and health risks (KCCA, 2012). Low-lying settlement areas, such as Nalukolongo, Bwaise, Kinawataka, Nateete, Ndeeba, and Katwe, are increasingly prone to levels of flooding that destroy houses, roads, and culverts as well as contaminating the water supply (Lwasa, 2010). There were five observed flood events in 1993, which increased to nine in 1997. There were eight flood events in 2007 (Lwasa, 2010).

Review and update of the 2002 Kampala Drainage Master Plan is anticipated to improve response to environmental management challenges associated with storm water runoff. The 2002 plan has been ineffective because the analysis has not been based on detailed rainfall intensity data. It also became outdated due to the change in the drainage pattern and increase of built up areas in the upland and lowland areas of the city (KCCA, 2014b). The World Bank has provided funding under the Kampala Institutional and Infrastructure Development Project Phase (KIIDP2) program for review and update of the Drainage Master Plan and to guide investment (World Bank, 2014).

UN-Habitat has also conducted a Flood Risk Assessment to demonstrate how flood risk can be addressed by the city in an integrated and comprehensive manner and with stakeholder participation (UN-Habitat, 2013).

KCCA plans to address sustainable urban drainage through enhancement of primary channels and secondary drainages, including:

- ✓ The redevelopment of The Nakivubo Channel, implementing sustainable drainage management plans for the precincts, construction of the secondary and tertiary channels, and creation of public parks and an animal sanctuary to boost eco-tourism.
- ✓ Complete construction of the Lubigi drainage channel, including secondary and tertiary drainage channels and an extension to the River Mayanja on Mityana Road.
- ✓ Other drainage system enhancements for the Nalukolongo, Kinawataka, and Kansanga wetlands (KCCA, 2012).

2.5 THE IMPACT OF EXCESS STORM WATER ON HOUSING IN NULUKOLONGO

The informal settlements/housing in this part of Kampala particularly Rubaga division are; Nateete, Busega, , Ndeeba Wankulukuku Kasubi, Kawaala, Kizito Block Najja II, Kosovo (Bukooza), Lungujja-Kintunzi , Mutundwe-Wabiyinja, Najjanankumbi, Namirembe Bakuli, Namungoona and Nankulabye. The earliest settlement is said to have been established as early as 1800 while the most recent settlements were established in 1989 up to date (Kampala Profiles, 2014).

Settlement in Nateete/Nalukolongo began as early as 1900; and has grown into a major centre of trade and other economic activity with a number of shopping centres, factories and markets. These provide employment opportunities, and have therefore attracted large numbers of people to the city especially this part. Key outstanding features of the settlement include; Nalukolongo Market, Police Stations, Playgrounds, Schools and Houses. Like Bwaise settlement in Kawempe, Nalukolongo is also known for flooding whenever there's a heavy down pour (Kampala Profiles, 2014).

2.5.1 Impact on Housing structure

Access to housing/shelter is a basic human right. Even though the government has an obligation to house its citizens, this has not been the case and as a result, there has been a local intervention. Residents, in their means, have been able to provide for the housing need in the places available to them.

Construction materials for the dwelling units in Rubaga/Nalukolongo, consists of households living in dwelling units constructed using permanent roof materials and permanent wall materials and some households living in dwelling units are constructed using permanent floor materials with both semi-permanent and temporary dwelling units (National Population and Housing Census, 2014).

The most common type of house for the people living in the slum areas of Rubaga division is the tenement (locally known as mizigo). This is a multi-unit structure with three or more housing units that are either one- or two-roomed. The existence of tenements, which are usually crowded together, is a sign of both high population and housing density where a large number of people live on a small piece of land (Kampala Profiles, 2014).

Housing structures everywhere serve a wide range of purposes and meet a variety of ends, and are therefore used for different uses. The most common ones in the case of the slums in Rubaga are; Residential use, Commercial (Business) use, Mixed use and other uses. Housing structures that are used only as abodes are categorized as residential, while those where people reside as well conduct business are referred to as mixed use. There are also those whose sole use is commercial (business) use, for example supermarkets, shops, and kiosks (Kampala Profiles, 2014).

In addition, schools, clinics, health centres, and water kiosks, among others, are categorized as others and in total, the informal settlements in Rubaga contain approximately 76,870 housing structures and majority which is 63% of the structures serve purely residential purposes (Kampala Profiles, 2014).

2.5.2 Impact on Household condition

There are 9,000 households in Nateete/Nalukolongo with an average size of 5 people (Kampala Profiles, 2014) and the housing sector recorded a general improvement. Overall, 67 percent of households in Uganda resided in detached dwellings. However, nearly half (47%) households resided in dwellings with only one room for sleeping. There was also significant improvement in the materials used for construction of the dwellings. About 44% of the households resided in dwellings constructed with permanent wall material. The equivalent shares for roof and floor were 70 and 34 percent respectively (National Population and Housing Census, 2014).

There was a general improvement in the demographics of the population with the Total Fertility Rate falling to 5.8 children per woman while the infant Mortality Rate decreased to 53 deaths per 1,000 live births. The Life Expectancy at Birth also increased to 63.3 years (National Population and Housing Census, 2014).

The household population consisted of (99 percent of the total population.) The Census 2014 enumerated a total of 7.3 million households with a population of 34.1 million .This gave an Average Household Size of 4.7.

The ‘Tadooba’ remained the most common source of lighting being used by 52 percent of the households. Only one in every five households (20%) had access to electricity. On the other hand, Wood fuel was the most common fuel used for

cooking, with only six percent (one in every 16) of the households using other fuels. Sanitation remains a challenge with only thirty percent of the households with unimproved toilet facilities. About 600,000 households did not have any toilet facility at all.

Only 27% of the households depended on earned income. One in every nine households (11%) was having only one meal per day (for adults). Some of the households (11%) received remittances from abroad in cash or in kind. More than two thirds of the households (69%) had at least one member owning a Mobile phone. Ownership of a Mobile among persons aged 10 years and above was at 38 percent. The radio remains a dominant source of information and about 60 percent of the households owned a radio (National Population and Housing Census, 2014).

There are **4,000** housing structures in Nateete/Nalukolongo as represented in the table below and the use of housing structures in Nalukolongo.

Table 1: Housing structure in relation with land uses.

Housing structure Use	**Residential**	**Mixed-use**	**Business**	**Other**	**Total**
No. of structures	1,000	2,500	450	50	**4,000**

Source: Kampala Profiles; Rubaga, 2014

2.5.3 Impact on Population in housing

There are approximately 414,750 people in the informal settlements of Lubaga division. The table below illustrates the different demographic aspects like; the number of households, household size and total population per settlement in Rubaga. The average household size is 5 people with some areas having the size go as high as 7 people (in Namungoona and Kizito Block Najjanankumbi II) and others as low as 4 people (Lungujja-Kitunzi, Mutundwe and Wankulukuku) (Kampala Profiles, 2014).

The settlement of ; Kasubi, Kawaala, Nateete/Nalukolongo, Nankulabye and Ndeeba have 40,000 or more people residing there while Kizito Block Najja II has the lowest population.

Table 2: Population distribution and household structure in Kampala

SETTLEMENT NAME	Households	Household Size	Total Population
BUSEGA	6,000	6	36,000
KASUBI	10,000	5	50,000
KAWAALA	7,000	6	42,000
KIZITO BLOCK NAJJA II	250	7	1,750
KOSOVO (BUKOOZA)	3,000	5	15,000
LUNGUJJA-KINTUNZI	6,000	4	24,000
MUTUNDWE-WABIYINJA	2,500	4	10,000
NAJJANANKUMBI	2,500	6	15,000
NAMIREMBE BAKULI	4,000	6	24,000
NAMUNGOONA	8,000	7	56,000
NANKULABYE	8,000	5	40,000
NATEETE/NALUKOLONGO	9,000	5	45,000
NDEEBA	8,000	5	40,000
WANKULUKUKU	4,000	4	16,000
TOTAL	**78,250**		**414,750**

Source: Kampala Profiles; Rubaga, 2014

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter explains in detail the research methods and the methodology to implement for this research study. There was explanation firstly; of all the choice of research approach, then the research design, as well as the advantages and disadvantages of the research tools chose. This was followed by a discussion on their abilities to produce valid results, meeting the aims and objectives set by this dissertation. Then to discuss the sample size and the sampling strategy applied during data collection as part of the study, and the data analysis methods which were used. It was concluded with a brief discussion on the ethical considerations and limitations posed by the research methodology, as well as general problems encountered during the research.

3.1 RESEARCH APPROACH

This research study was required the use of qualitative research strategy, where the research approach implemented has been that of interpretivism. (Willis, 2007) defined interpretivism as an approach which is implemented by the researcher in order to synthesize facts which are derived mainly from secondary sources, and which are qualitative in nature. He also observed that one characteristics of interpretivism is that these facts are abstract in nature, and governed by a variety of factors which are non-tangible and difficult to measure. These can be economic, social, or cultural factors. Therefore for the purposes of this research, the researcher chose the interpretivist approach, rather than the positivist and the pragmatist approaches, because abstract, non-quantifiable variables such as; identifying the areas which are prone to excess storm water, assessing the generation of excess storm water, examining the means by which storm water is managed and assessing the impact of excess storm water on housing in Nalukolongo. These are all elements, which are not easily quantifiable (measureable), and between which different and complex connections are expected to exist, therefore interpretivism is believed to be most applicable.

3.2 RESEARCH DESIGN

This research made use of both qualitative and quantitative research strategy in the sense that there was both no-numeric data and numerical data to be produced (Bell, 2005; Sarantakos, 2013; Silverman, 2004). A qualitative research strategy is one that base on the opinions and perceptions in order to have a better understanding of the problem. It is mostly used to explore attitudes, behaviors and experiences through methods such as focus group interviews, participant observations among others. The reason for this strategy to be inclusive in my study is that, fewer people take part in the study so the researcher came up with easy and connection between several different variables which were established through interpretation such as; assessing the generation of excess storm water, examining the means by which storm water is managed and assessing the impact of excess storm water on housing in Nalukolongo.

On the other hand, quantitative research design used specific numerical measures and thus was objective whereby, it generated statistics through use of large-scale survey research using methods such as questionnaires, structured interviews among other methods. This research design intended to reach many more people as possible compared to the one before and the contact to the people is quicker (Miles and Huberman, 1994, p.40). The validity, advantages and disadvantages of the tools used to implement the research strategy was discussed as follows;

3.3 THE TARGET POPULATION AND SAMPLE FRAME

This refers to the entire group of people which are of interest in the study process. Therefore, in my study I targeted the stakeholders in management of excess storm water and the impact of excess storm water that is poorly managed on housing in Nalukolongo such as; Community members (general and specific), Government officials (technical and politician), Others(NGOs and institutions) as detailed below;

3.3.1 Sampling Strategy

For the purposes of this study, the researcher examined severe separate groups of participants. A method of *stratified* sampling was chosen to be used, as the relationships between different sub-groups had to be observed (Kirby et. al,

2000: 339). Furthermore, a particular group of the total population was involved to the interviews/discussions, represented a sub-group of the original population in the area of study. Also, the participants were selected on the basis of specific criteria, such as*;* Community members (general and specific), Government officials (technical and politician), Others (NGOs and institutions), where a particular type of model has been implemented.

3.3.2 Sample frame and Design

The elements of the population to be sampled include the following; politicians, technical team such as Town clerk, local council chairpersons, households, representatives, official's representatives among others as illustrated below;

Table 3: The targeted sample population for the research

Stakeholders	**Target Population**	**Number**	**Technique**	**Reason**
Local Council I Chairperson and Councilors	Politicians	2	Systematic sampling	The Local Council I chairperson administers the zone and the entire area represented by the different councilors who represents the people at different levels and these are potential informants.
Land lords	Owners of the houses or building	4	Random sampling	There landlords were representing the key land owners in Nalukolongo.
Tenants	Community	37	Random	These had different views about storm water, management and impact on housing.
Builders or Constructors	Technical	2	Systematic sampling	Engaged in different developments.
Business People	Community	5	Random sampling	Occupy buildings in which they engage in commercial activities and developments and face different challenges caused by excess storm water.

Therefore, in total the sampled size consisted of 50 participants included in the gathering of the necessary data/ information to accomplish the study.

3.3 DATA NEEDS THAT GUIDED THE STUDY

Table 4: Data needs for the research undertaking guidance.

Research Objective	**Research tools**	**Expectations**	**Data sources**	**Methodology**	**Expected output**
To identify the areas which are prone to excess storm water in Nalukolongo.	Geographical Information System (GIS)	Specific areas in Nalukolongo which easily and frequently experience flooding.	Primary data and Secondary data.	ICT, Surveying and Mapping.	Map showing areas prone to excess storm water/flooding.
To assess the causes why of excess storm water stays longer in Nalukolongo.	Interview guide tool and questionnaires	Which factors that contributes to excess storm water to stay longer in Nalukolongo.	Primary and Secondary data.	Observation, Interview, photography and review literature.	Photographs and details in the recommendation.
To examine the means by which storm water is managed in Nalukolongo.	Questionnaires, note book, camera and observation.	Storm water management in Nalukolongo by incorporating aspects like wetlands and their management, drainage channels, waste water treatment, flooding, future sewage treatment facilities.	Primary data	Interviewing method, Mental mapping, Questionnaire and photography.	Photographs and details in recommendation.
To examine the impact of excess	Questionnaires, Interview	The impact of excess storm water on housing in	Primary data and secondary	Questionnaire, Interviewing	Details in the recommendation.

storm water on housing.	guide tool, camera and note book.	Nalukolongo in relationship with housing structure, household condition, land Ownership and Population.	data.	method, photography, Observation and review literature.	

3.4 RESEARCH METHODS EMPLOYED

For the purposes of this research, the researcher decided to use a combination of two of the classic physical planning research tools – questionnaires and interviews (Winchester, 1999; Sarantakos, 2013; Silverman, 2004; Greenfield, 2002). The questionnaires and interview are used complementarily whereby the researcher conducted interviews/interaction with an equal number of representatives of the population while filling the questionnaires by the researcher through asking questions. The advantages and disadvantages of each method are discussed below.

3.4.1 Questionnaires

Questionnaires were chosen for this research because they are a reliable and quick method to collect information from multiple respondents from the community in an efficient and timely manner. This was especially important when it came to relatively large projects, with several complex objectives, where time is one of the major constraints (Greenfield, 2002; Silverman, 2004; Bell, 2005). This study was not an exceptional and questionnaires were a quick and effective way for the researcher to reach multiple respondents within several days. A general disadvantage of the questionnaires however were; they are fixed and strict format, which eliminates the possibility for more in-depth or abstract observation (Bell, 2005; Sarantakos, 2013). Again, this study was not an exception from this rule, as the questionnaires provided linear and clear results, but many elements from the research were left uncovered.

3.4.2 Interviews

In order to cover more abstract aspects of the research, the researcher chose a complementary method, structured interviews consisting of several questions, which were asked through interactions among representatives of each participant groups. Interviews were often used as complementary research method in the socio-economic aspects, because they gave the opportunity for a more in-depth, open discussion, and more informal, free interaction between the interviewer and the interviewee (Potter, 2002; Winchester, 1999; Sarantakos, 2013). Despite being considered a disadvantage because it produced subjective results, the flexible format of the interviews were a major advantage for this study, as some nuances of the research such as exploring “emotions”, and

"psychological experience" were not properly captured with the questionnaire design. Of course the results from the interviews were not generalizable, because of the subjectivity of data obtained. On the other hand, their flexible format contributed for a deeper explanation and understanding of the connection between storm water management and housing.

3.4.3 Participant Observation

Upon embarking on this research, the researcher also considered participant observation as possible research method and this was where the researcher became a working member of the group or situation to be observed. The aim was to understand the situation from the inside: from the viewpoints of the people in the situation. The researcher shared the same experiences as the subjects, and this form of research was particularly effective in the study of small groups/small firms. Participant observation overt (everyone knows it is happening) or covert (when the subject(s) being observed for research purposes are unaware it is happening) (Colin Neville, 2007). However, due to the behavioral elements contained in the community of study in this research and because of time constraints and cost, the research method was of constrain to the researcher while using it when collecting data.

3.4.4 Secondary data sourcing

This is more less the same as literature review whereby information was gathered from the field of study through reading from existing literature about the variables of the research study such as earlier reports, News papers and articles.

3.4.5 Qualitative GIS

This technique was used in drafting sketches, measurements and also deductions in spatial context. This was therefore used to compare what existed before the status elevation and after came up with judgments.

3.5 DATA PROCESSING AND ANALYSIS

3.5.1 Data Processing

Data/ information obtained out of the field survey in Nalukolongo zone by the research, was organized, edited and tabulated for analysis.

3.5.2 Data Analysis

The data was entered in SPSS/STRATA which interpreted basing on the multiple responses from the respondents and the data used to derive relevant graphs and pie chart to show the statistics in line with the study objectives.

This therefore was involved tabulations, calculations and interpretation of questionnaires to derive statistics for presentations.

3.6 ETHICAL CONSIDERATIONS DURING FIELD SURVEY

There were several types of ethical issues, which the researcher had to take into consideration for this project. The most important one was related with the informed consent of the participants. All of the participants in this research study were informed about the purposes of this project, and expected to give their informed consent to participate in writing. Their identity as well as the names of the organisations and institutions they belonged to, were kept in strict confidentiality, thus meeting the requirements of the code of ethics of the research undertaking.

In addition, the privacy, secrecy and confidentiality policy of all of the organisations had to be taken into consideration as well, as the government institutions which have a very strict policy for access to their employees in regard to releasing information for research purposes. Therefore the researcher had to sign consent forms for confidentiality and privacy with the companies whose employees and managers agreed to participate in the study.

Finally, all the information which was collected in the course of this dissertation was used only for the purposes of the study, and was kept confidential.

3.7 CONSTRAINTS AND LIMITATIONS EXPERIENCED DURING FIELD SURVEY

There were several constraints and limitations that were experienced during this research study which included but not limited to;

Firstly, respondents requested for money to give out information regarding the necessary data that was need by the researcher such as; their housing status, storm water management, socio-economic status and others.

Secondly, the researcher was restricted by time and cost, which determined the choice of more efficient methods, such as the questionnaire, instead of the more time consuming focus groups or participant observation.

Another weakness of the methodology was related to the fact that the researcher use interpretivist approach, which was determined by the nature and the objectives of the research. In this sense the results and the achievements of this project were deemed as biased, because the connections between the different variables have been determined not on the basis of empirical evidence, but on the basis of the analytical and judgmental skills of the researcher, in the context of a particular academic field.

CHAPTER FOUR

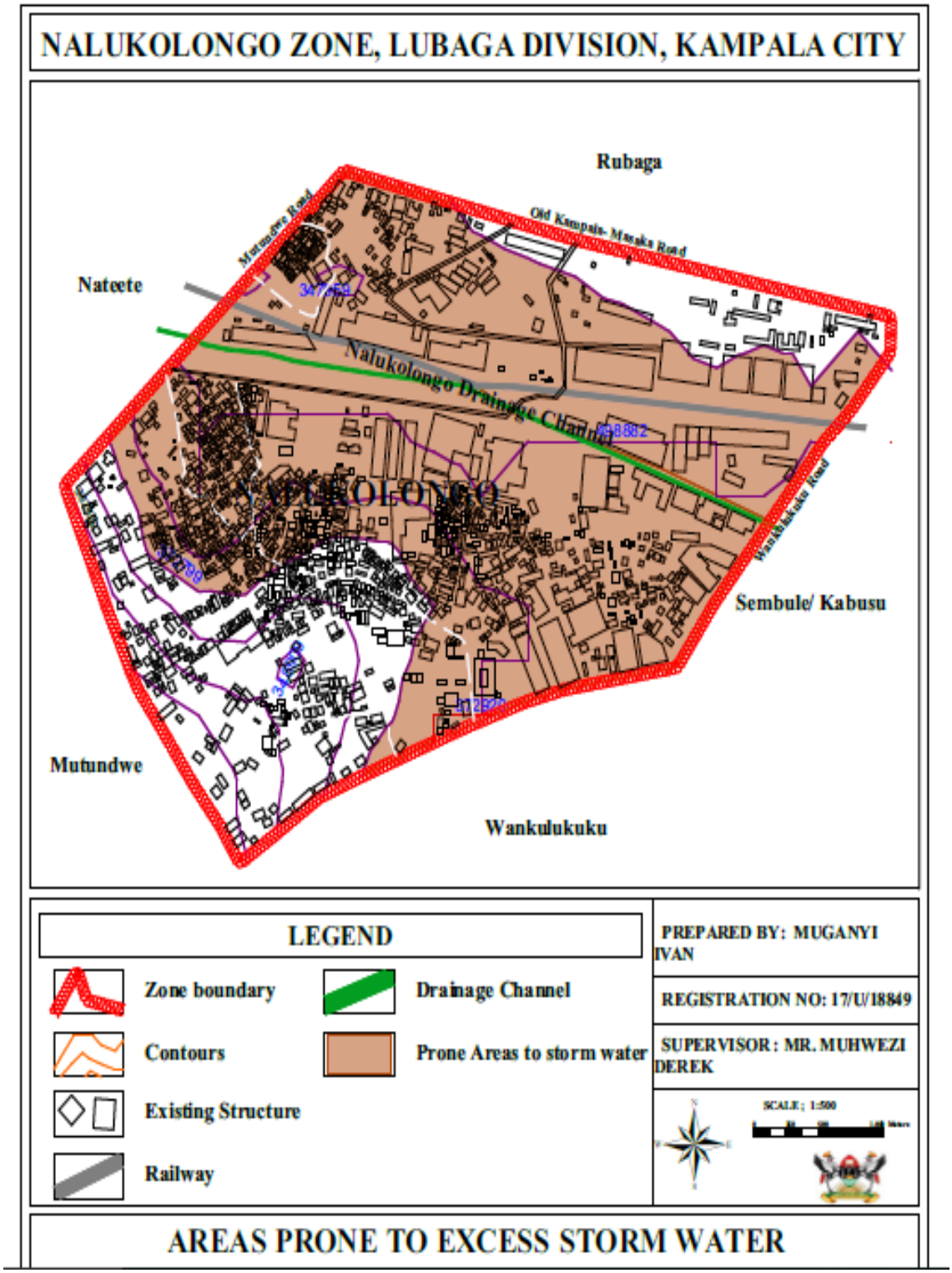
PRESENTATION AND DISCUSSION OF RESEARCH FINDINGS IN NALUKOLONGO

In this chapter highlights the findings obtained from the various field visits, conversations and interviews held with the concerned stake holders and analysis of data/ information obtained to come up with the representative data that is ought to be useful to all who will come across this research.

4.1 HAZARD PRONE AREAS TO EXCESS STORM WATER IN NALUKOLONGO

The areas in Nalukolongo zone which are prone to excess storm are within the elevation of (1,136 M) 3,727ft and below according to the data gathered from the field study of the area through employing the above prescribed methods, it was further found out that, these areas are situated adjust to the major drainage channel in the area; this is Nalukolongo drainage channel as the major channel and other minor tributaries since they are located in the lowest lowland of the area and these drainage channels also overflow due to large capacities of water that are beyond their threshold as shown in the map below;

Map 2: Hazard prone areas to excess storm water in Nalukolongo zone.



Source: Field survey and Digitalization 2021

4.2 WHY EXCESS STORM WATER STAYS LONGER IN NALUKOLONGO

According to the information gathered from the field survey in Nalukolongo, it was learnt that excess storm water is mainly experienced during the long rainy season from August to December and a short rainy season from February to June that has substantially heavier rainfall per month. The average annual rainfall is between 1,750mm and 2,000 mm, with monthly rainfall ranging from 50 to 260mm (World Meteorological Organization, 2013 in UN Habitat 2013) and excess storm water is attributed to the following factors;

4.2.1 PHYSICAL FACTORS

1) **Climatic changes**,

   Kampala as a whole where Nalukolongo zone (study area) is located, experiences tropical rainforest climate with variation such as two annual wet seasons. There is a long rainy season from August to December and a short rainy season from February to June that has substantially heavier rainfall per month. The average annual rainfall is between (1,750mm and 2,000 mm), with monthly rainfall ranging from approximately (50mm to 260mm).

   Rain water/ storm water while increase compared to the drainage channels' capacities in that the drainage channels particularly Nalukolongo drainage channel and other minor drainage channels are overwhelmed by these large volumes of water due to prolonged rainy/wet seasons in the area under the Victoria basin hence overflowing and this over flown water floods in the nearby areas along these drainage channels hence excess storm water is stays longer in the area.

2) **Terrain/ Relief,**

   Nalukolongo zone is relatively flat with the gradient of 1% which disables storm water flow by nature (gravitational force) hence stagnates and when it frequently rains, excess storm water accumulates in the area which floods in the neighborhood as shown in the figure below;

Flat landscape with stagnant storm water next to abandoned industries.

Source: field visit 2021

4.2.2 HUMAN FACTORS

1) **Increased construction of buildings,**

In Nalukolongo such as houses for settlement, commercial buildings and factories in the wetlands which would have been a key water catchment area. Constructions are also associated with land filling and buildings with paved surfaces which do not allow easy water infiltration. This has led to excess water from rain to flood in the neighborhood.

Industries/factories in wetland/

Newly constructed Makanga

water logged area.	**Building with paved surface.**

Source: field visit 2021

2) **Poor disposal of solid wastes,**

45% of households in Nalukolongo zone do not have where to dispose their solid wastes since they stay in haphazard areas which are not well planned without proper solid waste collection points, they deliberately disposal their household wastes in drainage channels because they are in their convenience and this blocks the drainage channels in that when it rains, excess storm water does not easily flow hence overflow of this water and flooding in the nearby areas as shown in the figure below;

Solid wastes disposed in and around the drainage channel.

Source: field visit 2021

3) **Poor maintenance of drainage channels,**

Nalukolongo whereby 75% of the minor drainage channels are dilapidated hence they are not able to perform their intended role of draining away storm water in Nalukolongo zone hence generation of excess storm water during rainy seasons as shown in the figures below;

	
Drainage channel through houses which is dilapidated.	**Drainage channel with grass in and around it.**

Source: field visit 2021

4) **Lack of compliance of dwellers to environmental and development regulations,**

60% of the developments (residential houses and factories) in Nalukolongo zone are constructed without observing the recommended 10M buffer zone from drainage channels hence leaving no allowance for future drainage channels' expansion and increase in excess storm water in the area according to Mr. Hussein, Chairman.

Factory building along Nalukolongo drainage channel.	**Kiosks along Nalukolongo drainage channel.**

Source: field visit 2021

5) Mis-use of drainage channels,

Nalukolongo zone dwellers mis-use drainage channels in that some people put the drainage channels at uses which they are not intended for such as washing Boda-bodas in the drainage channels which dilapidate such drainage channels and reduce on their capacity and when their need be, they are unable hence generation of excess storm and flooding as shown in the figures below;

	
Boda-boda washing in Minor drainage channel in Nalukolongo neighborhood.	**Boda-boda washing in drainage channel along Old Masaka Road.**

Source: field visit 2021

4.3 EXCESS STORM WATER MANAGEMENT IN NALUKOLONGO

From the field survey in Nalukolongo zone, data/ information collected reflected how storm water is managed at the different levels such as household level, the relationship between dwellers and the different aspects of storm water management mechanisms such as wetlands system and drainage system and the

future prospects of managing the increasing storm water in Nalukolongo zone as presented below;

4.3.1 Current methods of storm water management in Nalukolongo zone.

Storm water is currently managed at both household level and community level according to field survey as follows;

A) At community level

Excess storm water at community level is managed by the community authorities such as KCCA, Lubaga division and local council as follows;

- KCCA and Lubaga division regularly dredge Nalukolongo drainage channel and other drainage channels by removing the silt and solid wastes disposed there using excavators.
- KCCA and Lubaga division are trying to build reinforced embankments on the drainage channels in Nalukolongo to avoid silt from blocking the channels.
- Local council encourages the local community to engage in the communal activities of clearing the minor drainage channels by use of hoes, slashers and racks.
- Local council has regularly sensitized the community to properly dispose their wastes not into drainage channels but through proper means such as being connected to NWSC networks for liquid wastes and make use of garbage collectors.
- Local council has always created awareness in the community about the likely rainy seasons so as they prepare in advances to avoid the consequences of excess storm water such as clearing nearby channels.

B) At household level,

Excess storm water in Nalukolongo at household level is managed in the following ways;

- ✓ Connecting household waste water collection points to the nearby drainage channels both minor and major ones.
- ✓ Constructing minor drainage channels that link the household to other drainage channels.
- ✓

4.3.2 The community/ dwellers interference in excess storm water management in Nalukolongo

In the study to understand the management of excess storm water in Nalukolongo, it needed to include how dwellers interfere in excess storm water management in Nalukolongo especially the various aspects of mechanisms of management excess storm water as follows;

A) Interference with wetlands

Nalukolongo is a neighborhood located in a swampy area with various wetlands which is an essential aspect or mechanisms in managing excess storm water by acting as water catchment area and dwellers relate with them as below;

- 35% of the people dump wastes into the wetlands hence their contamination and destruction.
- 25% of the people use the wetlands as working places for activities like bricklaying and farming.
- 40% of the people fill land in these wetlands for construction of houses and factories.

B) Interference with drainage channels

The main drainage channel in Nalukolongo is Nalukolongo drainage channel which drains a large area such as Busega, Nateete, Kabusu, Ndeeba and others but it has other minor drainage channels attached to it while draining the various parts of Nalukolongo and dwellers in the neighborhood relate to them in the following ways;

- ❖ 50% of the households and factories dump their wastes both solid and liquid into the drainage channels which block them.
- ❖ 10% of the people use the top of drainage channels as working places/ spaces in that they construct temporary structures on them like kiosks.

	
Chain of kiosks on a roadside drainage channel	**Temporary bridges on channel**

Source: field visit 2021

4.4 THE IMPACT OF EXCESS STORM WATER ON HOUSING IN NALUKOLONGO

From the field study in Nalukolongo, it was found out that the excess storm water has adversely affected housing in Nalukolongo through the following aspects;

4.4.1 ON HOUSING STRUCTURES

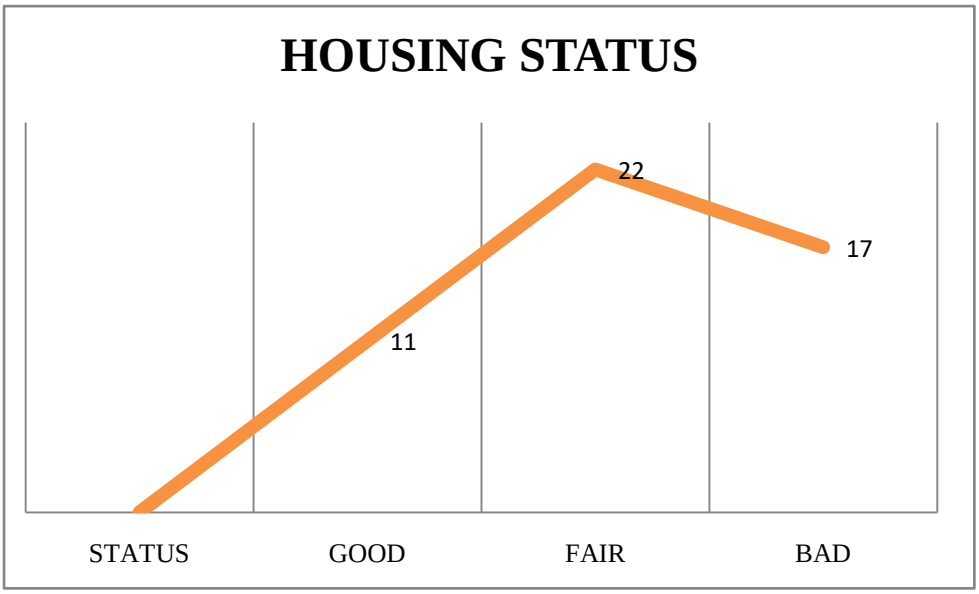
1) Retarded appearance of the buildings/houses in that the excess storm has soaked the walls of buildings hence affecting their nature/ appearance.

	
Soaked wall of a residential house	**Dilapidated wall fence**

Source: field visit 2021

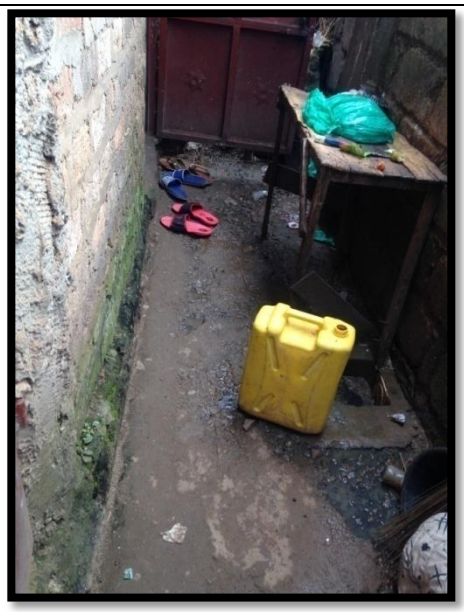
According to field survey, 39% of the people living in Nalukolongo zone stay in houses which are not at standard level for human living as represented below;

Line graph 1: The housing status in Nalukolongo zone.



Source: field visit 2021

2) Reduced life span of buildings and houses in that most houses were constructed on relatively weak foundations made of sand and bricks which are easily destroyed by the excess storm water as shown in the figures below;

	
Soaked foundation of houses	**Soaked foundation of house**

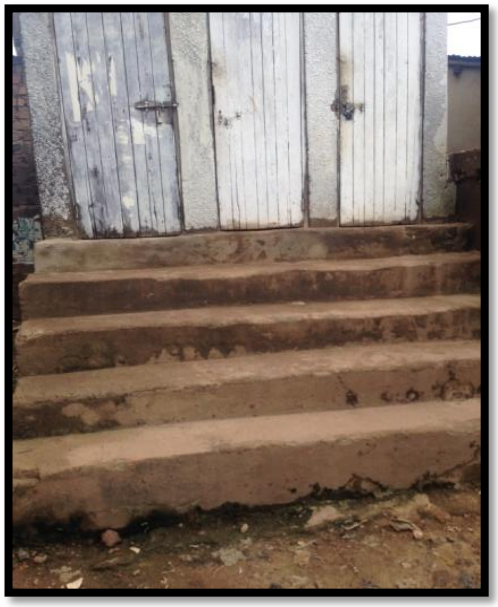
Source: field visit 2021

3) Destruction of floor surfaces of houses and buildings whereby the excess storm water weakens the floor surfaces since they soak them hence wear and tearing away as shown in the figures below;

	
Soaked and unpleasant floor	**Soaked stair cases**

Source: field visit 2021

4) Destruction of household facilities and structures whereby the excess storm water wares and tears part of the household facilities and structures like doors, paved compounds and others as shown in the figures below;

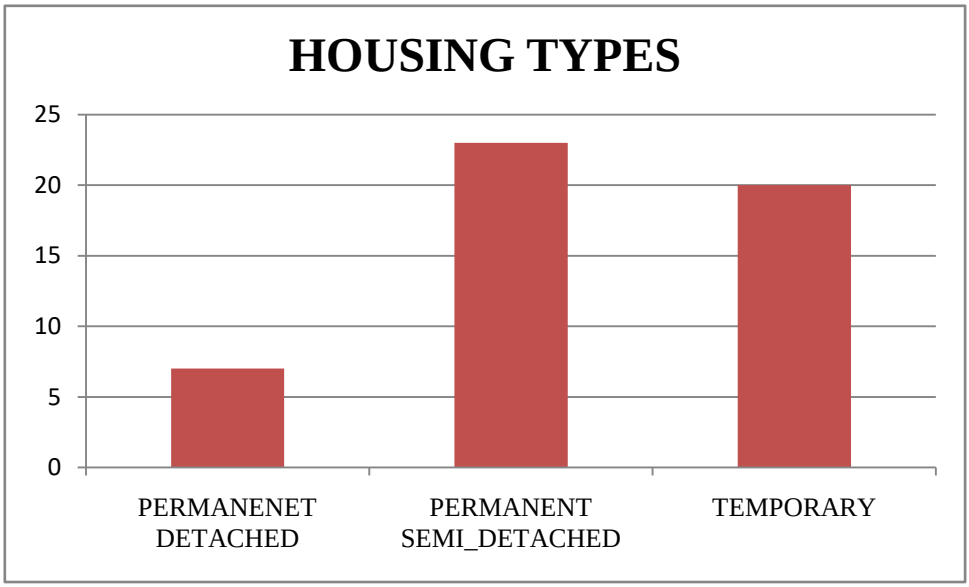
	
Door destroyed by storm water (worn out door)	**Doors at higher level to prevent storm water**

Source: field visit 2021

4.4.2 ON HOUSING COST

1) High construction costs in that according to Mr. Kizza, a builder, said that the construction cost in a Nalukolongo zones doubles that in Uplands like Kabusu, Rubaga and others in that it requires much construction material such as much masonry, hardcore stones and concrete for reinforcement to resist the storm water effects.
2) Rising in the number of temporary houses in the area whereby due to high construction costs which retards the aesthetic beauty of the neighborhood and people are tempted to put up wooden and metallic kiosks since they are less costly as presented below;

Bar graph 1: The housing types in Nalukolongo



Source: field visit 2021

3) Increasing maintenance costs of buildings/ houses in Nalukolongo whereby during rainy season, this excess storm water that is generated, destructs the buildings/ houses which requires frequent and regular maintenance and repair hence construction of temporary houses/ kiosks as shown in the figures below;

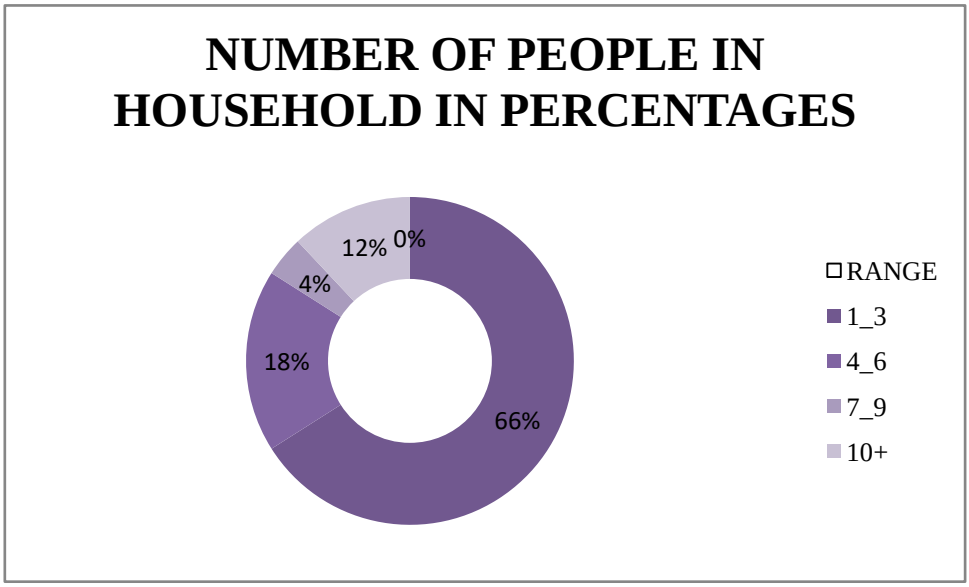
	
Kiosks in the heart of Nalukolongo	**Repair of building by painting**

Source: field visit 2021

4.4.3 ONHOUSING CONDITIONS

1) Excess storm water affects the micro-climatic conditions in houses/ buildings whereby it leads to cold humid conditions which are not favorable to human settlement hence the low number of people in most households as represented below;

Pie-chart 1: The number of people in each household.



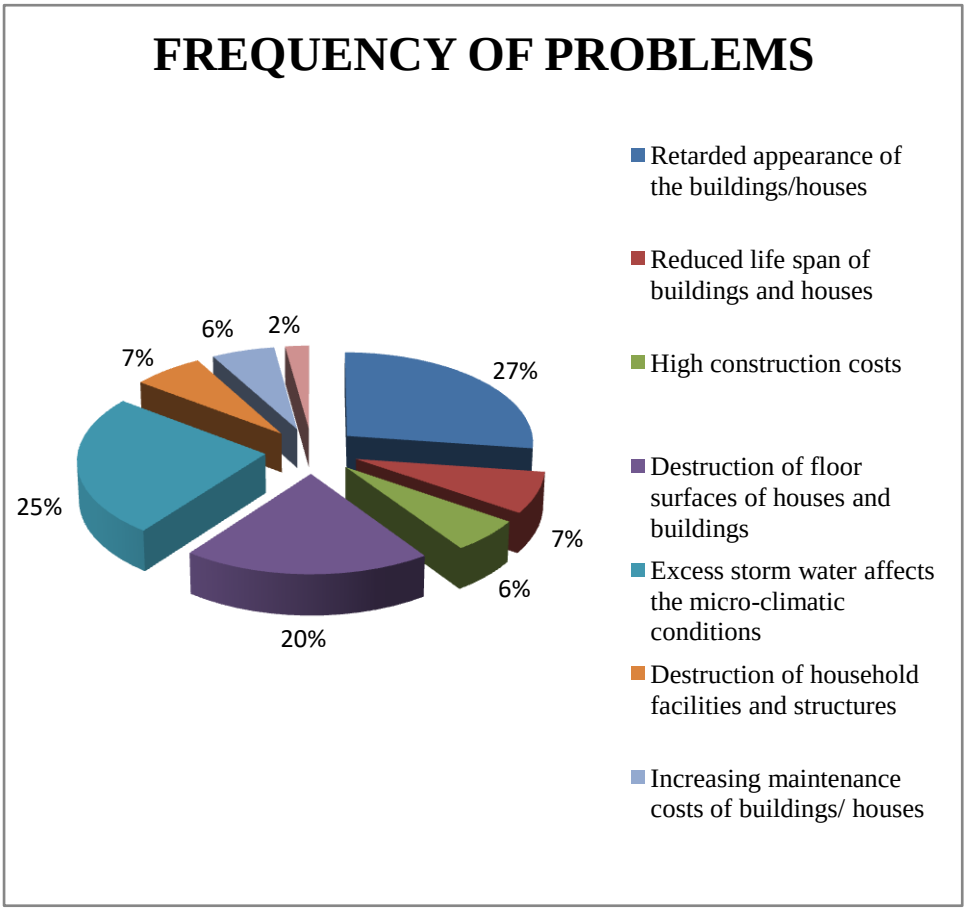
Source: field visit 2021

Table 5: Summary of frequency of problems caused by excess storm water on housing in Nalukolongo zone.

NO	PROBLEM	FREQUENCY
1	Retarded appearance of the buildings/houses	37
2	Reduced life span of buildings and houses	10
3	High construction costs	8
4	Destruction of floor surfaces of houses and buildings	27
5	Excess storm water affects the micro-climatic conditions	34
6	Destruction of household facilities and structures	9
7	Increasing maintenance costs of buildings/ houses	8
8	Rising in the number of temporary houses	3

Source: field visit 2021

Pie-chart 2: The frequency of impacts caused by excess storm water on housing in Nalukolongo zone.



Source: field visit 2021

CHAPTER FIVE

RECOMMENDATIONS AND CONCLUSION

In this chapter, it is about the recommendations made to the different stakeholders regarding poor management of excess storm water and its effects on housing in Nalukolongo such as the central government(Ugandan government), Urban authorities(KCCA and Lubaga division) and the entire community so as the problem is managed. And then conclusion of the research study.

5.1 SUMMARY OF THE RESEARCH FINDINGS

The field survey in Nalukolongo revealed that the hazard prone areas to excess storm water in Nalukolongo are places approximate to the drainage channels of the area; those are Nalukolongo drainage channel as the major channel and other minor tributaries whereby they are located in the lowest lowland of the area and these drainage channels also overflow due to large capacities of water that are beyond their threshold and there blockage by solid wastes dumped in them by the people.

Excess storm water in Nalukolongo stays longer and this is majorly attributed to both physical and human factors as discussed above and climatic changes/ prolonged rainy seasons that are experienced in the area under the Victoria basin where prolonged wet seasons occur and other underlying factors.

Excess storm water is managed at different levels such as household level by individuals, the relationship between dwellers and the different aspects of storm water management mechanisms such as wetlands and drainage channels and the future prospects of managing the increasing storm water in Nalukolongo.

Excess storm water has adversely affected the housing conditions in Nalukolongo through different ways such as; high costs of construction, high maintenance costs, destruction of household facilities, dilapidated houses and others as discussed above.

5.2 RECOMMENDATIONS TO STAKEHOLDERS

5.2.1 Recommendations to the Central Government

The Ugandan government is entitled to governing and administering the entire country and Nalukolongo inclusive and it plays the major role in problem solving and according to the research study, the following recommendations have been made to the government through the ministry of environment and water management, directorate of environment and agencies such as NEMA;

- ❖ Provision of climatic/weather information in form of weather focus in that through the National Meteorology Center, the government is capable of gathering weather and climatic information and delivers it to people through radios, TVs, social media and other means so as people are aware about the rainy seasons and prepare in advance.
- ❖ Strengthening and enforcing environmental and land laws and regulations in urban areas whereby developments are restricted from environmental sensitive areas like wetlands which are water catchment areas for excess storm water hence gazzeting such areas as public land under government administration to control and prevent encroachment.

5.2.2 Recommendations to the Urban Authorities

Urban authorities for this case include KCCA and Lubaga division council in particular, who are responsible for administering Nalukolongo under Rubaga parish, Lubaga division and below are some of the recommendations to these authorities in line with the study;

- ❖ Widening of Nalukolongo drainage channel and other drainage channels in Nalukolongo through "Kampala Drainage Master Plan" hence increasing their carrying capacity to avoid overflowing and flooding.
- ❖ Reinforcing of the drainage channel embankments with stones and concrete to control silting.
- ❖ Regular enforcement in Nalukolongo to crack down illegal developments in wetlands, buffers along drainage channels and standard developments based on plans hence mitigating the effects of excess storm water.
- ❖ Community involvement in storm water management projects such as encouraging private land owners to provide free land for expansion of drainage channels to catch up with increasing storm water volumes.

- ❖ Benchmarking from areas with similar problems and how they were managed especially storm water.

5.3.3 Recommendations to the Nalukolongo Community/ Dwellers

These are the recommendations made to community of Nalukolongo inclusive of their local leaders such as councilors, chairpersons and the dwellers as follows;

- ❖ The community of Nalukolongo should ensure regular maintenance of the drainage channels both major and minor whereby they should dredge them regularly to remove silt and garbage that blocks them and clear the vegetation that grow in them hence they are able to perform their function of draining away the excess storm water from the area.
- ❖ Proper disposal of solid wastes in that solid waste should be managed on individual basis such as keeping the rubbish in sacks and dust bins where it is collected regularly by the urban authorities than dumping such wastes into drainage channels which blocks them.
- ❖ Proper construction management of houses whereby since this area is a swampy one, houses should be constructed on strong foundations reinforced with masonry and concrete which is resistant to storm water and its effects and raised above ground level.
- ❖ Alternative construction and settlement areas whereby people should seek other areas for constructing houses in upland areas such as Rubaga, Kabusu and Mutundwe which are free from storm water hence preserving these fragile swampy areas.
- ❖ Implementation of EIA when carrying out construction and any development in such areas which are fragile to avoid endangering the environment and provide mitigation measures to likely negative outcomes of the developments which enable the environment to perform their role of water catchment of excess storm water.
- ❖ Recognition of buffers along drainage channels such as 10M along major drainage channels and 5M along minor drainage channels in that, such buffers are preserved for future expansion of these channels to cope up with the ever increasing storm waters due to prolonged rainy seasons.

5.3 CONCLUSION

The Central government in collaboration with urban authorities (KCCA and Lubaga division) are the responsible bodies for mitigating the negative effects of excess storm water on housing by properly managing it through controlling and monitoring development in such fragile areas since it is generated on large scale from rain and individuals should perform their responsibilities and roles without harming the environment which reacts in a negative way if adversely affected by human activities like poor garbage disposal and uncontrolled developments in the environment. Hence the law of nature, "Nature knows best".

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