BUSITEMA UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OF WATER RESOURCES ENGINEERING

FINAL YEAR PROJECT REPORT

ANALYSIS OF THE FLOOD PATTERNS USING HYDROLOGIC AND HYDRAULIC MODELS IN RIVER KAFU CATCHMENT

A CASE OF KIMENGO SUB COUNTY (MASINDI DISTRICT)

By

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A final year project proposal submitted to the Department of water resources engineering in partial fulfillment of the requirements leading to the Award of Bachelor's degree in water Resources engineering of Busitema University.

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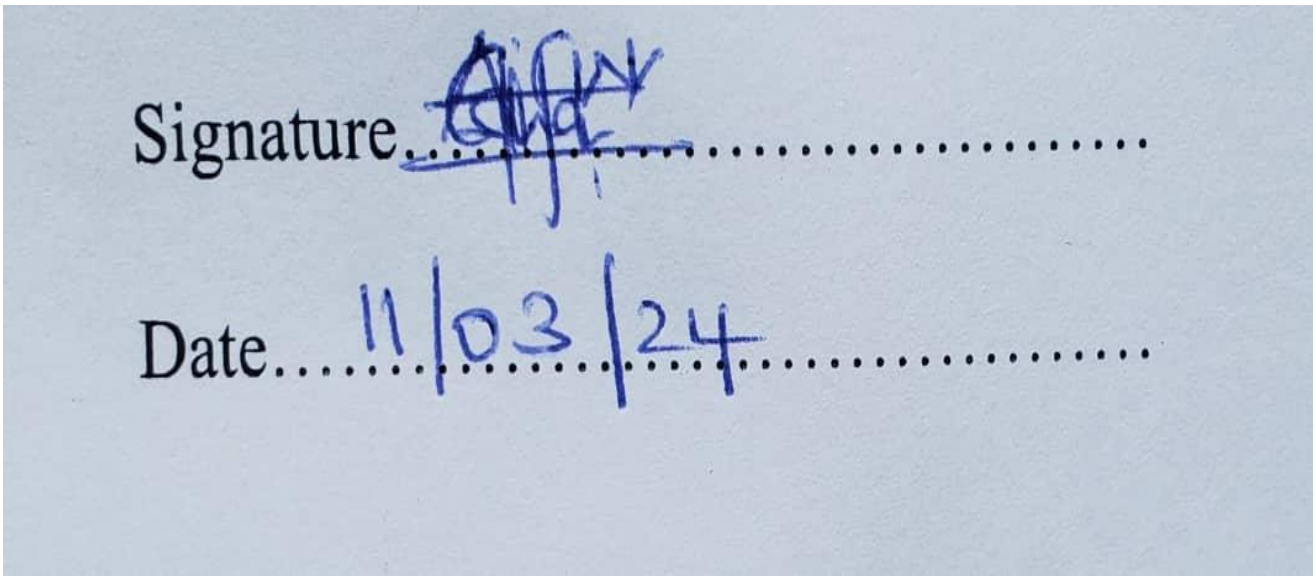
ABSTRACT

Floods are the most frequent type of natural disaster occurring all over the world. This research project shows that River Kafu floods almost every year with the most severe event in October 2021. Those floods caused death, destruction of property and displacement of over 10,000 people. Flood forecasting, Flood hazard mapping and flood risk zoning are quite effective non-structural procedures in managing floods that lower the risks floods may cause. The study was conducted to build a hydrological and hydraulic model in combination with Geographical Information System (GIS) for flood inundation mapping in Kafu Catchment basin. HEC-HMS and HEC-RAS models were employed to achieve the overall specified objective. Time series analysis of hydrological data has been done using Log Pearson type III frequency analysis method to obtain the rainfall intensities for different return periods such as 50yr, 100yr, 200yr and 500yr, Results of the rainfall frequency analysis which were the point depths of 52.78mm, 58.97mm, 65.09mm and 73.30mm for the respective return periods were used as an input for the hypothetical storm method in the hydrological model to generate the corresponding catchment discharges which was then used in the hydraulic model to develop the flood inundation maps, Water surface elevations and flow velocities in HEC-RAS. A sensitivity analysis of the hydrological model parameters used in this study showed that the model out puts are more sensitive to curve number compared to other parameters (percentage of imperviousness and lag time). The HEC HMS model was calibrated and validated using both manually and automatically by the Nash- Sutcliffe Efficiency (NSE) obtained was satisfactory. From the results of the hydraulic model, it was observed that, the flood plain inundated areas increase with the magnitude of flow within the modelled network indicating a high flood risk level for activities and settlements adjacent to the river banks. The simulated peak discharges of 46m^3/s, 113.3m^3/s, 202.6m^3/s, and 345.7m^3/s for the respective 50-, 100-, 200-, and 500-year return periods produced maximum channel flood depths of 2.497m, 2.887m, 3.429m, and 3.698m respectively as observed from the gauging station at Namyekudo, Masindi. Flood hazard maps were generated for the return periods in the Ras Mapper environment.

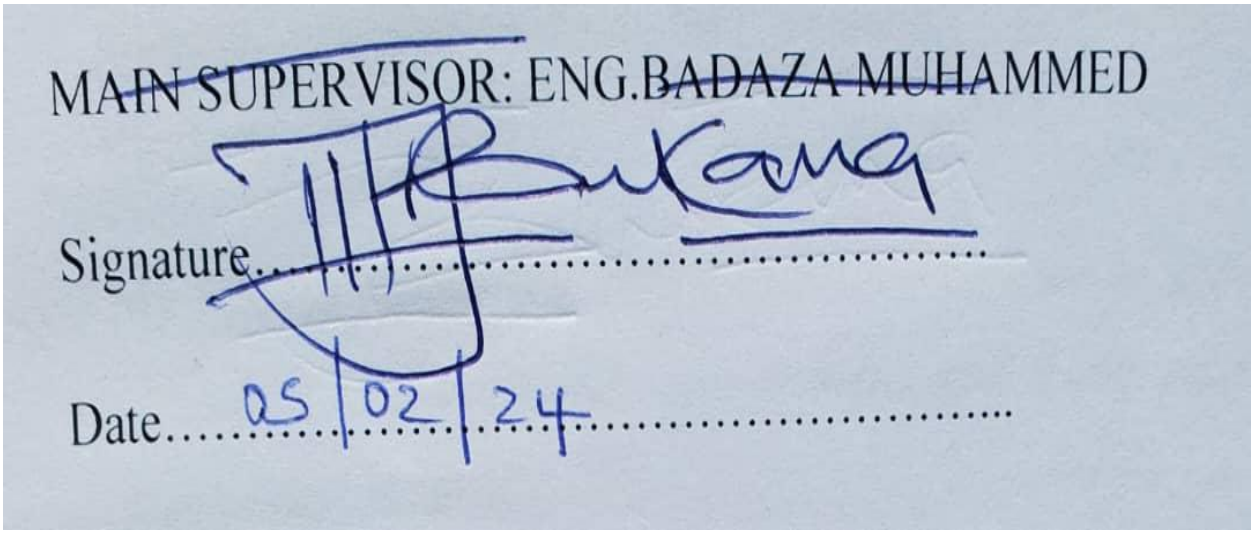
DECLARATION

I **KIRABO ASHA** do hereby declare that to the best of my knowledge and belief this report is my original work and has never been submitted to any other University, college, or Institution of higher learning for the purpose of meeting any academic requirement. It is therefore authentic and where any references or secondary information have been used, they have been given due acknowledgement.



APPROVAL

This project proposal report has been approved of my supervisor mentioned below



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I do greatly acknowledge a number of people whom without their support I would not have made it this far. Great appreciation goes to my project supervisor and my lecturers for their due diligence, parental guidance and competence in ensuring that my work meets the required standards.

My beloved mother Ms. Nalubega Flavia, my beloved grandmother Ms. Alice Walsh and my siblings. I thank you for your material and moral support. Lastly, I extend my sincere appreciation to all friends for always being there for me and giving me the required support in making it this far. Finally, to all whom I have not been able to mention, please thank you so much and may God reward you for that good work.

DEDICATION

I dedicate this project proposal report to my mother Ms. Nalubega Flavia, Ms. Alice Walsh, my siblings and friends whose sacrifice, guidance and support towards my education has exposed me to the world of Engineering. May God bless them.

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UBOS- Uganda Bureau of Standards

UNMA- Uganda National Meteorological Authority

DEM- Digital Elevation Model

DRWM- Directorate of Water Resources Management

OPM-Office of the Prime minister

MWE- Ministry of Water and Environment

CN- Curve Number

NDP- National Development Plan

SDG- Sustainable Development Goal

1.0 CHAPTER ONE

1.1 Introduction

This chapter entails relevant information about the project, problem statement, purpose, justification, objectives, and the scope of the study.

1.2 Back ground

The most common kind of natural disaster, a flood happens when water overflows and engulfs land. Heavy rainfall, overflowing rivers due to debris in the river that limits the river's capacity to store water, and other causes are frequently to blame for floods .Floods are one of the most devastating natural disasters to human life worldwide. In the last three decades of the 20th century, floods have cost almost US 386 billion dollars in economic losses, according to the United Nations, which also reports that 157,000 people have perished as a result of floods from 1995 to 2015 around the world **(Rukundo & Doğan, 2017)** Flooding is arguably the weather-related hazard that is most widespread around the globe. It can occur virtually anywhere. A flood is defined as water overflowing onto land that usually is dry.**(Iii, 2003)**

River is the main surface water body in Masindi district. A significant number of tributaries drain into River Kafu including Kayera, Nampwera, Kiizi, Iwamba and Kirinju from Kimengo hills, Ntoma, Kyakomere and Buitambogo prone **(OPM, 2016)** River Kafu is one of the major rivers in Uganda that are liable to flooding.

Kafu River located in the western part of Uganda. It starts from a swamp approximately 12 km (7.5 miles) north East of the village of Kitoma in Kibale District. It flows East wards at first then it turns north to empty into the Victoria Nile approximately 8km (5 miles) up stream of the town of Masindi district. Areas along R. Kafu are poorly drained and are flood prone. Floods mainly occur in the low lying areas of Masindi district during the rainy season. It was reported that most affected sub counties include Pakanyi, Kimengo , Miirya and part of Bwijanga.**(Profi, 2016)**

In December 2015, 1700 residents from the villages of Kididima, Kayera, Nyakarongo, Karangwe, and Myeba were displaced by floods from river Kafu two weeks ago. The affected people camped at a good Samaritan\'s land in the neighborhood. Over 2,700 hectares of crop

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