BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF MINING & WATER RESOURCES ENGINEERING

A FINAL YEAR PROJECT REPORT

REDESIGN OF DRAINAGE STRUCTURES ALONG KATEREMA-PAJWENDA GRAVEL ROAD IN MULANDA SUB COUNTY, TORORO DISTRICT

BY

OKECHO WILLBROAD

REG.NO: BU/UG/2014/146

okechowillbroad14@gmail.com; **0704978253/0779966553**

PROJECT SUPERVISORS

MAIN PROJECT SUPERVISOR: MR. OKETCHO YORONIMO

CO PROJECT SUPERVISOR: MR. LWANYAGA JOSEPH DDUMBA

A final year project report submitted to the Department of water resources and mining engineering in partial fulfillment for the award of the Bachelor of Science in Water Resources Engineering degree at Busitema University.

ABSTRACT

This thesis presents results of the assessment of drainage structures; performance on Katerema Pajwenda gravel road in Mulanda sub county region and redesign measures. Redesign measures were proposed based on UNRA drainage design manuals 2002 and 2011 for Low Volume Roads.

Descriptive and exploratory methods of research were used for this thesis work. Field visits of the catchment area that contributes runoff to the drainage structures were made and the existing problems were described.

The necessary secondary data for this research are land cover map, topographical map, geological map, and feasibility study of the road before construction. The primary data are photographs that show the existing drainage structures conditions, flood level marks and information that is gathered from the residences and road desk office about the performance of the drainage structures during the rainy season. Hydrological analysis was carried out by using Rational and SCS equations. Hydraulic parameters are determined by using Manning's equation.

Structural and hydraulically failures of drainage structures and roadways were investigated. Moreover, stations of the road were investigated that require construction of minor drainage structures but not constructed.

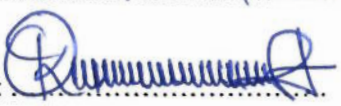
Suitable mitigation measures were proposed in order to make the road and drainage structures serve for the intended purposes sustainably. New drainage structures were proposed where they are lacking in the existing system.

DECLARATION

I **OKECHO WILLBROAD** solemnly declare that this project report is a result of my own efforts and tremendous work done during the research period and it has never been submitted to Busitema University or any other institution of higher learning for any academic award.

NAME: OKECHO WILLBROAD

REG NO: BU/UG/2014/146

SIGNATURE: 

DATE: 12TH/JUNE/2018

APPROVAL

This is to certify that this project report was written under the guidance of my supervisors on the topic ***"Redesign of drainage structures along Katerema – pajwenda gravel road*** and is now ready for submission to the senate of Busitema University.

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Mr. OKETCHO YORONIMO

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DATE

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Mr. LWANYAGA JOSEPH DDUMBA

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DATE

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I would like to extend my sincere thanks to the almighty GOD who has gifted me with life and has enabled me to reach this academic height as he has been the provider of all the necessary requirements.

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DEDICATION

This report is dedicated to my guardian, **Mr. Opio Julius** and my sisters, **Ms Achieng Eunice** and **Mrs. Ochwo Agnes Atoto** in appreciation for their selfless care and unflinching support provided to me since childhood, and for the spirit of hard work, courage and determination instilled into me, which attributes I have cherished with firmness and which have indeed made me what I am today.

LIST OF ACRONYMS

UNRA – Uganda Roads Authority

DEM – Digital Elevation Model

DWD – Directorate of Water Development

DWRM – Directorate of Water Resources Management

MWE – Ministry of Water and Environment

NARO – National Agricultural Research Organization

NFA – National Forestry Authority

UNMA – Uganda National Meteorological Authority

AAM - Average Antecedent Moisture

AASHTO - American Association of State Highway and Transportation Officials

ACPA - American Concrete Pipe Association

ADOT - Arizona Department of Transportation

ASCE - American Society of Civil Engineers

BDM - Bridge Design Manual

BMS - Bridge Management System

CN - Curve Number

DC - Design Class

DDDM - Draft Drainage Design Manual

DDM - Drainage Design Manual

GDM- Geometric Design Manual

HDS- Hydraulic Design Series

HEC- Hydraulic Engineering Circular (FHWA)

HEC- Hydrologic Engineering Center (USACE)

HEC-RAS- Hydrologic Engineering Center for River Analysis System

HEC-HMS- Hydrologic Engineering Center for Hydrology Modeling System

HSG- Hydrological Soil Group

IDF- Intensity-Duration-Frequency

LVRs- Low Volume Roads

USGS- United States Geological Survey

US SCS- United States Soil Conservation Service

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1 CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND

Water is the most important compound ensuring life in this planet. But on roads, the presence of water means mainly trouble. The main cause of road damage, and problems with serviceability of road networks, is excess water filling the pores of road materials in the road and subgrade soils.**(August, 2007)**

Despite massive progress in reducing poverty in several parts of the world over the past couple of decades, notably in East Asia and Africa, there are still about 1.4 billion people living at a subsistence level with less than US $1.25 per day; this constitutes 22% of the population in developing countries. At least 70% of them are living in rural areas.**(Fukubayashi and Kimura, 2014)**. The lack of accessibility to rural roads has been identified as one of the main causes of poverty among rural people since most of the rural roads and rural access roads in developing countries are unpaved, gravelled or even just earth roads **(Lebo and Schelling, 2001a)**. During the rainy seasons, they are in such a poor condition that people struggle to pass along them by tractor, bike or even non-motorized traffic (NMT), such as bicycles or animal-drawn carts. Due to the difficulty of reaching markets to sell their agricultural produce and other goods in the rainy seasons, rural people are locked into subsistence farming. Buyers also cannot reach the village; thus, the cash crops cannot be exchanged for money and the crops rot.

The road network is the backbone of the transport system in Uganda and therefore important that the network is maintained in condition that allows for effective, efficient, and sustainable movement of goods and passengers, ensures preservation of past road investments, and conserves the ecology and environment for future generations.**('Ministry of Transport and Public Works Design Manual for Low Volume Sealed Roads', 2013)**

According to **(Warati and Demissie, 2015)**, Water is the main contributor to the wear and damage of low-volume rural roads. The water can be in the form of ground water, surface water (streams and rivers) or rain and it can damage the road in several ways like by washing away the soil (erosion and scouring), by making the road body less resistant to traffic (i.e. weakening the load bearing capacity), by depositing soils (silting) which may obstruct the passage of water, or by washing away entire sections of the road or its structures.

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