



**BUSITEMA  
UNIVERSITY**  
*Pursuing Excellence*

**FACULTY OF ENGINEERING**

**DEPARTMENT OF MINING AND WATER RESOURCES ENGINEERING**

**FINAL YEAR PROJECT REPORT**

**DESIGN AND SIMULATION OF AN EARTH EMBANKMENT DAM FOR WATER  
HARVESTING FOR INCREASED AGRICULTURAL PRODUCTION**

**(Case study: Magola Sub-county along river Malaba)**

**BY**

**KIWEMPE STEVEN**

**BU/UG/2016/1717**

TEL: +256773732106/+256705209360

EMAIL: [stevenkiwempe62@gmail.com](mailto:stevenkiwempe62@gmail.com)

**SUPERVISORS:      ENG. MOHAMMED BADAZA**

**MR. ALLAN KASEDDE**

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*Final year project report by Kiwempe Steven, BU/UG/2016/1717, Busitema University*

## Abstract

Due to uneven distribution of rainfall throughout the year characterized by heavy rains in a short period of time following prolonged dry spells, it has necessitated the design of water harvesting structures to store water during heavy rains for multipurpose uses including controlling floods and water for irrigation during dry periods.

The overall objective for this project was to design and simulate an earth-embankment dam for agricultural production. The specific objectives were; to carry out hydrological data analysis thereby understanding the hydrological conditions of the river and watershed and estimate the crop water demand, locate a suitable dam site by considering primarily the topographical and geological characteristics of the study area, design the dam components and simulating the dam to evaluate its stability conditions.

Literature review discusses the dam definition and its history in Uganda, Various dam types, choice of dam type and site, possible failures of embankment dams, foundation conditions for dams, importance of reservoirs/dams, factors considered while selecting an irrigation water source and various dam components.

The various methods used in this study include; desk study, oral interviews, consultations and discussions as well as carrying out topographical surveys. All hydrological data was analyzed using Microsoft excel and XLSTAT. River discharge data was found with gaps which were filled using the "Multiple imputations" approach in XLSTAT. The minimum and maximum flows for the selected period of 37 years (1978-2014) were found to be 0.0 and 54.8m<sup>3</sup>/s in 1995 and 1979 respectively. The average flow and standard deviation were 15.1 and 9.7m<sup>3</sup>/s respectively. Analysis also shows a general increase in flow from 1997 to 2014. Dependable yields from the river were estimated using the flow-duration curve. Flows were estimated at 85, 90 and 95% of the time to be 8.5, 7.3 and 6.0m<sup>3</sup>/s respectively. The average annual Volume of water in the river was estimated to be 489.54Mm<sup>3</sup>. This is the amount of water that would be collected in a year if this river was impounded. This information was helpful to the researcher to know whether the river has adequate flow to meet the demand. For spillway design purposes, flood frequency analysis was carried out and the peak discharge was taken at 100year return period to be 66.25m<sup>3</sup>/s.

Locating a dam site was carried out using the Digital Elevation Model and the ArchHydro tools and 3D analyst tools in ArcGIS 10.4. Reservoir calculations were performed and by plotting the Elevation-Area and Elevation-Capacity curves using the python tool, the height of the dam was established.

Simulations were performed using Geostudio 2018 and the minimum factor of safety for slope stability was found to be 1.233. This value is greater than 1 indicating that the structure is safe and should be implemented.

**Declaration**

I **KIWEMPE STEVEN**, declare that this project report is of my own composition and has never been presented to any institution or University for any award or qualification.

Signature

Date

.....

.....

**Approval**

This project report is presented to Busitema University with the approval of my supervisors

**ENG. MOHAMMED BADAZA**

**MR. KASEDDE ALLAN**

Signature: .....

Date: .....

## **Dedication**

I dedicate this project report to my mother Ms. Nakibuule Gorret, brothers and sisters, Lecturers and the entire staff of Busitema University.

## **Acknowledgement**

Glory be to the Most-High God for His goodness and mercy for He has given me the strength and wisdom which have enabled me to compile this project report.

Secondly, I extend my sincere gratitude to my mother Ms. Nakibuule Gorret, and my brothers for their continued support in terms of finances, words of inspiration and encouragement which have been a foundation for my studies.

I also appreciate my supervisor, Eng. Mohammed Badaza, other Lecturers and my fellow students for having guided me during the compilation of this report.

## List of acronyms

FAO	Food and Agricultural Organization
MWE	Ministry of Water and Environment
USBR	United States Bureau of Reclamation
NECJOGHA	Network of Climate Journalists of the Greater Horn of Africa
USACE	United states Army Corps of Engineering
SCAPE	Systems Components Architectural Products and Environments
SCFB	Self-closing Flood Barrier
FEMA	Federal Emergency Management Agency
HVAC	Heating, Ventilation and Air Conditioning
GIS	Geographical Information Systems
DEM	Digital Elevation Model
USGS	United States Geological Survey
GDP	Gross Development Product
NIMP	National Irrigation Master Plan
GoU	Government of Uganda
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries

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