BUSITEMA UNIVERSITY
*Pursuing Excellence*

**FACULTY OF ENGINEERING**

**DEPARTMENT OF MINING AND WATER RESOURCES ENGINEERING**

**WATER RESOURCES ENGINEERING PROGRAMME**

**FINAL YEAR PROJECT REPORT**

# DESIGN AND CONSTRUCTION OF A RECYCABLE WATER SHOWER SYSTEM

**BY**

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## ABSTRACT

Showered water is wastewater generated from bathroom sinks and bathtubs from a household, hotel and institutions. Due to the percentage of showered water discharged, there is a lot of greywater discharged that needs to be recycled and reused. In Busitema University students' halls, showered water is discharged in the same sewer lines with black water hence wasted water. Frequent water shortages in some parts of Uganda have led to poor sanitation in the people's homes of residence, hospitals and institutions due to lack of enough water for showering and cleaning around the shower room. The purpose of the design project was to design and construct water recycling system for showered water that would utilize the available greywater from people's homes of residence to supplement on the only one available ground water source at the country. For the design to be done, showered water quality was determined by collecting samples and testing them using different water quality sensors like turbidity and electoral conductivity sensors, generated quantity of showered water was determined depending on the total water consumption by the students.

Design of various components of the recyclable water shower system was done using the given relevant formulas and equations. From the research, showered water being generated currently was 48,800 liters per day and projecting for 20 years 60,880 litres per day was estimated. The showered water being discharged showed poor physical chemical characteristics and thus needs treatment before reuse. Distribution pipes, collection tank were sized then treatment units where rapid sand filter, clear tank pump, storage tank and were sized.

**DECLARATION**

I **CHRISOSTOM MUGONDI** hereby declare that, this report is a true work of my hands and has never been presented by any person or institution for an academic award

Signature: .....

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**APPROVAL**

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## LIST OF ACRONYMS

E. coli.....Escherichia coli.

EPA.....Environmental Protection Agency.

gpd/ft..... gallons per day per feet

L/h/sq.m.....Liters per hour per square meter.

m/ s.....meters per second

m.....meter

mg/ l..... ..Milligrams per liter

ml.....milliliter

mm.....millimeters

ms/ cm.....milliseconds per centimeter

NWSC .....National Water and Sewerage Corporation

$P^H$.....Power of Hydrogen ion.

U.S.....United states

UGX.....Uganda shillings.

WHO..... World Health Organization

# CHAPTER ONE

## 1.0. INTRODUCTION

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

## 1.1 BACKGROUND

Today, the largest part of the earth's surface is covered with water and it is also found below the earth's surface. It is present in air in the form of water vapour, in all plants and animal's body. Sources of Water include surface and underground water, Rainwater, oceans, rivers, lakes, streams, ponds and springs are natural sources of water. Dams, wells, tube wells, hand-pumps, canals, etc, are man-made sources of water(Pedro and Valley, n.d.).

Water is highly demanded world-wide due to its various uses to household, industrial, agriculture, hydropower and many others(Pedro and Valley, n.d.). With growing populations and changing climates, the available water resources are stressed. Water is being provided to people in Uganda through digging up hand dug wells, springs and drilled boreholes for the case of ground water and pipe distribution by national water and sewerage cooperation for the case of surface water in order to be used by the community at a given price.

The effluent water after use is currently treated as grey water onsite using a septic tank and is drained through a soak pit. For commercial applications in cities, this water is conveyed in sewer lines and is centrally treated using standard treatment methods of, screening, coagulation, sedimentation, filtration and disinfection(Daniels and Mesner 2005) which is too costly to implement most especially when the amount of grey water is a lot and it calls for more treatment and in Uganda this role is tasked to NWSC. This is because there is shortage of water with in the country compared to the rapid raising population(Daniels and Mesner 2005).

From ancient times, the water shower has been upgraded from bathing in rivers, ponds, and water falls to showers.Showering is an activity that consumes a lot of water and energy resources(Recirculating and Work, n.d.). The first mechanical shower, operated by a hand pump, was patented in England in 1767 by William Feetham,

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