

FACULTY OF ENGINEERING

DEPARTMENT OF MINING AND WATER RESOURCES ENGINEERING

BACHELOR OF SCIENCE IN WATER RESOURCES ENGINEERING

A FINAL YEAR PROJECT REPORT

DEVELOPMENT OF A SURFACE WATER TREATMENT PLANT DESIGN TOOL

BY

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A final year project report submitted to the department of mining and water resources engineering in partial fulfilment of the requirements for the award of Bachelor of Science in Water Resources Engineering degree of Busitema University

MAY 2018

EXECUTIVE SUMMARY

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Water is considered a prime substance on earth for survival of all organisms. Safe and clean water originates through certain treatment processes, process units and plants. Water treatment plants are one of the crucial facilities in the world today since it involves production of water that is essentially safe and basic to the general public. They are designed and owned by water utility operators particularly NWSC in Uganda who are vested with task of extracting water from its source (rivers and lakes, etc.), treating it and supplying it to the users.

Most existing water treatment plants in some parts of Uganda produce water for the public that do not match with the National's water quality requirement following the low technological advancement in the company and the country at large. Their design is being done manually thus making the system inefficient since it involves human errors, bulky work, time consuming and much costs involved through labor.

A computerized water treatment plant design tool that encompasses automation in the design of new water treatment plants will eradicate this problem. This application is simple through inter input data needed for each process that provided, the program provide feature that enable the user to change the input data needed for each unit from lists contained different type of these parameters. The user can design and save results for the different water treatment process units under consideration viz. plain sedimentation basin, coagulation basin, flocculation basin, sedimentation basin and rapid sand filter basin regardless of the sequence of operation.

This design tool eradicates time wastage, human errors and bulky work that calls for higher costs. This automated design tool will lead to the development of new efficient treatment plants that will ensure production of water for consumption by the public that is palatable at relatively low costs.

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Firstly, I would love to thank the Almighty God for giving me wisdom, knowledge, health and patience to learn.

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DECLARATION

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I Nabimanya Edwin, hereby declare, to the best of my knowledge, that this final year project report is an outcome of my original work and that it has never been presented to any institution of learning for an academic award.

Signature NEhmand.

Date 2nd June 248

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III

APPROVAL

This is to certify that the project has been carried out under my supervision and this report is ready for submission to the Board of examiners and senate of Busitema University with my approval.

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Table of Contents

EXECUTIVE SUMMARY	i
ACKNOWLEDGEMENTS	ii
DECLARATION	iii
APPROVAL	iv
List of acronyms	viii
List of figures	ix
List of Tables	
CHAPTER ONE: INTRODUCTION	
1.0 Background of the study	
1.1 Problem statement	
1.2 Significance of the study	
1.3 Project objectives	
1.3.1 Main Objective	3
1.3.2 Specific objectives	3
1.4 Scope of the study	3
1.5 Justification	4
2 CHAPTER TWO: LITERITURE REVIEW	5
2.0 Introduction	5
2.1 Surface Water Treatment	5
2.2 Convectional water Treatment Plant	6
2.3 Convectional Water Treatment process	7
2.3.1 Pre-Sedimentation	7
2.3.2 Coagulation	7
2.3.3 Rapid Mixing	7
2.3.4 Flocculation	7
2.3.5 Sedimentation and pre-sedimentation	8
2.3.6 Filtration	.10
2.4 Water Quality Characteristics	.11
2.5 Design and Operation of Water Treatment	. 12
2.5.1 Design of flocculation basin	. 12
2.5.2 Design of pre-sedimentation and sedimentation treatment units.	12
	v

NABIMANYA EDWIN - BU.UG.2014.108

 ${\bf Q}$

ç

4

2.5	.3	Design of filtration unit	13
2.6	PR	OGRAM DEVELOPMNT TOOLS	14
2.6	.1	MATLAB	14
2.6	.2	The MATLAB system	15
2.7	Tes	ting and Verification of design tool results	16
2.7	1	Unit testing	16
2.7	.2	Verification	16
3 <u>C</u> H	APT	ER THREE: MÉTHODOLOGY	17
3.0	Intr	oduction	17
3,1	Тос	ol requirements and architecture	
3.1	. 1	Architecture	17
3.1	.2	Tool requirements	18
3.2	Dev	velopmental steps of computer program	18
3.3	Me	thodology for designing a surface water treatment plant design tool	19
3.3	.1	General assumptions for the design of treatment units of this study	19
3.3	.2	Treatment Plant capacity	20
3.3	.3	Design of a pre-sedimentation tank	20
3.3	.4	Design of a coagulation unit	22
3.3	.5	Design of flocculation basin	23
3.3	,6	Design of a sedimentation tank	25
3.3	.7	Design of a filtration unit-rapid sand filter	27
3.4	Me	thodology for simulation of the surface water treatment plant design tool	29
3.5	Tes	ting and validation of surface water treatment plant design tool	32
3.5	.1	Unit testing of design tool	32
3.5	.2	Validation of design tool	32
4 CH	IÁPT	ER FOUR RESULTS AND DISCUSSIONS	33
4.0	Res	sults	33
4,1		cussions	
		ER FIVE: CONCLUSION, CHALLENGES AND RECOMMENDATIONS	
5.0	Cor	nelusions	37

NABIMANYA EDWIN – BU.UG.2014.108

۰.

۰.

٧Ĭ

5.0.1	Conclusion on objective one	ľ
5.0. 2	2 Conclusion on objective two	7
5.0.3	Conclusion on objective three	7
5.0.4	General conclusion	;
5.1	Challenges	ţ
5.2	Recommendations)
REFERE	NCES)
APPEND	PIX	;

 \mathbf{c}_{3}

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ŧ

List of acronyms

NWSC- National water and Sewerage Corporation

Etc. - et cetera

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Dia - diameter

MATLAB- Matrix laboratory

WTP- Water treatment plant

SWTP- Surface water treatment plant

GUI- graphical use interface

Viz. - Namely

Pdf- portable document format

List of figures

÷.,

45

v

Figure 2:1 typical layout of a surface water treatment plant	6
Figure 2:2 Radial circular clarifier	
Figure 2:3 Different parts of a sedimentation basin	
Figure 2:4 Rapid sand filter type with different sections	. 13
Figure 3:1 Block diagram for the system	. 17
Figure 3:2 Design tool development steps	. 19
Figure 3:3 Computer program flow chart	. 29
Figure 3:4 computer program Interface	. 30
Figure 3:5 computerized design of a sedimentation basin	. 31
Figure 3:6 computerized design of a sedimentation basin with inputs and outputs	. 31
Figure 4:1 Comparison of rapid sand filter results	. 36

List of Tables

٩

EV.

Table 3-1 Design criteria and design equations for parameters needed for design of a Plain
sedimentation tank 20
Table 3-2 Design criteria and design equations for parameters needed for design of a coagulation
basin 22
Table 3-3 Design criteria and design equations for parameters needed for design of a flocculation
basin 23
Table 3-4 Design criteria and design equation for parameters needed for design of a sedimentation
tank 25
Table 3-5 Design criteria and design equation for parameters needed for design of a rapid sand
filter 27
Table 4-1 Comparison of the results for the design tool and the existing data for specific design
values for the coagulation unit 34
Table 4-2 Comparison of the results for the design tool and the existing data for specific design
values for the flocculation basin34
Table 4-3 Comparison of the results for the design tool and the existing data for specific design
values for the filtration unit 35

NABIMANYA EDWIN - BU.UG.2014.108

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CHAPTER ONE: INTRODUCTION

1.0 Background of the study

Water is the most important substance on earth for survival of all organisms (Chavan *et al.*, 2015). Water is considered to be one of the physical environments of human beings and has direct impact on their health. Effective utilization of the existing water resources is the need of the hours and of all times. The water available is to be treated as a solution to the issue. In total of 100% water available on earth, only 0.01% of the total water of the earth is available for consumption (Hagemann *et al.*, 2013). With the present population growth-rate and high water demand, there is a need to efficiently manage the available water resources which is the most problem in the world.

The availability of a reliable and clean supply of water is one of the most important determinants of our health. Historically, improvements in human health have been related to improvements in our water supply system from source to tap, therefore surface water treatment plants are important in modern society. Many diseases that can be contracted by humans can be waterborne such as typhoid, cholera, amoebiasis (amoebic dysentery), giardiasis, polio, paratyphoid, salmonella, etc. bacteria, protozoans, viruses, helminthes all can be and are waterborne and can cause illness in humans. Water is not a primary mode of transmission of any disease but when water carries an agent capable of causing an infection it is a medium that can carry an infection over a wider area to a more diverse population in a short period of time than almost any other mode of transmission expect perhaps air (Engelhardt, 2012) Surface water is mostly contaminated and not suitable for direct usage, consequently it is subjected to direct pollution from natural and human activities(Ishii *et al.*, 2013).

Clean and safe water is an engineering grand challenge (Wang *et al.*, 2014), thus there is a need to optimize the existing water plants as well as come up with better and improved plants which will produce water complying with quality constrains (Chamier *et al.*, 2012). Safe water basically originates through certain water treatment processes(Qu, Alvarez and Li, 2013). Water treatment is the process of removing pollutants from raw water to produce safe and clean water that matches with the required standards (Vigneswaran *et al.*, 2013). Different water treatment types consist of different treatment processes and units basing on the quality of raw water to be treated and the

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41

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