DESIGN AND DEVELOP AN INTERGRATED SYSTEM FOR LAKE WATER TREATMENT AT UTeM'S LAKE – FILTRATION DEVICE AND DEBRIS COLLECTION

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This report is submitted in partial
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DECLARATION

"I hereby declare that the work in this thesis is my own except for summaries and quotations which have been duly acknowledged."

Signature : .....

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DEDICATION

Especially for

Beloved mother and father

Hat Bin Arop

Noraini Binti Bakar

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First and above all, I praise Allah s.w.t for providing me this opportunity and granting me the capability to accomplish this project. I also would like to express my gratitude to my supervisor PM. Dr. Ir. Abdul Talib bin Din for his guidance and support, Universiti Teknikal Malaysia Melaka (UTeM) for providing useful data regarding to this projects. My thanks also go to all my best colleagues for their open handle and kindly guided, assisted and encouraged me to proceed successfully. Last but not the least, I would like to thank my dearest family for supporting me spiritually and encouraging me with their best wishes throughout this project. Actually it was not possible for me to complete a severe task without such help. So I pray the long life and good health for the entire person who has helped me.

ABSTRACT

The main objective of this project is to build waste filtration systems for Teknikal Malaysia Universiti of Malaka (UTeM). The main factor that needs to deal with on implementing this project is the most suitable waste filtration systems selections based on a few other factors such as water quality, water depth and flow rate of UTeM's lake. For the selection of suitable filtration systems, research was carried out about waste filtration systems. In an attempt to reserve required maximum oxygen for UTeM's lake, quality of water and rate of waste disposal must be known first. At the same time, mechanical characteristics and factors should be considered for the purpose of designing that waste filtration systems. Besides reducing the waste disposal at maximum level, this machine must not interrupt the water flow and any activities at UTeM's lake while the contruction cost and material choosing affordable.

ABSTRAK

Tujuan utama projek ini adalah untuk membangunkan sistem panapisan sampah bagi tasik Universiti Teknikal Malaysia Melaka (UTeM). Faktor utama yang harus di ambil berat ketika menjalankan projek ini adalah pemilihan sistem penapisan sampah yang paling sesuai berdasarkan beberapa faktor lain seperti kadar kualiti air, faktor kedalaman dan aliran tasik UTeM. Bagi pemilihan sistem yang sesuai, kajian di jalankan berkaitan sistem penapisan sampah. Dalam usaha untuk membekalkan keperluan oksigen yang maksimum untuk tasik UTeM, kadar kualiti air dan kadar sisa terbuang harus diketahui terlebih dahulu. Pada masa yang sama juga, ciri-ciri dan faktor-faktor mekanikal harus di ambil kira bagi tujuan mereka sistem panapisan sampah tersebut. Selain dapat mengurangkan sisa terbuang secara maksimum, reka bentuk sistem ini hendaklah tidak menghalang arus aliran dan sebarang aktiviti di tasik UTeM di samping kos pembuatan dan bahan yang tidak terlalu mahal.

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LIST OF ABBREVIATIONS AND SYMBOLS

UTeM	-	Universiti Teknikal Malaysia Melaka
FKM	-	Fakulti Kejuruteraan Mekanikal (Faculty of Mechanical Engineering)
BOD	-	Biochemical Oxygen Demand
COD	-	Chemical Oxygen Demand
Pa	-	Pascal's
DO	-	Dissolve Oxygen
CAD	-	Computer Aided Design
CFD	-	Computational Fluid Dynamic
MATLAB	-	Matrix laboratory
W	-	Watt
V	-	Volt
N	-	Newton
J	-	Joule
cm	-	centimetre
m	-	metre
mm	-	milimetre
in	-	inch
kg	-	kilogram
mg	-	miligram
L	-	Litre
mL	-	Mililitre
HP	-	Horse Power
min	-	minute
ºF	-	Degree Fahrenheit
ºC	-	Degree Celsius

K	-	Kelvin
Ø	-	Diameter
ft	-	feet
ppm	-	Parts per million
Hg	-	Mercury
FAS	-	Ferrous ammonium
QFD	-	Quality Function Development
HoQ	-	House of Quality
SOTR	-	Standard Oxygen Transfer Rate
R	-	Rating
WR	-	Weighted Rating
IW	-	Importance Weight

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Water is the most valuable resource and humans need it for survival. One of the ways to obtain it is from lake beside of rain, lake and others. Lake has been played such an essential role in daily life since thousand years as an early location for settlement.

Throughout human history, lakes have served as important sources of drinking water, food and irrigation for crops. In the earlier days, peoples preferred to settle at the lake because it not only supply water for their domestic needs and agricultural purposes but also enabled them to move from place to place using boats or rafts as their transport.

Nowadays, people depend on the lake for living purposes such as dam, to collect for fresh water source and in the same time as a source of electricity.

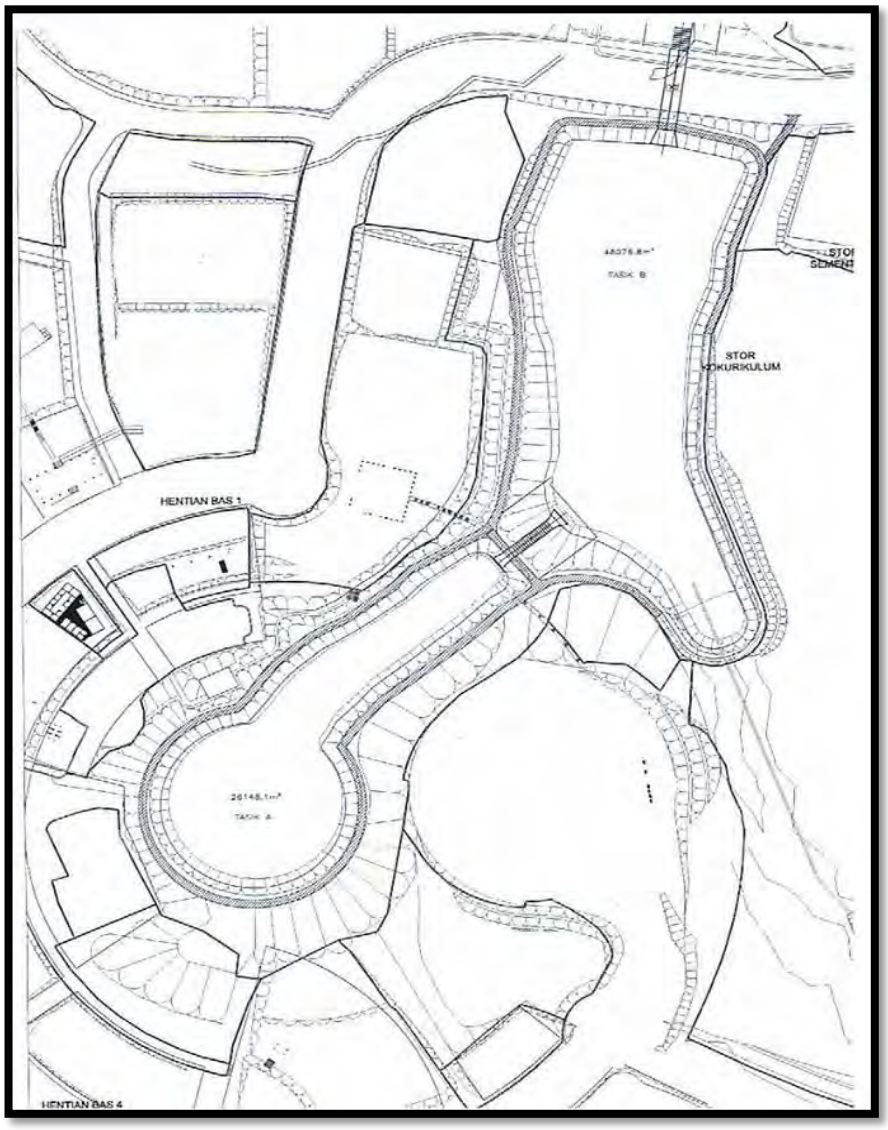

Figure 1.1: Map of UTeM's lake

1.2 OBJECTIVE

Design and develop an integrated system of device for lake water treatment in such a way to reduce BOD, COD, TSS and also to increase the content of dissolved oxygen in lake water- Filtration device and debris collection

1.3 SCOPE

Make research for overall UTeM's lake water based on analysis of water quality research made by UTeM Development Office especially in parameters of solid waste therapy and semi float.

1.4 PROBLEM STATEMENT

In this project, careful thought need to be given to several aspects. First of all is to design a suitable screening and sedimantation system composed base on biological oxygen demand (BOD) and chemical oxygen demand (COD) value.

Next, the level of BOD and COD in UTeM's lake need to be calculated precisely so that a proper amount of oxygen can be supplied by the screening and sedimentation system. Figure 1.2 shows the typical waste condition.

(a)

(b)

Figure 1.2: Typical waste condition (a) Jebat River (b) Putat River

1.5 IDEA CONCEPT DESIGN

The UTeM's lakes have 2 sides. There are lake A and B. In this project, a machine will be placed in the middle at the bottom of the lake for 26148.1m^2 and 48076.8m2 respectively. This machines will be operated depending on BOD and COD of the water.

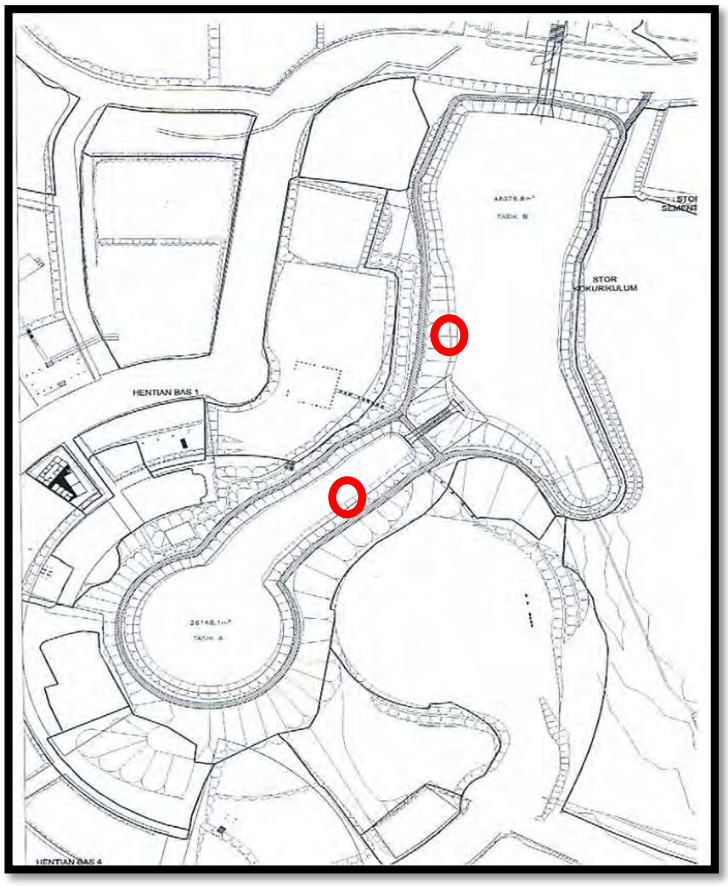

Figure 1.3: Locations of machine along the lake

1.6 REPORT OUTLINE

This project consist of two parts which are PSM 1 and PSM 2. PSM 1 consist of five parts which are introduction, literature review, methodology, concept design and conclusion.

Introduction describes about the definition, objectives, scope and the problems statement connected to the project. Literature review will briefly explain in term of method and measurement applied to obtain the data. Methodology consists of the technique applied in gaining the data. Result and discussion will be described in PSM 2.

1.7 RESEARCH METHODOLOGY

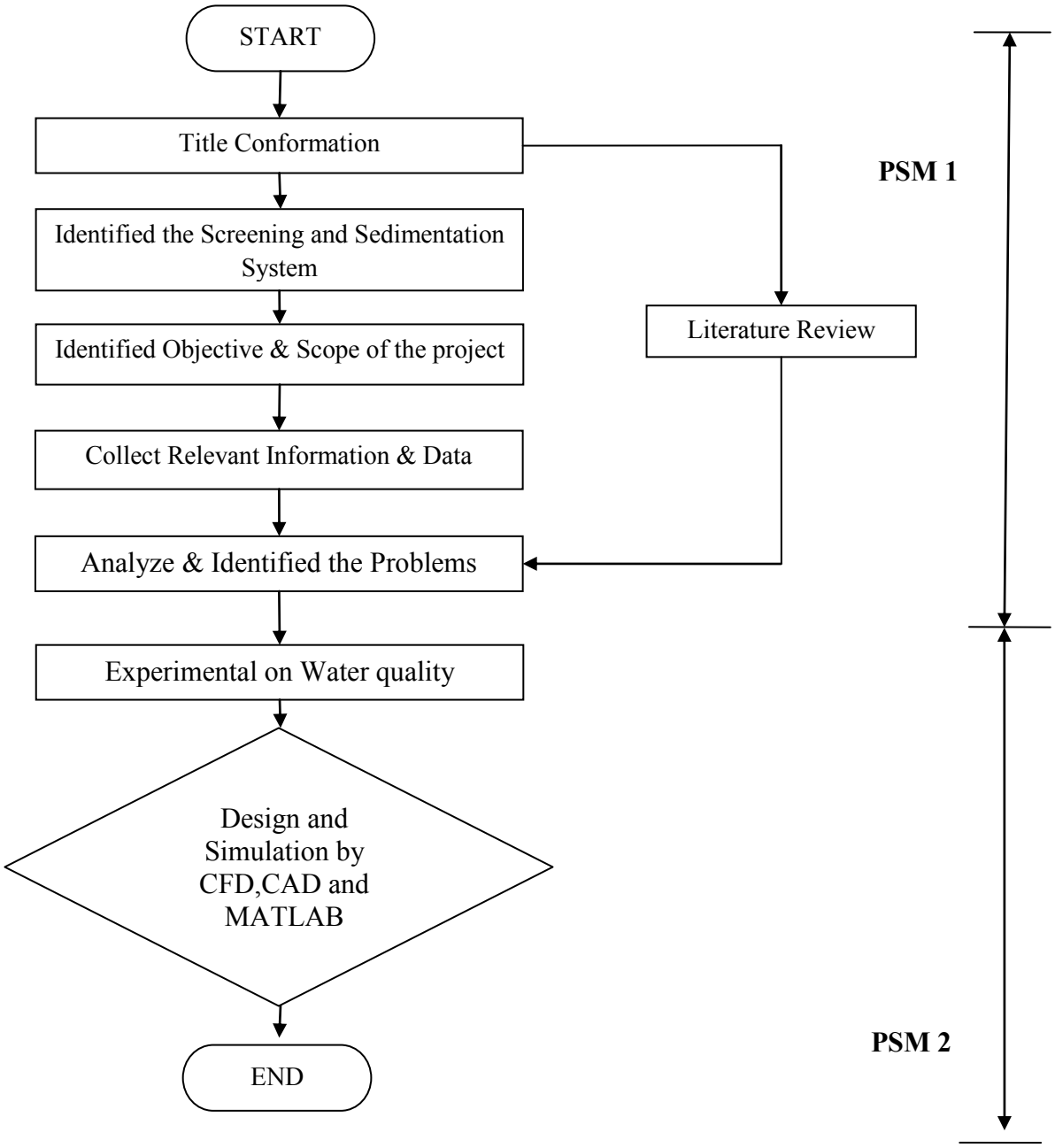

Figure 1.4: Flow process for PSM

CHAPTER 2

LITERATURE REVIEW

2.1 SCREENING

Screening is normally the first unit operation used at wastewater treatment plants. Our definition of a screen is that it is the equipment that protects the downstream process from objects that could cause disturbance and maintenance issues. It is a device with openings, commonly of regular size, that is utilized to hold on large solids discovered in the influent wastewater to the treatment plant. The general purpose of screen is to get rid of huge objects such as rag, paper, plastics, metal and other debris. These objects if not get rid of, may harm the pumping and sludge removal equipment, thus creating risky plants operations and maintenance problems. Fine screens are sometimes utilized in place where greater remotion of solids is needed to protect equipment which may be more sensitive to solids such as membrane bioreactors.

In the utilization of screening devices, all facet of screenings removal, transport and disposal must be analyse including the level of screenings removal required due to the possible effect on downstream treatment operation and equipment, health and safety of the operators smell potential and requirement for handling, transport, prior to disposal and disposal

choices. Thus, to accomplish effective screenings management an incorporated approach has to be enforced.

2.1.1 Classification of Screens

Wastewater screenings are generally categorized into either coarse screening or fine screening. Both are used in preliminary treatment of waste water. Fine screens may also be utilized as an optional primary treatment process or for getting rid of extra organic solids from sludge streams prior to sludge processing. The principal applications for microscreens are to remove undissolved solids from secondary effluent and from stabilization-pond effluent.

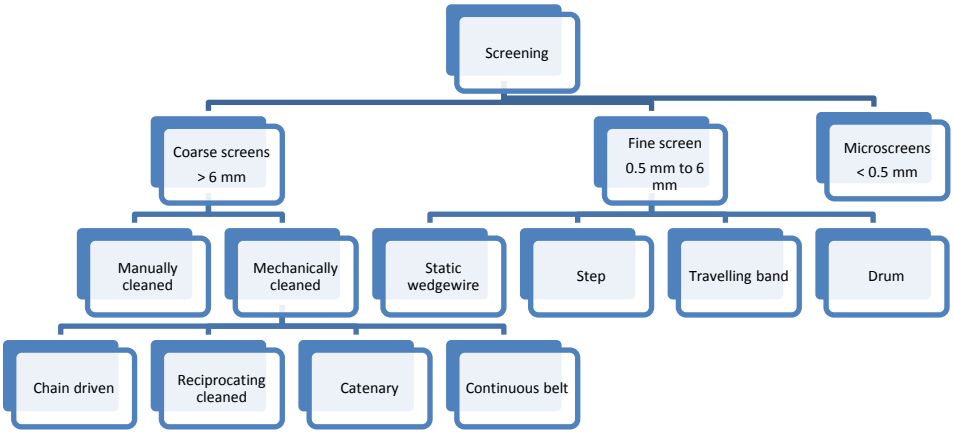

Figure 2.1: General classification for the types of screens