SPATIAL VARIATION OF SURFACE WATER QUALITY OF THE BERA LAKE SYSTEM USING WATER QUALITY INDEX (WQI) & NATIONAL WATER QUALITY STANDARD (NWQS) MALAYSIA

NUR MUSFIRAH BINTI MUHAMAD DIN

B. ENG(HONS.) CIVIL ENGINEERING

UNIVERSITI MALAYSIA PAHANG

SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor Degree of Civil Engineering

_____

(Supervisor's Signature)

Full Name : DR. MIR SUJAUL ISLAM

Position :

Date :

STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

_____

(Student's Signature)

Full Name : NUR MUSFIRAH BINTI MUHAMAD DIN

ID Number : AA14143

Date :

SPATIAL VARIATION OF SURFACE WATER QUALITY OF BERA LAKE SYSTEM USING WATER QUALITY INDEX (WQI) & NATIONAL WATER QUALITY STANDARD (NWQS) MALAYSIA

NUR MUSFIRAH BINTI MUHAMAD DIN

Thesis submitted in fulfillment of the requirements
for the award of the
Bachelor Degree in Civil Engineering

Faculty of Civil Engineering and Earth Resources

UNIVERSITI MALAYSIA PAHANG

JUNE 2018

ACKNOWLEDGEMENTS

Bismillahirrahmanirrahim,

Alhamdulillah, thank to Allah SWT, with His willingness for giving me strength and spirit to complete my Final Year Project with full of pride and dignity.

I would like to gratefully and sincerely thank to my supervisor, Dr.Mir Sujaul Islam for his guidance and advice during the progress research project and sharing his knowledge and experience in completing this project. Also, for his willingness to give his time so generously has been very appreciated.

I wish to thank Environmental Laboratory staff for their contribution to this project; Puan Azimah and Encik Qari to let me stay in the lab and guiding me through all my experimental works.

I would also like to extend my thank to my fellow friends, Nor Suhada bt Abdul Zaman, Maizatul Aida bt Mohd Redzuan, Nur Lyana Adibah bt Mushiwan, Sofea Natasha bt Shaharudin and all my friends for their help in offering me the resources during my progress research project. Hereby, I would like to acknowledge their comments and suggestions, which was crucial for successful completion of this study.

Finally, wish to thank my parents and family member for their support and encouragement throughout my study.

ABSTRAK

Satu kajian mengenai variasi spatial kualiti air permukaan sistem Bera Lake telah dijalankan di tiga stesen pensampelan yang terdapat di kawasan pertanian, kawasan resort dan jeti. Sejumlah lapan belas parameter kualiti air dianalisis termasuk ujian in-situ dan ujian makmal. Semua parameter dianalisis dan diukur mengikut kaedah standard. Parameter kualiti air dikelaskan berdasarkan Indeks Kualiti Air Jabatan Alam Sekitar dan Piawaian Kualiti Air Negara (NWQS) untuk Malaysia. Pembolehubah fizikal, kimia dan biologi ialah suhu, kekeruhan, pepejal terampai total (TSS), oksigen terlarut (DO), pH, permintaan oksigen biologi (BOD), permintaan oksigen kimia (COD), kekonduksian elektrik (EC), nitrogen ammonia, nitrat, fosfat, koliform, dan Escherichia coli (E.Coli). Keputusan menunjukkan bahawa kualiti air di Bera Lake berada di bawah Kelas II berdasarkan WQI, yang bermaksud, Tasik Bera sesuai untuk aktiviti rekreasi dan hubungan badan dibenarkan, namun rawatan asas yang diperlukan untuk bekalan air. Berdasarkan NWQS, kekonduksian elektrik (EC), total pepejal terampai (TSS), nitrogen amoniak berada di bawah kelas I dan nitrat adalah Kelas II. Parameter untuk kekeruhan, fosfat, permintaan oksigen biokimia (BOD) berada di bawah kelas (III) dan permintaan oksigen kimia (COD) berada di bawah Kelas II. pH dan oksigen terlarut berada di bawah Kelas III. BOD adalah lebih tinggi di kawasan pertanian (7.45mg / L) dan rendah di kawasan resort (1.15 mg / L), jadi BOD berada di bawah kelas III. Manakala untuk COD, nilai yang lebih tinggi adalah di kawasan resort (14.5 mg / L) dan lebih rendah di kawasan pertanian (10.25mg / L), jadi COD berada di bawah kelas II. Untuk jumlah pepejal yang digantung (TSS), nilai yang lebih tinggi adalah di kawasan pertanian (23.00 mg / L) dan lebih rendah di kawasan jeti (4.00 mg / L), jadi TSS berada di bawah kelas I. Aktiviti manusia di sekitar kawasan berhampiran Tasik Bera di sana. Aktiviti pertanian, seperti ladang kelapa sawit, memang menjejaskan kualiti air di Tasik Bera dan jika keadaan ini berterusan, mungkin menyebabkan kemusnahan alam sekitar di Bera Lake dengan itu boleh menyebabkan tumbuhan alga di tasik.

ABSTRACT

A study on the spatial variation of surface water quality of the Bera Lake system was conducted at three sampling stations which were at agriculture area, resort area and jetty area. A total of eighteen water quality parameters were analyzed including in-situ test and laboratory test. All the parameters were analyzed and measured according to standard method. Water quality parameters were classified based on Department of Environment Water Quality Index and National Water Quality Standard (NWQS) for Malaysia. The physical, chemical and biological variables were temperature, turbidity, total suspended solid (TSS), dissolved oxygen (DO), pH, biological oxygen demand (BOD), chemical oxygen demand (COD), electrical conductivity (EC), ammoniacal nitrogen, nitrate, phosphate, total coliform, and Escherichia coli (E.Coli). The results show that water quality at Bera Lake was under Class II based on WQI, which means, Bera Lake is suitable for recreational activity and body contact is allowed, however basic treatment required for water supply. Based on NWQS, electrical conductivity (EC), total suspended solid (TSS), ammoniacal nitrogen are under class I and nitrate were Class II. Parameter for turbidity, phosphate, biochemical oxygen demand (BOD) were under class (III) and chemical oxygen demand (COD) was under Class II. pH and dissolved Oxygen were under Class III. BOD was higher at agriculture area (7.45mg/L) and low at resort area (1.15 mg/L), so BOD was under class III. While, for COD the higher value was at resort area (14.5 mg/L) and lower at agriculture area (10.25mg/L), so COD was under class II. For total suspended solid (TSS), higher value was at agriculture area (23.00 mg/L) and lower at jetty area (4.00 mg/L), so TSS was under class I. Human activities at surrounding area near Bera Lake affected water quality there. Agricultural activity, such as palm oil plantation, indeed affects water quality in Bera Lake and if these situation continued, may have caused environmental degradation at Bera Lake hence may lead algal bloom in lakes.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AN	Ammoniacal Nitrogen
BOD	Biochemical Oxygen Demand
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
DOE	Department of Environment
EC	Electrical Conductivity
E-Coli	Escherichia Coli
mg/L	Milligram per litre
NTU	Nephelometric Turbidity Units
NH_3-N	Ammoniacal Nitrogen
NO_3^-	Nitrate
NWQS	National Water Quality Standard
TSS	Total Suspended Solids
TDS	Total Dissolved Solids
PO_4^{3-}	Phosphate
µs/cm	Microsiemens per centimetre
USEPA	Unites States Environmental Protection Agency
WQI	Water Quality Index

CHAPTER 1

INTRODUCTION

1.1 Introduction

The lake is the inland water that does not have a direct exchange with the sea. The lake ecosystem consists of the physical, chemical and biological properties found in these water bodies. The lake may contain fresh water or salt (in arid areas). They may be shallow or deep, permanent or temporary. Lakes of all kinds share many ecological processes and biogeochemistry and their studies are in the 'limnology' disciplines. The lake is a remarkable habitat to study the dynamics of ecosystems: the interactions between biological, chemical and physical processes are often either quantitatively or qualitatively than those on land or air. Because the boundaries between water and land and water and air are different, there is a tight coupling among many ecosystem components. The isolated lake is a saline due to evaporation or groundwater input. Although the lake contains 50.01% of all the water on Earth's surface, they hold 49.8% of the liquid surface freshwater. Many organisms rely on freshwater for life and humans often rely on lakes for abundant 'goods and services' such as drinking water, waste removal, fisheries, agricultural irrigation, industrial and recreational activities (Jain, 2016). Water is one of the most precious natural resources for all forms of life. Water also contamination poses considerable risks for human health as well as other living organisms. Monitoring and maintaining quality of water from various sources such as lakes, river, ponds ,etc.. As a natural wetland, the lake plays an important ecosystem for natural flood retention basin, reduces riverbank erosion, and acts as a natural sponge to absorb flood water in protecting the downstream area from fatal flooding. It also help to recharge groundwater aquifers by holding water and allowing it to infiltrate the ground slowly.

In Malaysia, the natural lakes that can be found are Tasik Bera and Tasik Chini in Pahang and also Tasik Loagan Bunut in Sarawak. They formed part of storage basins for water supply, agriculture and also for hydropower function. Lakes also play an important role as flood control detention storage to buffer the different flow between dry and wet season. (Dalwani, 2008). Bera Lake was a larger natural lake in Malaysia that state at the Pahang. Bera Lake expands the length of 35 km and 20 km wide, and surrounded by a sloping dipterocarp area of dry lowlands, peat swamp forest islands that support the diversity of animal and plant life, and maintain the lives of 'Semelai' branches of people inhabiting wetlands. Besides that, Bera Lake was the lake under the Convention on Wetlands due to Bera Lake was the naturally wetlands.

Bera Lake was characterized by aqueous landscape dominated by large blades such as pandunas leaves that make up narrow channels. Various ferns, orchids and epiphytes had be seen attached to the tree trunks while the barbed rattan was gleaned through bushes. Between high bamboo bamboo fields and solid row rows found in open water, dozens of pot plants hang in green and red, In dry areas, low rainforest trees and palm trees add to the diversity of wetland reserves. Bera Lake was an ecosystem that supports not only the diversity of animal and plant life, but also maintains the life of Semelai - indigenous people inhabiting wetlands. Other than that, Bera Lake was a sanctuary for more than 200 species of birds, 50 mammals and 94 species of fish. It was also a habitat that provides food and shelter for bird life, including rivets, eagles, eagles, but as a whole, the birds were very rare. Although it was extremely difficult to see in the wild, the extended wetlands and surrounding forests still support tigers, tapirs and elephants. It was also home to endangered reptile species such as Malayan False Gharial (a freshly eaten crocodile, fish eating fish), a fully-protected giant Tortoise Researcher, sought after Malayan Malaya Turtle, a reticulated pythons that can grow long of 18feet, prehistoric monitor lizards and many frog species.

.

1.2 Problem Statement

Extensive illegal exploration activities in lakeside lakes have resulted in the impact on water quality. This activities have cause the chemical and physical characteristic of the surface water quality. The possible effects of illegal exploration activities include impacts on stream flow regimes and impacts on erosion and sedimentation. Besides that, agricultural and land development also give impact to the surface of water quality. With development happen around the lake it affected to the damages of the plant around the area, the aquatic habitat and their system and made the lake to be polluted. Their role as wetlands are lost due to these problems mentioned and thus decreases the water quality. The function of this study is to determine physical and chemical water characteristic of the lake system. The water quality is depending on the eutrophication level of the lake. As the eutrophication become worst, the water quality also will be affected.

1.3 Objective of the study

The objectives of the study are:

i) To determine the physical, chemical and biological water characteristic in the lake system.
ii) To classify the water quality by assessing the Water Quality Index (WQI) and National Water Quality Standard (NWQS) for Malaysia.

REFERENCES

Allinance. (2010). Dissolved Oxygen: https://www.paesta.psu.edu/sites/default/files/paesta-idea/water_quality_parameter_info_acb.pdf

Boorse, W. &. (2014). *Environmental Science toward a Suistanble Future.* United States of America: Pearson.

Chandra, S. &. (2012). Water Quality. *Assessment of Water Quality Values in Porur Lake Chennai, Hussain Sagar Hyderabad and Vihar Lake Mumbai, India*, pp 508-515.

Chapman PJ Kay P, M. G. (2013). Water Quality . *Surface water quality* .

Chapman, P. K. (2013). *Surface Water Quality.* UK: Routledge.

Chiras, D. (2013). *Environmental Science.* United States of America: Jones & Bartlett Learning.

Chiras, D. (2015). *Environmental Science.* United States of America: Jones & Bartlett Learning.

Dalwani, S. &. (2008). World Lake Conference. *World Lake Confrence*.

EPA. (2012). Conductivity in Water. *Monitoring and Assessment*, pp5.9.

EPA. (2013). *Aquatic Life Ambient Water Quality Criteria for Ammonia*.

EPA. (2017). Revised Total Coliform Rule And Total Coliform Rule. *Drinking Water Requirements for States and Public Water Systems*.

Fussman, H. &. (2002). Lake Ecosystems. *Lake Ecosysytems*.

Gemma, W. (2014). Types Of Water Pollution: Forms, Causes And Consequences: https://blog.udemy.com/types-of-water-pollution/

Hicks, S. (2011). *Pollution*. Lake Scientist: http://www.lakescientist.com/pollution/

Jain, R. B. (2016). Sustainable Water Resources Management. *Water quality assessment of lake water: a review*, pp 161–173.

Kumar, A. (2008). *Environmental Issue and Solution.* New Delhi: Daya Publishing House.

L.Mays. (2009). Integrated Urban Water Management:. *Arid and Semi-Arid Regions*.

Miller, C. &. (1981). *Cumulative Silvicultural on watersheds.* New York : Springer -Verlag New York.

Mohan K.Wali, F. E. (2010). *The Environment Science, Issues, and Solutions.* US: Taylor & Francis Group.

Oram, B. (2014). *Water Research Center*. https://www.water-research.net/index.php/nitrate

PahangTourism. (2018). *Tourism Pahang Malaysia*. Pahang Tourism: http://www.pahangtourism.org.my/index.php/lake-bera

Realtechwater. (2015). *Realtechwater*. https://realtechwater.com/parameters/biochemical-oxygen-demand/: https://realtechwater.com/parameters/biochemical-oxygen-demand/

Smol. (2008). Pollution of Lakes and River. *Paleoevirnomnental Perseptive pollution of lakes and river*.

Spellman, F. (2015). *The Science of Water*. United Kingdom: CRC Press, Taylor & FGroup.

William P.Cunningham, M. C. (2007). *Environmental Science: A Global Concern.* New York: McGrawHill.