STUDY ON BED MATERIAL CHARACTERISTICS AND BED LOAD CONCENTRATION IN SUNGAI JEMBERAU AT TASIK CHINI

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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.

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Date : 30th May 2019

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Thesis submitted in partial fulfillment of the requirements
for the award of the
B.Eng (Hons) Degree in Civil Engineering

Faculty of Civil Engineering & Earth Resources

UNIVERSITI MALAYSIA PAHANG

MAY 2019

DEDICATION

This thesis dedicated to my parents, my family and friends for without their inspiration, coaching and enthusiasm none of this would be happened. Thanks for everythings.

ACKNOWLEDGEMENTS

In the name of Allah the Most Gracious, the Most Merciful, Praise to Him the Almighty that in his will and given strength to me for completing my progress report.

Praise and glory to ALLAH S.W.T, God of all creations and greetings and salutation we bring forth to our Prophet Muhammad S.A.W for overseeing this final year project one and constantly guiding this project towards completion. I would like to use this opportunity to deliver my special thanks to the Faculty of Civil Engineering and Earth Resources for providing me the platform to conduct this study at first place.

Moreover, I would like to second this very moment to thank and express my warmest and sincere gratitude to my supervisor, Madam Nadiatul Adilah Binti Ahmad Abdul Ghani for her germinal and constructive ideas, her continuous encouragement with deep guidance and support in making this study successful and fruitful. She always concerned about the progress level of this study and never at all hesitates to spend times with me for reviewing this project every week. I am truly grateful for her consistent supervision on this study, her tolerance of my naïve mistakes and persistent ideas in improving this study which has also helped me to deeply understand the need of this study.

I would like to express my gratitude to my parents for their willingness to sacrifice the time, having to believe in my strength and capabilities, and provide the funds throughout my days as a student. Losing my beloved one and only father in this world on two days before first presentation for Final Year Project 1, this thesis and research will always be in my mind and heart. I also want to thanks all my family Mohd Ghazali Bin Santari my late father, Rahawiah binti Dollah my mother, and my siblings Siti Nur Zalira Binti Mohd Ghazali, Nur Zuridah Binti Mohd Ghazali, Mohd Aiman Bin Mohd Ghazali and Nurul Izzati Binti Mohd Ghazali for unending support and love.

Besides that, I would like to express special thanks to my technician Geotechnical Laboratory, UMP and friends who worked along day and night helping each other with necessary information and knowledge in which are essential in the completion of this project. I am really appreciating their willingness to spend time with me to do this study. Last but not least, I also thank those who have directly or indirectly played a role in providing necessary contribution to this study.

ABSTRAK

Kajian ini telah dijalankan di Sungai Jemberau, Tasik Chini. Tujuan kajian ini adalah untuk mengenal pasti ciri-ciri dasar sungai dan kepekatan beban dasar di Sungai Jemberau disebabkan oleh aktiviti manusia dan juga dengan menggunakan kaedah yang tertentu dan untuk mengenal pasti corak corak mendapan / beban dasar yang disebabkan oleh proses pemendapan. Untuk menentukan ciri-ciri dasar sungai, dan ciri-ciri tanah, beberapa ujian yang berkaitan dengan ujian tanah telah dijalankan di Makmal Geoteknik, UMP. Ujian yang terlibat adalah taburan saiz zarah, kandungan kelembapan dalam usaha untuk mendapatkan ciri-ciri klasifikasi sample tanah. Keputusan ujian ayakan sample sediemen diklasifikasikan menggunakan jadual Unified Sistem Pengkelasan Tanah. Analisis untuk taburan saiz zarah menunjukkan keputusan yang paling tinggi adalah Sample 3 - 4.20mm diikuti oleh Sample 2 3.75mm, Sample 1 dan sample yang terakhir iaitu 2.75mm dan 1.15mm. Kandungan kelembapan sample pada waktu hujan iaitu untuk Jemberau 2A dan Jemberau 2B adalah 34.41% dan 39.12% dan diikuti dengan Chini 1A dan Chini 1B dengan catatan tarikh sample diambil selepas banjir adalah 29.99% dan 10.99%. Tambahan juga, hakisan permukaan juga memberikan sumbangan kepada peningkatan pengangkutan mendapan dan telah menjadi salah satu daripada masalah utama di Sungai Jemberau. Corak beban dasar pada setiap titik telah dikenal pasti melalui proses pemendapan. Corak beban dasar memberi perubahan mod pengangkutan mendapan di Sungai Jemberau. Beban dasar telah dinilai menggunakan dua formula yang berbeza yang iaitu Schoklitsch dan Duboys. Daripada analisis keputusan setiap formula Duboys boleh digunakan untuk meramalkan pengangkutan beban dasar untuk Sungai Jemberau.

ABSTRACT

The study conducted at Sungai Jemberau sample site. The purpose of this research was to identify the bed material characteristic and bed load concentration in Sungai Jemberau at Tasik Chini because of human activities and also to analyze the bed load discharge of Sungai Jemberau using selected method and to identify the sediment pattern/bed load pattern due to sedimentation process. In order to determine the bed material characteristic and bed load concentration and soil properties, several test were related soil testing conducted in the Geotechnical Laboratory, UMP. Testing that involved are a particle size distribution, moisture content that were carried out in classify properties of the soil sample. The sediment sample sieving test results was classified using Unified Soil Classification System (USCS). Analysis for particle size distribution were shown the highest particle size distribution were Sample 3 - 4.20mm followed by Sample 2 - 3.75mm, Sample 1 and last sample at were 2.75mm and 1.15mm. The moisture content for rainy day which is for Jemberau 2A and Jemberau 2B 34.41% and 39.12% and followed by Chini 1A and Chini 1B when recorded that date is after flood is 22.99% and 10.99%. Furthermore, the surface erosion also gives contribution to the increase of sediment transport and had become the one of main problem at Sungai Jemberau. The bed load pattern at each point were identified through the sedimentation process. The bed load pattern gave the variation of sediment transport modes at Tasik Chini. The bed load discharge were evaluated using two different methods which is direct sampling and formula predictions. Then, by using formulas which were Schoklitsch and Duboys equation. From the analysis of the results of each of the formula, Duboys can be used to predict bed load transport for Sungai Jemberau.

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LIST OF SYMBOLS

Q	Flow Rate of Water ($^{m^3}/_{S}$)
A	Area (m^2)
V	Velocity (m/s)
mm	Millimetre
km	Kilometre
m	Meter (m)
g	Gravitational Force ($^{m}/_{S^2}$)
n_s	Manning Coefficient
τ_C	Critical Shear Stress
τ_0	Actual Shear Stress
D_s	Mean Diameter (mm)
v	Viscosity ($^{m^2}/_{S}$)
γ	Specific Weight ($^{N}/_{m^3}$)
S	Slope
Gs	Bed Load Discharge (lb/sec-ft)
d	Depth of River
B	Width of River

LIST OF ABBREVIATIONS

UMP	University Malaysia Pahang
USCS	Unifies Soil Classification System
US	United State
Cu	Uniformity Coefficient
Cc	Coefficient of Gradation
Nov	November
Dec	December
pH	Potential Hydrogen
TSS	Total Suspended Solid
HACH DR 5000	Spectrophotometer Procedures Manual
A(1A,2A)	A is actually taken from malay word 'atas' which mean the sample is taken at the place with no flowing river water/ riverside. (1A means first sample at riverside for…)
B(1B,2B)	B is taken from malay words 'bawah' which means the sample is taken at in the river where the river water flow on it. (1B means first sample in the river for…)

CHAPTER 1

INTRODUCTION

1.1 Background

Sediment is natural earth material which consists of soil particles that are ranging in sizes from the smallest which are mud and sand to the larger sizes which include the gravels, cobbles and boulders. Sediment can move and deposited in a new location. Sediment can move from one place to another through the process of erosion. Erosion is the process of removal and transportation of rock or soil.

Sediment can be transported by a flow of water. Sediment transport can be in the form of bed-load and suspended load, which are depending on the size of the bed material particles and the flow conditions. Some factor which influence the sediment transport are flow conditions, sediment size and sediment density. Usually, the greater the flow of water, the more sediment will be transported while the movement of sediment will control the size and shape of bed forms.

The sediment load is varies from river to river. The velocity of the water is important in determining the way of how sediment is being transported. Bed-load transport depends on the flow characteristics and sediment properties, such as shear stress, surface roughness, and particle size, density, and shape. Bed load transport is the main connection between river hydraulics and river form and has a significant effect on restoring the channel geometry.

1.2 Background of Study

Tasik Jemberau is located in Tasik Chini, Pahang, Malaysia. The lake is located at the latitude and longitude coordinates of 3° 25' 31.8" (3.4255°) North and 102° 55' 8" (102.9189°) East. Sungai Jemberau is another river that connect with Tasik Chini. Besides, Laut Jemberau is a lake in Pahang and is nearby to Tanjung Kelantan, Tanjung Batu Busuk and Pulau Besar. Laut Jemberau is also close to Kawasan Cari Gali Batu Barik, Tasik Cini and Laut Gumum.

Human interference is one of the effects of sediment transport process that gives impacts on sediment load and bed load pattern. Vegetation removal from agricultural, logging activities, are the factor that will increase erosion and sediment loads of rivers. Erosion will cause the bed load to increase at the river. Therefore, the depth of river will decrease. When the depth of the river decreases, the volume of the flow rate remain same, and it will cause the flood.

The effect of excessive sediment in river will shorten the lifespan of dams and reservoirs. When a river is dammed and a reservoir is created, the sediments that used to flow along with the relatively fast-moving river water are, instead, deposited in the reservoir. Reservoirs will slowly fill up with sediment and mud.

Environmental science research there has been a great deal of important scientific research concerning issues relating to the Tasik Chini ecosystem and health of the lake, including the impact of the dam, the Sungai Chini Navigation Lock, deforestation and subsequent mining, and logging. This scientific research has highlighted problems, as residual fraction, with heavy metal concentrations, namely Cadmium, Copper and Lead, in the lake and sediment, although there is still a high level of organic content within the lakes (Ebrahimpour and Idris, 2008a). This indicates some hopefulness in respect of re-establishing the lake’s ecology and future sustainability. Further research compared mean metal concentrations in Tasik Chini with a range of water quality standards showing that the mean metals concentration in surface water were low and within the range of natural background except for iron and aluminium, with increased localized concentrations being associated with natural causes such as the monsoon season but influenced by human activities through mining. The

greatest concentrations were found at three sites, Tanjung Jerangking and Melai (Shuhaimi-Othman et al., 2008). It is possible to speculate that mining activity has increased the concentrations reaching the lake during the monsoon season.

1.3 Problems Statement

In 1995, a barrage was built at the estuary of the Tasik Chini to raise the lake water level to benefit tourism. The barrage has drastically reduced the dynamism of the water movement of the lake. Furthermore, extensive human activities such as farming, produce mining and logging have adversely affected the ecosystem of the lake, causing the widespread growth of the aquatic weed *Cabomba furcata* and reduction of water quality.

The people can no longer use the lake water for washing, bathing or drinking without concern. At Kampung Ulu Melai they have been obliged to pay for piped water from the mining companies that are culpable for the environmental damage in the first place, adding to a local sense of grievance and injury. The people complain that their health is being damaged by the contaminants from mining and logging. They inform us that skin problems and respiratory diseases are more common across all age groups now, as are stomach problems and bloating, sore throats and headaches. Through this study, bed load pattern through the sedimentation process at Sungai Jemberau can be determined (Sara Ashencaen and Jonathan Parker, April 2014)

1.4 Objectives

To conduct a study, the aim of the ultimate objective of the study should be specified so that the study can be done thoroughly according to its aim. Several objectives have been set which is:

- To identify bed material characteristic in Sungai Jemberau at Tasik Chini.
- To determine bed load concentration in Sungai Jemberau at Tasik Chini.

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