BANK SLOUGHING AND DEPOSITION AT AND NEAR MOUTH OF SUNGAI BAKO

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DEDICATION

To my supervisor, Dr. Law Puong Ling;

Civil program lecturers;

my beloved family and loved one;

my fellow course mates of 1999 —2002,

especially those in my classes

who were forthright in sharing their expectations

and concerns for their undergraduate studies

and thus helped shape the content of my courses.

These are the best times of my life.

GOD blesses you all.

Thank you.

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I wish to express and extend my sincerest to those people for their help and support throughout the preparation of my thesis; Bank Sloughing and Deposition At and Near Mouth of Sungai Bako, Kuching.

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ABSTRACT

This study was conducted at and near mouth of Sungai Bako, Sarawak that focuses on the depositional and riverbanks erosion or sloughing near river mouth of Sungai Bako. The objectives of this study are to identify the factors that causing the riverbank sloughing, erosion and deposition at and near mouth of Sungai Bako.

For this study, the morphology of a stretch of 1 kilometers from river mouth was investigated, namely five cross-section of the river, river profile, particle size distribution at the river bed, total suspended solid in the water and the flow characteristic.

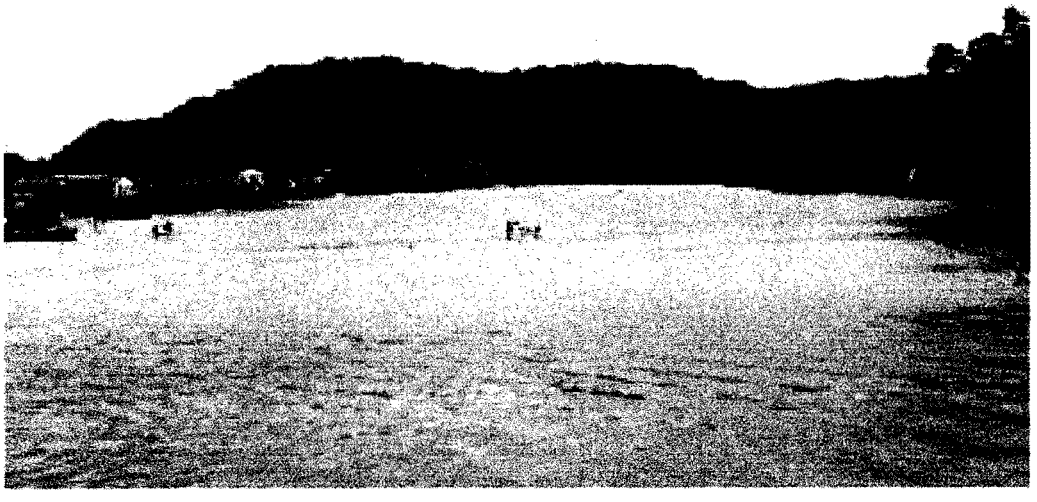
From this study, it is found that the river bank sloughing is due to destabilizing of the river bank soil with present of water and its mechanism such as wave, wetting medium and abrasion whereas deposition process is due to insufficient flushing effect from the upstream of the river since the existing of the Bako Causeway. These will make the out going materials is less than incoming material as the incoming velocity is higher than out going velocity during the medium high tide and mid low tide.

CHAPTER 1

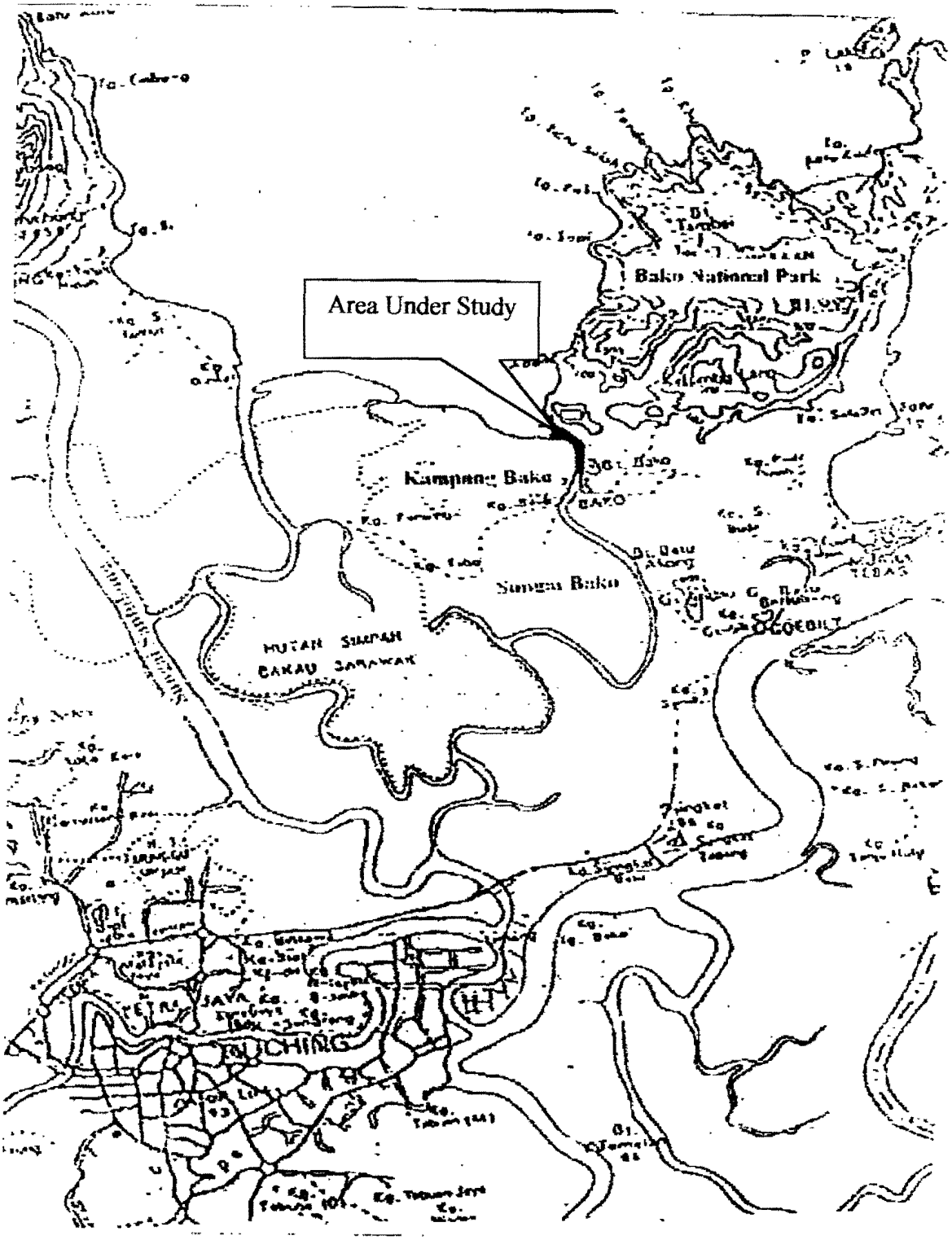
INTRODUCTION

1.1 Background

In order to fulfill the requirement of graduation the final year students has to complete their thesis as required by the Board of the University 's Academic. As given the project is focus on the causes of riverbed deposition and riverbank sloughing upon the mouth of Bako River. The project area is covered the area of particular part (1000 meters from the mouth of the river to up-stream part) of the mouth of Sungai Bako, as in Picture **1.1a and Map 1.1a**, just near the site of sand and gravel extraction.



Picture 1.1a



Location Map

1.2 Objectives

The objectives of this study are:

(a) To determine the causes and the patterns of deposition at and near mouth of Sungai Bako.

(b) To determine the causes of river bank sloughing or erosion stretching 1 km from river mouth.

1.3 Specific Aims

The specific aims of this study are:

(a) To gather the information of the cross-sections along a stretch of 1 Km from the mouth of Sungai Bako at 200 m intervals in order to determine the volumetric flow of the river.

(b) To investigate riverbed profile, characteristics and particles size distribution.

(c) To determine the velocities at the individuals cross-section using the Two point Method during mid-low tide and mid-high tide

(d) To analyze the water sample for suspended solids or the amount of materials bringing from the sea during water tide

(e) To determine the amount of the suspended solids bringing out from the river during the subsiding tide.

(f) To determine the causes and to estimate the rate of the bank sloughing or erosion by analysis the patterns of deposition stretching 1 km from river mouth.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The proposed project is entitled ": A Study of Bank Sloughing and Deposition at and Near Mouth of " Sungai Bako". As far as concern, the mouthpart of Sungai Bako now facing problem of swallowing process. The processes contribute about 1000 meters from the mouth up to the upstream part. This is due to deposition from transporting sand and bank sloughing.

2.2 Project Site

The project site was located a thousand meters upstream from the South China Sea estuary, bounded on both banks by Kampung Bako. It is within the First Division in the North Coast of Kuching. Geographically it locates at the end of the V-shape corner. The study will be focus more on the samples that taken from the site. These include the water samples, bed soil samples, flow characteristic, and those related. All those criteria will be analyzed to obtain the better finding as well, beside that site observation also important. In order to do these, the listed activities should be conducted:

- Measurement of channel geometry such as width, depth and area computation.

- Measurement of the river velocity discharge when the water tide.

- Sampling suspended solid in stream

- Sampling bed soil in stream

- Observation of surficial bank deterioration mechanisms.

2.3 Bank Sloughing and Deposition Features

The stream boundary in a given river reach is constantly changing with such interacting flow variables as velocity, depth, slope, load discharge, and characteristics of the bed material. Stream-bank stability depends on these interrelated stream variables as well as on channel geometry. Stream-bank erosion is accompanied by deposition. Bank erosion and retrogression or retreat occur in many ways, primarily as a result of one or a combination of the following:

i. Removal of soil particles from the bank surface either continuously or intermittently over a period of time

ii. Sequential failures of small segments of bank material

iii. Failure of a single large segment of bank material

Normally the changing conditions that affect bank stability (from U.S Army, Corp of Engineers – 1981a) as follows:

i At the surface

a Severe surface deterioration that may result in an unstable bank configuration, such as erosion by stream flow at the toe of the bank; erosion at the water surface due to waves; and erosion along the bank surface due to over bank flows.

b Deep tension cracks due to excessive drying of a cohesive soil or similar structural change that may cause the bank to weaken and become unstable. Crumbling may occur if excessive drying is followed by submergence.

c Overburden placed along the top of bank that may cause an otherwise stable bank to become unstable.

ii. Moisture content within the bank

a The slope of a cohesionless bank may be temporarily steeper than the angle of repose of the bank material due to capillarity or other temporary stabilizing effect. When the stabilizing effect is removed, the bank becomes unstable.

b With piping, cohesionless material is eroded from a location on the bank surface by seepage flow; a cavity develops and extends rapidly into the bank along a dominant seepage path.

c Liquefaction of fine-grained and loosely structured materials subject to rapid increase in pore pressure (as during rapid draw down or earthquake loading) results in a large segment of bank material flowing down slope as a fluid-like mixture.

d With a high water table and low stream level, an added hydraulic load is placed on the bank and may result in failure unless relieved by seepage or piping.

e Swelling and shrinking during wetting and drying affect the stability of clay soils. Substantial hydraulic pressures may result from water flowing

freely into deep tension cracks and into openings between different bank materials.

f The shear strength of clay soils is dependent on pore pressure and degree of saturation.

iii. Miscellaneous conditions

a Artesian or gravity flow in a cohesionless or porous layer can remove sediment by piping, resulting in shear failure of layers higher in the bank.

b A thin clay layer that weakens and compresses when saturated can cause shear failure in the upper bank.

c Lubrication by water and high hydrostatic pressure along interfaces between bank materials can cause low resistance to sliding, resulting in massive bank failure.

d Other site-specific combinations of failure mechanisms.

Where else for those different banks has different characteristic of sloughing or erosion as follows;

i. ***Cohesive banks*** have low permeability and tend to drain slowly. They become unstable under conditions of rapidly falling stage. They are subject to sudden failure by' bank caving, sloughing, or sliding when the banks are undercut or saturated. Large amounts of material can be eroded into the channel almost instantaneously'. Bank height is important in assessing stability of cohesive banks because such banks tend to be more unstable than noncohesive banks or banks of low cohesivity of equal height.

ii. ***Noncohesive banks*** are subject to surface erosion, resulting in a slow, piecemeal loss of bank material over a period of time. The rate of surface erosion is affected by' such factors as:

- Direction and magnitude of flow velocity adjacent to the bank
- 1urbulent fluctuation of the flow
- Magnitude and fluctuation of shear on the bank
- Seepage, piping, and wave forces

The angle of repose is small (as low as about 20 degrees) for soils made up of fine well rounded particles and large (to values greater than 45

degrees) for coarse angular particles. Finer grained cohesionless soils drain more slow than coarse-grained cohesionless soils and are, therefore, more susceptible to failure. Loose sandy material containing some fines is subject to liquefaction failure (flow slides). When such banks are saturated and the water level drops, pressures in the bank build up to where the sand particles slip and the soil mass acts as a liquid, with large quantities of hank material suddenly flowing into the channel.

iv. ***Stratified banks*** exhibit a complex erosion process. The layers of noncohesive material are subject to surface erosion; huts are partially' protected by' layers of cohesive material. Stratified banks are subject to erosion and sliding as a result of subsurface flow and piping.

- Subsurface flow from the bank into the river can result from a rise in groundwater table, fluctuation in river stage, wind or boat waves, and backwater from ice conditions.

- Piping occurs when subsurface flow through the permeable layers transports and removes particles from the permeable layers, allowing the overlying layers to drop and crack, thus becoming vulnerable to erosion from surface flow and sliding.