

**THE IMPACT OF WATERFRONT DEVELOPMENT TOWARDS WATER QUALITY
OF SUNGAI DANGA**

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Specialty dedicated to my dearest,

Father, HAJI OTHMAN BIN MD. JUSOH

Mother, HAJAH SHOBARIAH BINTI HANAFI

Brothers, MOHD ARIFF

ADAM

Sisters, SITI YUSRINA

ASIAH

ASMAK

HUD

Friends, SITI NURUL HANA RAMLI

NUR ATIQAH AAINAA ABD LATIFF

SAFFAA'TUL HUSNA ISMAIL

Thank you for your courage, advises, sacrifices and patience.

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“In the name of Allah, the Most Gracious, the Most Compassionate”

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ABSTRACT

Waterfront developments along Sungai Danga have caused negative impacts on society and natural environmental due to the lower water quality affecting the aquatic life and destruction of habitat as an indirect result of developments and soil erosion caused. The study area has experienced development since 1990's which mostly involving industrial and housing development. This research analyzed the current level water quality of Sungai Danga based on the Water Quality Index (WQI) and the Malaysian Interim National Water Quality Standard (INWQS). Water samples were collected from nine sampling stations along the river and analyzed to study the impact of current waterfront development. The methodology included analysis of secondary data, site visits and interview sessions with local communities as well as water samples to analyze the water quality. The respondents included developers, officers from the Department of Environment (DOE) and Majlis Perbandaran Johor Bahru Tengah (MPJBT). Water quality parameters analyzed included dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), suspended solids (SS), ammoniacal nitrogen (NH₃-N), alkalinity and acidity (pH), chromium (Cr), copper (Cu), nitrate (NO₃) and nitrite (NO₂) according to Standard Method 2002 and Hach DR5000. The stations were along Sungai Danga while the water samples were taken three times by taking into account the low tide and high tide. As a result, Sungai Danga water quality for year 2013 was much more polluted compared to previous year based on the results of WQI and INWQS obtained. According to WQI analysis, the water quality of Sungai Danga during low tide is much polluted than high tide. Water samples taken from all stations along Sungai Danga during low tide were found to be classified as Class IV. However, the water was cleaner at certain stations during high tide and classified as Class III. Based on comparison to INWQS, most parameters involved were categorized in Class V and IV such as COD, AN and heavy metals parameters which is Cr and Cu. Based on result gained from the interview sessions, most of the respondents agreed that depleting water quality was caused by the waterfront development along Sungai Danga. The results indicated that environmental monitoring should be further enforced in order to prevent and reduce the potential water quality impacts during construction, excavation and filling stage.

ABSTRAK

Pembangunan pesisir pantai di sepanjang Sungai Danga mengakibatkan impak negatif terhadap masyarakat setempat dan alam sekitar di mana kualiti air yang rendah memberi kesan kepada hidupan akuatik dan pemusnahan habitat akibat daripada pembangunan dan hakisan tanah. Kawasan kajian telah mengalami pembangunan sejak tahun 1990-an yang mana kebanyakannya melibatkan pembangunan industri dan perumahan. Kajian ini mengenalpasti tahap kualiti air terkini Sungai Danga berpandukan *Water Quality Index (WQI)* dan *Interim National Water Quality Standard (INWQS)*. Sampel air diambil daripada sembilan stesen ujikaji di sepanjang Sungai Danga dan dianalisis untuk mengkaji kesan pembangunan pesisir pantai yang sedang dijalankan. Metodologi merangkumi analisis daripada sumber kedua, lawatan tapak, temu bual bersama penduduk setempat ujikaji air untuk menganalisis kualiti air. Berdasarkan maklumat dari penyemakan sumber kedua, responden yang terlibat telah dikenalpasti dan temu bual dijalankan bagi mengumpul semua maklumat yang diperlukan. Responden yang terlibat adalah pemaju, pegawai daripada Jabatan Alam Sekitar (DOE) dan Majlis Perbandaran Johor Bahru Tengah (MPJBT). Parameter kualiti air yang dianalisis adalah oksigen terlarut (DO), permintaan oksigen biokimia (BOD), permintaan oksigen kimia (COD), pepejal terampai (SS), nitrogen ammonia (AN), kealkalian dan keasidan (pH), kromium (Cr), kuprum (Cu), nitrat (NO_3) and nitrit (NO_2) berpandukan *Standard Method 2002* dan *Hach DR5000*. Stesen ujikaji adalah di sepanjang Sungai Danga dan sampel air diambil sebanyak tiga kali dengan mengambil kira keadaan air surut dan pasang. Hasilnya, kualiti air Sungai Danga bagi tahun 2013 adalah lebih tercemar berbanding tahun terdahulu berdasarkan keputusan WQI dan INWQS yang diperolehi. Berdasarkan analisis WQI, kualiti air Sungai Danga ketika air surut adalah lebih tercemar berbanding air pasang. Sampel air dari semua stesen yang diambil di sepanjang Sungai Danga ketika air surut diklasifikasikan sebagai Kelas V. Walaubagaimanapun, kualiti air Sungai Danga ketika air pasang adalah lebih bersih di sesetengah stesen ujikaji dengan klasifikasi Kelas III. Berdasarkan perbandingan dari INWQS, kebanyakan parameter yang terlibat berada dalam Kelas V dan V seperti parameter COD, AN dan parameter logam berat iaitu Cr dan Cu. Menurut hasil daripada sesi temu bual, kebanyakan responden yang terlibat bersetuju bahawa penurunan kualiti air adalah berpunca daripada pembangunan pesisir pantai yang berlaku di sepanjang Sungai Danga. Hasil kajian menunjukkan pemantauan alam sekitar perlu dikuatkuasakan dengan lebih kukuh untuk mencegah dan mengurangkan impak kualiti air adalah melibatkan fasa pembinaan, penggalian dan penimbunan serta pasukan alam sekitar dan pengurusan tapak.

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LIST OF ABBREVIATIONS

BOD	Biochemical Oxygen Demand
BRA	Boston Redevelopment Agency
COD	Chemical Oxygen Demand
DID	Department of Irrigation and Drainage
DO	Dissolved Oxygen
DOE	Department of Environment
EQA	Environmental Quality Act
FELDA	Federal Land Development Authority
GPS	Geographical Positioning System
INWQS	Interim National Water Quality Standard
IRDA	Iskandar Regional Development Authority
LDDC	London Docklands Development Corporation
MONRE	Ministry of Natural Resources and Environment
MPJBT	Majlis Perbandaran Johor Bahru Tengah
NRDC	National Resources Defense Council
SS	Suspended Solids
WQI	Water Quality Index

LIST OF SYMBOLS

mg/L	milligram per liter
NO ₃	Nitrate
NO ₂	Nitrite
NH ₃ -N	Ammoniacal Nitrogen
Cr	Chromium
Cu	Copper
%	Percentage

CHAPTER 1

INTRODUCTION

1.1 Introduction

Historically in Malaysia, human civilization began along river banks. Since the beginning of civilization, rivers have played a major and important role in shaping and influencing the nation development and the cultures of people. Settlements have historically sprung up along river banks, hence, many urban cities in Malaysia such as Kuala Lumpur, Terengganu, Malacca, Kuantan, Kota Bharu and Kuching were established after waterfront settlements had developed – on river edges or in river valleys (Andaya, 2001; Weng, 2005). It has the advantages to recreate the image of the city and attracting people back to deserted downtowns. In fact, it will improve the economic investment of the city. Besides, there are many functions of the river such as providing transportation medium and source of the food.

1.2 Waterfront Development

Waterfront development has been a well-established phenomenon internationally. As the economy began to change in the 1980's, so did the land uses along many of the river and waterfront locations. Malaysia has seen the importance of waterfront development and begun to develop the waterfront area. As a consequence, some villages are named after the rivers that run through them, namely "Sungai Rengit, Sungai Mati and Sungai Kapal in Johor (Yassin, Eves, and McDonagh, 2010a).

1.3 Problem Statement

Waterfront development has grown rapidly nowadays in the state of Johor especially in the area of Johor Bahru City Centre. Water - based projects attract considerable attention not only from environmentalists but also from politicians and the public. Rapid development of the waterfront contributes many problems related to the natural environment as well as the communities along the rivers.

Few of problems causes by rapid developments were the depletion of the water quality and reduction in fisheries catches. Besides that, the waterfront development processes cause soil erosion to the study area. This is one of the factors that contribute to water quality depletion. This may cause to habitat destruction as well especially when the developed area consist of swamp or forestry area.

1.4 Objectives

Objectives of this study are:

1. To study the past and present developments along Sungai Danga waterfront.
2. To analyze water quality samples taken from Sungai Danga based on Water Quality Index (WQI) and Interim National Water Quality Standard (INWQS) for Malaysia.
3. To analyze the trends of water quality of Sungai Danga based on INWQS from 2008 till 2013.
4. To analyze the impacts of current activities of waterfront development towards water quality of Sungai Danga.

1.5 Scopes of Study

This study involved the sampling of water samples and survey of respondents related to the waterfront development along Sungai Danga of Johor Bahru. The study focused at the previous and present developments which have existed and being constructed in the study area and also includes the residential area nearby and current activities occur in Sungai Danga itself.

There are few parties involved in order to gather all related data for this study which are Department of Environment (DOE), Majlis Perbandaran Johor Bahru Tengah (MPJBT), local communities and related developers in the study area. Interviews session were conducted in order to obtain the information about the waterfront developments in the area and their opinions regarding the current situation and problem that been raised nowadays. The information was used to understand better about the history of the study area.

1.6 Significance of Study

The study has highlighted the trends of water quality arising from the impact of waterfront development. The data collection shows the overall situation of Sungai Danga waterfront in both aspect of water and development. The results from the study analysis which involving Water Quality Index (WQI) and Interim National Water Quality Standard (INWQS) are used to determine the classification and pollutant status of particular water bodies. Therefore, these results indicate the current water quality of Sungai Danga and the flow of water quality can be formed.

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