

# The Proposed Land Reclamation and Dredging of Kuantan Waterfront Resort City, Kuantan, Pahang

## Environmental Impact Assessment (Second Schedule)

Volume I : Executive Summary

October, 2016

Project Proponent:



**NEWSTON**

EIA Consultant:



# The Proposed Land Reclamation and Dredging of Kuantan Waterfront Resort City, Kuantan, Pahang

---

## Environmental Impact Assessment (Second Schedule)

Volume I : Executive Summary

October, 2016

Prepared for:



**NEWSTON**

**Ideal Heights Development Sdn. Bhd.**  
No, 1 & 2, Jalan Bukit Idaman 8/1,  
Bukit Idaman, P.O. Box 20,  
68100 Batu Caves,  
Selangor Darul Ehsan.  
T: +603 - 6138 6102  
F: +603 - 6138 7890

Prepared by:



**Dr. Nik & Associates Sdn. Bhd.**  
No. 22 & 24, Jalan Wangsa Delima 6,  
Kuala Lumpur Suburban Centre (KLSC)  
Section 5, Pusat Bandar Wangsa Maju,  
53300 Kuala Lumpur.  
T: +603 - 4145 8888  
F: +603 - 4145 8877

Copyright © 2016 by DR. NIK AND ASSOCIATES SDN. BHD. (DNASB)

All rights reserved. No part of this publication may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of DNASB.



---

## Executive Summary

# Contents

<b>1.</b>	<b>Introduction</b>	<b>1</b>
	1.1 Project Title	1
	1.2 Project Proponent and EIA Consultant	1
	1.3 Project Location	2
	1.4 Project Chronology	5
	1.5 EIA Study Approach	7
	1.5.1 Policies	7
<b>2.</b>	<b>Terms of Reference</b>	<b>7</b>
<b>3.</b>	<b>Statement of Need</b>	<b>7</b>
	3.1 Promoting Tourism Sector	8
	3.2 Supports Government's Development Plans and Strategies	8
	3.2.1 Kuantan Local Plan (Amendment) 2013 - 2015	8
	3.2.2 Pahang Structure Plan 2002 - 2020	8
	3.2.3 East Coast Economic Region (ECER)	8
	3.2.4 National Physical Plan 2 (NPP-2)	9
	3.3 Contribute to State/Federal Income and Improving Living Standards and Sustainability	9
	3.4 Modernisation of Infrastructure Development and Logistics	9
	3.5 Create New Jobs and Business Opportunities	9
	3.6 Mitigate Erosion along Tanjung Lumpur Shoreline	10
	3.7 Improvement to Sungai Kuantan and River Mouth Sedimentation Problem	10
<b>4.</b>	<b>Project Option</b>	<b>11</b>
	4.1 Build Option	11
	4.2 No-build Option	11

<b>5.</b>	<b>Project Descriptions</b>	<b>13</b>
5.1	General Site Descriptions	13
5.1.1	Northern Shoreline (Sungai Kuantan river mouth - Tanjung Pelindung Tengah)	13
5.1.2	Middle Shoreline (Kampung Tanjung Lumpur)	13
5.1.3	Southern Shoreline (Kampung Anak Air - Kampung Baharu)	13
5.2	Project Concept	15
5.3	Project Component	15
5.3.1	Land Clearing	15
5.3.2	Reclamation	15
5.3.3	Dredging	18
5.4	Project Phases	18
5.5	Project Activities	22
5.5.1	Pre-construction Survey	22
5.5.2	Land Clearing	22
5.5.3	Reclamation and Dredging	23
5.5.3.1	Installation of Boundary Marker Buoy	23
5.5.3.2	Transportation of Rock/Granite	23
5.5.3.3	Construction of Perimeter Bunds	23
5.5.3.4	Dredging of the Sungai Kuantan River Mouth, Navigation Channel and Seafront Area within the Newly-Created Land	23
5.5.3.5	Fill Material Transportation	24
5.5.3.6	Placement of Fill Material	24
5.5.3.6.1	Silt Curtain Installation	26
5.5.3.7	Treatment of Fill Materials	26
5.5.3.8	Construction of Coastal Protection Structures	26
5.5.4	Disposal of Dredged Material	26
5.5.5	Sand Borrow Area	28
5.6	Post Reclamation (Topside Development)	29
<b>6.</b>	<b>Existing Environment</b>	<b>31</b>
6.1	Physico-Chemical Environment	31
6.1.1	Bathymetry	31
6.1.2	Current Flow	32
6.1.3	Wave Condition	32
6.1.4	Sediment Transport	32
6.1.4.1	Cohesive Sediment Transport (Sand)	33
6.1.4.2	Non-cohesive Sediment Transport (Mud)	33
6.1.5	Coastal Morphology	33
6.1.6	Soil Characteristic	33
6.1.6.1	Section 1: BH1 and BH7	34
6.1.6.2	Section 2: BH1 and BH8	34
6.1.6.3	Section 3: BH2, BH3 and BH4	35
6.1.7	Climate and Meteorology	35
6.1.7.1	Flooding Condition	35
6.1.7.2	Winds	35
6.1.8	Hydrology and Drainage	35

6.1.9	Land Use	37
6.1.10	Water Quality	37
	6.1.10.1 Estuarine Water Quality	39
	6.1.10.2 Coastal Water Quality	39
6.1.11	Sediment Quality	40
6.1.12	Air Quality	41
6.1.13	Noise	42
6.1.14	Vibration	42
6.1.15	Marine Traffic	43
	6.1.15.1 Existing Navigation Approach	43
	6.1.15.2 Existing Anchorage	44
	6.1.15.3 Existing Marine Activities and Utilization	44
	6.1.15.3.1 Fishing Activities	44
	6.1.15.3.2 Kuantan Port	44
6.1.16	Land Traffic	45
6.2	Existing Biological Environment	46
	6.2.1 Terrestrial Flora (Mangrove)	46
	6.2.2 Terrestrial Fauna (Birds)	46
	6.2.3 Marine Biological Environment	47
	6.2.3.1 Phytoplankton	47
	6.2.3.2 Zooplankton	47
	6.2.3.3 Macrobenthos	47
	6.2.3.4 Fish Fisheries Resources	47
6.3	Existing Human Environment	48
	6.3.1 Community's Profile	50
	6.3.1.1 Demographic Profile	50
	6.3.1.2 Socio-economic Profile	51
	6.3.2 Survey Results on Opinions and Perceptions	51
	6.3.2.1 Level of Project Awareness	51
	6.3.2.2 Perception towards the Proposed Project	51
	6.3.2.3 Perception of Impacts on Health and Safety	52
	6.3.2.4 Perception of Impacts on Aesthetics and Culture	53
	6.3.2.5 Project Assessment and Local Acceptability	53
	6.3.3 The Fishing Community in the Study Area	55
	6.3.4 Feedback from the Focus Group Discussion	56
	6.3.5 Feedback from the Public Dialogue	56
6.4	Environmentally Sensitive Areas (ESAs)	57
	6.4.1 Kuantan Forest Reserve	59
	6.4.2 Beserah Forest Reserve	59
	6.4.3 Mangroves (Sungai Kuantan)	59
	6.4.4 Teluk Cempedak	59
	6.4.5 Sungai Kuantan	59
	6.4.6 Sungai Galing	59
	6.4.7 Tanjung Lumpur Bridge	60
	6.4.8 Tanjung Tembeling	60
	6.4.9 Populated Areas	60

<b>7.</b>	<b>Summary of Evaluation of Impacts with Pollution Prevention and Mitigation Measures (P2M2)</b>	<b>60</b>
7.1	Residual Impacts	78
7.2	Project Evaluation	78
7.2.1	Valuation of Significant Change in Environmental Services	78
7.2.2	Overall Assessment	78
<b>8.</b>	<b>Environmental Management Plan (EMP)</b>	<b>81</b>
8.1	Land-Disturbing Pollution Prevention and Mitigation Measures (LDP2M2)	81
8.2	Performance Monitoring (PM)	81
8.3	Compliance Monitoring (CM)	81
8.4	Impact Monitoring (IM)	81
8.5	Environmental Auditing	81
<b>9.</b>	<b>Study Findings</b>	<b>84</b>



# Figures

Figure E1	Location of the Proposed Project in Kuantan, Pahang
Figure E2	Project Location at Tanjung Lumpur, Kuantan
Figure E3	Coordinates Points of the Proposed Project Area
Figure E4	Proposed Land Reclamation and Dredging Areas
Figure E5	Proposed Dredging Area within the Project Site
Figure E6	General Site Descriptions
Figure E7	Land Clearing Areas Boundary Coordinates
Figure E8	Reclaimed Land Boundary Coordinates
Figure E9	The Proposed Designated Depth of Dredging Areas
Figure E10	Dredging Boundary Coordinates
Figure E11	Project Phasing
Figure E12	Main Sequence Activities
Figure E13	Schematic Illustration of Reclamation Sequence
Figure E14	Proposed Disposal Area
Figure E15	Sand Borrow Area from Kuala Sungai Pahang
Figure E16	Overall Concept Masterplan of the Topside Development
Figure E17	Bathymetric Chart No. 1379
Figure E18	Bathymetry Survey (June 2013)
Figure E19	Location and Cross Section of Boreholes
Figure E20	Catchment Area adjacent to the Project Site
Figure E21	Water Quality Sampling Stations
Figure E22	Sediment Quality Sampling Stations
Figure E23	Air Quality Sampling Stations
Figure E24	Noise Sampling Stations
Figure E25	Vibration Sampling Stations
Figure E26	Fishing Zone in Malaysia (Except for Kedah, Penang, Perak and Selangor)
Figure E27	The 5-km Radius of the Study Area
Figure E28	Overall Perceived Impacts of the Proposed Project
Figure E29	Level of Acceptability of the Proposed Project
Figure E30	Environmentally Sensitive Areas

## Tables

Table E1	Project Chronology
Table E2	Project Compliance Policies
Table E3	Estimated Job Creation
Table E4	Proposed Options of Reclamation Layout
Table E5	Project Timeline
Table E6	Estimated Volume of Reclamation Material
Table E7	Summary of the Proposed Dredging Works
Table E8	Estimated Volume to be Dredged
Table E9	Coordinates of Boreholes
Table E10	Mukim and Planning Blocks in the District of Kuantan
Table E11	Water Quality Parameters
Table E12	Sediment Quality Parameters
Table E13	Number of Merchant Vessels Anchoring at the Kuantan Port
Table E14	Distribution of Respondents by Settlement within the Proposed Project Area
Table E15	Awareness and Knowledge about the Proposed Project (%)
Table E16	Ratings of Perceived Socio-economic Advantages and Disadvantages brought about by the Proposed Project (% Saying Yes)
Table E17	Ratings of Perception of Impacts on Health and Safety brought about by the Proposed Project (% Saying “Yes”)
Table E18	Ratings of Perception of Impacts on Aesthetics and Culture brought about by the Proposed Project (% Saying Yes)
Table E19	Reasons for Agreeing or Disagreeing to the Implementation of the Proposed Project (%)
Table E20	Fishermen’s Perceived Impacts of Reclamation on Their Fishing Activities
Table E21	List of ESAs Located within the Project Area
Table E22	Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures on the Physical and Biological Environment
Table E23	Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures on the Human Environment
Table E24	Environmental Services Potentially Affected by the Proposed Project
Table E25	Proposed Environmental Monitoring Programme

# Executive Summary

## 1. Introduction

### 1.1 Project Title

The project for which this Environmental Impact Assessment (EIA) (Second Schedule) report is prepared is entitled the “**Environmental Impact Assessment (Second Schedule) for the Proposed Land Reclamation and Dredging of Kuantan Waterfront Resort City (KWRC), Kuantan, Pahang**” (hereafter referred to as “the Project” or “KWRC”).

### 1.2 Project Proponent and EIA Consultant

The address and contact information of the Project Proponent are as follows:

**Ideal Heights Development Sdn. Bhd.**

No. 1 & 2, Jalan Bukit Idaman 8/1,  
Bukit Idaman, P.O. Box 20,  
68100 Batu Caves,  
Selangor Darul Ehsan.

Contact person : Mr. Heap Wei Guan, *Managing Director*  
Email address : wg\_heap@yahoo.com  
Telephone : +603 - 6138 6102  
Facsimile : +603 - 6138 7890

The Project Proponent has appointed Dr. Nik & Associates Sdn. Bhd. to carry out the EIA study. The contact details are as follows:

**Dr. Nik & Associates Sdn. Bhd.**

No. 22 & 24, Jalan Wangsa Delima 6,  
Kuala Lumpur Suburban Centre (KLSC),  
Section 5, Pusat Bandar Wangsa Maju,  
53300 Kuala Lumpur.

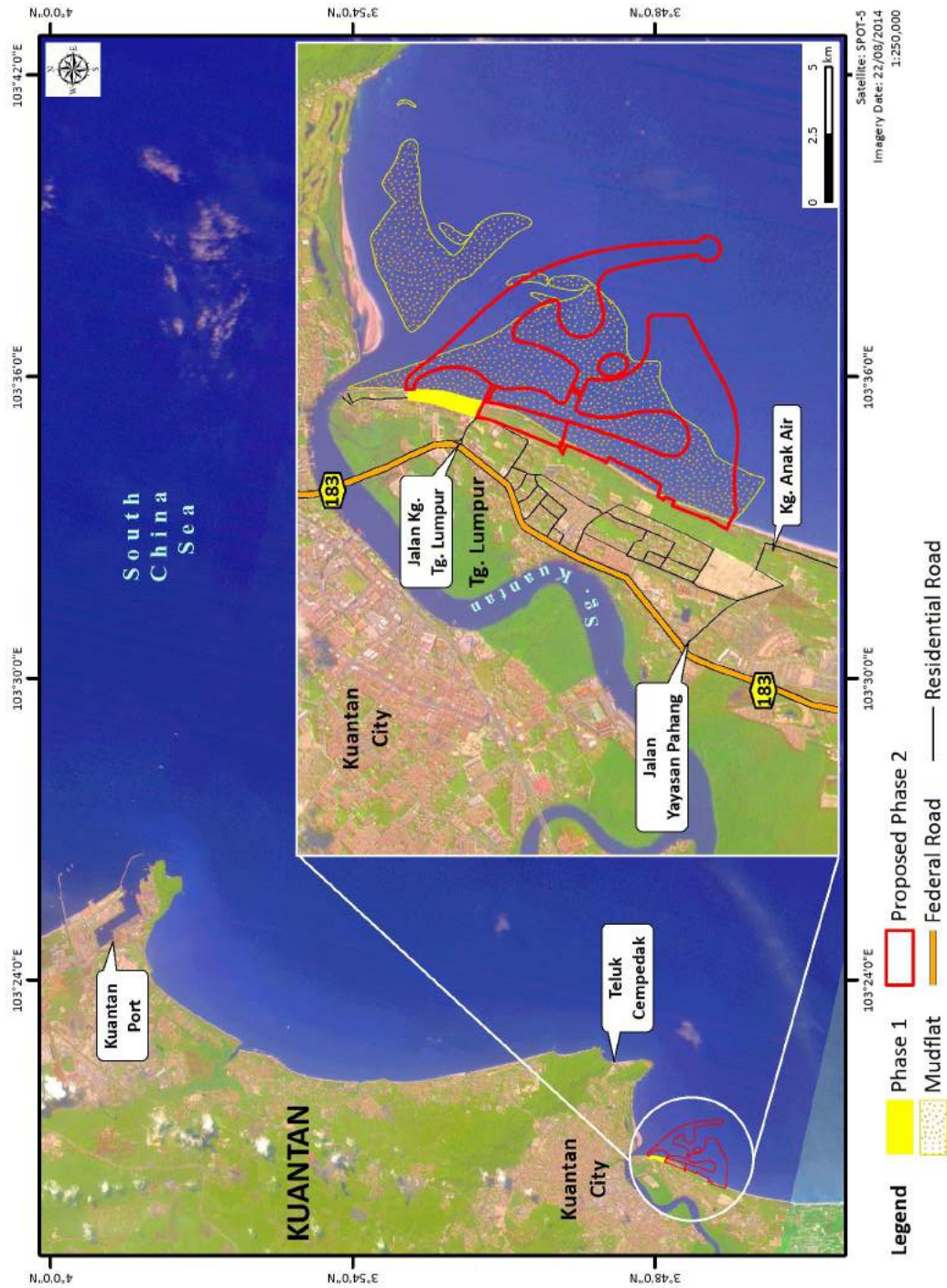
Contact Person : Rosniza Ramli, *Study Team Leader* (EIA Study)  
Email address : rosniza@drnik.com.my  
Telephone : +603 - 4145 8888  
Facsimile : +603 - 4145 8877

### 1.3 Project Location

Ideal Heights Development Sdn. Bhd., a wholly owned subsidiary of Ideal Heights Properties Sdn. Bhd. intends to perform a mixed development involving land reclamation at east coast of Peninsular Malaysia in the capital city of Pahang, Kuantan (*Figure E1*). The proposed project lies on an extensive mudflat and abuts 3 km along the coastline of Tanjung Lumpur where the northern border is opposite the on-going construction of KWRC Phase 1 whereas the southern border ends at Kampung Anak Air (*Figure E2*). The Project is located 2 km east of Kuantan City and 4 km south of Teluk Cempedak. Kuantan Port is located approximately 11 km away towards north of the Project. With a distance of less than 300 m from Sungai Kuantan river mouth, the existing navigation channel of Sungai Kuantan runs parallel to the northern boundary of the Project site. The coordinates of the proposed project are shown in *Figure E3*.



**Figure E1** ► Location of the Proposed Project in Kuantan, Pahang



**Figure E2** ▶ Project Location at Tanjung Lumpur, Kuantan

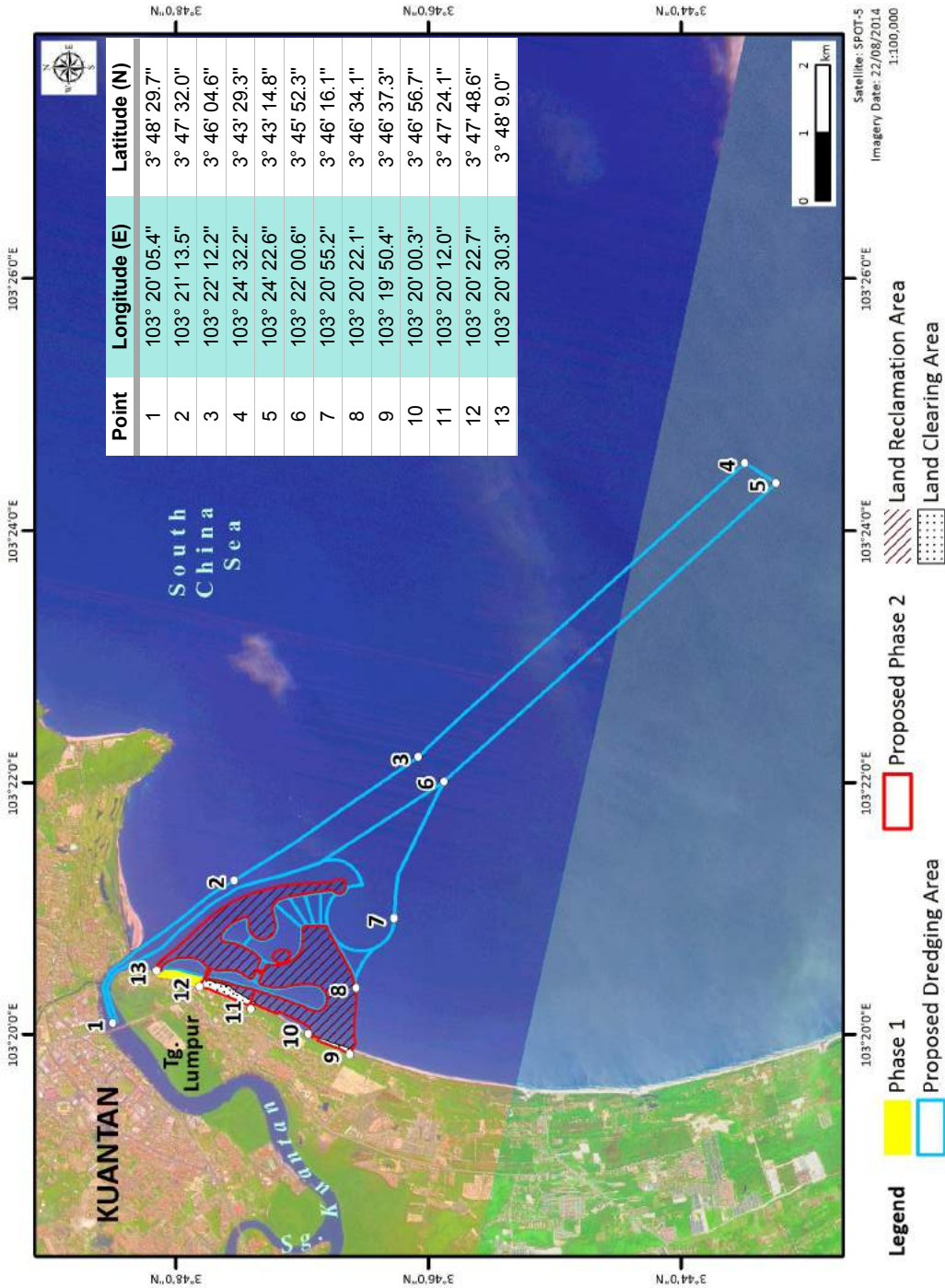
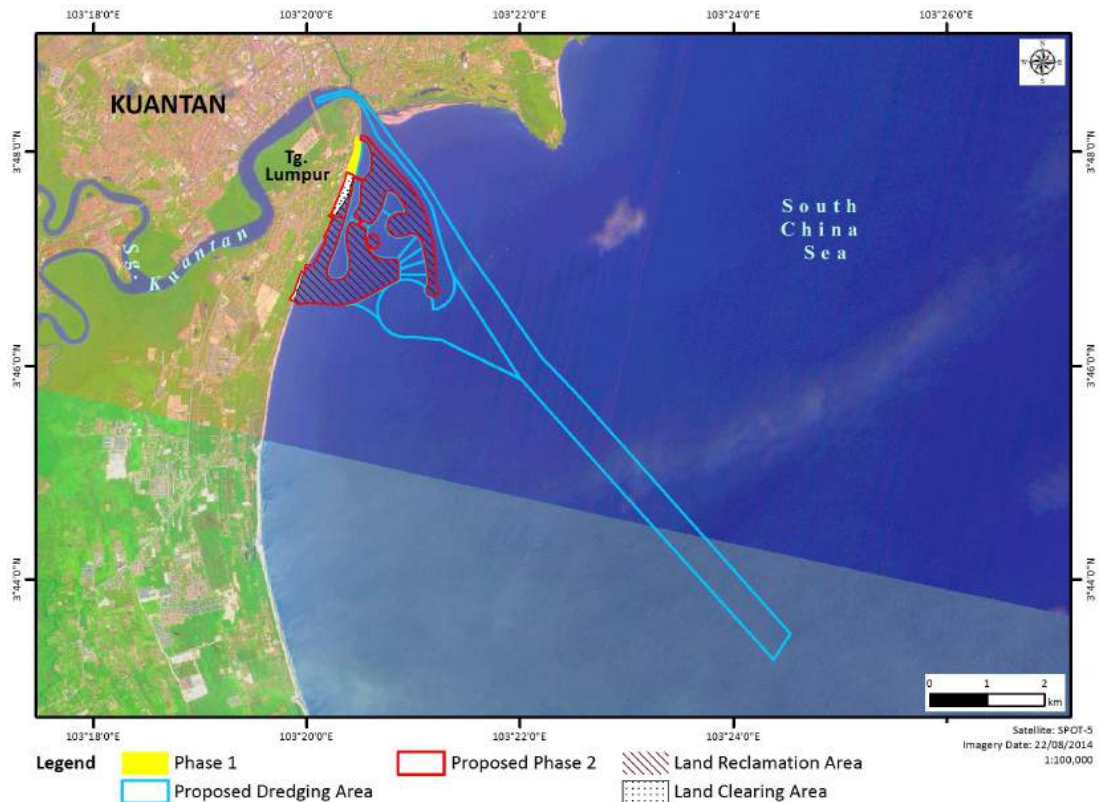


Figure E3 ▶ Coordinates Points of the Proposed Project Area

The proposed man-made land will also bring about improvements to Sungai Kuantan river mouth. The Project Proponent is committed to dredge the Sungai Kuantan river mouth and its navigational channel. Suitable dredged material will be used as the reclamation fill material. The proposed project includes land clearing, reclamation and dredging area which are presented in *Figure E4*.



**Figure E4** ► Proposed Land Reclamation and Dredging Areas

#### 1.4 Project Chronology

Since the Project involved land reclamation and dredging, it has been tabled to several federal and state agencies for approval. The chronology of the project is tabulated in *Table E1*.

**Table E1** ► Project Chronology

Date	Item
13 <sup>th</sup> January 2012	Pahang State Government has given Newston International Group Sdn. Bhd. (Newston) to reclaim 500 ac of land in Tanjung Lumpur, Kuala Kuantan.
18 <sup>th</sup> October 2012	Agreement signing between Pahang State Government and Newston, witnessed by HRH of Sultan Pahang.
5 <sup>th</sup> June 2013	Appointment of EIA Consultant for EIA and Hydraulic Studies (Dr. Nik & Associates Sdn. Bhd.).
6 <sup>th</sup> November 2013	PEIA study for Phase 1 has been approved by DOE Pahang (Ref: AS: C50/013/700/022(44)).
17 <sup>th</sup> July 2014	Approval preliminary site assessment (PAT) for Phase 2.
21 <sup>st</sup> November 2014	Pahang State Government has agreed to reserve 1,168 ac to pave way for KWRC project, with development land/title less than 500 ac.
Early 2015	KWRC has been successfully incorporated into Rancangan Tempatan Daerah Kuantan 2013-2015.
20 <sup>th</sup> May 2015	Meeting with JPBD Pahang on MPFN Status of the proposed Project.
27 <sup>th</sup> August 2015	Meeting with JPBD Pahang and other state technical agencies on MPFN Status of the proposed Project.
18 <sup>th</sup> December 2015	TOR submission to DOE Federal.
21 <sup>st</sup> December 2015	Hydraulic Study submission to DID Federal.
4 <sup>th</sup> January 2016	Development Order for KWRC Master Plan has been approved in principle by Majlis Perbandaran Kuantan (MPK).
27 <sup>th</sup> January 2016	A site visit involving DOE's officers, panels experts, EIA consultants and Project Proponent.
9 <sup>th</sup> February 2016	Focus Group Discussion (FGD) sessions with fishermen and locals.
12 <sup>th</sup> February 2016	TOR Panel Review Meeting at DOE Putrajaya.
9 <sup>th</sup> April 2016	Poster announcement of Public Dialogue.
11 <sup>th</sup> April 2016	Approval of TOR.
18 <sup>th</sup> April 2016	Hydraulic Study (Revision 02) submission to DID Federal.
23 <sup>rd</sup> April 2016	Public Dialogue was held at Dewan Serbaguna Peramu, Kuantan.
11 <sup>th</sup> May 2016	Approval of Hydraulic Study.
4 <sup>th</sup> August 2016	MPFN has approved the KWRC development with conditions.



## 1.5 EIA Study Approach

The scope of work of this EIA study follows the requirements of relevant framework, policies, conditions and guidelines. The proposed project concept and location is compatible and supported by policies, laws and guidelines published by the government agencies such as Federal Department of Town and Country Planning, Pahang Department of Town and Country Planning, Federal Department of Environment, Kuantan Municipal Council and other relevant agencies.

### 1.5.1 Policies

The following policies have been referred to in order to analyze the proposed Project's compliance as summarized in *Table E2*.

**Table E2** ► Project Compliance Policies

Policies	Compliance	Remarks
National Physical Plan-2 (NPP2)	√	The proposed project takes into account all the policies applicable and adheres to it.
National Coastal Zone Physical Plan (RFZPPN)	√	The proposed project has been approved by the National Physical Planning Council (MPFN).
Pahang Structure Plan (2002-2020) (RSNP)	√	The proposed project is consistent with the relevant strategies outlined by the State Government.
Kuantan Local Plan (Amendment) 2013-2015	√	The Project aims to draw investors in boosting the economic growth of Kuantan thus, making it in-line with its local plan that gazettes the area for business and services activities.
East Coast Economic Region (ECER) 2008	√	The KWRC development is parallel to the objective designated for its area as tourism local corridors.
National Policy of Climate Change 2010	√	The proposed project considers the principles sustainable development and conserving the environment.
National Biodiversity Policy 1998	√	The proposed project takes into account the sustainability of the Project site's biodiversity.
Integrated Shoreline Management Plan (ISMP) Pahang	NA	The ISMP has been deemed obsolete thus it is not considered in this study.

## 2. Terms of Reference

A Terms of Reference (TOR) for the Project is required to be submitted to the Department of Environment (DOE) for approval prior to the submission of its EIA Report. The TOR Panel Review Meeting was held on 12<sup>th</sup> February 2016 and a revised TOR was submitted later. The TOR was then approved by DOE on 11<sup>th</sup> April 2016.

### **3. Statement of Need**

The KWRC land reclamation will cover an area of 273.57 ha (676 acres) and a built-up area of approximately 472.67 ha (1,168 acres). The proposed reclaimed land will be developed into six (6) major land use components i.e. tourist attraction and facilities, residential development, commercial development, etc.

#### **3.1 Promoting Tourism Sector**

The development of KWRC will act as a growth catalyst not only for Kuantan but also for the East Coast Malaysia under the East Coast Economic Region (ECER) plan. The KWRC strategic location in the South China Sea is suitable to be developed into tourism sector. It is aimed to position itself as a dynamic tourism gateway to Kuantan by capitalizing on its waterfront advantage. Water themed developments such as Indoor Aquaria, Water Theme Park, International Cruise Terminal, Marina and Yacht Facilities are proposed to be built.

To further diversify the tourism sector, the KWRC will be developed into a new commercial and business center that is supported with international class facilities which comprise M.I.C.E. (Meetings, Incentives, Conferencing, Exhibitions), Duty Free Complex, Premium Outlets, Business Park etc.

#### **3.2 Supports Government's Development Plans and Strategies**

The development of KWRC is congruent with and will support the development plans and policies set by the government. These include:

##### **3.2.1 Kuantan Local Plan (Amendment) 2013 - 2015**

Based on the Kuantan Local Plan (Amendment) 2013 - 2015, the Project site is designated in the Planning Sub Block (BPK) 2.19 which has been gazetted for land reclamation. The future land use for BPK 2.19 are business and service activities which is in line with the KWRC development.

##### **3.2.2 Pahang Structure Plan 2002 - 2020**

The State Government of Pahang aims to develop the Tourism and Service Sector into becoming the main contributor towards Pahang's Gross Domestic Product in the coming years. Various facilities and infrastructures are required to cater to the current and future demand, and developments like KWRC will help to contribute towards these requirements.

##### **3.2.3 East Coast Economic Region (ECER)**

Various employment and business opportunities will be created from the very beginning of the KWRC project's implementation, to the groundwork and construction, and when the project is fully completed as well as during operational

stage. These opportunities will promote economic growth of Kuantan by offering attractive investment or business partnership opportunities as well as raising the living standards of the locals by creating new employment opportunities, and thereby contributing towards realising the visions as promulgated by the ECER project.

### 3.2.4 National Physical Plan 2 (NPP-2)

One of the key implementation measures and policies under NPP-2 which KWRC will contribute to is through Sustainable Tourism Development. Kuantan has been identified as one of the National Regional Growth Conurbation under NPP-2. At present, there is a dearth of quality units in Kuantan and this will affect the district's progress in the coming years. This is where developments like KWRC will prove to be an asset by fulfilling the expected demands and requirements, and thereby contributing to support the tourism sector.

### 3.3 Contribute to State/Federal Income and Improving Living Standards and Sustainability

The KWRC is envisaged to promote the development of its surrounding area of Tanjung Lumpur by creating employment and new business opportunities in terms of training, education and employment. These will come about right from the early stage of the project's implementation that include the groundwork and construction. These opportunities will continue when the project is completed and operational.

### 3.4 Modernisation of Infrastructure Development and Logistics

The implementation of KWRC will see improvements in the basic infrastructure and logistics within the area. Among the development components is the construction of new access roads and the upgrading of existing local kampung roads e.g. Jalan Tanjung Lumpur and Lorong Anak Air. Public transport services to and from KWRC will also be upgraded, and this will be directly beneficial to the local communities living around the development area. The KWRC development will improve the existing transportation modes including over land and water.

### 3.5 Create New Jobs and Business Opportunities

The KWRC will result in new jobs and business opportunities right from the early phase of its implementation. When fully completed, the various residential and business components are projected to create around 5,000 new job opportunities to the local communities (*Table E3*).

**Table E3** ► Estimated Job Creation

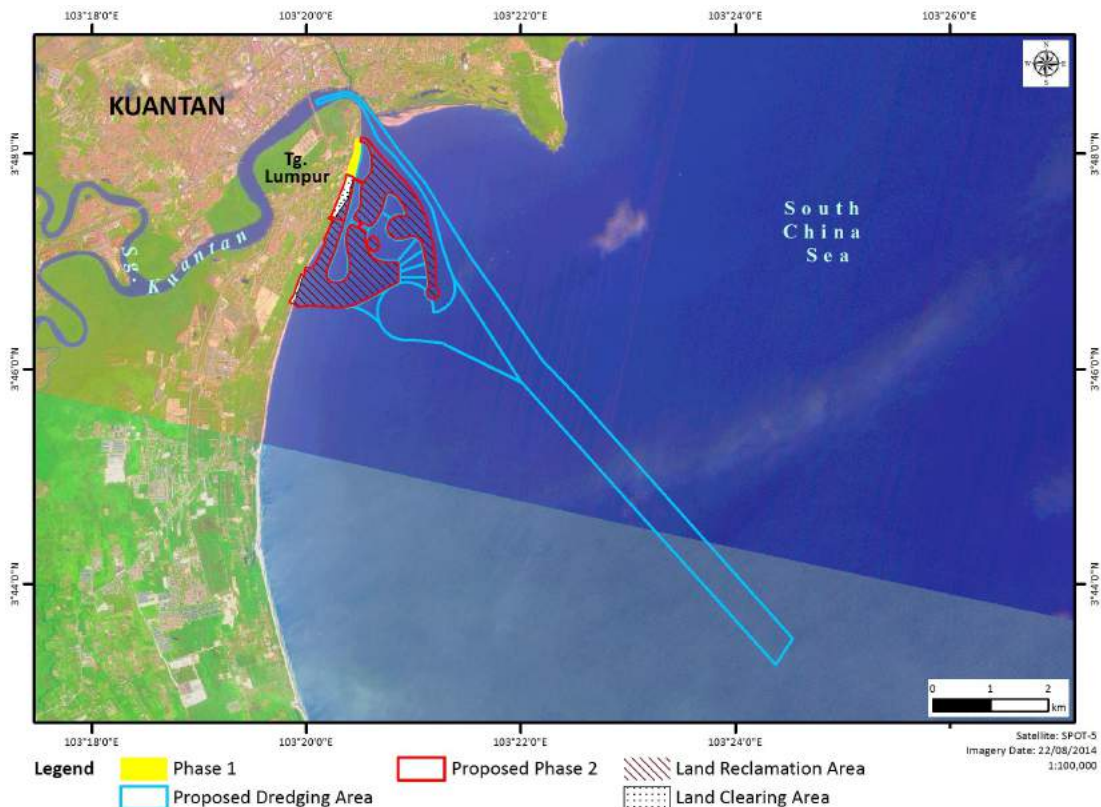
Sector	Estimated Job Creation
Tourism attraction, hotels, theme parks and commercial development	4,050
Residential development	350
Medical, tourism and education centre	600
<b>Total</b>	<b>5,000</b>

### 3.6 Mitigate Erosion along Tanjung Lumpur Shoreline

According to the National Coastal Erosion Study (UPEN, 1985), the Tanjung Lumpur shoreline has retreated significantly over the past decades. The shoreline was classified as Category III and later it was reclassified as Category I. Category I means areas where the rates of erosion considered in conjunction with economic, transportation, recreation, and demographic values and with structures intended to protect such values indicate that action to halt erosion may be justified. As such, the proposed land reclamation abutting the shoreline will indirectly mitigate the erosion issue along the Tanjung Lumpur shoreline. The reclamation configuration was designed by taking into account the hydraulic requirements i.e. change in wave, current, etc.

### 3.7 Improvement to Sungai Kuantan and River Mouth Sedimentation Problem

Implementation of the KWRC project will also bring about improvements to the river mouth of Sungai Kuantan. The KWRC project will help to resolve this with a unique and effective proposition that will result in a “win-win” solution for all the affected parties. Instead of the government having to allocate a sizeable budget to dredge and dispose of the sediment at the river mouth, the Project Proponent will undertake the works. The dredged materials will then be transported and used as fill material (*Figure E5*).



**Figure E5** ► Proposed Dredging Area within the Project Site

## 4. Project Option

A few options were considered for this project and discussed according to Build Option and No-Build Option.

### 4.1 Build Option

KWRC will elevate the present status of Tanjung Lumpur which has the potential for growth into becoming Kuantan's first Integrated Leisure, Retail and Entertainment Destination within an enclave that also offers seafront living. Several reclamation layouts had been assessed according to several factors, especially in terms of the impacts towards the environment. The final layout/configuration takes into account, but not limited to, the following:

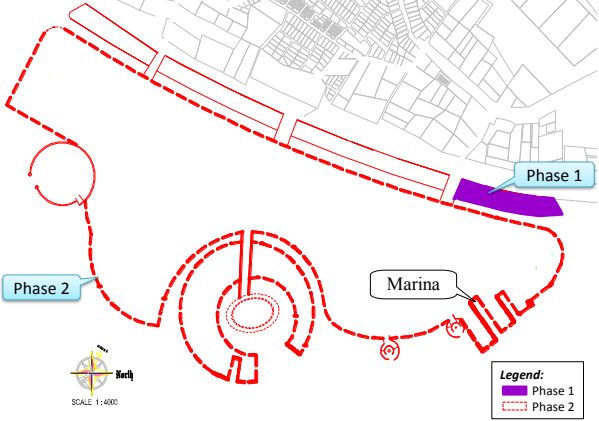
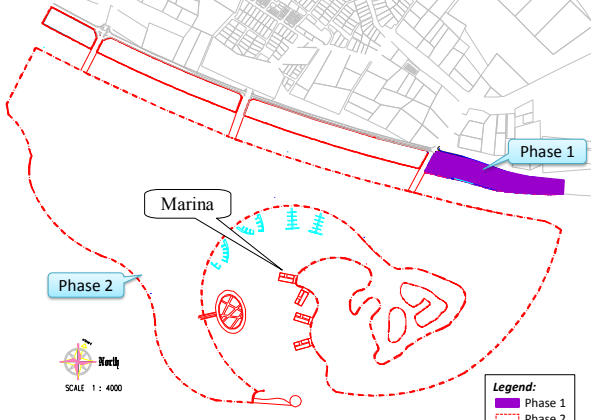
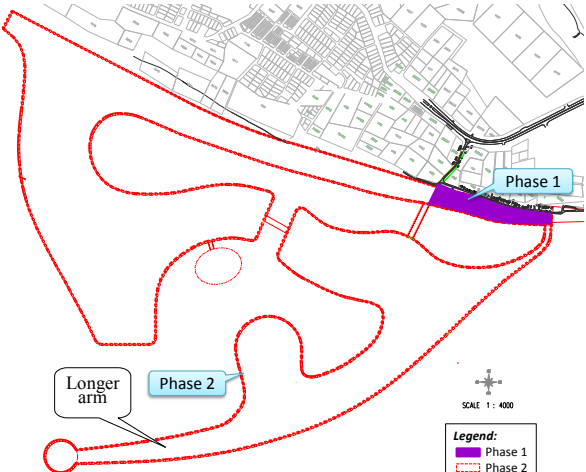
- i) Environmentally Sensitive Areas (ESAs) nearby; and
- ii) Hydraulic components i.e. change in wave, current, etc.

All the proposed options are as presented in *Table E4*.

### 4.2 No-Build Option

Without the implementation of the Project, some of the national and state development objectives will not be achieved since the proposed Project is unique in its own concept. The existing seafood and fishing businesses will be maintained status quo. However, this will reduce the attractiveness of the area, both to businesses and tourists alike. In addition, the opportunity for significant economic development will have to be relinquished resulting in lower growth for the region. Such a situation will undermine the overall objective of making Kuantan as one of the most vibrant business and social centers in the country.

**Table E4** ▶ Proposed Options of Reclamation Layout

Options	Descriptions
<p><b>Option 1</b></p> 	<p>The man-made island was designed with a shape of a half moon and it is connected to the mainland by three bridges.</p> <p>Based on the hydraulic assessment, the marina is located facing the dominant Northeast wave direction. This will expose the marina to the rough (choppy) water especially during the monsoon season. Thus, this layout was rejected.</p>
<p><b>Option 2</b></p> 	<p>The previous shape was revised where the marina is located in the inner part of the layout. However, this layout is still not hydraulically friendly due to an opening is provided near the Sungai Kuantan river mouth. Sedimentation may occur within the area and cause stagnant water during low tide.</p> <p>Hence, this option is not opted.</p>
<p><b>Option 3</b></p> 	<p>A totally new layout was designed to overcome the previous issue and the reclaimed land is designed abutting the coastline.</p> <p>A longer arm is proposed at the Northeast of the project. It acts as a breakwater to protect from the wave impact during monsoon. Coastal protection structures are planned to be built at the perimeter of the reclaimed land to overcome any erosion that may occur.</p> <p>Therefore, Option 3 is selected as the final reclamation configuration.</p>

## 5. Project Descriptions

### 5.1 General Site Descriptions

The general site descriptions within the 5-km study area cover the existing physical environments as shown in *Figure E6*. The descriptions are categorized into three (3) sections which are listed as follows:

- i) Northern shoreline (Sungai Kuantan river mouth - Tanjung Pelindung Tengah);
- ii) Middle shoreline (Kampung Tanjung Lumpur); and
- iii) Southern shoreline (Kampung Anak Air - Kampung Baharu).

#### 5.1.1 Northern Shoreline (Sungai Kuantan river mouth - Tanjung Pelindung Tengah)

Within the northern shoreline, there are industrial area, a boarding school, a Marine Police Headquarters and a fish processing factory. Harbours, jetties and a floating village are also found in the area. There is a wet fish market near the river bank where the local Tanjung Api fishermen sell their catch. A recreational park named "Esplanade Tanjung Api" is located further out into the sea at the Sungai Kuantan river mouth.

#### 5.1.2 Middle Shoreline (Kampung Tanjung Lumpur)

Tanjung Lumpur is a traditional fishing village located at the mouth of Sungai Kuantan. The coastline here is fairly flat with a slope of one degree and with very little vegetation. The northern part of Tanjung Lumpur is retreating at an average of one metre per year and a relocation of houses was undertaken in the 1990s. There are still several houses on the shorefront that are exposed to erosion due to coastal flooding during surge events. Presently however, apart from these severe storm surge events, the coastal road is not under threat due to the extremely flat coastal profile. Mangroves are found fringing along Sungai Kuantan. These mangroves are an important resource with respect to the local fishing industry. At the central part of Tanjung Lumpur, housing development with the associated services is already dense within the area.

The mixed development of KWRC Phase 1 is the kick-start project for the overall KWRC project. It comprises of a serviced apartment, a commercial complex, a showroom and a commercial bungalow being developed on the Tanjung Lumpur coastline.

#### 5.1.3 Southern Shoreline (Kampung Anak Air - Kampung Baharu)

Kampung Anak Air is located about 4.5 km south of Tanjung Lumpur. The foreshore features an extensive coastline of sandy beaches. A medium-class resort hotel is located near the coastline i.e. Suntiana Resort. Moving inwards to the mainland, construction works for a modern residential development is being developed within the neighbourhood of Kampung Anak Air.

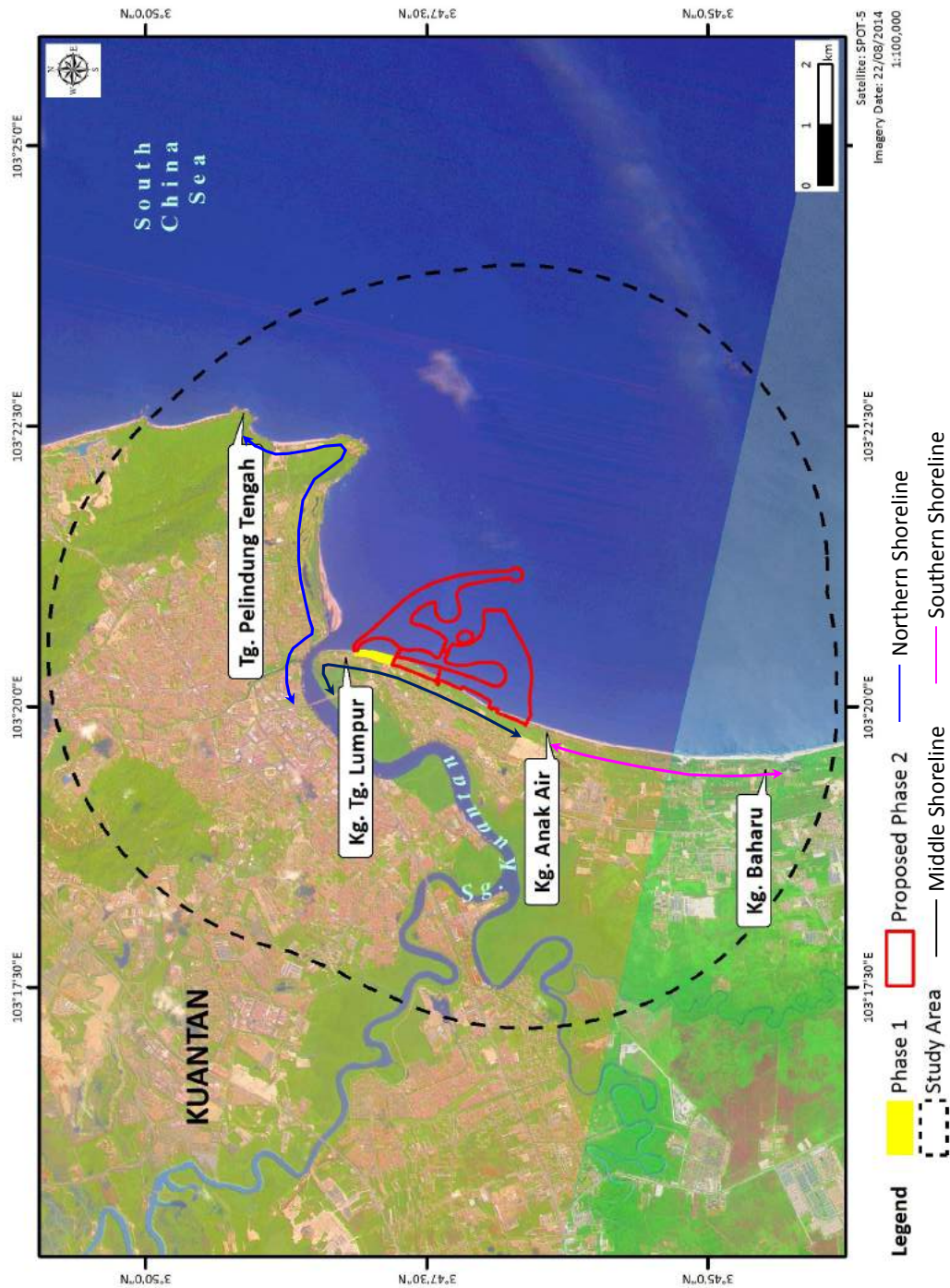


Figure E6 ▶ General Site Descriptions



## 5.2 Project Concept

The KWRC Phase 2 development will be set with the KWRC Phase 1 as a backdrop and abutting the coastline of Tanjung Lumpur. It involves land reclamation for mixed development bordering the shoreline of Tanjung Lumpur which is nearby Sungai Kuantan's river mouth. The Sungai Kuantan river mouth is known for sedimentation issues that create obstacles for navigational access to and from Sungai Kuantan. In order to overcome this, the Project Proponent has taken the initiative to dredge the river mouth and its navigation channel. Subsequently, suitable dredged material will be used as a filling material for this Project.

## 5.3 Project Component

The project will be implemented in phases comprising the following components:

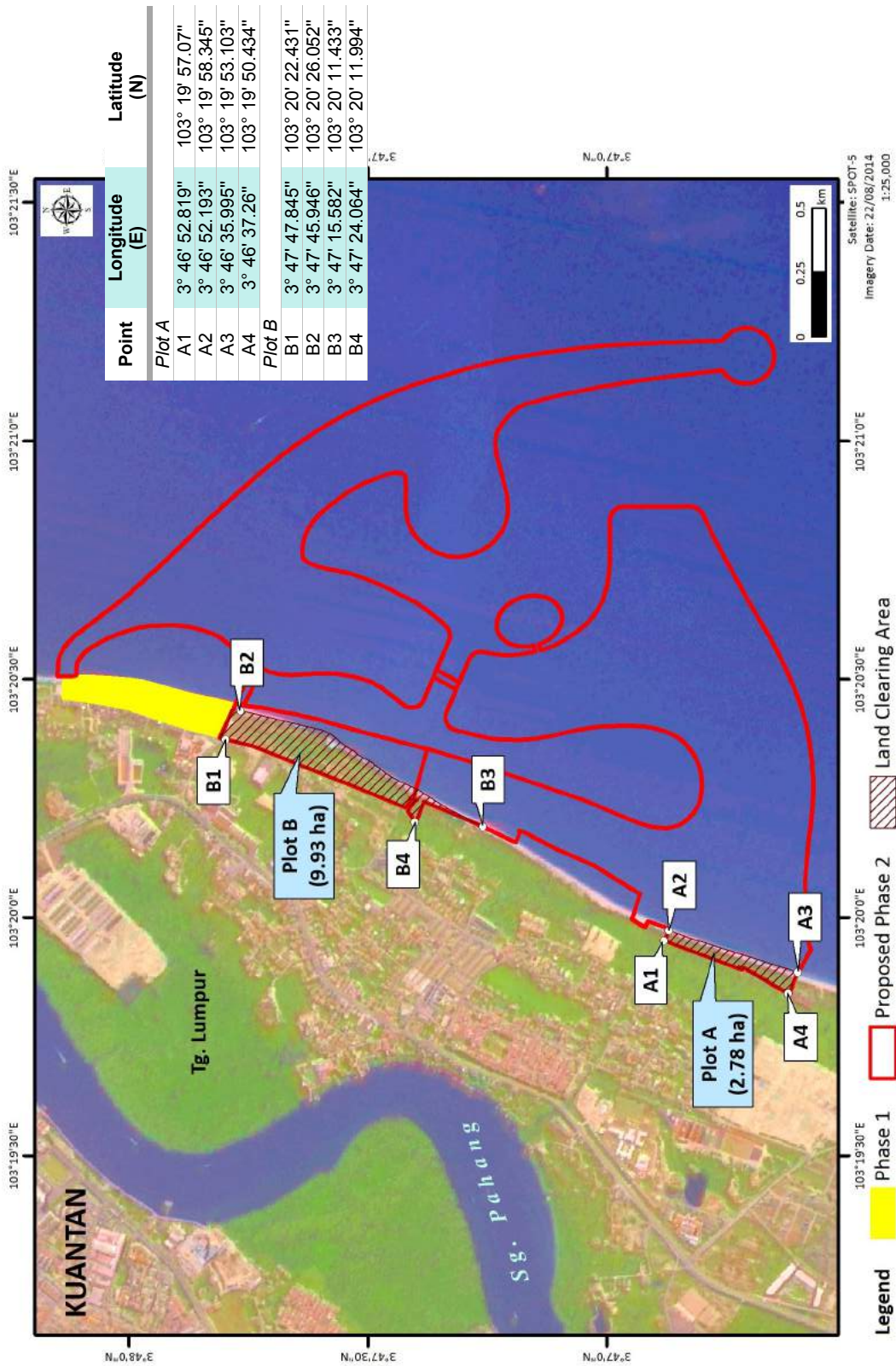
- i) Land clearing;
- ii) Reclamation; and
- iii) Dredging.

### 5.3.1 Land Clearing

About 12.71 ha of the total project area are overlapped on the existing shoreline which comprise two plots, i.e. Plot A (2.78 ha) and Plot B (9.93 ha). The land clearing areas for both plots overlapped on a satellite image are as presented in *Figure E7*.

### 5.3.2 Reclamation

The proposed reclamation area will be reclaimed with a designated level of +5.0 m CD and a slope gradient of 1:3 to ensure its stability. The coordinates of the reclaimed land are shown in *Figure E8*.



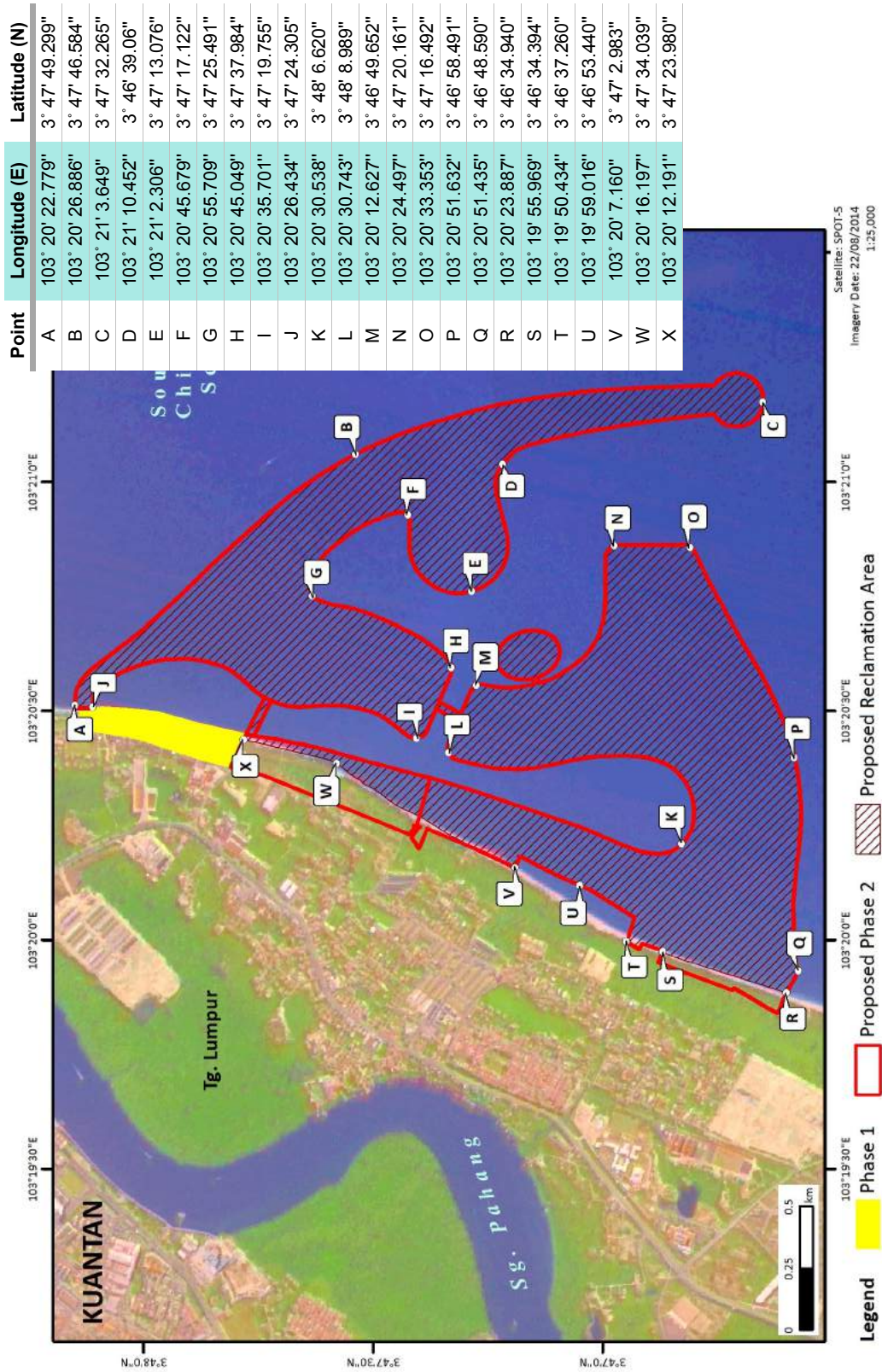


Figure E8 ▶ Reclaimed Land Boundary Coordinates

### 5.3.3 Dredging

Dredging activity will take place in the Sungai Kuantan and its river mouth, navigation channel and seafront area within the newly created land. The dredging works will be carried out by deploying Cutter Suction Dredger (CSD) and Trailer Suction Hopper Dredger (TSHD). The dredging works will be conducted in accordance with the phases (continuing from KWRC Phase 1), as the following:

- i) Phase 2a – Dredging will be conducted to create a 12 m CD deep navigation channel starting from about 100 m downstream of Tanjung Lumpur bridge extending 12 km seaward (southeast); and
- ii) Phase 2b – Dredging will be done for the following:
  - a. Lagoon (dredged to 3 m CD);
  - b. Canal (4 m CD);
  - c. Inner marina (4 m CD);
  - d. Outer marina (6 m CD);
  - e. Cruise terminal (6 to 9 m CD); and
  - f. Turning basin (12 m CD).

*Figure E9* shows the proposed designated depth of dredging areas and the dredging boundary coordinates are presented in *Figure E10*.

## 5.4 Project Phases

The man-made land operation works will be divided into three (3) major components i.e. land clearing, reclamation and dredging as shown in *Figure E11*. The proposed summary work scheduled is listed in *Table E5*. Phase 2b will be executed after the completion of Phase 2a. It should be noted that the 40 months period is only for land clearing, reclamation and dredging purpose and does not include the topside development.

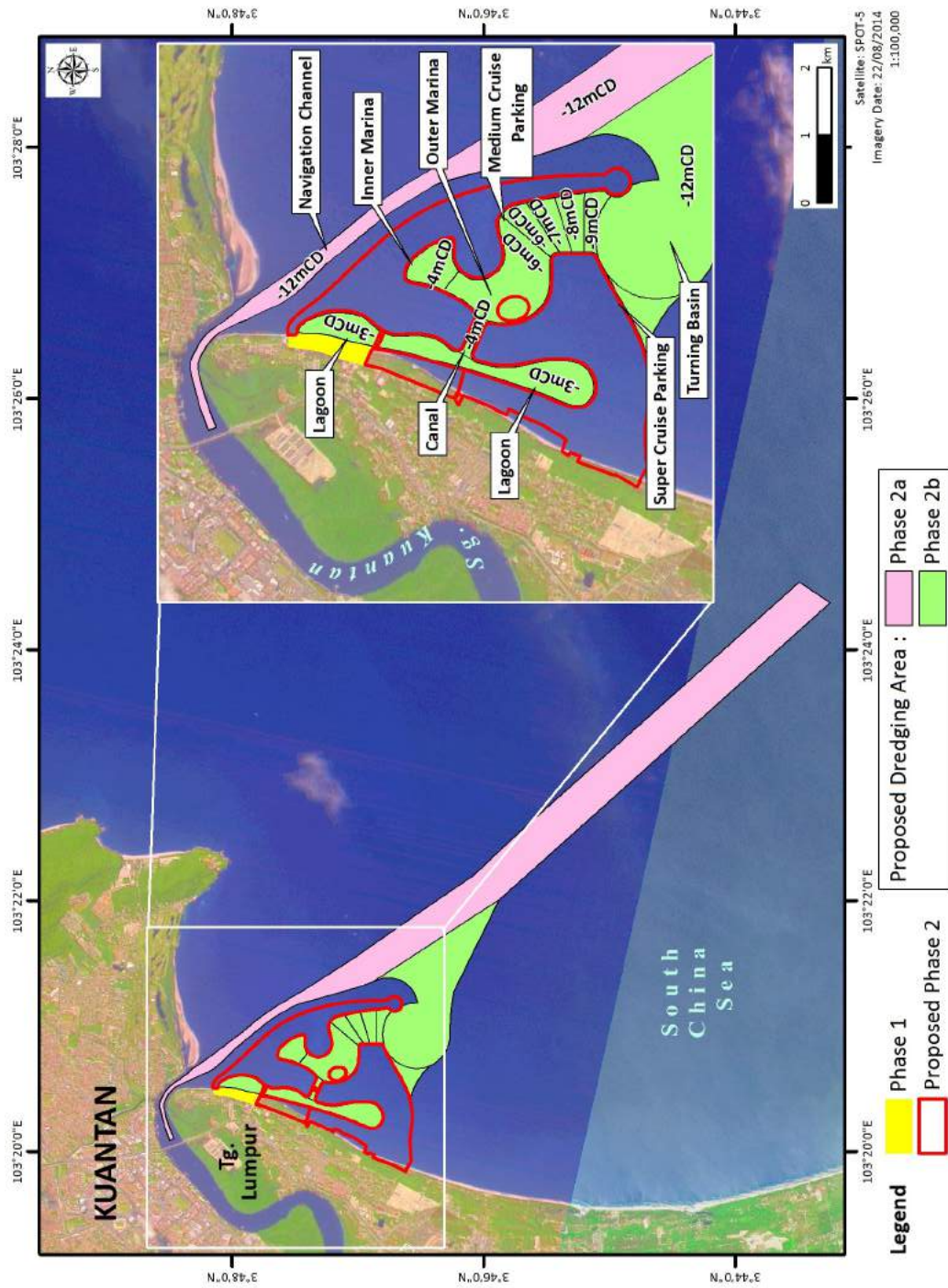


Figure E9 ▲ The Proposed Designated Depth of Dredging Areas

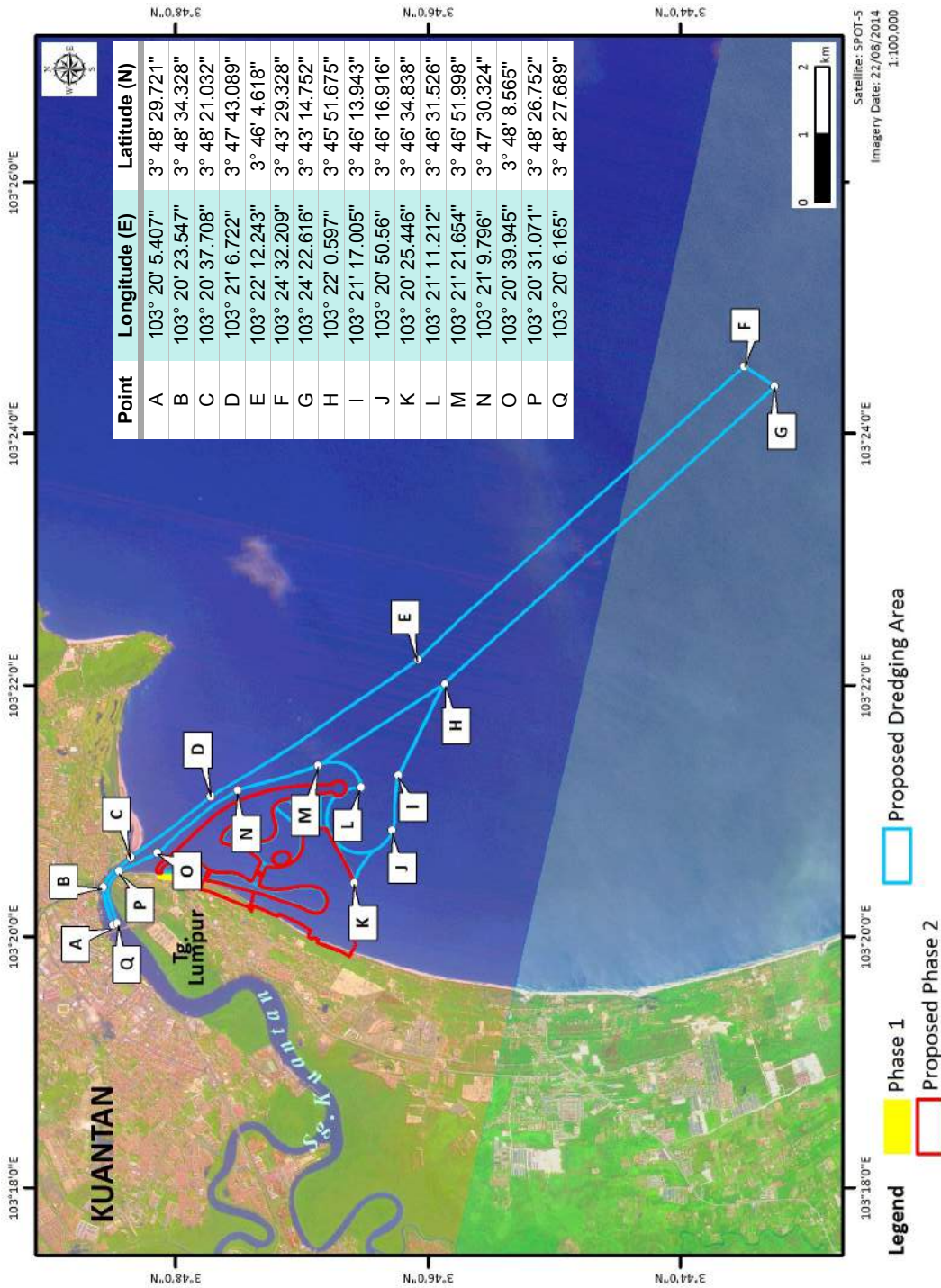


Figure E10 ► Dredging Boundary Coordinates

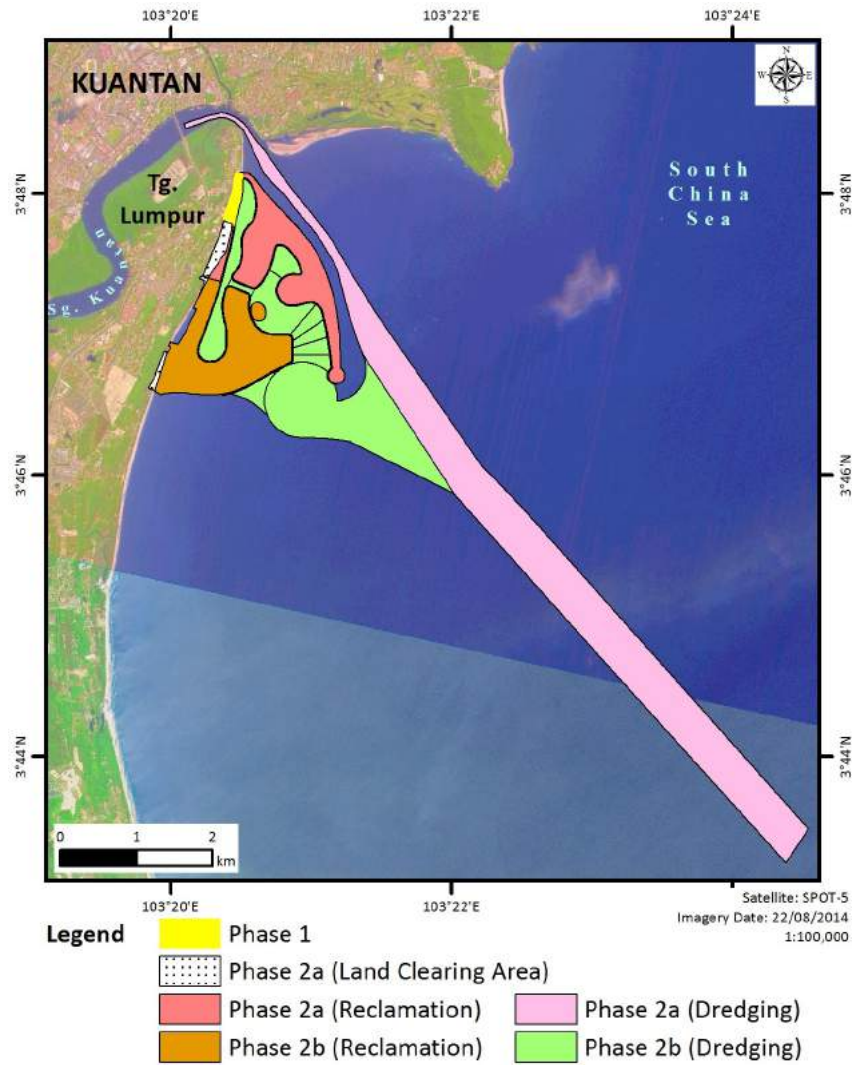


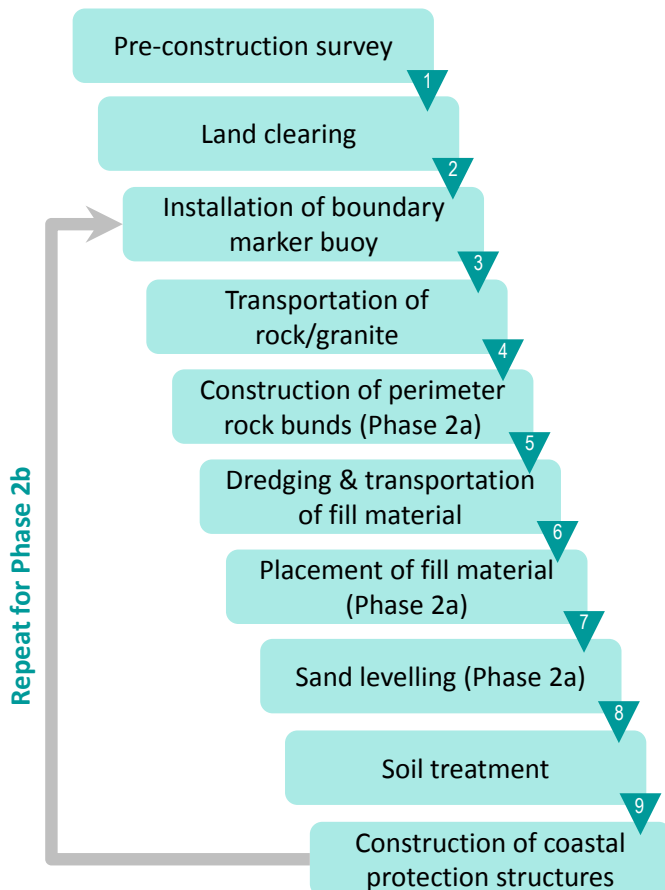
Figure E11 ► Project Phasing

Table E5 ► Project Timeline

Project Components		Commences	Completion	Period (Month)
Phase 2a	Land Clearing	Month 1	Month 2	22
	Reclamation	Month 1	Month 22	
	Dredging			
Phase 2b	Reclamation	Month 23	Month 40	18
	Dredging			
<b>Total</b>				<b>40</b>

## 5.5 Project Activities

The main sequence activities for this project are as follows:



**Figure E12** ►  
Main Sequence Activities

### 5.5.1 Pre-construction Survey

The pre-hydrographic survey will be conducted to determine the existing depths of the seabed and to establish the exact quantity required for the land reclamation activities. The topographic survey will be carried out to determine the existing land configuration of the coastline and identify land features.

### 5.5.2 Land Clearing

Land machineries such as excavators, bulldozers and lorries will be deployed to clear off the land. The land-clearing activities are to follow best management practice to minimise impacts towards the environment, mainly on water quality. The vegetation wastes will be collected and disposed of at an approved landfill or disposal site by the contractor.



### 5.5.3 Reclamation and Dredging

Approximately 10 million m<sup>3</sup> of reclamation material is needed for the reclamation purposes based on the total area calculated as listed in *Table E6*. Suitable material (sand) from the dredging works will be used as fill material. This method will enable dredged materials from the project area to be beneficially re-used rather than disposing it offshore.

**Table E6** ► Estimated Volume of Reclamation Material

Project Phase	Area (ha)	Volume of Reclamation Material (m <sup>3</sup> )
Phase 2a	123.05	4,559,566.63
Phase 2b	150.52	6,119,358.80
<b>Total</b>	<b>273.57</b>	<b>10,678,925.43</b>

#### 5.5.3.1 Installation of Boundary Marker Buoy

Certain areas need to be restricted from being entered for safety purposes during the working period. The designated working areas will be marked with lighting or bright-coloured buoys. Early notice will be given to the Marine Department before any works are executed.

#### 5.5.3.2 Transportation of Rock/Granite

Rocks will be transported from the quarry to the project site via sea route by flat-top barges. Later, they will be towed by using tug boats or by a material/dump vessel. Approximately 3,000 to 5,000 tonnes of rocks will be transported each day.

#### 5.5.3.3 Construction of Perimeter Bunds

Prior to any placement of fill material, a temporary rock bund will be constructed at the perimeter of the reclamation boundary area. The construction of perimeter rock bund will be executed starting from the mainland towards the sea.

#### 5.5.3.4 Dredging of the Sungai Kuantan River Mouth, Navigation Channel and Seafront Area within the Newly-Created Land

Dredging will be conducted to deepen the navigation channel with a boundary of 100 m away from the Tanjung Lumpur bridge to an extent of 12 km seaward (southeast) to a level of -12 m CD. The dredging will also be done to dredge the seafront area within the newly-created land with a varying depth of -3 m to -12 m CD. A summary of the proposed dredging works is tabulated in *Table E7*. The estimated volume to be dredged is tabulated in *Table E8*.

**Table E7** ►  
Summary of the Proposed  
Dredging Works

Design Characteristics	Properties
Design depth	-3 m to -12 m CD
Total area	845 ha
Estimated volume	49 million m <sup>3</sup>
Required volume	10 million m <sup>3</sup>
Side slope	1V: 5H
Type of dredged material	Sand and coarse silt
Vessel	CSD and TSHD

**Table E8** ► Estimated Volume to be Dredged

Phase	Location	Average Existing Depth (m CD)	Proposed Depth to be dredged (m CD)	Area to be Dredged (m <sup>2</sup> )	Estimated Volume to be Dredged (m <sup>3</sup> )
Phase 2a	Navigation channel	6.74	12	5,228,225	27,496,592.98
	Lagoon	0.77	3	491,828	1,096,776.44
	Canal	0.64	4	31,892	107,157.12
Phase 2b	Inner marina	1.20	4	124,030	347,284.00
	Outer marina	1.40	6	349,556	1,814,957.60
	Cruise terminal	2.64	6 to 9	311,542	1,514,094.12
	Turning basin	3.00	12	1,858,666	16,727,994.00
<b>Total</b>				<b>8,440,739</b>	<b>49,104,856.26</b>

*Notes:*

1. Average existing depth for navigation channel is based on Bathymetric Chart No.: 3445.
2. Estimated volume to be dredged is calculated based on area method.

### 5.5.3.5 Fill Material Transportation

Two trailer suction hopper dredgers (TSHDs) are to be used for the reclamation and dredging works. A cutter suction dredger (CSD) is to be used for the dredging works at shallow areas. The CSD and TSHD have a capacity of 1,500 m<sup>3</sup> and 10,000 m<sup>3</sup> respectively.

### 5.5.3.6 Placement of Fill Material

Given the large reclamation area, it is considered that, practically, the land reclamation will need to be carried out progressively in a series of approximately 50-acre reclamation areas. The schematic reclamation sequences are further illustrated in *Figure E13*.

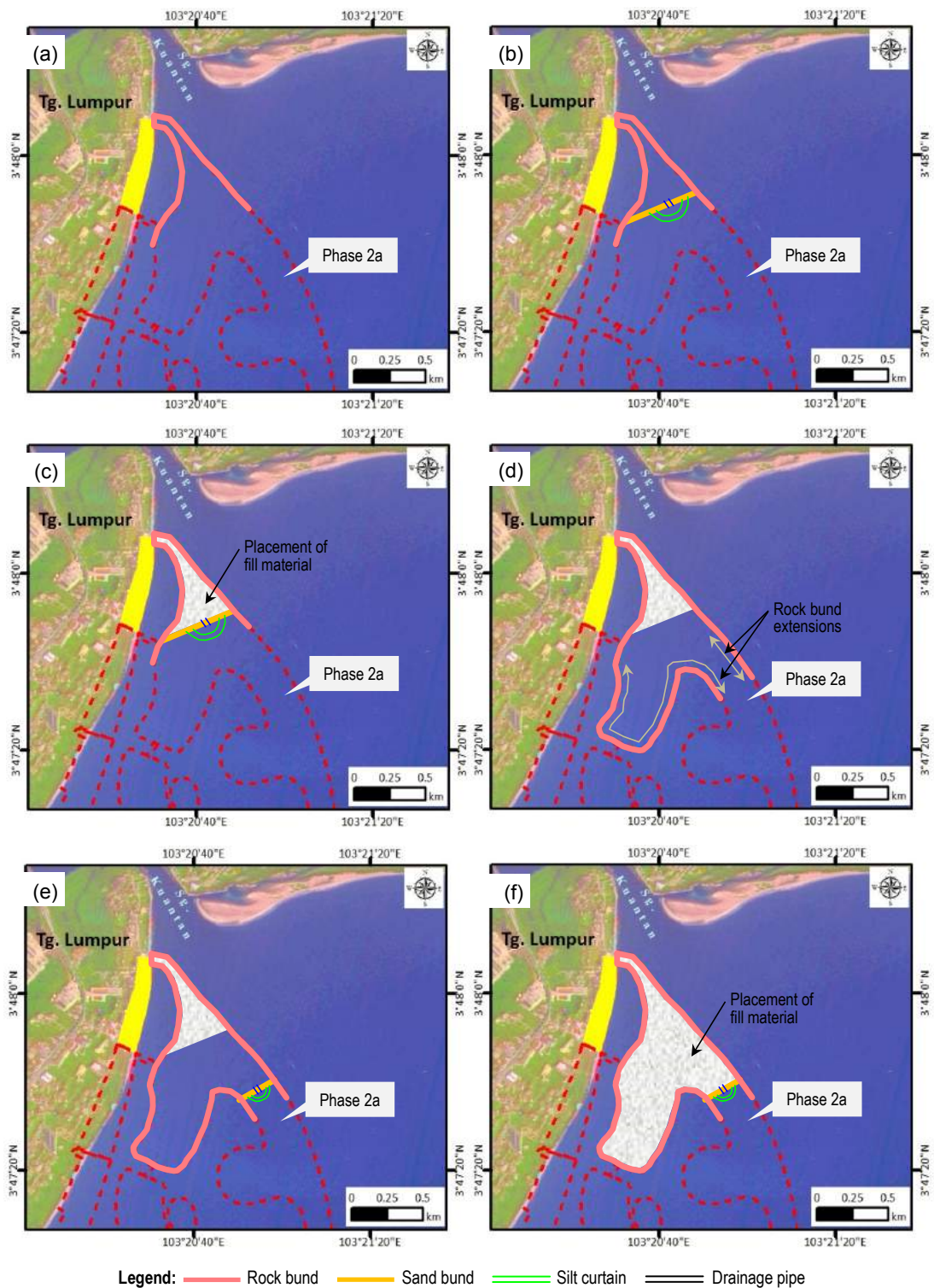


Figure E13 ► Schematic Illustration of Reclamation Sequence

#### **5.5.3.6.1 Silt Curtain Installation**

Silt curtain will be installed at the drainage pipe outlet and forming a “C” shaped to contain turbid water dispersing out from the working area. The process of silt curtain installation will begin with the preparation of the mooring system and concrete sinker. Workers will join lines, ropes, shackles, floater and moorings on land first followed by the joining of ground chain, main anchor line and mooring bridle. The hoisting work of concrete block sinker will be conducted using mobile crane onto the shore or by anchor boat. After the installation of concrete sinker is completed, a work boat will be used to join the silt curtain panels.

#### **5.5.3.7 Treatment of Fill Materials**

Prefabricated Vertical Drain (PVD) is part of the treatment of fill material and will be carried out after the filling activities are completed. This method is used to accelerate the consolidation of soft soil. The PVD is installed at regular spacing (1.3 m centre to centre) into soft soil to create shorter drainage path, enabling the excess water to flow horizontally through the longitudinal grooves on both sides of the core.

#### **5.5.3.8 Construction of Coastal Protection Structures**

The construction of coastal protection structures will be commenced once the reclaimed material has been filled up to the designated platform level. The formation of the constructed perimeter rock bund will be trimmed to provide the final slope profile of the revetments.

### **5.5.4 Disposal of Dredged Material**

Unsuitable dredged materials which are not used for the reclamation purposes will be disposed of at a proposed disposal area (1,526.52 ha). The disposal area is located 16.0 nm (29.63 km) away from the project site (*Figure E14*). Generally, disposal of the dredged materials will be done using self-propelled split hopper. It is anticipated that four (4) barges would be used to transport and dispose the dredged material at the disposal area. The proposed location has taken into consideration the guidelines as formulated by the Department of Environment (DOE) in determining the disposal site and method of disposing the dredged materials. Nevertheless, this location will need to be approved by the Marine Department of Malaysia prior to any disposal activity being done.

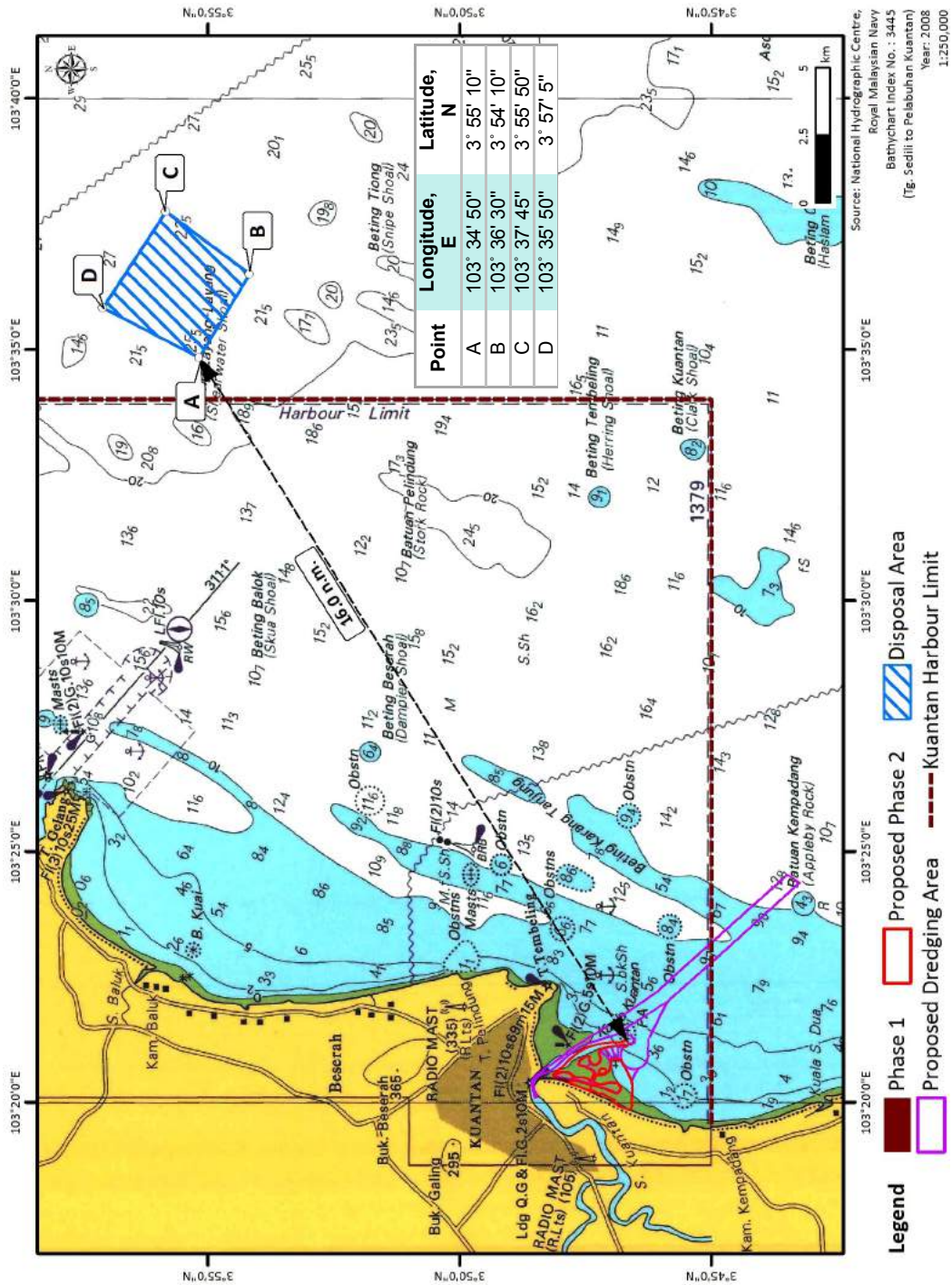
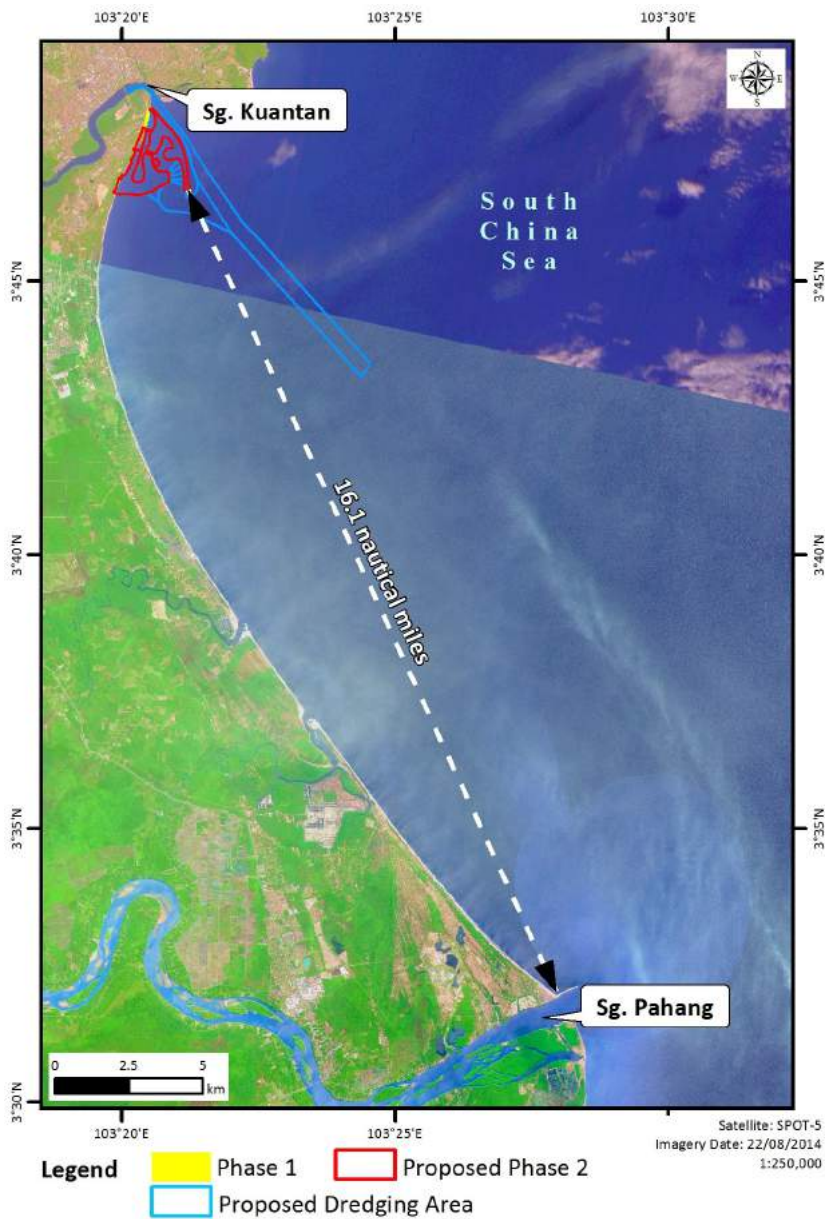


Figure E14 Proposed Disposal Area

### 5.5.5 Sand Borrow Area

In any case, if the dredged material is unsuitable to be used as fill material, an alternative sand borrow area at Kuala Sungai Pahang is proposed (*Figure E15*). It is located approximately 16.1 nm (29.82 km) away and the dredged material will be shipped via trailer suction hopper dredger (TSHD) to the project site. However, a separate EIA study should be submitted to the Pahang Department of Environment (DOE) for approval as dredging is listed as one of the activities subject to the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015.



**Figure E15** ► Sand Borrow Area from Kuala Sungai Pahang

## **5.6 Post Reclamation (Topside Development)**

The five (5) major developments on the reclaimed land include 28.39% for tourism attractions and associated facilities, 7.04% for commercial development, 5.71% for residential development, 1.67% for education and health facilities, and 15.07 % for utilities development.

*Figure E16* depicts the overall concept master plan of the topside development. It is envisaged to transform the area from a typical fishing village to a tourism-related area. The main feature of KWRC is that it is a unique mixed development along coastal Pahang that aims to create a new and vibrant residential township with modern business centres that are linked to various leisure and community facilities.



Figure E16 ▶ Overall Concept Masterplan of the Topside Development  
 Source: SS Planning & Consult (2015)



## 6. Existing Environment

### 6.1 Physico-Chemical Environment

This chapter will describe the existing physico-chemical, biological and human environment as well as environmental sensitive areas (ESAs) in close proximity to the project site.

#### 6.1.1 Bathymetry

From the Bathymetry Chart No. 1379 (published in 1984 with a new edition released in 2006) (*Figure E17*), the drying area at the site had a maximum width of about 1.5 km (i.e. from low water line towards the 0 m CD depth) between Teluk Baharu and the Sungai Kuantan river mouth. However, for this EIA study, results from a new survey that was conducted in July 2013 was used as shown in *Figure E18*.

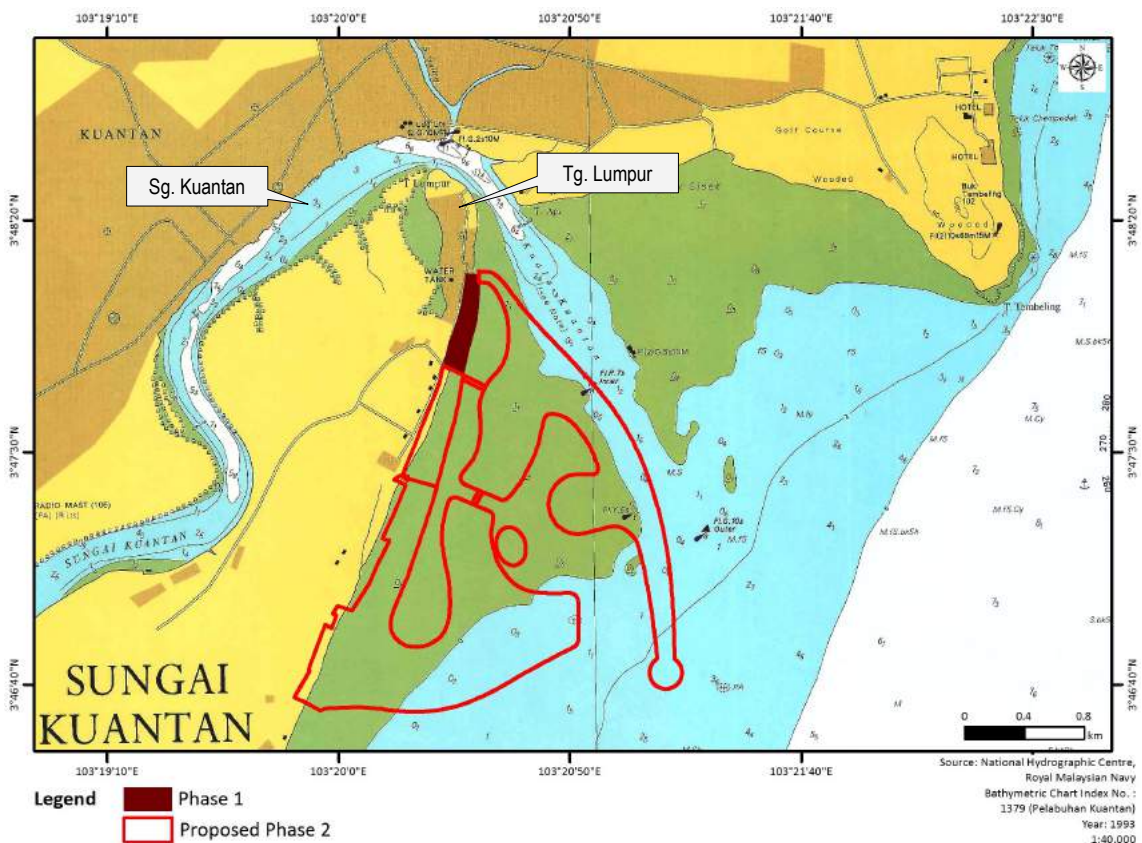


Figure E17 ► Bathymetric Chart No. 1379

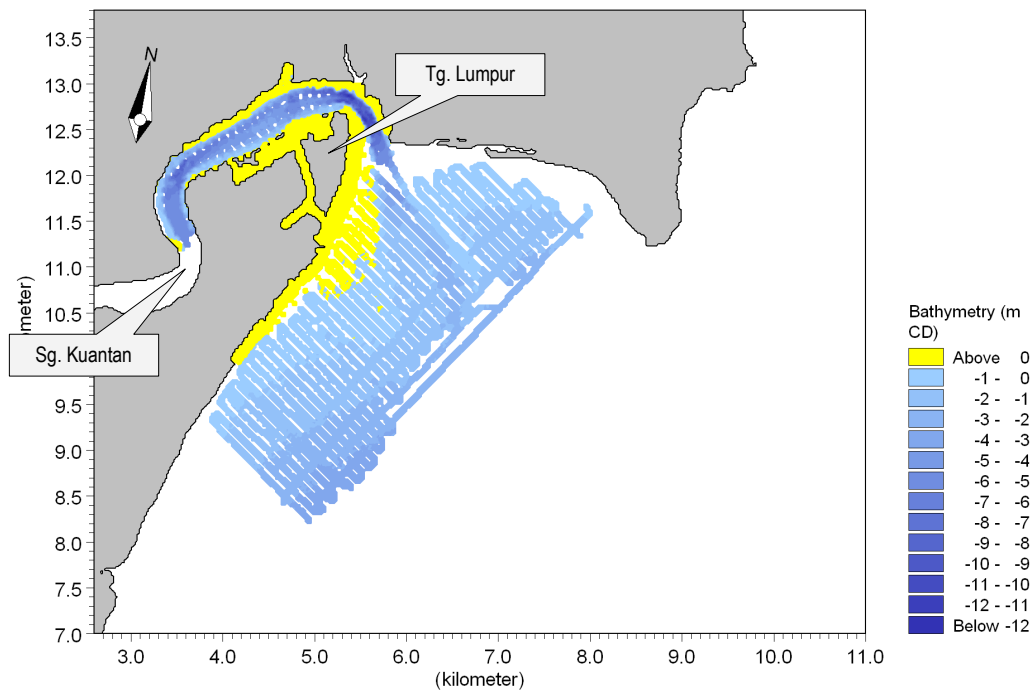


Figure E18 ► Bathymetry Survey (June 2013)

### 6.1.2 Current Flow

Maximum current speed occurs during flood and ebb flow. Flow is to the north during ebb flow and reverses during flood flow. Current speeds are significantly reduced during neap period. It can be inferred that mean and maximum current speeds of up to about 0.6 and 1.7 m/s can occur in front of the river mouth. The magnitude and extent of changes are generally relatively similar for all seasonal conditions.

### 6.1.3 Wave Condition

The highest wave heights experienced at the project are from 90°N. This is followed by waves propagating from 60, 120, 150 and 30°N.

### 6.1.4 Sediment Transport

There are two (2) types of sediment transport which are cohesive sediment transport and non-cohesive sediment transport.

#### 6.1.4.1 Cohesive Sediment Transport (Sand)

Erosion is observed in Sungai Kuantan and in front of the river mouth where the mean and maximum current speeds are about 0.4 and 1.3 m/s respectively.

#### 6.1.4.2 Non-cohesive Sediment Transport (Mud)

The net transport capacity in the vicinity of Tanjung Tembeling headland is towards west reaching 1890, 394 and 55 m<sup>3</sup>/year/m for the Northeast Monsoon, Southwest Monsoon and inter-monsoon periods.

#### 6.1.5 Coastal Morphology

Due to Kampung Tanjung Lumpur's proximity to the active spit shoreline, the area was classified as Category III ("Critically Eroded") in the National Coastal Erosion Study (UPEN, 1985). In 1997, 1.2 km of the Tanjung Lumpur coast was reclassified as Category I due to the very sensitive nature of the northern shoreline, which experiences large-scale changes during floods. Recent site visits showed there are indications that morphology activities still occurring within the project site. From the final draft NCES (JPS, 2016), the area is now classified as Category I ("Low").

#### 6.1.6 Soil Characteristic

As stated in the geological site map of Peninsular Malaysia (Minerals and Geoscience Malaysia, 2012), the Project is located on Quaternary deposit. The investigation work was carried out by Strata Drill Sdn. Bhd. Eight (8) numbers of rotary wash boreholes were carried out as shown in *Figure E19* and its coordinates are tabulated in *Table E9*.

Point	Latitude	Longitude
BH1	3° 46' 47.997"	103° 20' 19.357"
BH2	3° 46' 59.775"	103° 20' 39.702"
BH3	3° 47' 37.894"	103° 20' 39.702"
BH4	3° 48' 14.086"	103° 20' 40.773"
BH5	3° 47' 28.471"	103° 21' 07.97"
BH6	3° 46' 42.429"	103° 21' 15.037"
BH7	3° 47' 02.559"	103° 20' 10.149"
BH8	3° 47' 50.315"	103° 20' 34.134"

**Table E9** ►  
Coordinates of Boreholes

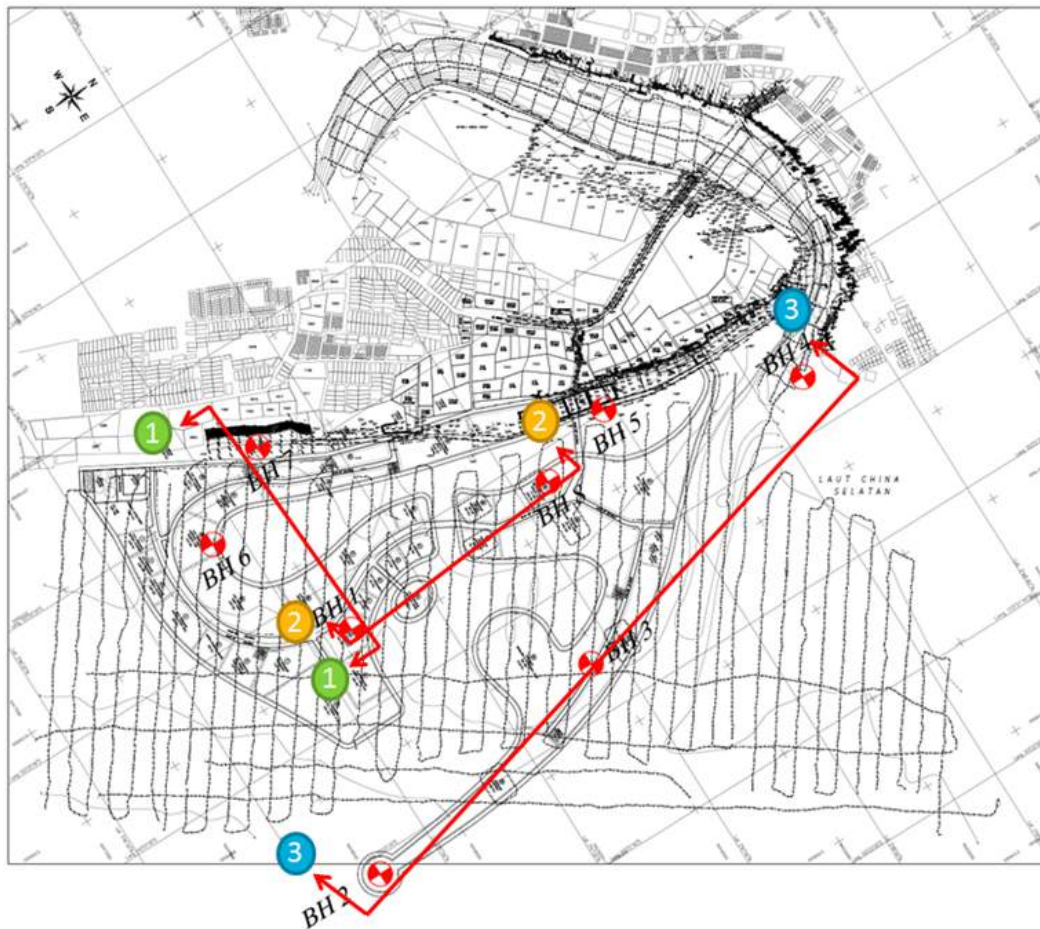


Figure E19 ► Location and Cross Section of Boreholes

#### 6.1.6.1 Section 1: BH1 and BH7

BH1 consists of soft to medium stiff clay. The thickness of this layer was about 15.0 m. This is followed by a layer of medium dense sand. Traces of gravel were also encountered at depth of 22.5 m.

BH7 consist mostly sand whereby loose sand was encountered until depth of 10.5 m. Subsequently, medium to dense sand was encountered until termination depth of borehole. No traces of compressible layer were found at BH7.

#### 6.1.6.2 Section 2: BH1 and BH8

For BH8, very soft clay was encountered until depth of 4.5 m while medium to dense sand was encountered at depth of 16.0 m.

### 6.1.6.3 Section 3: BH2, BH3 and BH4

Top layer soil at BH2 and BH3 consisted of 3.0 m thick loose sand. Underlying this layer, soft clay was encountered with a thickness of approximately 6.0 m. At 18.0 m depth, medium to dense sand were encountered at BH2 and BH3. For BH4, soft clay was encountered until depth of approximately 4.5 m. Underlying this layer, medium dense sand was found with a thickness of approximately 7 m.

## 6.1.7 Climate and Meteorology

The climate at the Project site is generally characterized as humid tropical with uniform temperature, high humidity and copious rainfall. Four rainfall regimes are inherent here:

- i) Northeast Monsoon from December to March;
- ii) Inter-monsoon period from April to May;
- iii) Southwest Monsoon from June to September; and
- iv) Inter-monsoon period from October to November.

### 6.1.7.1 Flooding Condition

Tanjung Lumpur area had experienced flooding in 2009. However, the most recent flood in December 2014 was reported as being the worst flood in Kuantan since 2012. The floods were due to the heavy rain and increase of the water level in the sea and the rivers, in addition to the poor drainage system in some areas.

### 6.1.7.2 Winds

At the project site, calm periods (wind speeds of less than 1 m/s) annually occur about 1.9% of the time. Wind speeds reach up to 10 m/s for the dominant mean wave directions. The dominant wind directions are from the northeast and southwest based on the annual wind rose.

## 6.1.8 Hydrology and Drainage

Tanjung Lumpur and the city of Kuantan are separated by Sungai Kuantan which flows through the middle. These areas are linked by the Tanjung Lumpur Bridge.

In Tanjung Lumpur, stormwater will drain either directly into the adjacent swamps, the South China Sea or Sungai Kuantan, or it infiltrates into the sandy soil. *Figure E20* shows the river catchment within the study area.

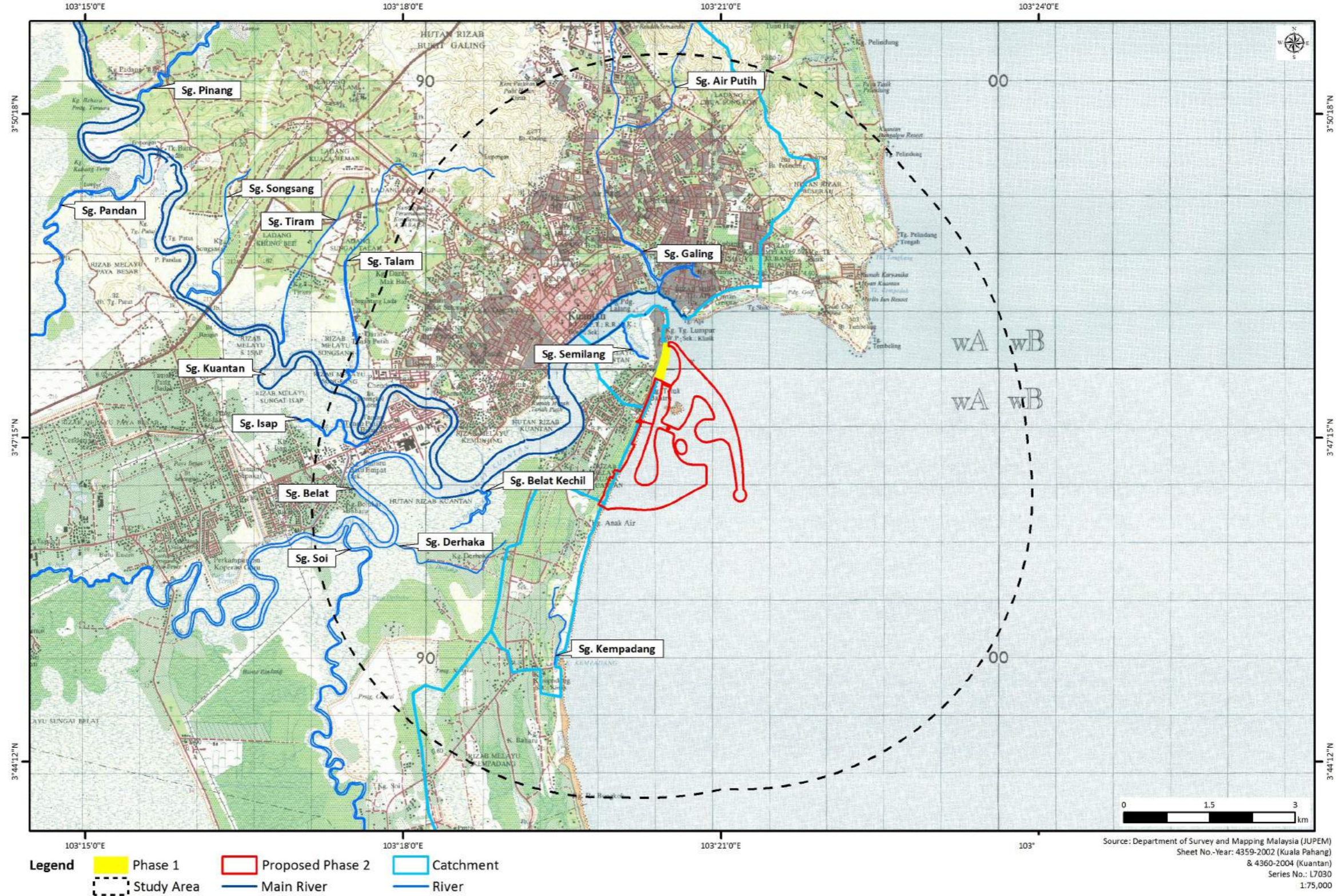


Figure E20 ► Catchment Area adjacent to the Project Site

### 6.1.9 Land Use

The land use study area is listed under the designated planning of the Kuantan Local Plan 2013-2015 and the Pahang Structure Plan 2002-2020. In these plans, the land use is divided into a planning control area known as “Planning Block” (BP). Further subdivision of the Planning Block result in smaller “Sub Planning Blocks” (BPK). *Table E10* shows details of the planning and sub planning blocks. The KWRC is sited in BP4: Jaya Gading-Gambang.

**Table E10** ► Mukim and Planning Blocks in the District of Kuantan

BP	Name	No. of Sub Planning Blocks (BPK)	Area (Ha)	Percentage (%)
1	Sungai Karang	9	25,365.00	8.57
2	Beserah	12	4,935.00	1.67
3	Bandar Kuantan	15	13,515.00	4.57
4	<b>Jaya Gading - Gambang</b>	<b>18</b>	<b>37,524.00</b>	<b>12.68</b>
5	Penur	6	22,300.00	7.53
6	Kuala Kuantan	2	28,461.00	9.62
7	Ulu Kuantan	4	88,600.00	29.93
8	Ulu Lepar	4	75,300.00	25.44
<b>Total</b>			<b>296,000.00</b>	<b>100.00</b>

Source: Kuantan Local Plan 2013-2015

### 6.1.10 Water Quality

Water quality samplings that were carried out include marine and river waters within the proposed project site. Eleven (11) sampling stations were identified and are portrayed as in *Figure E21*. The water quality parameters being studied are listed in *Table E11*.

**Table E11** ► Water Quality Parameters

Item	Parameters
Physical	Temperature, salinity, pH, conductivity, turbidity, DO, TSS
Anions	Ammonical nitrogen, phosphate, nitrate
Cations/Heavy Metals	Cr, Cd, Cu, Ni, Fe, Pb, Mn, As, Hg
Organics	BOD, COD, TOC, oil and grease
Microbial	<i>E.coli</i> , Faecal Coliform, Enterococci
Depths	Three depths (surface, middle, bottom)
Tides	Spring (flooding and ebbing)

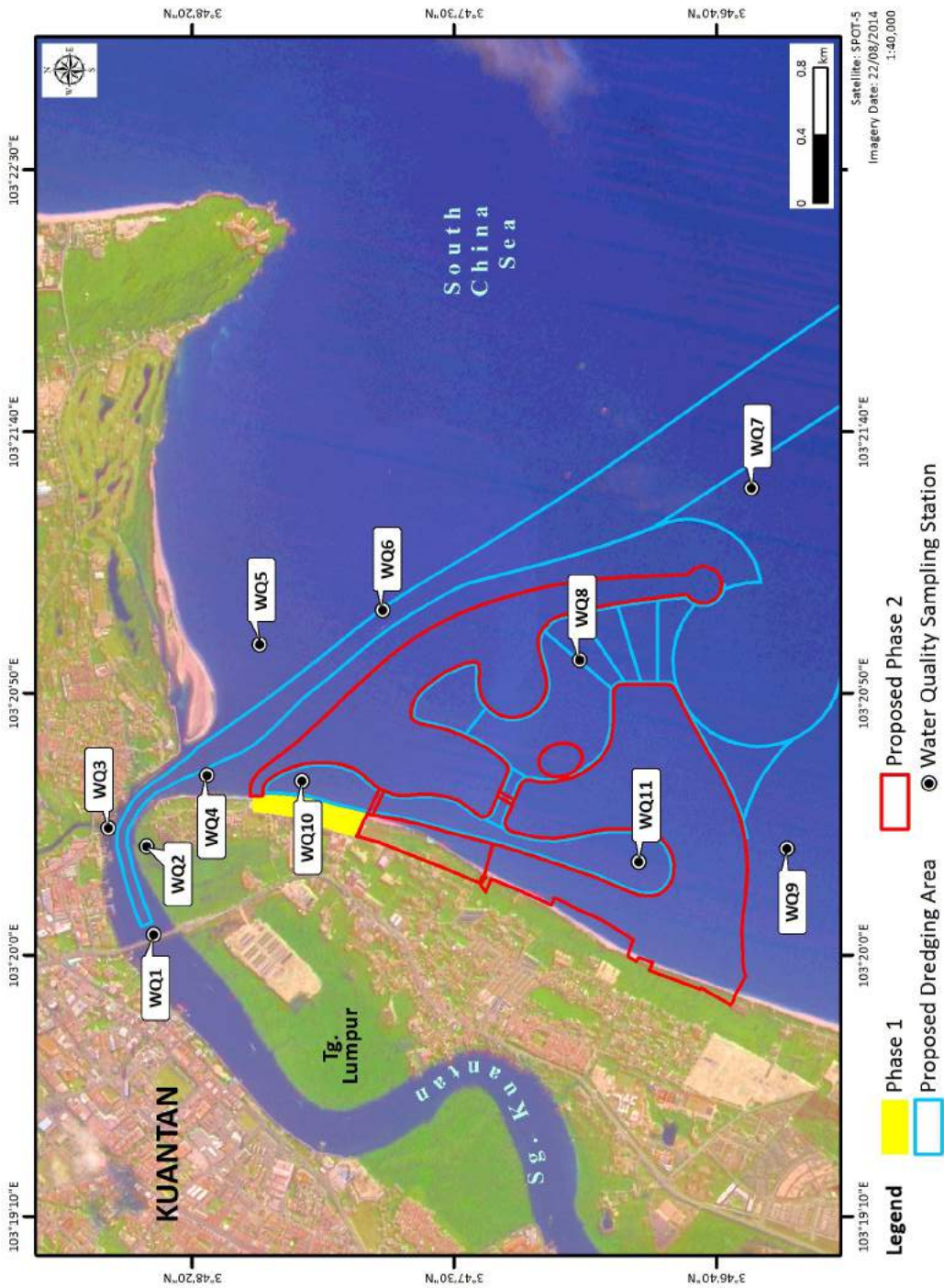


Figure E21 ► Water Quality Sampling Stations



The water samples from WQ 1 to WQ 4 were compared to Class E (suitable for mangroves, estuarine and river mouth water) of Marine Water Quality Criteria and Standard (MWQCS) whereas WQ 5 to WQ 11 were compared to Class 2 (suitable for marine life, fisheries, coral reefs, recreational and mariculture) of the MWQCS. The findings of baseline water quality results are as follows:

#### 6.1.10.1 Estuarine Water Quality

The water quality at the river mouth of Sungai Kuantan (WQ1) was generally moderate. BOD remained less than 6 mg/L, whereas NH<sub>3</sub>-N was in the range of 0.33 to 0.39 mg/L (different depths); with correspondingly low TSS and turbidity. Fecal coliform and *E. coli* also remained undetected except at the surface.

At Sungai Semilang (WQ2), BOD was between 7 to 11 mg/L, NH<sub>3</sub>-N between 0.30 to 0.57 mg/L and phosphate between 0.06 to 0.25 mg/L. On the other hand, TSS and turbidity was significantly elevated during ebbing, as levels went up to 269 mg/L and 200 NTUs respectively.

At Sungai Galing (WQ3); organic, ammonia, phosphate and bacterial levels were very pronounced. BOD<sub>5</sub> was between 4 to 10 mg/L, phosphate 0.21 to 0.27 mg/L and *E. coli* up to a whopping 8,000 cfu/100 mL. Enterococci were also between 64 to 174 cfu/100 mL.

At WQ4 however, the water quality of Sungai Kuantan became more deteriorated after contribution from coastal tributaries, particularly Sungai Galing. At this location, *E. coli* levels shot up to between 1,600 to 2,000 cfu/100 mL. An overall increment in NH<sub>3</sub>-N (0.5 mg/L) and phosphate (0.1 to 0.2 mg/L) were also detected.

#### 6.1.10.2 Coastal Water Quality

The elevated faecal coliform and *E. coli* levels dissipated at the coastal zone (WQ5 and WQ6) to less than 200 cfu/100 mL or non-detected during both ebbing and flooding. BOD, NH<sub>3</sub>-N and TSS were also further reduced at the coastal zone. Activities involving body contact is still not advisable in view of the close proximity with Sungai Galing and Sungai Kuantan river mouth.

At WQ7 and WQ9 (open sea); the low constituent levels were apparent throughout. Only at WQ7 some elevation in NH<sub>3</sub>-N was detected up to 0.43 mg/L at the surface during ebbing.

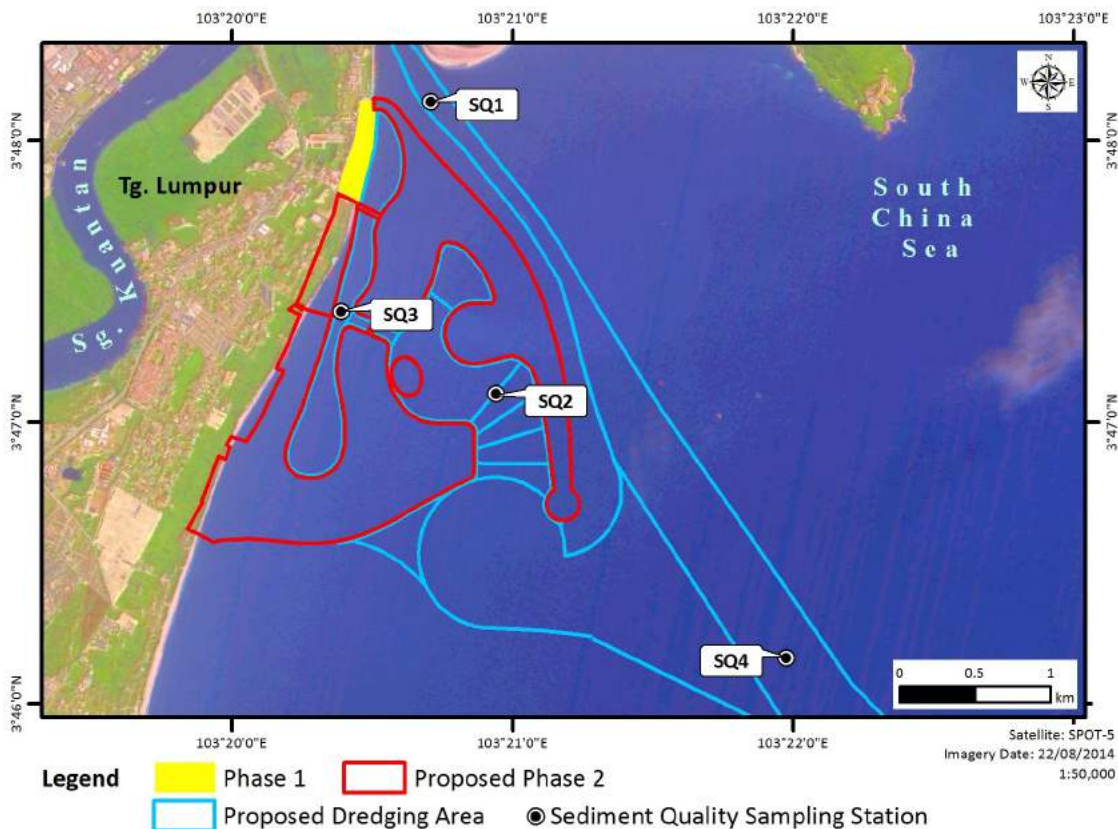
Within the proposed marina of the project site (WQ8, WQ10 and WQ11) most constituents remained low. However, NH<sub>3</sub>-N and phosphate were slightly elevated at WQ10 and WQ11 (above 0.3 mg/L and 0.1 mg/L at times).

An increase in TSS at WQ10 and WQ11 (during ebbing, between 57 to 62 mg/L) was also incurred, probably due to re-suspended sediment at the mud-plain area. Although at low levels (0.001 to 0.003 mg/L), arsenic (As) was detected in the water column at all sampling stations.

### 6.1.11 Sediment Quality

Sediment sampling stations were selected as in *Figure E22*. Sediment samples were collected using a Van Veen Grab sampler. The sediment samples were tested for the parameters as listed in *Table E12*. Chemical analyses were done in accordance with the US EPA Standard.

Based on the results, arsenic is the only constituent that exceeded desired thresholds at all sampling stations, between 3 to 12 mg/kg. Generally, arsenic is a naturally occurring element in soil in Malaysia. Terrestrial activities which incurs soil disturbance (e.g. bauxite mining) may precipitate out arsenic; which can be transported by runoff to rivers/coastline. Along the way, it settles down to sediment. Besides this, the arsenic may already be inherently present in the sediment along the coastline.



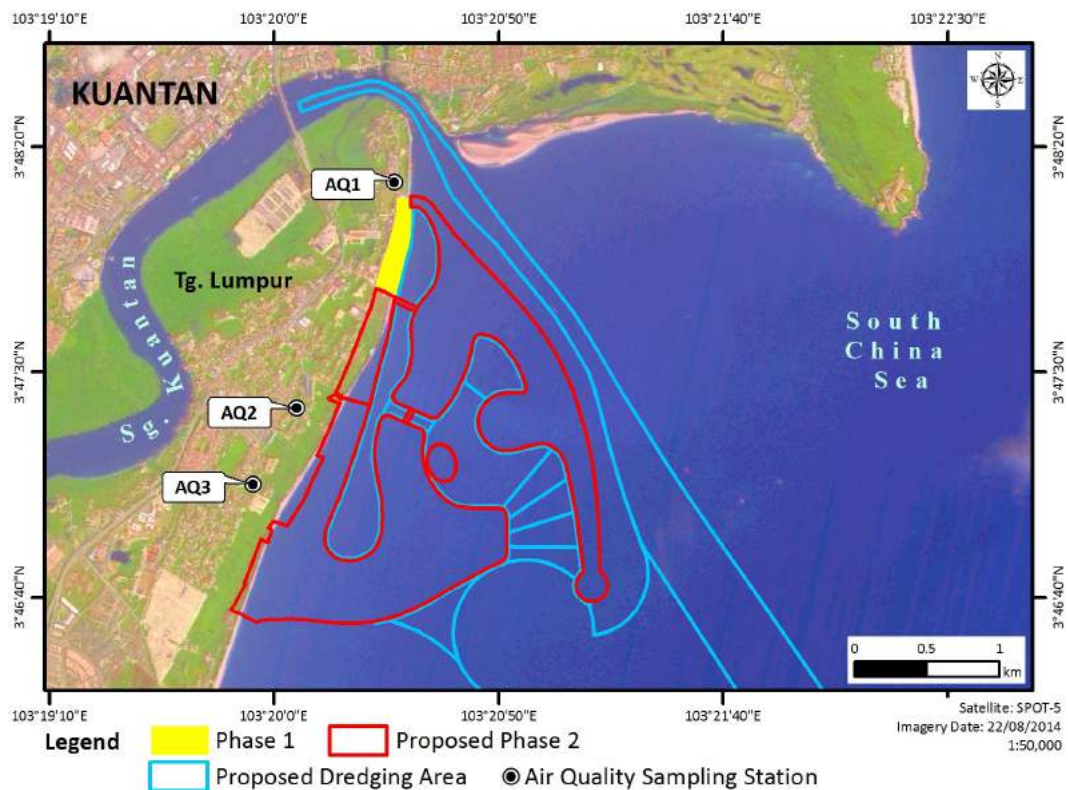
**Figure E22** ► Sediment Quality Sampling Stations

**Table E12** ► Sediment Quality Parameters

Parameter	Units	Method Used
Zinc as Zn	mg/kg	USEPA 3050 B, 6010 B
Nickel as Ni	mg/kg	USEPA 3050 B, 6010 B
Copper as Cu	mg/kg	USEPA 3050 B, 6010 B
Chromium as Cr	mg/kg	USEPA 3050 B, 6010 B
Lead as Pb	mg/kg	USEPA 3050 B, 6010 B
Arsenic as As	mg/kg	USEPA 3050 B, 6010 B
Cadmium as Cd	mg/kg	USEPA 3050 B, 6010 B
Nitrate	mg/kg	Leaching, APHA 4500 NO <sub>3</sub> -H
Total Phosphorus	mg/kg	USEPA 3050 B, 6010 B
Oil and Grease	mg/kg	APHA 5520 E

### 6.1.12 Air Quality

Baseline ambient air quality was measured at three (3) locations as shown *Figure E23*. The total suspended particulates (TSP) results were compared with the Recommended Malaysian Air Quality Guidelines (RMAQG). Meanwhile, PM<sub>10</sub> and PM<sub>2.5</sub> results were compared with the Interim Target 2 in 2018; Malaysian Ambient Air Quality Standards 2013. The overall results indicate that the baseline concentrations of the selected parameters are below the recommended guideline and standard.



**Figure E23** ► Air Quality Sampling Stations

### 6.1.13 Noise

Noise measurements were conducted to establish the existing noise levels at three (3) locations within the study area as shown in *Figure E24*. The baseline results were compared with the DOE's "Interim Guidelines for Maximum Permissible Sound Levels by Receiving Land Use" (Schedule 1). Overall, the noise levels recorded were below the guidelines limit. The sources of noises generated at all sampling stations were mainly from human activities and vehicle movements i.e. the sound of passing vehicles.

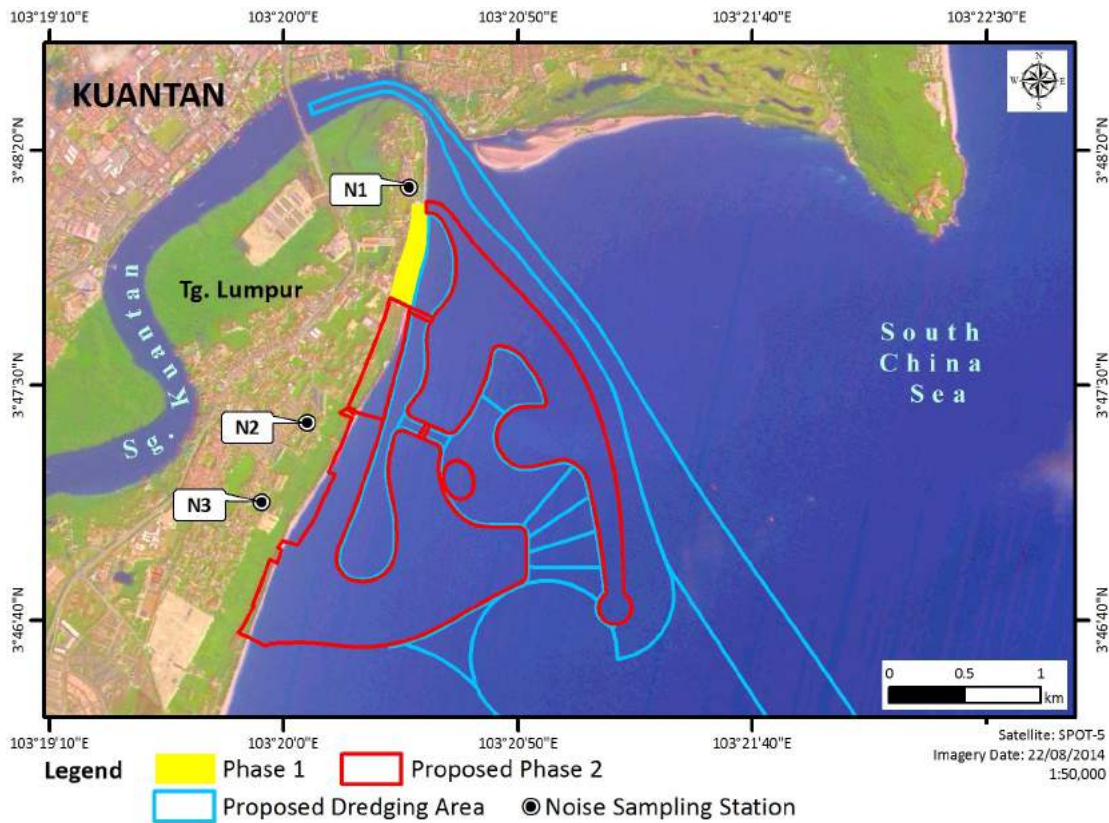


Figure E24 ► Noise Sampling Stations

### 6.1.14 Vibration

The sampling stations for vibration level are as shown in *Figure E25*. The vibration sampling results were compared with the "Planning Guidelines for Vibration Limits and Control in the Environment" published by the Department of Environment (DOE), Malaysia. From the results, the existing vibration levels measured were between 0.889 mm/s to 6.223 mm/s at all stations for all three (3) stations.

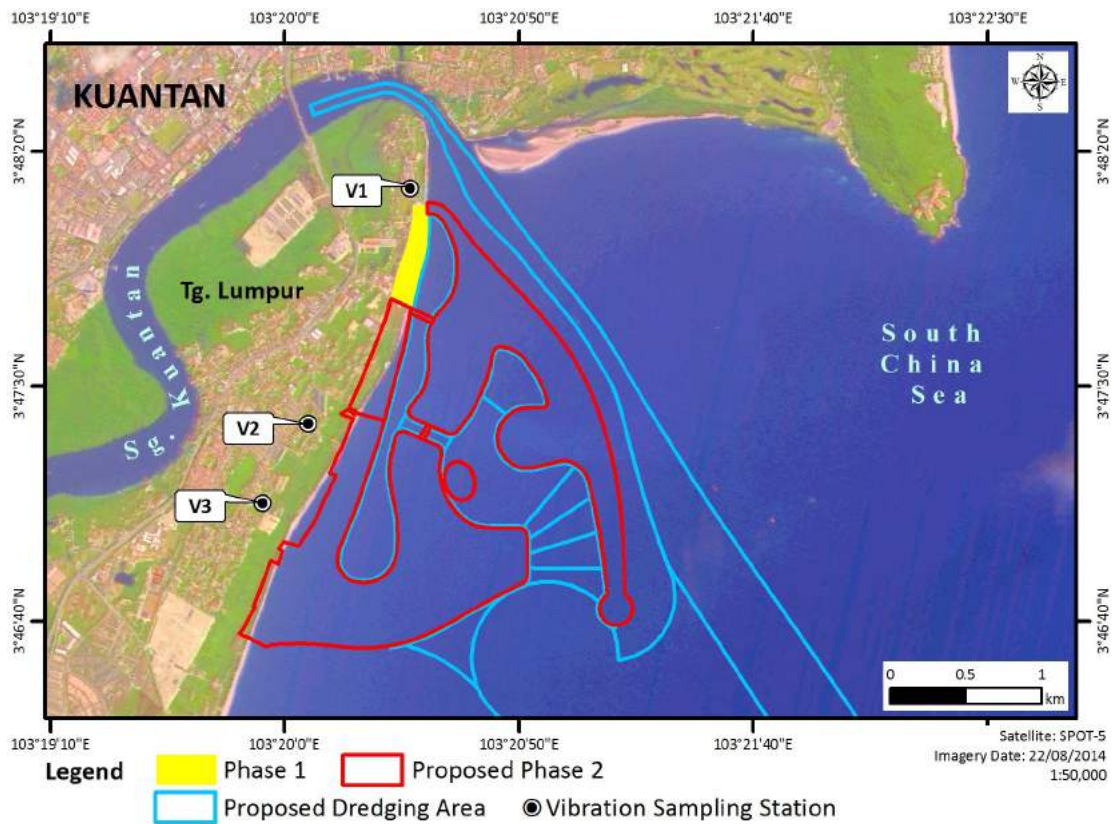


Figure E25 ► Vibration Sampling Stations

### 6.1.15 Marine Traffic

The marine traffic and navigational study was done to identify and address the existing commercial marine traffic, including fishing vessels and any other marine traffic which transits, berths or uses the navigable water within the study area.

This study will not address the Marine Traffic Risk Assessment (MTRA), the operational issues and the viability of the proposed Project.

#### 6.1.15.1 Existing Navigation Approach

Sungai Kuantan river mouth (Kuala Kuantan) is entered 2.74 km west of Tanjung Tembeling which is fronted by a drying bank. A dredged channel is marked by lighted buoys and is indicated by a lighted range towards across the bank. The channel is subject to constant change, especially during the Northeast Monsoon, and the range lights and buoys are relocated whenever necessary. The river is accessible to vessels of up to 3 m draft.

#### **6.1.15.2 Existing Anchorage**

Vessels with drafts of up to 13 m can anchor northeast and southwest of the approach channel which is a good holding ground of mud and sand, although this anchorage is exposed to the Northeast Monsoon. A secondary anchorage can be taken at the Sungai Kuantan river mouth, in depths of 8.2 to 9.2 m and it is located 1.29 km south-southeast of Tanjung Tembeling. Anchorage is also available 3.70 km southeast of Tanjung Tembeling, in a depth of 12 m.

#### **6.1.15.3 Existing Marine Activities and Utilization**

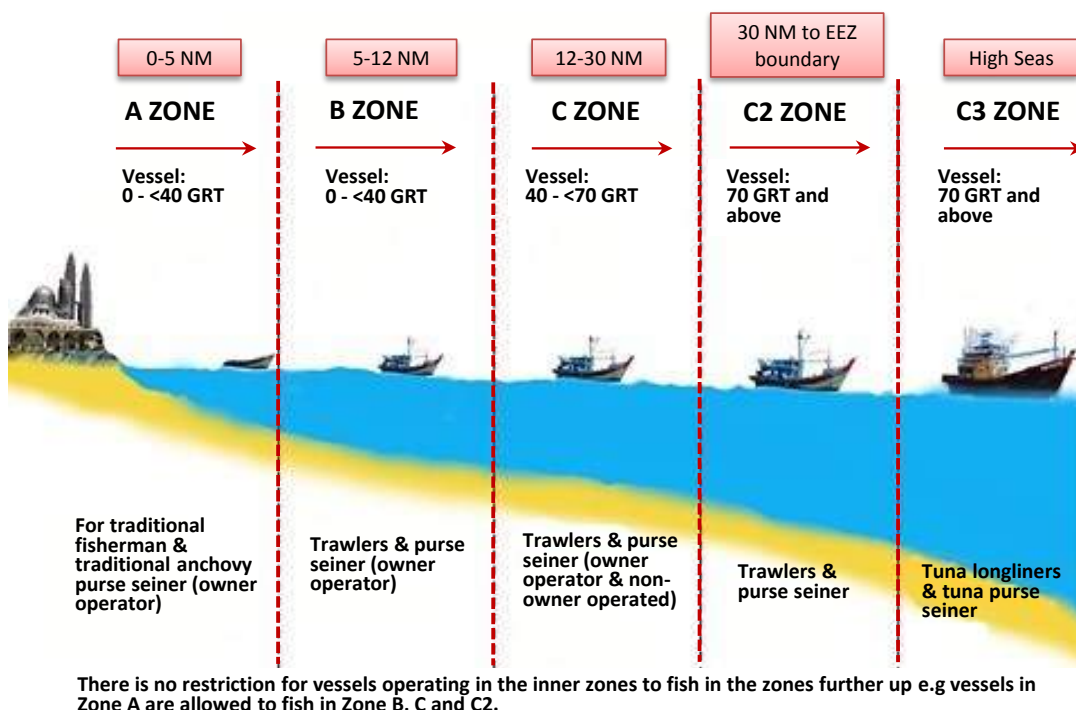
The proposed project is located in an area close to the south of Sungai Kuantan river mouth at South China Sea and within the Kuantan Port Limit.

##### **6.1.15.3.1 Fishing Activities**

The Sungai Kuantan river mouth is lined with small jetties, a sandy beach and with many fishing boats moored off the coast. These show that the area is an important fishing base. The project is located in Zone A which comprises a distance of up to 5 nm (9.26 km) from the shoreline. The permitted fishing vessels and equipment within this zone are traditional fishermen boats and the usage of traditional anchovy purse seine nets. Most of the Malays own traditional fishing vessels (Zone A) while the majority of the Chinese fishermen own trawlers (Zone C). Details of each fishing zone are as illustrated in *Figure E26*.

##### **6.1.15.3.2 Kuantan Port**

Kuantan Port is located 14.2 nm (26.3 km) north of the project site and offers more than four (4) km of berths that accommodate a wide variety of cargo ships. Kuantan Port services some of the world's major shipping routes, including the Pacific Rim, Middle East, Far East, Europe, Asean region and the west coast of the United States. *Table E13* lists the number of merchant vessels anchoring at Kuantan Port.



**Figure E26** ► Fishing Zone in Malaysia (Except for Kedah, Penang, Perak and Selangor)  
 Source: Malaysia Department of Fisheries

**Table E13** ► Number of Merchant Vessels Anchoring at the Kuantan Port

Year	Container	Tanker	Bulk Carrier	General Cargo	Misc.	Total
2010	477	940	367	515	106	2405
2011	460	971	484	422	103	2440
2012	434	1079	458	405	94	2470
2013	336	1062	455	475	78	2406
2014	329	987	433	524	88	2361

Source: Malaysia Marine Department (2015)

### 6.1.16 Land Traffic

The existing traffic flow on the surrounding road network was assessed and discussed in this section. Current peak hour traffic volumes on the roads within the study area was determined from classified manual traffic counts at the following junctions:

- i) JCT1: Ingress and egress junction of Jalan Pantai Sepat and Federal Road 183: Jalan Tanjung Lumpur; and
- ii) JCT2: T-junction of Jalan Yayasan Pahang and Federal Road 183: Jalan Tanjung Lumpur.

It could be observed that the existing condition during peak hours, the road network surrounding the proposed project operates at a good level of service (LOS) with LOS A at most roads.

## 6.2 Existing Biological Environment

The main biological components assessed within the study area comprise of terrestrial and marine environment. The descriptions of these components are based on the field surveys and study plots conducted and supplemented by available published and unpublished data of the various institutes and government agencies.

### 6.2.1 Terrestrial Flora (Mangrove)

Three (3) visits were made, i.e. in September 2013 (site visit), February 2014 (land survey) and September 2015 (survey by boat). The land survey covered was from Tanjung Lumpur to Kampung Anak Air. The vegetation fringing the sandy coastal area was commonly herbs, shrubs and disturbed patches of scrub forest. Disturbed mangrove patches were observed at Tanjung Lumpur and Tanjung Api.

Overall, healthy mangrove forests were observed along the rivers on both or either side of the river banks. Most of the mangrove trees were flowering/ fruiting. Among the most noteworthy mangrove species observed were *Ceriops zippeliana*, *Kandelia candel*, *Bruguiera sexangula*, *Merope angulata*, and *Brownlowia argentata*. These species are among the uncommon/rare species of mangroves plants in Malaysia but are abundant in the study area, especially the *Kandelia candel* and the *Brownlowia argentata*. The *Brownlowia argentata* is listed by the IUCN Redlist as a “Data Deficient” mangrove plant (Polidoro *et al.* 2010).

However in Malaysia, the *Brownlowia argentata* can be categorised as “Critically Endangered” mangrove plant species (Ong *et al.* 2015). It is suggested that a specific propagation programme should be undertaken for ex-situ conservation of the *Kandelia candel* and the *Brownlowia argentata*.

### 6.2.2 Terrestrial Fauna (Birds)

The objective of this survey was to obtain an inventory of the avifauna of the study area, by using visual and audio identification methods besides photography. From the survey done, a total of 72 species of birds from 26 families were recorded from the study area. The conservation status of all birds recorded are of “Least Concern (LC)” according to the IUCN Red List of Threatened Species, except for the following six (6) species:

- i) Chestnut-bellied Malkoha;
- ii) Cinnamon-headed green Pigeon;
- iii) Jambu Fruit Dove;
- iv) Mangrove Pitta;
- v) White-chested Babbler (which are near threatened); and
- vi) Chinese Egret (which falls under the category vulnerable).



### 6.2.3 Marine Biological Environment

The marine biological sampling involves four (4) important marine fauna mainly the phytoplankton, zooplankton, macrobenthos and fisheries.

#### 6.2.3.1 Phytoplankton

From the sampling conducted, a total of 22,946 phytoplankton individuals from 53 different species have been sampled and identified. From the overall total abundance, the Phylum Bacillariophyta has the highest percentage which is 62.43% and the lowest abundance is Ochrophyta with 0.031%. Generally, the diversity and richness index values within the study area were fairly high and the evenness index value was good. The dominant index value was very low, which specified that the population was still in equilibrium and no indication of disturbance was shown.

#### 6.2.3.2 Zooplankton

From the data, 61 species of zooplankton have been identified. A total of 5,435,306 individuals was sampled. The Arthropoda (Crustacea and Chelicerata) was the most dominant phylum which contributed more than 80% of total abundance. Overall results from the zooplankton sampling showed combinations of good diversity, richness and evenness values, and the low dominance values recorded indicated that the zooplankton population is still in relatively good condition. There was no indication of disturbance within the coastal areas.

#### 6.2.3.3 Macrobenthos

A total of 2,088 macrobenthos individuals from 44 different taxa was sampled and identified. Polychaetes were the most abundant where they represent 58.20% of the total macrobenthos sampled, this is followed by Crustacea with 19.20% of the total individuals, and then molluscs and echinoderms. The overall results showed that the macrobenthos community within the study area was in good condition. There were high numbers of species present, high abundance, and with good ecological index values. There was no indication of disturbance or unbalanced condition.

#### 6.2.3.4 Fish and Fisheries Resources

The fisheries study was done at an area of 5 nm (9.26 km) from the shoreline. Trawling nets were used to collect samples i.e. fishes, crustaceans and molluscs. The route for towing was within 03° 46' 12.9" N, 103° 21' 21.6" E and 03° 50' 40.7" N, 103° 23' 26.4" E. To enhance the quality of the trawl sample data, several visual surveys on the local fishermen's catch and interviews were done, especially at the fish-landing base.

From the survey conducted, a total of 67 species from 39 families have been recorded. Generally, the species richness recorded during the survey is moderate, and it is expected to be much higher if a longer period had been set. There are no invasive (introduced) species of fish that have been recorded and they are categorized as “Least Concern”, meaning that they are widespread and abundant. The survey showed that approximately 80% of the total catch was represented by trash fish. The major component of the trash fish was from the family Leiognathidae which included *Gaza* spp., *Leiognathus* spp. and *Secutor* spp. (*ikan kekek*).

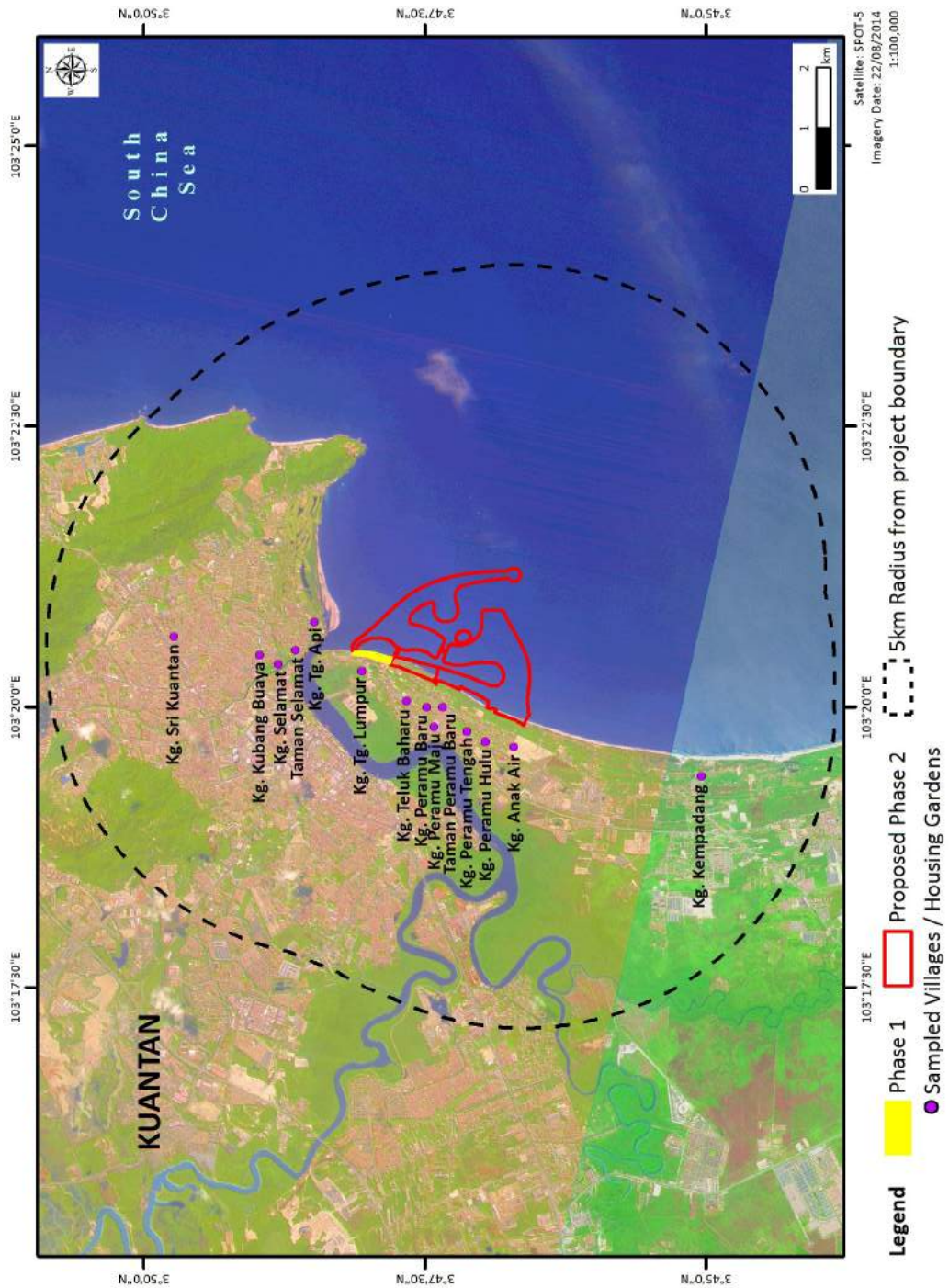
### 6.3 Existing Human Environment

A socio-economic survey was conducted to gather the perceptions and identify the communities’ attitude towards the proposed project. The study area covers an area of 5 km from the perimeter of the proposed project site. It is located in the Mukim of Kuala Kuantan, which is the largest of the six (6) mukims in the District of Kuantan (*Figure E27*).

Altogether, 302 samples (comprising head of households as respondents) from the residential areas within the study area were drawn randomly using a purposive sampling technique. The distribution of the samples is shown in *Table E14*.

**Table E14** ► Distribution of Respondents by Settlement within the Proposed Project Area

Sampling Area	Fishermen	Public	Business Operators	Beach Users
Kg. Tg.Lumpur	23	0	24	15
Kg. Teluk Baharu	-	8	-	-
Kg. Peramu Maju	-	16	-	-
Kg. Peramu Tengah	37	15	-	-
Kg. Peramu Baru	-	15	-	-
Kg. Peramu Hulu	-	4	-	-
Taman Peramu Baru	-	11	-	-
Kg. Anak Air	-	6	-	-
Kg. Tanjung Api	20	4	15	15
Kg. Selamat	-	13	-	-
Taman Selamat	-	10	-	-
Kg. Kempadang	35	-	-	-
Kg. Sri Kuantan	-	10	-	-
Kg. Kubang Buaya	-	15	-	-
<b>Total</b>	<b>115</b>	<b>118</b>	<b>39</b>	<b>30</b>
<b>Grand Total</b>		<b>302</b>		



In addition to the opinion-poll study whereby the locals were selected to participate in the survey, two Focus Group Discussion (FGD) sessions were conducted before the public dialogue, meeting representatives of two local community groups namely the fishermen and the general public. The main aim of the FGD session was to have an interactive discussion with the participants regarding the proposed project in relation to their settlement and activities and also to provide the platform for them to raise any issues pertaining to the impact of the proposed project on them.

Besides that, a Public Dialogue was also conducted to enable a face-to-face discussion between the stakeholders and the study team-cum-representative of the Project Proponent, insofar as the project details were concerned. The latter would enable the stakeholders to have a clearer perspective with what they were being put into, and to air any issues that matter to them. The feedbacks from such a forum would be of tremendous value to the study team in drawing conclusions and propagating recommendations of the study to be considered by all the parties concerned. Held at Dewan Orang Ramai Kampung Peramu, the public dialogue was conducted on 23rd April 2016, attended by 85 people comprising locals and other interested individuals.

### **6.3.1 Community's Profile**

The analysis of data gathered from the questionnaire survey revealed the community profile in respect to its demographic, social and economic characteristics of the different components of the society.

#### **6.3.1.1 Demographic Profile**

In terms of age, between 50 to 64% of the respondents were generally matured adults of the age from 30 to 49 years. The median age varies from 39 years to 47 years, showing that the respondents were relatively young and generally termed as "matured adults". However, the age distribution of the sampled population (respondents' total number of household members) points to an age structure of a mixed age structure.

The sex ratio was found to be imbalanced with either males outnumbering females as in the case of the fishermen households with a ratio of 133M/100F, or females outnumbering males with a ratio of 88 M/100 F as in the case of the public households. The deficit of males among the public households could probably be due to net out-migration of males seeking better opportunities outside the area. Likewise, the excess of males in the fishermen households would most probably be due to net out-migration of females and the presence of external fishermen working as awak-awak or juragan in the local fishing industry. The inconsistency of the age and sex structure of the study area to the mukim pattern could probably be due to the difference between the micro and aggregate situations.

### 6.3.1.2 Socio-economic Profile

The educational background of the respondents is varied, with the fishermen being least educated while the public and beach users were categorised as being more educated. Economically, with the exception of the fishermen and the business operators who were solely employed in their respective sector, public and private sector employees stood out as the main occupations of the general public and the beach users. On a whole, the income profile of the respondents showed one with 84% of the fishermen earning less than RM 1,001 a month with a mean monthly income of RM 1,398 and the business operators tend to earn more, with an average income of RM 2,047 a month.

Almost all of the respondents owned the house they lived in, which mainly featured village and garden housing. However, among the fishermen, only 68.7% owned the house lot or compound where 11.3% were lodgers while 20% lived on reserved land. Among the public, the percentage owning their own housing lots was higher at 93.2% and the remaining 6.8% were lodgers.

As a major part of the study area is undergoing urbanization, it is not surprising to discover that more than one-third of the respondents were recent movers to the area, having been in the vicinity for less than 10 years. Most of them were from other parts of Pahang and Terengganu. A small fraction came from Kelantan and Melaka. For the migrants, their moves were mainly motivated by job-seeking or starting a business. Their subsequent purchase of houses and properties commensurate with the impression that the area is fast becoming an important dormitory area for outer Kuantan.

## 6.3.2 Survey Results on Opinions and Perceptions

### 6.3.2.1 Level of Project Awareness

The public's awareness and knowledge about the KWRC is summarized in *Table E15*.

### 6.3.2.2 Perception towards the Proposed Project

Analysis of the responses pointed to fairly strong agreement among the respondents that the project would bring several advantages to them, except for the opportunity for property ownership and employment opportunities to their household members (*Table E16*).

**Table E15** ► Awareness and Knowledge about the Proposed Project (%)

Awareness and Knowledge	Fisherman	General Public	Business Operator	Beach User
<b>Awarances:</b>				
Knew about the project	27.8	15.3	17.9	26.7
Did not know	70.4	84.7	76.9	66.6
Not sure	1.8	0.0	5.1	6.7
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
<b>Source of knowledge:</b>				
Mass media	3.1	66.7	22.2	75.0
Village head and Penghulu	18.8	-	22.2	-
Household member	-	11.1	33.4	-
Other villagers/neighbours	71.9	22.2	22.2	12.5
District Officer	6.2	-	-	12.5
Others	-	-	-	-
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Source: Field data, 2014

**Table E16** ► Ratings of Perceived Socio-economic Advantages and Disadvantages brought about by the Proposed Project (% Saying Yes)

Perception	Fisherman	General Public	Business Operator	Beach User
<b>Advantages:</b>				
Job opportunities to members of own household	58.3	50.0	82.1	56.7
Employment opportunities to local population	91.3	97.5	94.9	86.7
Improvement of basic amenities	100.0	100.0	94.9	86.7
Increased value of land / property	100.0	100.0	94.9	80.0
Increased standard of living	100.0	100.0	94.9	63.3
Increased business opportunities	36.5	100.0	94.9	63.3
Increased opportunity for property ownership	0.0	11.9	23.1	26.7
<b>Disadvantages:</b>				
Loss of employment	0.0	0.0	100.0	30.0
Loss of source of income	0.0	0.0	100.0	30.0
Displacement	0.0	0.0	79.5	40.0
Loss of property	0.0	0.0	2.6	40.0
Marginalization of existing population	47.0	0.0	46.2	53.3
Narrowing of channel at the river mouth	14.8	78.8	15.4	40.0

Source: Field data, 2014

### 6.3.2.3 Perception of Impacts on Health and Safety

Table E17 shows how the locals perceived the impacts of the project on their health and safety.

**Table E17** ► Ratings of Perception of Impacts on Health and Safety brought about by the Proposed Project (% Saying “Yes”)

Characteristic	Fisherman	General Public	Business Operator	Beach User
Increased accident with fishing boats	3.5	2.5	2.6	3.3
Increased noise pollution	5.2	57.6	7.7	13.3
Increased traffic at ingress & egress	85.2	-	71.8	93.3
Increased air pollution	70.4	10.2	56.4	73.3
Increased water pollution	49.6	10.2	41.0	53.3
Hazardous to people	30.4	-	43.6	33.3
Disturb peace / tranquility	27.0	-	38.5	23.3
Increased communicable diseases	5.2	-	5.1	6.7

Source: Field data, 2014

#### 6.3.2.4 Perception of Impacts on Aesthetics and Culture

An analysis of the perception of impacts on aesthetics and culture revealed that all the respondents were fairly sure about the impacts of the development on the aesthetics and culture of the area as summarised in *Table E18*.

**Table E18** ► Ratings of Perception of Impacts on Aesthetics and Culture brought about by the Proposed Project (% Saying Yes)

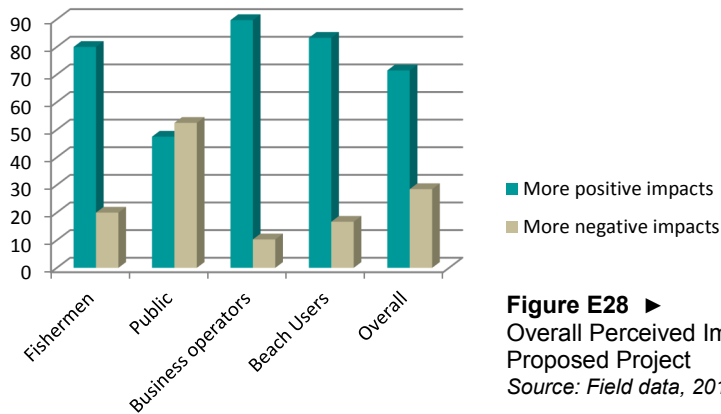
Perception	Fisherman	General Public	Business Operator	Beach User
Affect landform of the area	38.3	0.0	53.8	43.3
Affect beauty of landscape/seascape	29.0	0.0	23.1	30.0
Affect air quality	43.5	0.0	30.8	40.0
Affect water quality	45.2	0.0	33.1	46.7
Affect tranquility of the area	47.0	0.0	35.9	50.0
Affect community integration	5.2	0.0	7.7	10.0
Affect local tradition	0.0	0.0	2.6	0.0
Affect historical places	0.0	0.0	2.6	0.0
Affect place of worship	0.0	0.0	2.6	0.0
Affect important buildings	0.0	0.0	0.0	0.0

Source: Field data, 2014

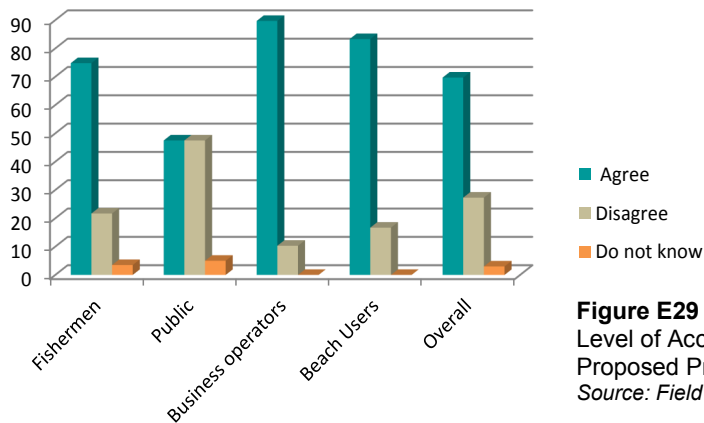
#### 6.3.2.5 Project Assessment and Local Acceptability

About 71% said it would bring about more positive than negative impacts whilst 29% ascribed to the latter (*Figure E28*).

Those who perceived that the project would be more advantageous seem to support the implementation of the project, whilst those who perceived that it would be more disadvantageous were split in their decision on whether or not to support the project (*Figure E29*). Overall, 69.7% agreed to the implementation of the project whilst 27.3% disagreed and the remaining 3% not sure.



**Figure E28** ▶  
 Overall Perceived Impacts of the Proposed Project  
 Source: Field data, 2014



**Figure E29** ▶  
 Level of Acceptability of the Proposed Project  
 Source: Field data, 2014

The reasons for agreeing were mainly because they believe that the project would be able to bring about an increase in job opportunities for the locals and that it could become one of the tourist destinations in Pahang (Table E19). Some also reasoned that the project would be able to bring about more facilities and amenities, making the area more attractive and more systematically developed. Some foresee a boost in business opportunities and commerce for the locals.



**Table E19** ► Reasons for Agreeing or Disagreeing to the Implementation of the Proposed Project (%)

Reasons	Fisherman	General Public	Business Operator	Beach User
<b>For Agreeing:</b>				
For progress and development	22.1	-	14.3	8.0
Employment opportunities to the locals, Increased standard of living and infrastructure	20.9	42.9	25.8	60.0
Attract tourists to come & increased property value	22.1	39.3	28.5	12.0
Beneficial to future generation	12.8	1.8	-	-
Pahang's economy will thrive	10.5	1.8	-	4.0
Chances for locals to get involved in/increase business	7.0	14.2	28.5	16.0
Village area will be more developed	4.7	-	2.9	-
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
<b>For Disagreeing:</b>				
Disturbing fishing route and inshore fishermen	60.0	41.2	-	-
Marine water will be polluted	20.0	4.8	-	20.0
'Kepah' picking by fisherman family will be affected	16.0	1.6	-	-
Income of coastal fishermen will be affected	4.0	37.9	-	-
Marginalisation of the locals	-	14.5	-	40.0
More disadvantages	-	-	25.0	40.0
Fear of small businesses to be displaced	-	-	75.0	-
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Source: Field data, 2014

### 6.3.3 The Fishing Community in the Study Area

The fishermen in the study area comprised three groups: the owner-operators at 38.3%, the lease-operators at 29.5% and the remaining work as *awak-awak* or crew/hired workers. According to *Table E20*, approximately two-thirds felt that the main impacts would be the decline in fish landing and increased cost of fishing, or that they had to bear higher production cost in terms of repairing their damaged fishing gears and farther maneuvering distance needed to go out fishing or to anchor in.

**Table E20** ► Fishermen's Perceived Impacts of Reclamation on Their Fishing Activities

Perceived Impacts of Reclamation	Percent (%)
Disturb fishing activities	48.7
Affect fish landing	60.9
Damage to fishing gears	22.6
Increased cost of fishing	63.5

Source: Field Survey, 2014

#### **6.3.4 Feedback from the Focus Group Discussion**

Issues raised by the fishing groups clearly reflect the type of impacts they would be facing, such as perceived loss of fishing ground due to the reclamation works, inconveniences faced during construction and operation, loss of employment and income. Hence, compensation was seen to be a way out, preferably as a one-off, to lessen their burden. They also saw the need to deepen the Sungai Kuantan river mouth. Another issue raised was the fear that they may lose their fish-landing jetties, which they wanted to be close to their settlement. Many of these jetties were not permanently owned. Last but not least, the expectation that their children and the locals be given due consideration and priority for the employment opportunities created from the Project.

Contrary to the fishing community, the local villagers who would be indirectly affected were more opinioned by raising wider issues such as aesthetic and culture i.e. the loss of natural sea view and the loss of the existing village atmosphere. They also feared that the locals would lose out to outsiders as they foresaw the development types are not conducive to the locals. Hence the locals would be marginalized. Issues on water quality and marine water pollution were also raised, especially pertaining to outfall and sewerage from the topside development. Besides issues on job opportunities for the next generation, the economic impacts and the need to train locals to be more competitive were also mentioned. They also appealed for the next generation be given the right to own affordable houses in their own village area.

#### **6.3.5 Feedback from the Public Dialogue**

85 people (81 Malay and 4 Chinese) mainly from among the locals, especially fishermen, had attended the public dialogue. Generally, they were not against development. However, there were pertinent issues related to their daily activities which they had expressed concerned about. Their concerns could be summarized into three (3) major issues of which the latter would be the directly impacted group:

- i) The concern over reclamation affecting fishing activities and livelihood and the associated demand for compensation;
- ii) The concern over landing and mooring facilities that would be affected by the reclamation works; and
- iii) The concern over the project's contribution to future generation.

The issues raised by the representatives of the fishing communities were seen to be not so different from those expressed by the respondents in the social survey, particularly with regards to the concerns of the impacted fishing communities.

## 6.4 Environmentally Sensitive Areas (ESAs)

As stipulated in the Second National Physical Plan (NPP2), ESAs refer to areas that are of critical importance in terms of goods, services and life-support systems. In addition, they also refer to areas that harbour the wealth of the nation's biodiversity. The Kuantan Local Plan 2015 has also identified that ESAs are areas such as forest reserve, mangroves forest reserve, riverbank, coastal areas, heritage conservation areas etc. The distances from the project area and the ranks of these nearby ESAs are as tabulated and shown in *Table E21* while *Figure E30* shows the locations of ESAs.

**Table E21** ► List of ESAs Located within the Project Area

Rank	ESA Layers	Location	Closest Distance from the Project site (km)
Rank 1	Forest reserve	Kuantan Forest Reserve	1.18
		Beserah Forest Reserve	3.52
Rank 2	Mangroves	Along the Sungai Kuantan	0.26
	Shoreline	Pantai Teluk Cempedak	3.0
		Pantai Tanjung Sisek	0.9
Rank 3	River mouth	Sungai Kuantan	0.26
		Sungai Galing	0.48
		Sungai Semilang	0.71
	Structure	Tanjung Lumpur Bridge	0.75
	Tourism attraction	Tanjung Tembeling	2.61
Others	Populated area (within study area circumference)	Kampung Tanjung Lumpur	0.23
		Kampung Peramu Maju	0.74
		Kampung Peramu Hulu	0.57
		Kampung Anak Air	0.40
		Kampung Tanjung Api	0.51
		Kampung Teluk Baharu	0.44
		Kampung Derhaka	2.47
		Kampung Kempadang	3.04
		Kampung Ru Bongkok	5.10
		Kampung Baharu	4.05
		Kampung Teluk Sisik	2.51
		Kampung Padang Lalang	0.83



Figure E30 ► Environmentally Sensitive Areas

#### 6.4.1 Kuantan Forest Reserve

The 339 ha of the Kuantan Forest Reserve are located strategically in the heart of Kuantan whereby this forest reserve has become one of the attractions among locals as well as international visitors. As a result, the State Government had undertaken various initiatives to develop the area into a Mangrove Park. Various species of mangroves i.e. *Rhizophora apiculata* and *Xylocarpus* can easily be identified.

#### 6.4.2 Beserah Forest Reserve

Beserah Forest Reserve is located 16 km from the city of Kuantan via the Kuantan-Cherating road. This forest comprises of various kinds of tree species i.e. meranti and balau. Among the main attraction is Gua Beserah. The area is open for the public to enjoy outdoor activities such as hiking and caving.

#### 6.4.3 Mangroves (Sungai Kuantan)

The Sungai Kuantan estuary supports over 1,000 ha of mangroves. Most of the mangroves are confined to the southern banks of Sungai Kuantan or its tributary, Sungai Belat. The mangroves are important with respect to the local fishing industry, playing an important role as it provides spawning and feeding areas for many marine and intertidal species.

#### 6.4.4 Pantai Teluk Cempedak

Teluk Cempedak is located just a five (5) km away from the city along the east coast and is a well-known beach in Kuantan. The beach is well-served with visitor facilities, including gazebos, footpaths, convenience shops, street lamps and several public squares.

#### 6.4.5 Sungai Kuantan

Sungai Kuantan flows from Sungai Lembing through Kuantan City before flowing out to the South China Sea. It has a catchment area of about 1,684 km<sup>2</sup> with the length of approximately 97 km. The Sungai Kuantan is a fishing base for a substantial fishing fleet of coastal and offshore trawlers. The area continues to be an important fishing base as it is lined with small jetties, sand beach and several fishing boats moored off the coast.

#### 6.4.6 Sungai Galing

Sungai Galing is 7.7 km long and has a catchment area of 22.65 km<sup>2</sup>. Along the banks, the river is surrounded by a rapid development where there are industrial activities at the upstream while Kuantan City is at its downstream. This has exposed Sungai Galing to water pollution, flash flood, erosion and other effects of development.

#### **6.4.7 Tanjung Lumpur Bridge**

The 424 m long Tanjung Lumpur Bridge is one of the most prominent riverine infrastructures in the east coast of the Peninsular Malaysia. It is assigned as a critical part of Federal Route 183 (Tanjung Lumpur Highway). In anticipation of the high volume of marine traffic, the bridge is structurally reinforced to withstand impacts and possible collisions by boats and vessels that pass underneath as they traverse along the Sungai Kuantan stretch. The wide footings of the bridge have become a resting place for fishermen to anchor their boats and to sew their fishing nets on.

#### **6.4.8 Tanjung Tembeling**

Tanjung Tembeling is located approximately three (3) km from Tanjung Lumpur. This cape rises to an elevation of 100 m from the sea level and is largely forested. At the end of the cape lies the resort of Kuantan Tembeling Resort. Towards the coast, the beaches are protected by giant rocks. During low tide, the beach is exposed where a wide mudflat becomes visible.

#### **6.4.9 Populated Areas**

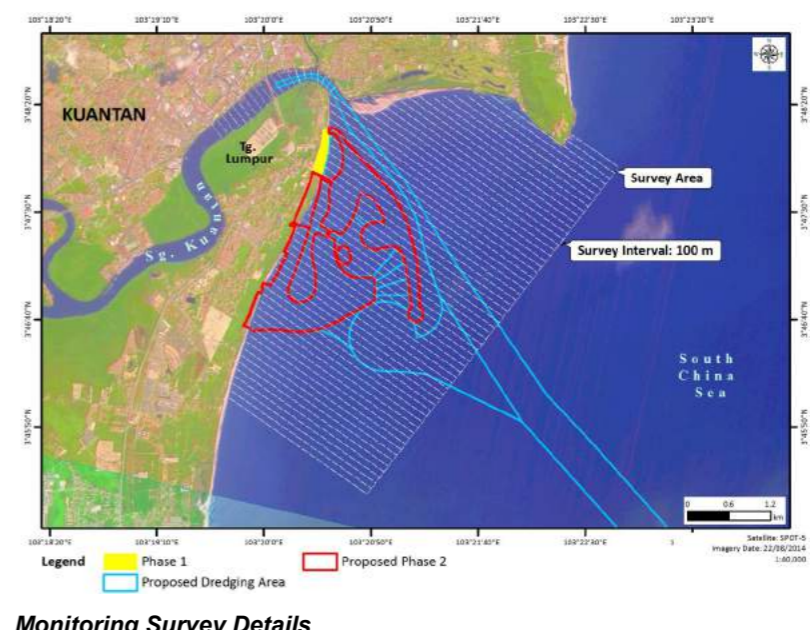
It is expected that the impacts from the implementation of this proposed development will not only be on the environment but also on the population of the surrounding areas, mainly within the vicinity of Tanjung Lumpur. The communities of the locals surrounding the proposed project area are generally involved in the fishing industry, public or private sector and running small businesses. Most of the families are local residents who have been living in the area for decades.

## **7. Summary of Evaluation of Impacts with Pollution Prevention and Mitigation Measures (P2M2)**

A summary of evaluation of impacts on physical, biological and human environment and its mitigation measures are shown in *Table E22 and Table E23*.

**Table E22** ► Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures on the Physical and Biological Environment

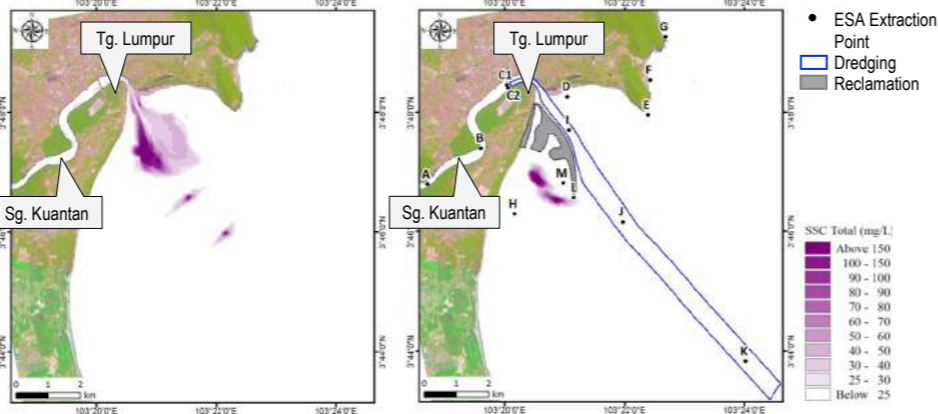
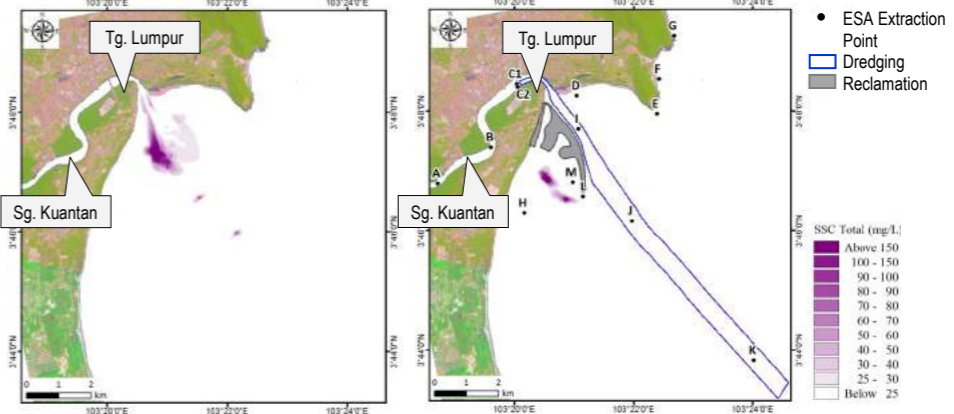
Project Components	Affected Environmental Components	Significant Potential Impacts	Magnitude of Significant Potential Impacts	Pollution Prevention and Mitigation Measures (P2M2s)	Reference Page																								
1. Land clearing	Water quality	i) The area will be cleared off and it is relatively a flat ground with existing vegetation of common herbs, shrubs and disturbed patch of scrub forest. ii) The land clearing area is located nearby the shoreline, the bare earth condition could accelerate surface erosion if not mitigated accordingly.	X	i) The land clearing should be done within the designated area only and must be minimised as much as possible during rainy seasons. ii) Sufficient temporary drains at the land clearing area must be designed to cater for storm water outflow into the adjacent water courses. iii) Lorry loads should be securely covered and dusty roads should be regularly sprayed with water to control spillage and fugitive dust. iv) Hoarding is recommended to be installed along the boundary of the site areas.	7-2																								
2. Reclamation and dredging	a) Bathymetry	Reclamation and dredging activities will result in changes on the bathymetry of the project area.  <b>Bathymetric levels: Before and After Reclamation and Dredging Activities</b> <table border="1"> <thead> <tr> <th>Affected Area</th> <th>Before (m CD)</th> <th>After (m CD)</th> </tr> </thead> <tbody> <tr> <td>Navigation channel</td> <td>-2 to -12</td> <td>-12</td> </tr> <tr> <td>Lagoon</td> <td>0</td> <td>-3</td> </tr> <tr> <td>Canal</td> <td>0</td> <td>-4</td> </tr> <tr> <td>Inner marina</td> <td>-2</td> <td>-4</td> </tr> <tr> <td>Outer marina</td> <td>-2 to -4</td> <td>-6</td> </tr> <tr> <td>Cruise terminal</td> <td>-2</td> <td>-6 to -9</td> </tr> <tr> <td>Turning basin</td> <td>-4</td> <td>-12</td> </tr> </tbody> </table>	Affected Area	Before (m CD)	After (m CD)	Navigation channel	-2 to -12	-12	Lagoon	0	-3	Canal	0	-4	Inner marina	-2	-4	Outer marina	-2 to -4	-6	Cruise terminal	-2	-6 to -9	Turning basin	-4	-12	T / D	i) Periodic bathymetric and nearshore surveys can be done to assess nearshore and bed level changes during and after development. ii) It is a survey with alongshore line intervals of 100 m extending 2.5 km to the north of the development, 1 km to the south the project and extending 1 km seaward could be done. iii) The survey shall extend 50 m landward of the high water mark. iv) Each survey shall be done at three months interval during the construction phase. The report for each survey is to be submitted to DID. The survey can be done at half-yearly intervals during the post-construction phase for up to three years or after receiving consent from DID to discontinue the survey. v) Information from periodic survey could also be used to determine the need and extent of the maintenance dredging required after the project is completed.	7-3 to 7-4
Affected Area	Before (m CD)	After (m CD)																											
Navigation channel	-2 to -12	-12																											
Lagoon	0	-3																											
Canal	0	-4																											
Inner marina	-2	-4																											
Outer marina	-2 to -4	-6																											
Cruise terminal	-2	-6 to -9																											
Turning basin	-4	-12																											



**Key:**

- X Insignificant and excluded from matrix
- T Impact that is potentially but on a temporary basis and will ensure equilibrium after certain period of time.
- M Impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.
- D Potentially significant adverse impact for which a design solution has been identified.
- R Residual and significant adverse impact
- E Significant environmental enhancement

**Table E22 (cont'd)** ► Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures on the Physical and Biological Environment

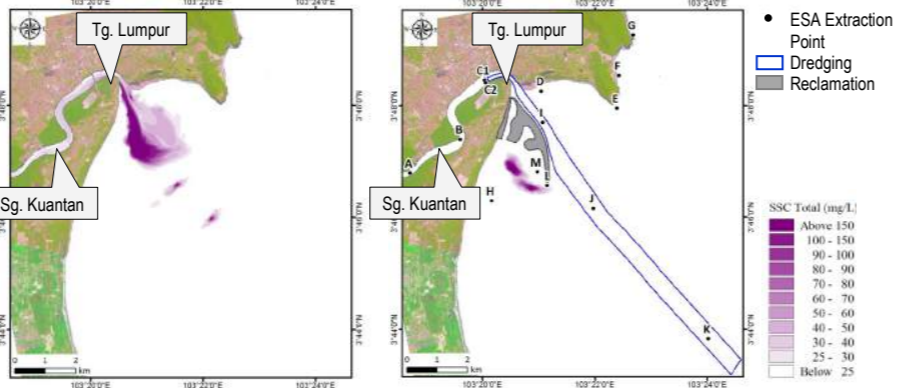
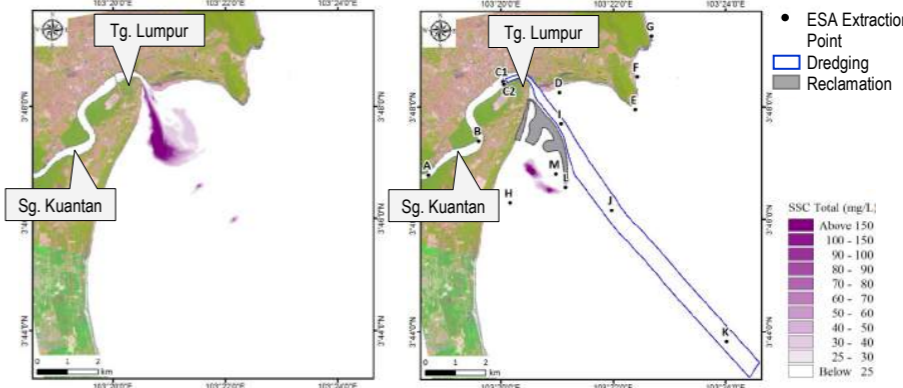
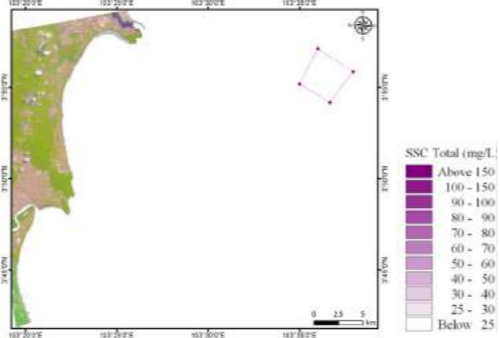
Project Components	Affected Environmental Components	Significant Potential Impacts	Magnitude of Significant Potential Impacts	Pollution Prevention and Mitigation Measures (P2M2s)	Reference Page
	b) Geotechnical stability	i) The dredging designed for this project is 100 meters away from the base of Tanjung Lumpur Bridge. ii) Assessing from the neighbouring exposed bank of Sungai Kuantan, it can be anticipated that the foundation soil within the river bed consists of clayey, silty and sandy material. iii) This suggest that with a distance of 100 meters from where the dredging starts, the impact of lateral force will not be in effect. iv) Thereby, the structure is assumed to be intact.	D	No mitigation measure is required.	7-3
2. Reclamation and dredging (cont'd)..	c) Hydraulic – sediment dispersion	i) Option 1 <ul style="list-style-type: none"> <li>Phase 2a: The maximum plume excursions for suspended sediment concentration of more than 25 mg/L are about 2.5 and 1.5 km towards approximately southwest and northeast from the source respectively. The dispersion extends up to about 6 km upstream of the river mouth.</li> <li>Phase 2b: The maximum plume excursions for suspended sediment concentration of more than 25 mg/L are about 1 and 1.7 km extending approximately east and southwest from the source respectively.</li> </ul>  <p><b>Maximum Excess Suspended Sediment Concentration for Option 1: Pure Tide Condition</b></p>	M	<b>Contained condition</b> i) Option 1 <ul style="list-style-type: none"> <li>Phase 2a: The maximum plume excursions for suspended sediment concentration of more than 25 mg/L is about 1.3 km extending approximately southwest and northeast from the source. The dispersion extends approximately 1.3 km upstream of the river mouth.</li> <li>Phase 2b: The maximum plume excursions for suspended sediment concentration of more than 20 mg/L are about 1.5 and 0.7 km towards approximately southwest and southeast from the source respectively.</li> </ul>  <p><b>Maximum Excess Suspended Sediment Concentration for Option 1: Pure Tide Condition</b></p>	7-5 to 7-55

**Key:**

- X Insignificant and excluded from matrix
- T Impact that is potentially but on a temporary basis and will ensure equilibrium after certain period of time.
- M Impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.
- D Potentially significant adverse impact for which a design solution has been identified.
- R Residual and significant adverse impact
- E Significant environmental enhancement



**Table E22 (cont'd)** ► Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures on the Physical and Biological Environment

Project Components	Affected Environmental Components	Significant Potential Impacts	Magnitude of Significant Potential Impacts	Pollution Prevention and Mitigation Measures (P2M2s)	Reference Page
2. Reclamation and dredging (cont'd)..	c) Hydraulic – sediment dispersion (cont'd)...	ii) Option 2 <ul style="list-style-type: none"> <li>Phase 2a: The maximum plume excursions for suspended sediment concentration of more than 25 mg/L is about 3.5 km that extends approximately southwest and northeast from the source. The dispersion extends approximately 9 km upstream of the river mouth.</li> <li>Phase 2b: The maximum plume excursions for suspended sediment concentration of more than 25 mg/L are about 1 and 1.7 km extending approximately east and southwest from the source respectively.</li> </ul>  <p style="text-align: center;">a) Phase 2a                      b) Phase 2b</p> <p style="text-align: center;"><b>Maximum Excess Suspended Sediment Concentration for Option 2: Pure Tide Condition</b></p>	M	Contained condition (cont'd) ii) Option 2 <ul style="list-style-type: none"> <li>Phase 2a: The maximum plume excursions for suspended sediment concentration of more than 25 mg/L are about 2.5 and 2 km extending approximately southwest and northeast from the source respectively. The dispersion extends up to about 2 km upstream of the river mouth.</li> <li>Phase 2b: The maximum plume excursions for suspended sediment concentration of more than 25 mg/L are about 1.5 and 0.5 km extending approximately southwest and southeast from the source respectively.</li> </ul>  <p style="text-align: center;">a) Phase 2a                      b) Phase 2b</p> <p style="text-align: center;"><b>Maximum Excess Suspended Sediment Concentration for Option 2: Pure Tide Condition</b></p>	7-5 to 7-55
		iii) Disposal of Dredged Material <ul style="list-style-type: none"> <li>The maximum plume excursions for suspended sediment concentration of more than 25 mg/L is less than 0.05 km from the source respectively. The concentration of the suspended sediment plume reduces rapidly away from the source once the dredged spoils enter the water column.</li> </ul>  <p style="text-align: center;"><b>Maximum Excess Suspended Sediment Concentration due to Disposal Activities: Pure Tide Condition</b></p>	M	No mitigation measure is required.	

**Key:**

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>X Insignificant and excluded from matrix</li> <li>T Impact that is potentially but on a temporary basis and will ensure equilibrium after certain period of time.</li> <li>M Impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.</li> </ul> | <ul style="list-style-type: none"> <li>D Potentially significant adverse impact for which a design solution has been identified.</li> <li>R Residual and significant adverse impact</li> <li>E Significant environmental enhancement</li> </ul> |
|--|---|

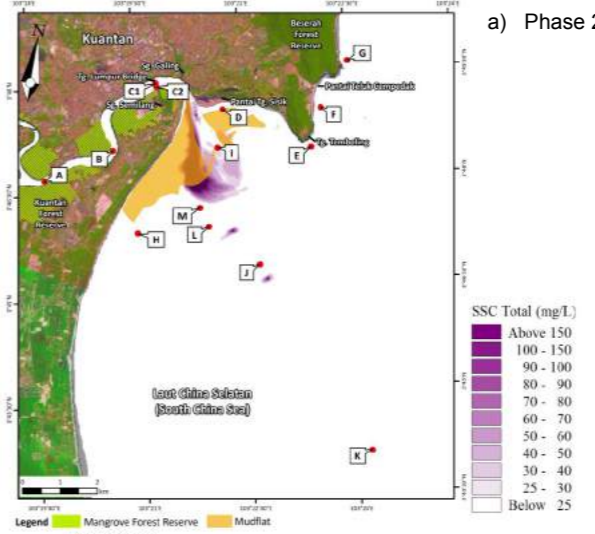
**Table E22 (cont'd)** ► Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures on the Physical and Biological Environment

Project Components	Affected Environmental Components	Significant Potential Impacts	Magnitude of Significant Potential Impacts	Pollution Prevention and Mitigation Measures (P2M2s)	Reference Page																																																																																													
2. Reclamation and dredging (cont'd)..	c) Hydraulic – sediment dispersion (cont'd)...	iv) Impact of Sediment Dispersion on ESAs	M		7-5 to 7-55																																																																																													
		<p><b>Option 1</b></p> <ul style="list-style-type: none"> <li>The maximum suspended sediment concentrations for uncontained condition near Kuantan Forest Reserve is 24 mg/L but reduced to 15 mg/L with contained condition.</li> <li>The maximum spill concentrations near Pantai Tanjung Sisek and Kuantan Tembeling Resort are about 6 and 4 mg/L for both uncontained and contained condition respectively.</li> <li>The sediment spill at Teluk Cempedak, Beserah Forest Reserve and Tanjung Lumpur sandflat is relatively undetectable.</li> </ul> <p><b>Maximum Suspended Spill Dispersion Concentration for Option 1</b></p> <table border="1"> <thead> <tr> <th rowspan="3">Point</th> <th rowspan="3">Location</th> <th colspan="2">Phase 2a</th> <th colspan="2">Phase 2b</th> </tr> <tr> <th colspan="2">Maximum Concentration (mg/L)</th> <th colspan="2">Maximum Concentration (mg/L)</th> </tr> <tr> <th>Uncontained</th> <th>Contained</th> <th>Uncontained</th> <th>Contained</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>Kuantan Forest Reserve</td> <td>24</td> <td>15</td> <td>0</td> <td>0</td> </tr> <tr> <td>B</td> <td>Hutan Rizab Paya Laut Kuantan</td> <td>25</td> <td>15</td> <td>1</td> <td>0</td> </tr> <tr> <td>C1</td> <td>Tanjung Lumpur Bridge (northern pier)</td> <td>24</td> <td>14</td> <td>1</td> <td>0</td> </tr> <tr> <td>C2</td> <td>Tanjung Lumpur Bridge (southern pier)</td> <td>24</td> <td>15</td> <td>1</td> <td>0</td> </tr> <tr> <td>D</td> <td>Pantai Tanjung Sisek</td> <td>6</td> <td>4</td> <td>0</td> <td>0</td> </tr> <tr> <td>E</td> <td>Kuantan Tembeling Resort</td> <td>6</td> <td>4</td> <td>0</td> <td>0</td> </tr> <tr> <td>F</td> <td>Teluk Cempedak</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>G</td> <td>Beserah Forest Reserve</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>H</td> <td>Tanjung Lumpur sandflat</td> <td>1</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>I</td> <td>Navigation channel (upstream)</td> <td>32</td> <td>24</td> <td>1</td> <td>0</td> </tr> <tr> <td>J</td> <td>Navigation channel (midstream)</td> <td>2</td> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>K</td> <td>Navigation channel (downstream)</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>L</td> <td>Southeastern end of development</td> <td>9</td> <td>6</td> <td>8</td> <td>5</td> </tr> <tr> <td>M</td> <td>Marina entrance</td> <td>8</td> <td>5</td> <td>3</td> <td>2</td> </tr> </tbody> </table>				Point	Location	Phase 2a		Phase 2b		Maximum Concentration (mg/L)		Maximum Concentration (mg/L)		Uncontained	Contained	Uncontained	Contained	A	Kuantan Forest Reserve	24	15	0	0	B	Hutan Rizab Paya Laut Kuantan	25	15	1	0	C1	Tanjung Lumpur Bridge (northern pier)	24	14	1	0	C2	Tanjung Lumpur Bridge (southern pier)	24	15	1	0	D	Pantai Tanjung Sisek	6	4	0	0	E	Kuantan Tembeling Resort	6	4	0	0	F	Teluk Cempedak	0	0	0	0	G	Beserah Forest Reserve	0	0	0	0	H	Tanjung Lumpur sandflat	1	0	0	0	I	Navigation channel (upstream)	32	24	1	0	J	Navigation channel (midstream)	2	1	0	0	K	Navigation channel (downstream)	0	0	0	0	L	Southeastern end of development	9	6	8	5	M
Point	Location	Phase 2a		Phase 2b																																																																																														
		Maximum Concentration (mg/L)		Maximum Concentration (mg/L)																																																																																														
		Uncontained	Contained	Uncontained	Contained																																																																																													
A	Kuantan Forest Reserve	24	15	0	0																																																																																													
B	Hutan Rizab Paya Laut Kuantan	25	15	1	0																																																																																													
C1	Tanjung Lumpur Bridge (northern pier)	24	14	1	0																																																																																													
C2	Tanjung Lumpur Bridge (southern pier)	24	15	1	0																																																																																													
D	Pantai Tanjung Sisek	6	4	0	0																																																																																													
E	Kuantan Tembeling Resort	6	4	0	0																																																																																													
F	Teluk Cempedak	0	0	0	0																																																																																													
G	Beserah Forest Reserve	0	0	0	0																																																																																													
H	Tanjung Lumpur sandflat	1	0	0	0																																																																																													
I	Navigation channel (upstream)	32	24	1	0																																																																																													
J	Navigation channel (midstream)	2	1	0	0																																																																																													
K	Navigation channel (downstream)	0	0	0	0																																																																																													
L	Southeastern end of development	9	6	8	5																																																																																													
M	Marina entrance	8	5	3	2																																																																																													

**Key:**

- |   |   |   |   |
|---|---|---|---|
| X | Insignificant and excluded from matrix  | D | Potentially significant adverse impact for which a design solution has been identified. |
| T | Impact that is potentially but on a temporary basis and will ensure equilibrium after certain period of time.   | R | Residual and significant adverse impact   |
| M | Impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended. | E | Significant environmental enhancement   |

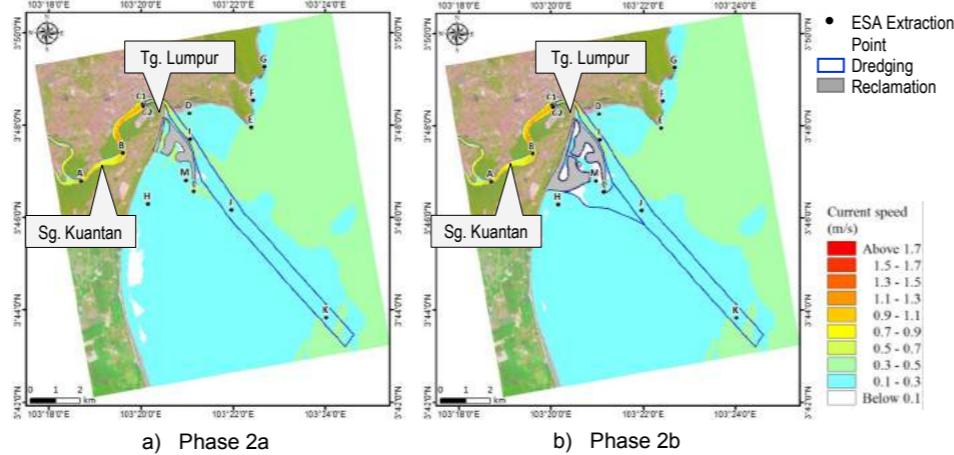
**Table E22 (cont'd)** ► Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures on the Physical and Biological Environment

Project Components	Affected Environmental Components	Significant Potential Impacts	Magnitude of Significant Potential Impacts	Pollution Prevention and Mitigation Measures (P2M2s)	Reference Page																																																																																														
2. Reclamation and dredging (cont'd)..	c) Hydraulic – sediment dispersion (cont'd)...	iv) Impact of Sediment Dispersion on ESAs (cont'd)...	M	 <p>a) Phase 2a</p>	7-5 to 7-55																																																																																														
		<p><b>Option 2</b></p> <ul style="list-style-type: none"> <li>The maximum suspended sediment concentrations for the uncontained condition near Kuantan Forest Reserve is 26 mg/L but reduced to 15 mg/L with contained condition.</li> <li>The maximum spill concentrations near Pantai Tanjung Sisek and Kuantan Tembeling Resort are about 6 and 3-4 mg/L for uncontained and contained conditions respectively.</li> <li>The sediment spill at Teluk Cempedak, Beserah Forest Reserve and Tanjung Lumpur sandflat is relatively undetectable.</li> </ul> <p><b>Maximum Suspended Spill Dispersion Concentration for Option 2</b></p> <table border="1"> <thead> <tr> <th rowspan="3">Point</th> <th rowspan="3">Location</th> <th colspan="2">Phase 2a</th> <th colspan="2">Phase 2b</th> </tr> <tr> <th colspan="2">Maximum Concentration (mg/L)</th> <th colspan="2">Maximum Concentration (mg/L)</th> </tr> <tr> <th>Uncontained</th> <th>Contained</th> <th>Uncontained</th> <th>Contained</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>Kuantan Forest Reserve</td> <td>26</td> <td>15</td> <td>0</td> <td>0</td> </tr> <tr> <td>B</td> <td>Hutan Rizab Paya Laut Kuantan</td> <td>31</td> <td>18</td> <td>1</td> <td>0</td> </tr> <tr> <td>C1</td> <td>Tanjung Lumpur Bridge (northern pier)</td> <td>30</td> <td>18</td> <td>1</td> <td>0</td> </tr> <tr> <td>C2</td> <td>Tanjung Lumpur Bridge (southern pier)</td> <td>40</td> <td>24</td> <td>1</td> <td>0</td> </tr> <tr> <td>D</td> <td>Pantai Tanjung Sisek</td> <td>6</td> <td>3</td> <td>0</td> <td>0</td> </tr> <tr> <td>E</td> <td>Kuantan Tembeling Resort</td> <td>6</td> <td>4</td> <td>0</td> <td>0</td> </tr> <tr> <td>F</td> <td>Teluk Cempedak</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>G</td> <td>Beserah Forest Reserve</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>H</td> <td>Tanjung Lumpur sandflat</td> <td>1</td> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>I</td> <td>Navigation channel (upstream)</td> <td>36</td> <td>24</td> <td>1</td> <td>0</td> </tr> <tr> <td>J</td> <td>Navigation channel (midstream)</td> <td>2</td> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>K</td> <td>Navigation channel (downstream)</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>L</td> <td>Southeastern end of development</td> <td>9</td> <td>5</td> <td>8</td> <td>5</td> </tr> <tr> <td>M</td> <td>Marina entrance</td> <td>22</td> <td>13</td> <td>3</td> <td>2</td> </tr> </tbody> </table>				Point	Location	Phase 2a		Phase 2b		Maximum Concentration (mg/L)		Maximum Concentration (mg/L)		Uncontained	Contained	Uncontained	Contained	A	Kuantan Forest Reserve	26	15	0	0	B	Hutan Rizab Paya Laut Kuantan	31	18	1	0	C1	Tanjung Lumpur Bridge (northern pier)	30	18	1	0	C2	Tanjung Lumpur Bridge (southern pier)	40	24	1	0	D	Pantai Tanjung Sisek	6	3	0	0	E	Kuantan Tembeling Resort	6	4	0	0	F	Teluk Cempedak	0	0	0	0	G	Beserah Forest Reserve	0	0	0	0	H	Tanjung Lumpur sandflat	1	1	0	0	I	Navigation channel (upstream)	36	24	1	0	J	Navigation channel (midstream)	2	1	0	0	K	Navigation channel (downstream)	0	0	0	0	L	Southeastern end of development	9	5	8	5	M	Marina entrance
Point	Location	Phase 2a		Phase 2b																																																																																															
		Maximum Concentration (mg/L)		Maximum Concentration (mg/L)																																																																																															
		Uncontained	Contained	Uncontained	Contained																																																																																														
A	Kuantan Forest Reserve	26	15	0	0																																																																																														
B	Hutan Rizab Paya Laut Kuantan	31	18	1	0																																																																																														
C1	Tanjung Lumpur Bridge (northern pier)	30	18	1	0																																																																																														
C2	Tanjung Lumpur Bridge (southern pier)	40	24	1	0																																																																																														
D	Pantai Tanjung Sisek	6	3	0	0																																																																																														
E	Kuantan Tembeling Resort	6	4	0	0																																																																																														
F	Teluk Cempedak	0	0	0	0																																																																																														
G	Beserah Forest Reserve	0	0	0	0																																																																																														
H	Tanjung Lumpur sandflat	1	1	0	0																																																																																														
I	Navigation channel (upstream)	36	24	1	0																																																																																														
J	Navigation channel (midstream)	2	1	0	0																																																																																														
K	Navigation channel (downstream)	0	0	0	0																																																																																														
L	Southeastern end of development	9	5	8	5																																																																																														
M	Marina entrance	22	13	3	2																																																																																														

**Key:**

- X Insignificant and excluded from matrix
- T Impact that is potentially but on a temporary basis and will ensure equilibrium after certain period of time.
- M Impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.
- D Potentially significant adverse impact for which a design solution has been identified.
- R Residual and significant adverse impact
- E Significant environmental enhancement

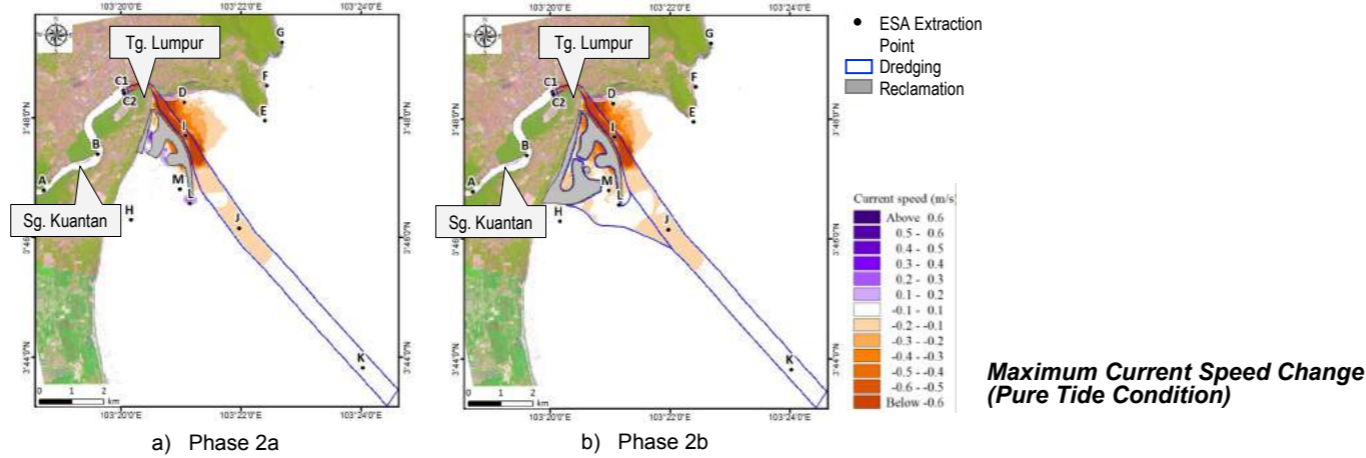
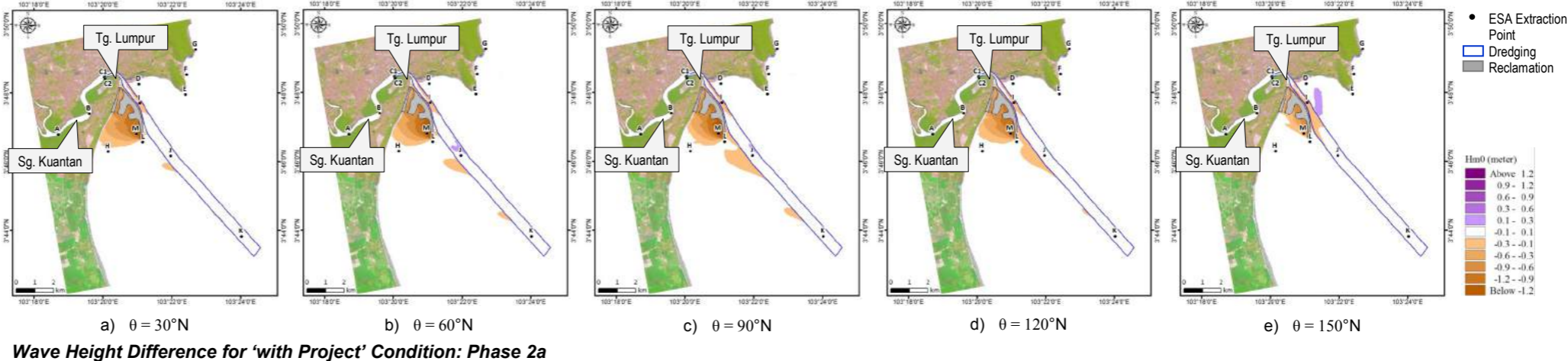
**Table E22 (cont'd)** ► Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures on the Physical and Biological Environment

Project Components	Affected Environmental Components	Significant Potential Impacts	Magnitude of Significant Potential Impacts	Pollution Prevention and Mitigation Measures (P2M2s)	Reference Page
	c) Hydraulic – sediment dispersion (cont'd)...		M	<p><b>Construction of Perimeter Bund</b></p> <p>It is recommended that a perimeter bund is constructed enclosing the reclamation area. This will reduce the amount of fine material that is dispersed by the currents during the filling process. The bund forming the reclamation edge will then be armoured with rocks that provides protection against waves and currents.</p>	7-5 to 7-55
2. Reclamation and dredging (cont'd)..	d) Hydraulic – current speeds	<p>i) The proposed project creates local changes to current flow patterns.</p> <p>ii) Current speed decrease occurs at the dredged navigation channel and within reclamation area.</p> <p>iii) The reclamation's southeastern end experienced current speed increase.</p> <p>iv) Construction of reclaimed land for Phase 2a induced current speed increase within the water body.</p> <p><b>Phase 2a</b></p> <ul style="list-style-type: none"> <li>■ The maximum current speed increase of up to about 0.34 and 0.60 m/s occurs at the southeastern end of reclamation and within the water body bounded by the reclamation.</li> <li>■ The maximum current speed decrease is up to about 1.28 and 0.79 m/s at the dredged area and between the reclamation and the mainland respectively.</li> <li>■ However, the changes in current speeds for Phase 2a can be considered temporary as the entire reclamation will come to be realized.</li> </ul> <p><b>Phase 2b</b></p> <ul style="list-style-type: none"> <li>■ The maximum current speed increase is up to about 0.16 and 0.28 m/s at the southeastern end of the reclamation and water body bounded by the reclamation respectively.</li> <li>■ The maximum current speed decrease is up to about 1.27 and 0.89 m/s which occurs within the dredged area and within the water body bounded by the reclamation respectively.</li> </ul>  <p style="text-align: center;"><b>Maximum Current Speed Plots (Pure Tide Condition)</b></p>	X	No mitigation measure is required.	7-56 to 7-82

**Key:**

- X Insignificant and excluded from matrix
- T Impact that is potentially but on a temporary basis and will ensure equilibrium after certain period of time.
- M Impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.
- D Potentially significant adverse impact for which a design solution has been identified.
- R Residual and significant adverse impact
- E Significant environmental enhancement

**Table E22 (cont'd)** Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures on the Physical and Biological Environment

Project Components	Affected Environmental Components	Significant Potential Impacts	Magnitude of Significant Potential Impacts	Pollution Prevention and Mitigation Measures (P2M2s)	Reference Page
2. Reclamation and dredging (cont'd)..	d) Hydraulic – current speeds (cont'd)...	 <p>a) Phase 2a      b) Phase 2b</p>	X	No mitigation measure is required.	
		<p><b>Impact of Current Speed on ESAs</b></p> <ul style="list-style-type: none"> <li>Changes in mean and maximum current speeds are generally localised within the project site.</li> <li>There is minimal changes in the mean and maximum current speeds at the ESAs based on the simulation results.</li> </ul>	X	No mitigation measure is required.	
	e) Hydraulic – water levels and flooding impacts	Based on simulation results, the results do not show any rise in water levels after the reclamation. As such, it can be deduced that there would be no direct changes to the water levels and flood levels at these locations.	X	No mitigation measure is required.	7-82 to 7-85
	f) Hydraulic – waves	<ul style="list-style-type: none"> <li>The changes in wave heights due to the proposed project are localised and do not affect the adjacent southern and northern coastlines.</li> <li>An insignificant increase in wave height of up to about 0.2 m occurs in front of the river mouth for waves propagating from 150°N with wave heights of up to 1.2 m.</li> <li>A localised wave height decrease of up to about 1.6 m occurs in the proposed marina for waves propagating from 90°N.</li> <li>The wave height changes after the dredging works inside the navigation channel are insignificant.</li> </ul>	X	No mitigation measure is required.	7-86 to 7-97
		 <p>a) <math>\theta = 30^\circ\text{N}</math>      b) <math>\theta = 60^\circ\text{N}</math>      c) <math>\theta = 90^\circ\text{N}</math>      d) <math>\theta = 120^\circ\text{N}</math>      e) <math>\theta = 150^\circ\text{N}</math></p> <p><b>Wave Height Difference for 'with Project' Condition: Phase 2a</b></p>			

**Key:**

- X Insignificant and excluded from matrix
- T Impact that is potentially but on a temporary basis and will ensure equilibrium after certain period of time.
- M Impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.
- D Potentially significant adverse impact for which a design solution has been identified.
- R Residual and significant adverse impact
- E Significant environmental enhancement

**Table E22 (cont'd)** ► Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures on the Physical and Biological Environment

Project Components	Affected Environmental Components	Significant Potential Impacts	Magnitude of Significant Potential Impacts	Pollution Prevention and Mitigation Measures (P2M2s)	Reference Page
2. Reclamation and dredging (cont'd)..	f) Hydraulic – waves (cont'd)...	<p>a) <math>\theta = 30^\circ\text{N}</math>      b) <math>\theta = 60^\circ\text{N}</math>      c) <math>\theta = 90^\circ\text{N}</math>      d) <math>\theta = 120^\circ\text{N}</math>      e) <math>\theta = 150^\circ\text{N}</math></p> <p><b>Wave Height Difference for 'with Project' Condition: Phase 2b</b></p> <p><b>Impact of Waves on ESAs</b></p> <ul style="list-style-type: none"> <li>There is a significant reduction in wave heights within the waters of surrounding areas after development.</li> <li>Wave height decrease of varying degree occurs within the proposed cruise channel, marina and south of the reclamation for most simulated directions.</li> <li>The project reduces wave heights by as much as 98% for incoming waves from 30, 60, 90, and 120°N within the marina. There is relatively little impact due to waves from 150°N.</li> <li>The highest wave height encountered along the development is about 1.6 m fronting the southeastern end of development.</li> <li>It can be inferred from the results that waves propagating from 90°N induce the most impact along the surrounding shoreline. This is followed by waves coming from 60, 120, 30°N. The least impact is felt for incoming waves from 150°N.</li> </ul>	X	No mitigation measure is required.	7-86 to 7-97
	g) Hydraulic – sedimentation and erosion	<p><b>i) Cohesive Sediments (Mud)</b></p> <ul style="list-style-type: none"> <li>It indicates that the bed level changes induced by the project are localised within the immediate vicinity of the Project site.</li> <li>The changes are relatively similar for seasonal conditions.</li> </ul> <p><b>Phase 2a</b></p> <ul style="list-style-type: none"> <li>Erosion was observed within the proposed lagoon and inner marina of up to about 0.6 and 0.4 m/year respectively</li> <li>Sedimentation of about 0.1 m/year is predicted to occur in the proposed channel.</li> <li>Sedimentation of up to about 1.2 m/year can be observed immediately in front of the river mouth abutting the reclamation.</li> <li>Erosion is observed to extend approximately 3 km upstream of the bridge.</li> <li>Erosion of up to about 0.6 m/year can be observed extending about 2 km upstream of the proposed navigation channel.</li> </ul>			T

**Key:**

- X Insignificant and excluded from matrix
- T Impact that is potentially but on a temporary basis and will ensure equilibrium after certain period of time.
- M Impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.
- D Potentially significant adverse impact for which a design solution has been identified.
- R Residual and significant adverse impact
- E Significant environmental enhancement

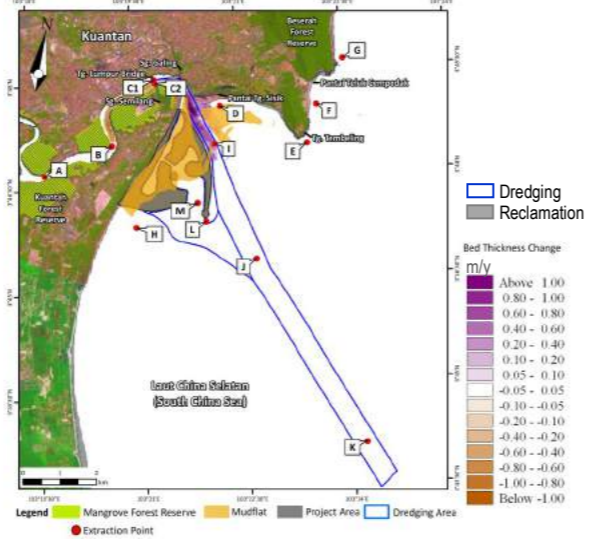
**Table E22 (cont'd)** ► Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures on the Physical and Biological Environment

Project Components	Affected Environmental Components	Significant Potential Impacts	Magnitude of Significant Potential Impacts	Pollution Prevention and Mitigation Measures (P2M2s)	Reference Page
2. Reclamation and dredging (cont'd)..	g) Hydraulic – sedimentation and erosion (cont'd)...	<p><b>Projected Bed Level Change (Pure Tide Condition): Existing Condition vs. Phase 2a</b></p> <p><b>Phase 2b</b></p> <ul style="list-style-type: none"> <li>■ Sedimentation of up to about 1 m/year is predicted to occur within the project water area.</li> <li>■ Sedimentation of about 0.6 m/year is predicted to occur at the turning basin.</li> <li>■ Sedimentation of up to about 1.2 m/year can be observed immediately in front of the river mouth for both phases.</li> <li>■ Erosion is observed to extend approximately 3 km upstream of the bridge.</li> <li>■ Erosion of up to about 0.6 m/year can be observed extending about 2 km upstream of the proposed navigation channel.</li> </ul> <p><b>Projected Bed Level Change (Pure Tide Condition): Existing Condition vs. Phase 2b</b></p>	T	<p><b>Proposed Mitigation Works South of the Proposed Project</b></p> <p>v) Periodic bathymetric and nearshore surveys can be done to assess nearshore and bed level changes during and after development. A survey with alongshore line intervals of 100 m extending 2.5 km to the north of the development, 1 km to the south the development and extending 1 km seaward could be done. The survey shall extend 50 m landward of the High Water mark.</p>	7-101 to 7-116

**Key:**

- X Insignificant and excluded from matrix
- T Impact that is potentially but on a temporary basis and will ensure equilibrium after certain period of time.
- M Impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.
- D Potentially significant adverse impact for which a design solution has been identified.
- R Residual and significant adverse impact
- E Significant environmental enhancement

**Table E22 (cont'd)** ► Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures on the Physical and Biological Environment

Project Components	Affected Environmental Components	Significant Potential Impacts	Magnitude of Significant Potential Impacts	Pollution Prevention and Mitigation Measures (P2M2s)	Reference Page																																																									
2. Reclamation and dredging (cont'd)..	g) Hydraulic – sedimentation and erosion (cont'd)...	<p><b>Impact of Sedimentation and Erosion on ESAs (Cohesive Sediments - Mud)</b></p> <ul style="list-style-type: none"> <li>Slight erosion of up to about 0.1 m/yr was observed at the Tanjung Lumpur Bridge piers and near Hutan Rizab Paya Laut Kuantan upon completion of the dredging works.</li> <li>Sedimentation of up to about 0.1 m/yr can occur within the navigation channel abutting the project.</li> </ul>	T	Refer to page ES-68 to ES-69	7-101 to 7-116																																																									
		 <p><b>Average Sedimentation Rates for Cohesive Sediments at ESAs and around the Project Site</b></p> <table border="1"> <thead> <tr> <th rowspan="2">Point</th> <th rowspan="2">Location</th> <th colspan="2">Average Sedimentation Rate (m/year)</th> </tr> <tr> <th>Phase 2a</th> <th>Phase 2b</th> </tr> </thead> <tbody> <tr><td>A</td><td>Kuantan Forest Reserve</td><td>0.0</td><td>0.0</td></tr> <tr><td>B</td><td>Hutan Rizab Paya Laut Kuantan</td><td>-0.1</td><td>-0.1</td></tr> <tr><td>C1</td><td>Tanjung Lumpur Bridge (northern pier)</td><td>-0.1</td><td>-0.1</td></tr> <tr><td>C2</td><td>Tanjung Lumpur Bridge (southern pier)</td><td>-0.1</td><td>-0.1</td></tr> <tr><td>D</td><td>Pantai Tanjung Sisek</td><td>0.0</td><td>0.0</td></tr> <tr><td>E</td><td>Kuantan Tembeling Resort</td><td>0.0</td><td>0.0</td></tr> <tr><td>F</td><td>Teluk Cempedak</td><td>0.0</td><td>0.0</td></tr> <tr><td>G</td><td>Beserah Forest Reserve</td><td>0.0</td><td>0.0</td></tr> <tr><td>H</td><td>Tanjung Lumpur sandflat</td><td>0.0</td><td>0.0</td></tr> <tr><td>I</td><td>Navigation channel (upstream)</td><td>0.1</td><td>0.1</td></tr> <tr><td>J</td><td>Navigation channel (midstream)</td><td>0.0</td><td>0.0</td></tr> <tr><td>K</td><td>Navigation channel (downstream)</td><td>0.0</td><td>0.0</td></tr> <tr><td>L</td><td>Southeastern end of development</td><td>0.0</td><td>0.0</td></tr> <tr><td>M</td><td>Marina entrance</td><td>0.0</td><td>0.0</td></tr> </tbody> </table> <p>Note: Negative values indicate erosion; Positive values indicate sedimentation</p>				Point	Location	Average Sedimentation Rate (m/year)		Phase 2a	Phase 2b	A	Kuantan Forest Reserve	0.0	0.0	B	Hutan Rizab Paya Laut Kuantan	-0.1	-0.1	C1	Tanjung Lumpur Bridge (northern pier)	-0.1	-0.1	C2	Tanjung Lumpur Bridge (southern pier)	-0.1	-0.1	D	Pantai Tanjung Sisek	0.0	0.0	E	Kuantan Tembeling Resort	0.0	0.0	F	Teluk Cempedak	0.0	0.0	G	Beserah Forest Reserve	0.0	0.0	H	Tanjung Lumpur sandflat	0.0	0.0	I	Navigation channel (upstream)	0.1	0.1	J	Navigation channel (midstream)	0.0	0.0	K	Navigation channel (downstream)	0.0	0.0	L	Southeastern end of development	0.0
Point	Location	Average Sedimentation Rate (m/year)																																																												
		Phase 2a	Phase 2b																																																											
A	Kuantan Forest Reserve	0.0	0.0																																																											
B	Hutan Rizab Paya Laut Kuantan	-0.1	-0.1																																																											
C1	Tanjung Lumpur Bridge (northern pier)	-0.1	-0.1																																																											
C2	Tanjung Lumpur Bridge (southern pier)	-0.1	-0.1																																																											
D	Pantai Tanjung Sisek	0.0	0.0																																																											
E	Kuantan Tembeling Resort	0.0	0.0																																																											
F	Teluk Cempedak	0.0	0.0																																																											
G	Beserah Forest Reserve	0.0	0.0																																																											
H	Tanjung Lumpur sandflat	0.0	0.0																																																											
I	Navigation channel (upstream)	0.1	0.1																																																											
J	Navigation channel (midstream)	0.0	0.0																																																											
K	Navigation channel (downstream)	0.0	0.0																																																											
L	Southeastern end of development	0.0	0.0																																																											
M	Marina entrance	0.0	0.0																																																											

**Key:**

- X Insignificant and excluded from matrix
- T Impact that is potentially but on a temporary basis and will ensure equilibrium after certain period of time.
- M Impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.
- D Potentially significant adverse impact for which a design solution has been identified.
- R Residual and significant adverse impact
- E Significant environmental enhancement



**Table E22 (cont'd)** ► Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures on the Physical and Biological Environment

Project Components	Affected Environmental Components	Significant Potential Impacts	Magnitude of Significant Potential Impacts	Pollution Prevention and Mitigation Measures (P2M2s)	Reference Page																																																										
2. Reclamation and dredging (cont'd)..	g) Hydraulic – sedimentation and erosion (cont'd)...	<p>ii) <b>Non-cohesive Sediments (Sand)</b></p> <ul style="list-style-type: none"> <li>Transport capacity decrease at the proposed dredged navigation channel, within reclamation area, and dredged marina channel.</li> <li>Transport capacity increase at the northeast edge of the dredged channel and concentrated at the tip of the southeastern end of the reclamation.</li> <li>The most significant sediment transport change for both phases scenarios occur during the Northeast Monsoon period.</li> </ul> <p><b>Phase 2a</b></p> <ul style="list-style-type: none"> <li>Sediment bypassing from Tanjung Tembeling headland is partially interrupted by the reclaimed land and expect to deposit inside the dredged area.</li> <li>Sedimentation of up to about 1.1 m/year is predicted to occur.</li> <li>Decrease in sand transport capacity occurs within the development’s dredged area as a result of the relatively low current speeds and wave sheltering.</li> <li>Sedimentation at the marina entrance is expected to be about 0.6 m/year.</li> <li>The coastline of about 1 km immediate south of the reclamation is expected to erode by about 0.2 m/year due to interruption of sediment bypassing originating from Tanjung Tembeling.</li> <li>There is slight increase in sand transport capacity at the tip of southeastern end of the reclamation and at the northeastern edge of the dredged channel where potential scour of about 0.4 m/year is estimated.</li> </ul> <p><b>Phase 2b</b></p> <ul style="list-style-type: none"> <li>Sediment bypassing from Tanjung Tembeling headland has been partially interrupted by the Phase 2a.</li> <li>The sediments deposit within the dredged area where sedimentation of up to about 1.1 m/year is expected.</li> <li>Sedimentation at the proposed marina entrance is expected to be about 0.6 m/year.</li> <li>The coastline of about 1 km immediate south of the project is expected to erode by about 0.1 m/year due to interruption of sediment bypassing originating from Tanjung Tembeling.</li> <li>There is slight increase in sand transport capacity at the tip of southeastern end of the reclamation and at the northeastern edge of the dredged channel where potential scour of about 0.5 m/year is estimated.</li> </ul>	T	Refer to page ES-68 to ES-69	7-101 to 7-116																																																										
		<p><b>Impact of Sedimentation and Erosion on ESAs (Non-cohesive sediments - Sand)</b></p> <ul style="list-style-type: none"> <li>The changes in the sediment transport capacity are localised.</li> </ul> <table border="1"> <thead> <tr> <th rowspan="2">Point</th> <th rowspan="2">Location</th> <th colspan="2">Average Bed Level Change (m/year)</th> </tr> <tr> <th>Phase 2a</th> <th>Phase 2b</th> </tr> </thead> <tbody> <tr><td>A</td><td>Kuantan Forest Reserve</td><td>0</td><td>0</td></tr> <tr><td>B</td><td>Hutan Rizab Paya Laut Kuantan</td><td>0</td><td>0</td></tr> <tr><td>C1</td><td>Tanjung Lumpur Bridge (northern pier)</td><td>0</td><td>0</td></tr> <tr><td>C2</td><td>Tanjung Lumpur Bridge (southern pier)</td><td>0</td><td>0</td></tr> <tr><td>D</td><td>Pantai Tanjung Sisek</td><td>0</td><td>0</td></tr> <tr><td>E</td><td>Kuantan Tembeling Resort</td><td>0</td><td>0</td></tr> <tr><td>F</td><td>Teluk Cempedak</td><td>0</td><td>0</td></tr> <tr><td>G</td><td>Beserah Forest Reserve</td><td>0</td><td>0</td></tr> <tr><td>H</td><td>Tanjung Lumpur sandflat</td><td>-0.1</td><td>-0.1</td></tr> <tr><td>I</td><td>Navigation channel (upstream)</td><td>1.1</td><td>1.1</td></tr> <tr><td>J</td><td>Navigation channel (midstream)</td><td>0</td><td>0</td></tr> <tr><td>K</td><td>Navigation channel (downstream)</td><td>0</td><td>0</td></tr> <tr><td>L</td><td>Southeastern end of development</td><td>-0.4</td><td>-0.5</td></tr> <tr><td>M</td><td>Marina entrance</td><td>0.6</td><td>0.6</td></tr> </tbody> </table> <p><i>Average Sedimentation Rates for Non-cohesive Sediments at ESAs and around the Project Site</i></p> <p><i>Note: Negative values indicate erosion; Positive values indicate sedimentation</i></p>	Point			Location	Average Bed Level Change (m/year)		Phase 2a	Phase 2b	A	Kuantan Forest Reserve	0	0	B	Hutan Rizab Paya Laut Kuantan	0	0	C1	Tanjung Lumpur Bridge (northern pier)	0	0	C2	Tanjung Lumpur Bridge (southern pier)	0	0	D	Pantai Tanjung Sisek	0	0	E	Kuantan Tembeling Resort	0	0	F	Teluk Cempedak	0	0	G	Beserah Forest Reserve	0	0	H	Tanjung Lumpur sandflat	-0.1	-0.1	I	Navigation channel (upstream)	1.1	1.1	J	Navigation channel (midstream)	0	0	K	Navigation channel (downstream)	0	0	L	Southeastern end of development	-0.4	-0.5	M
Point	Location	Average Bed Level Change (m/year)																																																													
		Phase 2a	Phase 2b																																																												
A	Kuantan Forest Reserve	0	0																																																												
B	Hutan Rizab Paya Laut Kuantan	0	0																																																												
C1	Tanjung Lumpur Bridge (northern pier)	0	0																																																												
C2	Tanjung Lumpur Bridge (southern pier)	0	0																																																												
D	Pantai Tanjung Sisek	0	0																																																												
E	Kuantan Tembeling Resort	0	0																																																												
F	Teluk Cempedak	0	0																																																												
G	Beserah Forest Reserve	0	0																																																												
H	Tanjung Lumpur sandflat	-0.1	-0.1																																																												
I	Navigation channel (upstream)	1.1	1.1																																																												
J	Navigation channel (midstream)	0	0																																																												
K	Navigation channel (downstream)	0	0																																																												
L	Southeastern end of development	-0.4	-0.5																																																												
M	Marina entrance	0.6	0.6																																																												

Key:

- X Insignificant and excluded from matrix
- T Impact that is potentially but on a temporary basis and will ensure equilibrium after certain period of time.
- M Impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.
- D Potentially significant adverse impact for which a design solution has been identified.
- R Residual and significant adverse impact
- E Significant environmental enhancement

**Table E22 (cont'd)** ► Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures on the Physical and Biological Environment

Project Components	Affected Environmental Components	Significant Potential Impacts	Magnitude of Significant Potential Impacts	Pollution Prevention and Mitigation Measures (P2M2s)	Reference Page
2. Reclamation and dredging (cont'd)..	h) Water quality	<ul style="list-style-type: none"> <li>i) Oil and grease from dredgers and vessels employed for the project may spill into the sea and cause contamination.</li> <li>ii) Improper discharge of waste from these vessels may also have negative impacts to the surrounding water.</li> <li>iii) Dredging activity will cause disturbance to the surface layer of the seabed, thus suspending solids in the water column and consequently affecting the water turbidity.</li> <li>iv) Improper disposal of dredging material will generate sediment plume that may cause turbidity to the adjacent area.</li> </ul>	M	<ul style="list-style-type: none"> <li>i) Dredging and reclamation works will be carried out with several control measures such as controlled dredging and multi-tiered protection in order to achieve the targeted 'zero plume' dredging.</li> <li>ii) Silt curtains will be installed at necessary locations around the project area as specified in <i>Chapter 5</i>. These silt curtains should be monitored periodically and well maintained.</li> <li>iii) There should be a good system of solid waste management on board of the vessels. All solid wastes must be collected using dedicated containers. These containers will be unloaded at the permissible jetty and the wastes will be transferred to a designated place for disposal.</li> <li>iv) A thorough Emergency Response Plan (ERP) which includes oil spill prevention and response must be formulated according to the requirement and approved by relevant authorities.</li> <li>v) It is recommended that a monthly water-quality monitoring programme is to be done at three depths: surface, middle and bottom.</li> <li>vi) Satellite monitoring of sediment plume is highly encouraged.</li> <li>vii) All dredgers and vessels should operate under their designated capacity only. Overloading should be prohibited. During bad weather, navigation speed should be reduced to avoid spillage.</li> <li>viii) All vessels transporting the dredged material should be closely monitored. The discharging of dredged material should be done only at the designated reclamation area.</li> <li>ix) In the event that spillages do occur, the vessel must be immediately halted and leakages plugged to avoid further contamination to the marine environment. The authorities must be alerted of these accidental spillages as well.</li> </ul>	7-116 to 7-117
	i) Marine biological environment	<ul style="list-style-type: none"> <li>i) Sediment dispersion may cause turbidity in the in the water column if it is not executed accordingly, which can affect the marine habitat (mainly the seabed ecosystem).</li> <li>ii) Dredging activity may possibly release suspended sediments into the water column both during the excavation and during the transportation of sand from hopper to barge.</li> </ul> <p><b>Plankton and Benthos</b></p> <ul style="list-style-type: none"> <li>i) The impact seems to be minimal within the adjacent waters of the proposed project as their dynamicity is largely influenced by daily tidal movements.</li> </ul> <p><b>Fisheries</b></p> <ul style="list-style-type: none"> <li>i) Although the reclamation and dredging activities will have a temporary impact on the water quality, there is no significant fish population of economic importance within the area.</li> <li>ii) Nevertheless, fish are mobile nekton possibly will swim away from the dredging area.</li> </ul>	T	<ul style="list-style-type: none"> <li>i) Good dredging practices must be employed at all times to minimize the impact to the surroundings.</li> <li>ii) As for the loss of benthic communities, there is no feasible mitigating measures as the circumstances are inevitable. However, it should be noted that once the dredging works have finished, the communities will be restored in due time by the natural processes.</li> </ul>	7-117 to 7-120

Key:

- |   |   |   |   |
|---|---|---|---|
| X | Insignificant and excluded from matrix  | D | Potentially significant adverse impact for which a design solution has been identified. |
| T | Impact that is potentially but on a temporary basis and will ensure equilibrium after certain period of time.   | R | Residual and significant adverse impact   |
| M | Impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended. | E | Significant environmental enhancement   |

**Table E22 (cont'd)** ► Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures on the Physical and Biological Environment

Project Components	Affected Environmental Components	Significant Potential Impacts	Magnitude of Significant Potential Impacts	Pollution Prevention and Mitigation Measures (P2M2s)	Reference Page
2. Reclamation and dredging (cont'd)..	j) Marine traffic and navigation safety	i) There will be additional marine vessels, i.e. tugboats, CSD, TSHD etc. plying within the coastal water in the vicinity of the project site. ii) Frequent movements of large vessels may disrupt the small fishing boats mooring nearby. iii) The existing navigation route may face interference and temporary aids for navigation purposes may need to be established. iv) There may also be increased risk of accidents and collision with fishermen's boats.	M / T	i) Project Proponent should ensure that the contractors follow all procedures and regulations set by the relevant authorities. ii) Frequent security patrols should ensure that fishing activities are prohibited within or nearby the project's working area. iii) A restricted area will need to be established to encompass the entire working area, and this area should be clearly marked with lighted markers buoys. iv) All relevant authorities, such as the Chief Marine Officer of Kuantan Port and their licensed port operator, Kuantan Port Consortium, the Port Officer, local Marine Department Officers, the Fisheries Department etc., must be informed in advance prior to any operation commencing and for the application of permits, licenses, etc. v) Dumping of waste, surplus materials or other debris into the coastal waters are strictly prohibited throughout the project period.	7-120
	k) Air quality	i) The nature of reclamation works will present an open surface with loose soil that is susceptible to wind erosion. ii) Exhaust emissions from marine vessels and machineries i.e. excavators, trucks and bulldozers. iii) These impacts are relatively of short term and very localized.	X	i) Maintenance of the deployed vessels and operating machineries should be done regularly. ii) Material-handling systems and site stockpiling of materials should be designed. iii) Air quality monitoring should be done periodically to ensure that the air quality level does not exceed the limit set by DOE.	7-120
	l) Noise	i) Additional noise may occur during compaction and ground improvement works. ii) However, this noise impact is minimal.	X	i) Maintenance of the deployed vessels and operating machineries should be done regularly. ii) Noise monitoring should be done periodically to ensure the noise level does not exceed the limits set by DOE.	7-121
3. Post-reclamation	a) Terrestrial biological environment	i) The existence of the newly reclaimed land will has no further impact on terrestrial flora and fauna as these have already been gone during the land clearing and reclamation phases. ii) Certain commensal species such as the pigeons, pipits ( <i>Anthus sp.</i> ), doves, bulbuls, mynah birds, crows, etc. may still thrive in the disturbed area.	X	i) Replanting of mangrove species such as the fast-growing Api-Api ( <i>Avicennia sp.</i> ), Bakau ( <i>Rhizophora sp.</i> ), Perepat ( <i>Sonneratia sp.</i> ), etc. should be promoted in the disturbed area (if any). ii) Proper landscaping and re-vegetation will enhance the aesthetic qualities of the Project area. iii) The permanent structure of the revetment should be well-maintained to protect the coastline and the reclaimed land. The tidal mudflats in the area will finally recover and thus, provide a more conducive habitat for shorebirds (resident species).	7-121
	b) Human environment – fishermen communities	The existence of the reclaimed land may give additional cost and fuel incurred to the local fishermen as they need to travel farther from their usual route.	D	i) A committee needs to be established comprising the authorities (i.e. LKIM, DOF), Project Proponent, State Government and representatives from the fishermen communities. ii) A formula should be worked out by this committee to provide appropriate compensation to the affected fishermen.	7-121
4. Operational Phase	a) Water quality	i) Two (2) sewage treatment plants (STPs) to be built and it will be treated to Standard A and discharged into the existing waterways. ii) The proposed reclamation reduces flushing in the vicinity of the project site.	D	Appropriate measures will be designed to reduce the release of pollution load into the open waters.	7-122
	b) Marine traffic	i) Once the marina cruise terminal is operating, it is envisaged the number of yachts and cruise ships entering and docking at the facilities will increase. ii) The marina is located off the main marine traffic routes and it is fairly protected from waves and currents.	D	i) All vessels using the marina facilities are to ensure that they fully abide by all the Local and International Rules and Regulations appertaining to the Prevention of Pollution of the Sea. ii) Ensure that all berthing at the marina are thoroughly inspected prior to their initial call at the facility. iii) Carry out regular in-house routine operational training and safety drills, and also to participate in more comprehensive safety drills at the marina to train and re-train personnel in all emergency procedures. iv) Regular dialogue sessions between the Project Proponent and local fishermen should be done. These are to educate and inform the fishermen that fishing within the project area may pose risks. Regular feedback from both sides should be encouraged.	7-122

Key:

- X Insignificant and excluded from matrix
- T Impact that is potentially but on a temporary basis and will ensure equilibrium after certain period of time.
- M Impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.
- D Potentially significant adverse impact for which a design solution has been identified.
- R Residual and significant adverse impact
- E Significant environmental enhancement

**Table E22 (cont'd)** ► Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures on the Physical and Biological Environment

Project Components	Affected Environmental Components	Significant Potential Impacts	Magnitude of Significant Potential Impacts	Pollution Prevention and Mitigation Measures (P2M2s)	Reference Page
<b>4. Operational Phase (cont'd)...</b>	c) Land traffic dispersal	i) Trip generation during morning and evening peak hour are 10,725 and 14,922 vph respectively. ii) The existing road network would not be able to accommodate the future traffic demand.	D	i) Junction 1 will be widened to dual lane carriageway by Year 2021 and later on will be upgraded to 3 phases signalized junction by Year 2025. ii) Junction 2 will be widened to dual lane carriageway. Lorong Anak Air 2 and Lorong Anak Air 4 will be widened to single lane carriageway by Year 2025.	7-122 to 7-125
	d) Solid waste generation	i) Solid waste may originate from the commercial and business activities such as rubbish from packaging of materials and other wastes. ii) Dumping of wastes into the sea can pose significant risk to marine life. It also poses a threat to vessels in the waterways.	M	i) A sufficient number of covered garbage bins should be provided at suitable locations. ii) A well-planned municipal waste collection schedule should be prepared and implemented within the project development.	7-125
	e) Obstruction of Sea View	The sea view is a unique feature enjoyed by the locals of Tanjung Lumpur. The locals will have to get used to having buildings from the proposed development.	D	A boardwalk will be provided to allow visitors and local residents to enjoy the sea view.	7-125
	f) Infrastructure and Utilities	The newly created land will support many activities such as commercial, residential, recreational, institutional, health care and infrastructure facilities. It is anticipated that the newly created development will support approximately 25,000 people.	X	No mitigation measure is required.	7-125 to 7-126
<b>5. Abandonment Plan</b>	a) Temporary closure	i) Temporary closure of reclamation and dredging related activities cease with the intent of resuming activities in the future. ii) Design failures, financial challenges, political issues and extreme climatic conditions.	X	i) All construction machineries and equipment as well as vessels should be moved out from the reclamation site. ii) Unstable construction structures and solid wastes should be appropriately removed and disposed of. iii) All necessary safety signages should be put at strategic places and it should be clearly visible to the fishermen and other marine users especially at night. iv) Marked marine routes within the reclamation site should be installed to facilitate the marine users. v) Sufficient notice of abandonment plan should be given to the marine user such as the fishing community and tourism sector that use the coastal waters.	7-126 to 7-127
	b) Permanent closure	There is no intent to resume reclamation and dredging activities and the partially created land will remain as it is.	X	i) Project Proponent should notify the Marine Department and Kuantan Port Authority to give notice to mariners about the newly created land. ii) All permanent structures that could not be kept safe should be removed or demolished. iii) Construction of the perimeter bund should be fully completed. Any damages of the perimeter bund should be repaired. iv) Any bare exposed ground should be protected from surface erosion by turfing and revegetation.	7-126 to 7-127

**Key:**

- |   |   |   |   |
|---|---|---|---|
| X | Insignificant and excluded from matrix  | D | Potentially significant adverse impact for which a design solution has been identified. |
| T | Impact that is potentially but on a temporary basis and will ensure equilibrium after certain period of time.   | R | Residual and significant adverse impact   |
| M | Impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended. | E | Significant environmental enhancement   |

**Table E23** ► Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures on the Human Environment

Project Components	Affected Environmental Components	Significant Potential Impacts	Magnitude of Significant Potential Impacts	Pollution Prevention and Mitigation Measures (P2M2s)	Reference Page
1. Reclamation and dredging	a) Labour	Reclamation would require a large number of workers as the nature of work requires both in-shore and overland construction activities. As the reclamation is to be carried out in phases, the manpower requirements for reclamation in Phase 2a will be in the range of 500 workers during the peak of the reclamation works. The impact of the Project on the labour force will be significant – again, if at least 30% of the jobs generated are filled by the locals from within as well as from the surrounding study area. However, these job opportunities are temporary in nature and for a limited duration during the construction period.	D	<ul style="list-style-type: none"> <li>i) The boost in local employment would only be effective if a portion of the labour required is recruited from within the local area.</li> <li>ii) Recruitment of labour from among the locals would be most beneficial if taken from the unemployed source or new entrants to the labour market, and not pinching from other employments.</li> <li>iii) It should also be similarly applied to employing local contractors and sub-contractors who should be given priority in the selection process.</li> </ul>	7-127 to 7-128
	b) Livelihood	<ul style="list-style-type: none"> <li>i) Dredging activities would indirectly affect the livelihood of the local inshore fishermen until the construction is completed. The majority would not be as affected since they go out to fish further away from the shore.</li> <li>ii) It is to be noted that the transportation of dredged materials to the designated offshore disposal area could become a potential source in damaging fishing nets and traps.</li> <li>iii) Increased population size would bring about increased demand in basic goods and services.</li> </ul>	D	<ul style="list-style-type: none"> <li>i) The installation of silt curtain.</li> <li>ii) The boundary of the reclamation activities and dredger route should be marked with buoy markings.</li> <li>iii) Some form of compensation, where applicable, should be looked into and worked out with the affected parties through their representatives and should be settled accordingly and amicably.</li> <li>iv) Concerted arrangement should be made to involve the locals; otherwise the latter would stand to lose.</li> </ul>	7-128 to 7-129
	c) Safety	<ul style="list-style-type: none"> <li>i) Industrial accidents may have the potential to occur if the workers are not properly supervised and managed.</li> <li>ii) The additional marine traffic loads from the transportation of machineries and construction materials would make the marine traffic condition in the area stressful.</li> <li>iii) The navigation channel is also the main route taken by fishing boats to get in and out of Sungai Kuantan and the nearby Sungai Kuantan river mouth landing and berthing area.</li> <li>iv) They would be faced with potential safety threats if any of the dredging activities untowardly get in their way.</li> </ul>	D	<ul style="list-style-type: none"> <li>i) "Safety First" should always be stressed upon.</li> <li>ii) Marking the routes taken by the barges with buoys and lighting them at night.</li> <li>iii) Local fishing community should be informed of the scheduled trips of the barges by either disseminating the information to them or by displaying the timetable at strategic places so that it could easily be read by the fishermen.</li> <li>iv) Transportation of materials to and from the construction sites should be carried out during daylight hours only.</li> </ul>	7-129 to 7-130
	d) Base camp/ socio-cultural	<ul style="list-style-type: none"> <li>i) During occupation of the accommodation provided, crowding may occur not only on a per room basis but also in the overall arrangement of the lodging blocks which may tend to be close to one another.</li> <li>ii) The presence of foreign workers, probably numbering up to several hundreds and coexisting alongside the locals, could disrupt the cultural and racial balance of the area, thus transforming the social makeup of the area into a more cosmopolitan entity.</li> <li>iii) Other associated problems are those of social and health problems.</li> </ul>	X	<ul style="list-style-type: none"> <li>i) The condition of the base or workers' camps would have to fit into a certain decent living standard that provide well-ventilated space, basic amenities, proper sanitation and non-crowding.</li> <li>ii) The implication of social and cultural problems arising from accommodating foreign workers within one camp could be avoided if workers of different cultural backgrounds would be housed separately but sharing common facilities to promote social integration.</li> <li>iii) Racial clashes and other social problems could be avoided if workers' interests are looked after, cordial relationship maintained and cultural understanding and tolerance inculcated.</li> <li>iv) The emergence and rise of new strains of diseases, which had been associated with foreign workers, could be checked and overcome by having proper recruitment procedures and health screening before permission to work is granted.</li> </ul>	7-130 to 7-131

Key:

- X Insignificant and excluded from matrix
- T Impact that is potentially but on a temporary basis and will ensure equilibrium after certain period of time.
- M Impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.
- D Potentially significant adverse impact for which a design solution has been identified.
- R Residual and significant adverse impact
- E Significant environmental enhancement

**Table E23 (cont'd)** ► Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures No mitigation measure required.

Project Components	Affected Environmental Components	Significant Potential Impacts	Magnitude of Significant Potential Impacts	Pollution Prevention and Mitigation Measures (P2M2s)	Reference Page
1. Reclamation and dredging (cont'd)...	e) Tranquility and aesthetics	<ul style="list-style-type: none"> <li>i) Dredging activities may tend to look unsightly, especially with the use of the Cutter Suction Dredger which would be floating and working at the site throughout the construction period.</li> <li>ii) The surrounding waters would be murky and thus repulsive to onlookers. However, the visual impact is temporary while construction lasts.</li> <li>iii) The present natural panorama of the sea view fronting the coasts that stretch from Kampung Tanjung Lumpur where the KWRC Phase 1 is located to Kampung Anak Air where the KWRC Phase 2 ends would also be lost forever.</li> </ul>	X	<ul style="list-style-type: none"> <li>i) Noise pollution could be minimized by the deployment of good and well-maintained vehicles and machineries and also by restricting the working hours to end not later than 8 pm.</li> <li>ii) Exposed dry surfaces should be sprayed with water to prevent it from being blown away by surface wind.</li> </ul>	7-131
	a) Employment	<ul style="list-style-type: none"> <li>i) The impact on employment could be significant depending on the ratio of labour recruited from the local area or from an external area, with benefits accrued to the former if some are employed from there.</li> <li>ii) The impact of the external labour would be different depending on the number moving or not moving into the locality and those who move with or without family.</li> </ul>	D	<ul style="list-style-type: none"> <li>i) The proposed project should strive to have some local recruitment ratio for it to be relevant in the development of the area.</li> <li>ii) Targets for the proportion of local recruitment may be set. It is normally set for at least 30%. The potential local employment benefits can be encouraged through appropriate skills training programmes.</li> </ul>	7-133
2. Post-Reclamation and Operational Phase	b) Income and Revenue	<ul style="list-style-type: none"> <li>i) This is a definite positive remuneration and contribution to additional local earnings and from those spent locally which would contribute to additional local income.</li> <li>ii) If the percentage of total expenditure on goods and services (excluding labour) that would be spent in the local area in purchasing local goods and services is significant, then the local economy would thrive.</li> <li>iii) There are also rates such as assessment rates, quit rent, fees and royalties to be paid and these would create net change in local authority receipts pointing to surpluses or higher returns.</li> </ul>	D	For the local area to economically reap the full benefits from the proposed project should many opt to commute to work, a well-planned local centre to accommodate the working population should be developed together with the supporting services. As such, the economic impact could then be fully harnessed.	7-133 to 7-134
	c) Wider Multiplier Effects	<ul style="list-style-type: none"> <li>i) The workforce, which may be substantial (and well paid), can generate considerable retail expenditure in the locality on a whole range of goods and services.</li> <li>ii) The proposed project itself requires mixed supplies ranging from multiple tourism and health products to be supplied by local firms, to provisions for the canteen. These can also boost the local economy.</li> <li>iii) The additional workforce may demand other services locally such as health, education and housing, which may generate additional construction. These demands will create additional employment.</li> <li>iv) Overall, the net effect may be considerably larger than the original direct injection of jobs and income into the locality. Such wider economic impacts are considered as beneficial and long-term in nature.</li> </ul>	X	No mitigation measure is required.	7-133 to 7-134
	d) Demography, Housing and Other Services	<ul style="list-style-type: none"> <li>i) Increase in the population of the area and possibly changing the age, sex structure of the nearby local population as well as its nationality components.</li> <li>ii) Require accommodation or housing within reasonable commuting distance of the proposed Project site.</li> <li>iii) Place additional demands on a range of local services, including schools, health and recreational facilities, police and emergency services.</li> <li>iv) Financial implications for the local authorities in the area, with additional costs of service provision set against an increase in revenues.</li> </ul>	D	<ul style="list-style-type: none"> <li>i) To encourage the maximum recruitment of labour from within daily commuting distance of the project site, thereby reducing the number of workers and families from moving into the impact zone.</li> <li>ii) Providing additional accommodation for the workforce or to encourage the use of unoccupied or under-occupied accommodation into the impact zone, depending on the condition of the local housing and accommodation market, developer policy on site hostel and local authority's policies.</li> <li>iii) Provision of certain facilities by the developer such as a (in-house) medical centre, fire-fighting equipment and recreational facilities for the workforce.</li> </ul>	7-134

**Key:**

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>X Insignificant and excluded from matrix</li> <li>T Impact that is potentially but on a temporary basis and will ensure equilibrium after certain period of time.</li> <li>M Impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.</li> </ul> | <ul style="list-style-type: none"> <li>D Potentially significant adverse impact for which a design solution has been identified.</li> <li>R Residual and significant adverse impact</li> <li>E Significant environmental enhancement</li> </ul> |
|--|---|

**Table E23 (cont'd)** ► Summary of Potential Impacts, Their Magnitude and Proposed Pollution Prevention and Mitigation Measures on the Human Environment

Project Components	Affected Environmental Components	Significant Potential Impacts	Magnitude of Significant Potential Impacts	Pollution Prevention and Mitigation Measures (P2M2s)	Reference Page
2. Post-Reclamation and Operational Phase (cont'd)...	e) Socio-cultural	With a new population size living in the area, the magnitude of the social impacts could be enormous. Social and cultural conflicts and frictions may evolve if measures for cordial and harmonious living are not promoted.	X	i) Problems of integration and clash of lifestyles may lead to failure and disappointment. These could be avoided if the residential areas created would not be exclusively enclaved, with equal opportunities being opened for all to participate in the everyday doings and regular happenings in the local area or impact zone. ii) The role of the local authority and management body is crucial in seeing to the implementation of the events by involving all in whatever amenities provided and functions organised for the area. The creation of the feeling of oneness is important in determining that all members of the public would feel that they belonged. iii) With regards to the marginalization of the locals, it could be mitigated by identifying deserving local manpower to be recruited and trained for specific skills required by the multifaceted development in the area. In so doing, the locals could directly take part by contributing to and benefitting from the development of their area. iv) Alienation could also be overcome by ensuring the integration of the surrounding population with the new development through the provision of proper access, infrastructures and high level of connectivity within the area.	7-134
	f) Lifestyle	i) There would be a creation of a bipolar society – the well-to-dos (among the salaried workers) and the not-so-well-to-dos (generally among non-salaried workers) between the KWRC development area and the surrounding area. ii) Different lifestyles would also appear within the KWRC development area itself where development has a ready creation of a mixed development of not only physical in nature but for different social levels too.	D	The role of the KWRC management body is crucial in seeing to its implementation by involving all in whatever amenities provided and functions organised for the area.	7-135
	g) Aesthetics	The natural panorama of the sea view fronting the coasts that stretch from Kampung Tanjung Lumpur where the KWRC Phase 1 is located to Kampung Anak Air where the KWRC Phase 2 ends would be lost forever. The new structures may have their own charms and the aesthetic value of the sea front would be in the eyes of the beholders. Their presence may actually help to attract different type of patrons, visitors or tourists who have a preference for such coastal urban structures.  However, it must also be acknowledged that the creation of the extended land would definitely alter the map of the Pahang coasts, albeit in the vicinity of Sungai Kuantan river mouth, altogether.	X	No mitigation measure is required.	7-135

Key:

- X Insignificant and excluded from matrix
- T Impact that is potentially but on a temporary basis and will ensure equilibrium after certain period of time.
- M Impact that is potentially significant but about which there is insufficient data to make a reliable prediction. Close monitoring and control is recommended.
- D Potentially significant adverse impact for which a design solution has been identified.
- R Residual and significant adverse impact
- E Significant environmental enhancement

## 7.1 Residual Impacts

Residual impacts refer to the net environmental impacts after proper mitigation measures have been implemented. It can be envisaged that the remaining impacts would be as follows:

- i) Erosion and sedimentation;
- ii) Increasing marine traffic;
- iii) Increasing land traffic;
- iv) Changes in viewscape; and
- v) Impact on socio-economy.

## 7.2 Project Evaluation

### 7.2.1 Valuation of Significant Change in Environmental Services

Of the eight (8) potential changes in environmental services as listed in *Table E24*, three (3) are considered to be significant enough for evaluation. These are:

- i) Loss of mudflat due to reclamation;
- ii) Loss of mudflat due to capital and maintenance dredging; and
- iii) Loss of fishing ground access to sea (higher cost of fishing effort).

### 7.2.2 Overall Assessment

When discounted at the rate of 8%, the total present value of the stream of annual loss amounts to RM28.9 million over a period of 50 years. The corresponding values for 6% and 4% discount rates are RM36.5 million and RM48.8 million respectively. This study notes that the sum should not be construed as indicating Project feasibility. Rather, they provide some indication of the magnitude, in monetary terms, of the reduction in the flow of environmental services as a result of the implementation of the Project over the evaluation period.



**Table E24** ► Environmental Services Potentially Affected by the Proposed Project

No.	Environmental Components	Environmental Services Affected	Location and Impacted Individuals/Communities	Spatial Extent	Remarks
1.	<b>Marine biology</b> - Loss of mudflat due to reclamation.	Permanent loss is expected for the entire mudflat making up the footprint of the reclamation site. This mudflat serves as crustacean feeding ground and macrobenthos habitat. This activity will result in some loss in the amount of resources important to support marine life since such area serves as habitat for benthos and feeding ground for fishes.	The exact location of the reclamation boundary is shown in <i>Chapter 5 (Figure 5.5)</i> of this EIA report. Fishermen and local communities deriving benefits from the marine resources will likely be impacted.	A total of 273.57 hectares will be reclaimed. A significant part of this area (approximately 156.2 hectares) is mudflat that will be lost, as shown in <i>Figure 7.46</i> .	Total loss of mudflat. The productivity loss method is used to evaluate the loss in environmental services and functions.
2.	<b>Marine biology</b> - Loss of mudflat due to capital and maintenance dredging.	Temporary loss is expected for the entire would-be-dredged mudflat. This mudflat serves as crustacean feeding ground and macrobenthos habitat. The dredging activity will result in some loss in the amount of resources important to support marine life since such area serves as habitat for benthos and feeding ground for fishes.	The exact locations of the reclamation and dredging boundaries are shown in <i>Chapter 5 (Figures 5.5 and 5.7 respectively)</i> of this EIA report. Generally, the mudflat is located at the navigation channel, lagoon, canal, inner marina, outer marina, cruise terminal and turning basin. Fishermen and local communities deriving benefits from the marine resources will likely be impacted.	Although 845 hectares will be dredged, the area involving mudflat is approximately 80.8 hectares as depicted in <i>Figure 7.46</i> .	Initial loss of mudflat habitat during dredging work. The hydraulic modelling results indicate that the frequency of dredging required is about once a year. Marine organisms are not expected to recover fully during the intervening period between dredging works. A three-year full-recovery period is assumed, suggesting an average productivity of about one-sixth for the year following dredging work. However, because of the frequency of dredging and hence frequent/repeated disruptions to the mudflat habitat, the loss in environmental services is considered total and permanent. The productivity loss method is used to evaluate the loss in environmental services and functions.
3.	<b>Terrestrial biology</b> - Potential reduction in environmental services obtainable from mangrove area due to sedimentation and erosion.	Loss of mangrove area, thus resulting in some loss in the amount of resources important to support marine life. Mangrove areas are known to provide environmental services including: <ul style="list-style-type: none"> <li>■ Production of charcoal and poles;</li> <li>■ Provision of feeding and breeding grounds for shrimp, fish, crab and mollusc;</li> <li>■ Provision of traditional goods;</li> <li>■ Carbon sequestration function;</li> <li>■ Shoreline protection; and</li> <li>■ Option, existence and biodiversity value.</li> </ul>	Kuantan mangrove forest on the southern bank of Sungai Kuantan. Fishermen and local communities deriving benefits from the marine resources as well as the general population that benefit from carbon sequestration function will likely be impacted.	Results of hydraulic modelling show that the impact due to sedimentation and erosion is negligible or undetectable.	Since no impact is expected, no valuation is necessary.
4.	<b>Socio-economy</b> - Loss of fishing ground and hindrance of access to the sea.	Reduction in the size of fishing ground because part of the sea will be reclaimed. The reclamation will force the fishermen to find alternative fishing ground/s, potentially increasing their operational cost. The reclaimed land mass and terminal will also hinder direct movements of coastal fishing vessels. Thus some fishermen will incur additional cost when going to and coming back from the fishing ground.	The reclaimed area is as stated in the <i>Chapter 5 (Section 5.3.2)</i> of this EIA report. The directly affected stakeholders are the coastal (Zone A) fishermen operating from six jetties identified in the study area namely, Kampung Tanjung Lumpur, Kampung Tanjung Api, Kampung Peramu, Kampung Selamat, Kampung Anak Air and Kampung Kempadang. Fishermen in these areas operate around 110 vessels.	All of the reclaimed area.	Fishermen who routinely fish in the affected area will have to find other locations. The additional cost of fishing involves the increase in cost of travelling to and from the alternative fishing ground. They may have to travel further away because conflict may arise as they are encroaching into traditional fishing grounds of existing fishermen.

Table E24 (cont'd) ► Environmental Services Potentially Affected by the Proposed Project

No.	Environmental Components	Environmental Services Affected	Location and Impacted Individuals/Communities	Spatial Extent	Remarks
5.	<b>Water quality</b>	An increase in suspended TSS during reclamation and dredging works that reduces the quality and therefore productivity of marine habitat.	Coastal waters around reclaimed land and the dredging work area.	With the installation of silt curtain during reclamation and dredging, the extent of impact is confined to the narrow strip between the silt curtain and the perimeter bund (in the case of reclamation) and the confined dredging work area that will be done in stages.	Mitigating measures through the installation of silt curtain during reclamation and dredging works will render the impact insignificant. Pelagic and demersal fish will be able to avoid unfavourable conditions. No valuation is therefore necessary. However, please refer to the impacts of dredging and reclamation works on marine biology.
6.	<b>Coastal morphology</b>	Erosion and sedimentation due to the introduction of reclaimed land to the existing coastal area.	Hydraulic modelling results show that erosion and sedimentation impacts occur mostly within the proposed project site such as the navigation channel, lagoon and marina area. Outside of the project site, sedimentation of 1.2m/year is expected in front of the river mouth of Sungai Kuantan and erosion along a 1km coastal area immediately south of the project site.	The bed level changes induced by the various development scenarios are localized in or within the immediate vicinity of the project area.	Sedimentation at the river mouth of Sungai Kuantan will be mitigated through annual maintenance dredging of the navigation channel. The expected erosion of the 1 km coastal zone will be mitigated by implementing a beach nourishment programme as proposed in <i>Chapter 8 (Figure 8.24)</i> . No valuation is therefore necessary.
7.	<b>Recreational services</b>	Impact on certain areas that reduces the value of recreational services.	Potential areas that may be impacted include Teluk Cempedak (a nationally-known recreational beach) and the lesser-known Tanjung Tembeling (where a resort is located). Visitors who benefit from the recreational services are the directly impacted stakeholders.	The beach areas of Teluk Cempedak and Tanjung Tembeling.	The hydraulic modelling results showed that the two areas will not be impacted by an increase in suspended sediment, potential erosion or accretion. No valuation is therefore necessary.
8.	<b>Aesthetics</b>	Change in the form of <b>intrusion</b> of man-made structures into the <b>view scape</b> following project completion.	Areas surrounding the reclaimed land. Coastal villagers and visitors to where the newly reclaimed land is visible will likely be impacted. As will fishermen plying close by, who will see the reclaimed land and built infrastructure.	The shore area where the reclaimed land plus built structures are visible.	The direction of impact of the project on aesthetics is uncertain since it is hard to argue with certainty that the project will give rise to negative impact on the general aesthetics of the area. It will not be surprising if some people may even consider the project, once completed, to actually enhance the aesthetic quality of the area.

## 8. Environmental Management Plan (EMP)

The proposed environmental monitoring programme can be divided into four (4) types of monitoring:

- i) Land-Disturbing Pollution Prevention and Mitigation Measures (LDP2M2)
- ii) Performance monitoring (PM);
- iii) Compliance monitoring (CM);
- iv) Impact monitoring (IM); and
- v) Environmental Auditing.

### 8.1 Land-Disturbing Pollution Prevention and Mitigation Measures (LDP2M2)

The Best Management Practice (BMP) proposed is to provide sufficient temporary drains at the working area. Monitoring of BMPs shall consist of visual inspection to ensure that it has been implemented and maintained as well as to evaluate whether additional BMPs are required.

### 8.2 Performance Monitoring (PM)

Performance monitoring (PM) is to prevent system function failures and to ensure that it is working properly and optimally. For this project, the PM is required in maintaining silt curtains and vessels operation.

### 8.3 Compliance Monitoring (CM)

Compliance monitoring (CM) programme for this project includes water, sediment, air and noise. The CM will be conducted on monthly or quarterly basis.

### 8.4 Impact Monitoring (IM)

Impact monitoring, namely bathymetric survey will be done during and after the completion of the project to assess the impact of bed level changes as results of the reclamation and dredging activities.

### 8.5 Environmental Auditing

An environmental audit will be carried out based on the Environmental Audit Guidance Manual published by the DOE. It will be done by a 3rd party Auditor registered with the DOE as well as Certified Erosion, Sediment and Storm Water Inspector (CESSWI).

A summary of the overall proposed environmental monitoring programme is listed in *Table E25*.

**Table E25** ▶ Proposed Environmental Monitoring Programme

Item	Parameter	Monitoring Stations	Sampling Frequency	Environmental Quality Criteria	Reporting Requirement
Water quality	Temperature, Salinity, pH, Conductivity, Turbidity, DO, BOD, TOC, TSS, and Oil and Grease, AN, Phosphate, Nitrate, Heavy Metals, Faecal Coliform, <i>E.coli</i> , <i>Enterococci</i> .	As per Table 6.4 and Figure 6.30, Chapter 6 – Existing Environment	Monthly	Results will be compared with the baseline and Malaysia Marine Water Quality Criteria and Standard (MWQCS)	Report to be submitted to DOE monthly and quarterly.
Sediment quality	Zinc, Nickel, Copper, Chromium, Lead, Arsenic, Cadmium.	As per Table 6.8 and Figure 6.31, Chapter 6 – Existing Environment	Quarterly	Results will be compared with the baseline and US EPA Standard.	Report to be submitted to DOE quarterly
Air quality	TSP, PM <sub>10</sub> , PM <sub>2.5</sub> .	As per Table 6.12 and Figure 6.32, Chapter 6 – Existing Environment	Quarterly	Results will be compared with the baseline and Recommended Malaysian Air Quality Guidelines (RMAQG).	Report to be submitted to DOE quarterly
Noise	L <sub>min</sub> , L <sub>max</sub> , L <sub>10</sub> , L <sub>50</sub> , L <sub>90</sub> , L <sub>eq</sub> (24 hours profile).	As per Table 6.17 and Figure 6.33, Chapter 6 – Existing Environment	Quarterly	Results will be compared with the baseline and DOE's "Interim Guidelines for Maximum Permissible Sound Levels by Receiving Land Use" (Schedule 1).	Report to be submitted to DOE quarterly

**Table E25 (cont'd) ▶ Proposed Environmental Monitoring Programme**

Item	Parameter	Monitoring Stations	Sampling Frequency	Environmental Quality Criteria	Reporting Requirement
Environmental Audits	To audit the compliances with the EIA approval conditions and the relevant environmental regulations and guidelines.	The whole project's implementation and its activities.	Quarterly	Environmental Audits should be carried out by a third party Environmental Auditor (registered with DOE).	Report to be submitted to DOE quarterly.
Bathymetric Survey	Near shore and bed level change.	As per <i>Figure 8.1</i> .	<ul style="list-style-type: none"> <li>▪ Once every three (3) months during the construction phase</li> <li>▪ Once every six (6) months during the post construction phase</li> </ul>	Results will be compared to the baseline condition.	Report to be submitted to DID not later than three (3) months after the completion of each survey.

## 9. Study Findings

From the overall assessment, it can be concluded that the implementation of the Project is expected to cause minimal impacts on the environment, particularly on social environment. However, continuous commitment is required from the Project Proponent in implementing all mitigation measures proposed so that this development will be beneficial not only for the Project Proponent but also for the locals as well as the State of Pahang.



---

## Ringkasan Eksekutif

# Kandungan

<b>1.</b>	<b>Pengenalan</b>	1
	1.1 Tajuk Projek	1
	1.2 Penggerak Projek dan Perunding EIA	1
	1.3 Lokasi Projek	2
	1.4 Kronologi Projek	5
	1.5 Pendekatan Kajian EIA	7
	1.5.1 Polisi	7
<b>2.</b>	<b>Terma Rujukan</b>	7
<b>3.</b>	<b>Keperluan Projek</b>	7
	3.1 Mempromosikan Sektor Pelancongan	8
	3.2 Menyokong Pelan Pembangunan dan Strategi Kerajaan	8
	3.2.1 Rancangan Tempatan Daerah Kuantan Pindaan 2013 - 2015	8
	3.2.2 Rancangan Struktur Negeri Pahang 2002 - 2020	8
	3.2.3 Wilayah Ekonomi Pantai Timur (ECER)	8
	3.2.4 Rancangan Fizikal Negara ke-2 (NPP-2)	9
	3.3 Menyumbang kepada Pendapatan Negeri / Persekutuan dan Meningkatkan Taraf Hidup dan Kelestarian	9
	3.4 Pembangunan Infrastruktur dan Logistik yang Moden	9
	3.5 Mewujudkan Peluang Pekerjaan dan Perniagaan yang Baru	9
	3.6 Mengatasi Masalah Hakisan di epanjang Persisiran Pantai Tanjung Lumpur	10
	3.7 Penambahbaikan kepada Sungai Kuantan dan Masalah Pemandapan di Muara Sungai Kuantan	10
<b>4.</b>	<b>Pilihan Projek</b>	11
	4.1 Dengan Projek	11
	4.2 Tanpa Projek	11



<b>5.</b>	<b>Keterangan Projek</b>	<b>13</b>
5.1	Kawasan Tapak Projek	13
5.1.1	Persisiran Pantai Utara (Muara Sungai Kuantan - Tanjung Pelindung Tengah)	13
5.1.2	Persisiran Pantai Tengah (Kampung Tanjung Lumpur)	13
5.1.3	Persisiran Pantai Selatan (Kampung Anak Air - Kampung Baharu)	13
5.2	Konsep Projek	15
5.3	Komponen Projek	15
5.3.1	Pembersihan Tanah Sedia Ada	15
5.3.2	Penambakan	15
5.3.3	Pengerukan	18
5.4	Fasa Projek	18
5.5	Aktiviti Projek	22
5.5.1	Tinjauan Pra-pembinaan	22
5.5.2	Pembersihan Tanah Sedia Ada	22
5.5.3	Penambakan dan Pengerukan	23
5.5.3.1	Pemasangan Boya Penanda Sempadan	23
5.5.3.2	Pengangkutan Batuan	23
5.5.3.3	Pembinaan Benteng Perimeter Batuan	23
5.5.3.4	Pengerukan di Muara Sungai Kuantan, Alur Pelayaran dan Kawasan Pinggiran Laut di Kawasan Tambakan	23
5.5.3.5	Fill Material Transportation	24
5.5.3.6	Perletakan Bahan Isian Tambakan	24
5.5.3.6.1	Pemasangan Tirai Kelodak	26
5.5.3.7	Rawatan Bahan Isian Tambakan	26
5.5.3.8	Pembinaan Struktur Pelindung Pantai	26
5.5.4	Pelupusan Bahan Kerukan	26
5.5.5	Kawasan Sumber Pasir	28
5.6	Pasca Penambakan (Pembangunan atas Tanah Tambakan	29
<b>6.</b>	<b>Persekitaran Fizikal Sedia Ada</b>	<b>31</b>
6.1	Keadaan Fizikal Sedia Ada	31
6.1.1	Batimetri	31
6.1.2	Aliran Arus	32
6.1.3	Ombak	32
6.1.4	Pengangkutan Sedimen	32
6.1.4.1	Pengangkutan Kohesif (Lumpur)	33
6.1.4.2	Pengangkutan Tidak Kohesif (Pasir)	33
6.1.5	Morfologi Persisiran Pantai	33
6.1.6	Ciri-ciri Tanah	33
6.1.6.1	Seksyen 1: BH1 dan BH7	34
6.1.6.2	Seksyen 2: BH1 dan BH8	34
6.1.6.3	Seksyen 3: BH2, BH3 dan BH4	35
6.1.7	Iklim dan Meteorologi	35
6.1.7.1	Banjir	35
6.1.7.2	Angin	35
6.1.8	Hidrologi dan Saliran	35
6.1.9	Guna Tanah	37

6.1.10	Kualiti air	37
	6.1.10.1 Kualiti Air Payau	39
	6.1.10.2 Kualiti Air Marin	39
6.1.11	Kualiti Sedimen	40
6.1.12	Kualiti Udara	41
6.1.13	Hingar	42
6.1.14	Gegaran	42
6.1.15	Trafik Marin	43
	6.1.15.1 Laluan Pelayaran Sedia Ada	4
	6.1.15.2 Kawasan Berlabuh Sedia Ada	44
	6.1.15.3 Aktiviti Marin dan Kemudahan Sedia Ada	44
	6.1.15.3.1 Aktiviti Perikanan	44
	6.1.15.3.2 Pelabuhan Kuantan	44
6.1.16	Trafik Darat	45
6.2	Persekitaran Biologi Sedia Ada	46
	6.2.1 Flora Terrestrial (Bakau)	46
	6.2.2 Fauna Terrestrial (Burung)	46
	6.2.3 Persekitaran Biologi Marin	47
	6.2.3.1 Fitoplankton	47
	6.2.3.2 Zooplankton	47
	6.2.3.3 Makrobentos	47
	6.2.3.4 Ikan dan Sumber Perikanan	47
6.3	Persekitaran Sosio-ekonomi Sedia Ada	48
	6.3.1 Profil Komuniti	50
	6.3.1.1 Latar Belakang Demografi Responden	50
	6.3.1.2 Profil Sosio-ekonomi Responden	51
	6.3.2 Keputusan Kajian Mengenai Pandangan dan Persepsi	51
	6.3.2.1 Tahap Kesedaran Terhadap Projek	51
	6.3.2.2 Persepsi Terhadap Pembangunan Cadangan	51
	6.3.2.3 Persepsi Terhadap Kesihatan dan Keselamatan	52
	6.3.2.4 Perception Terhadap Estetik dan Budaya	53
	6.3.2.5 Penilaian dan Penerimaan Projek	53
	6.3.3 Komuniti Nelayan dalam Kawasan Kajian	55
	6.3.4 Maklumbalas daripada Perbincangan Kumpulan Sasaran	56
	6.3.5 Maklumbalas daripada Sesi Dialog Umum	56
6.4	Kawasan Sensitif Alam Sekitar (KSAS)	57
	6.4.1 Hutan Simpan Kuantan	59
	6.4.2 Hutan Simpan Beserah	59
	6.4.3 Hutan Bakau (Sungai Kuantan)	59
	6.4.4 Pantai Teluk Cempedak	59
	6.4.5 Sungai Kuantan	59
	6.4.6 Sungai Galing	59
	6.4.7 Jambatan Tanjung Lumpur	60
	6.4.8 Tanjung Tembeling	60
	6.4.9 Kawasan Penempatan	60

<b>7.</b>	<b>Penilaian Impak dan Langkah-Langkah Kawalan bagi Persekitaran Fizikal, Biologi dan Sosio-ekonomi</b>	<b>60</b>
7.1	Sisa-sisa Impak	78
7.2	Penilaian Projek	78
7.2.1	Penilaian Perubahan Khidmat Alam Sekitar	78
7.2.2	Penilaian Keseluruhan	78
<b>8.</b>	<b>Pelan Pengurusan Alam Sekitar (EMP)</b>	<b>81</b>
8.1	Langkah Kawalan dan Pencegahan Pencemaran untuk Tanah Terganggu (LDP2M2)	81
8.2	Pemantauan Prestasi (PM)	81
8.3	Pemantauan Pematuhan (CM)	81
8.4	Pemantauan Impak (IM)	81
8.5	Audit Alam Sekitar	81
<b>9.</b>	<b>Kesimpulan</b>	<b>84</b>

# Rajah

Rajah R1	Lokasi Cadangan Projek di Kuantan, Pahang
Rajah R2	Lokasi Projek di Tanjung Lumpur, Kuantan
Rajah R3	Titik Koordinat bagi Kawasan Cadangan Projek
Rajah R4	Cadangan Kawasan Penambakan dan Pengerukan
Rajah R5	Kawasan Cadangan Pengerukan
Rajah R6	Kawasan Tapak Projek
Rajah R7	Koordinat Sempadan Kawasan Pembersihan Tanah Sedia Ada
Rajah R8	Koordinat Sempadan Kawasan Penambakan
Rajah R9	Cadangan Kedalaman untuk Kawasan Pengerukan
Rajah R10	Koordinat Sempadan Kawasan Pengerukan
Rajah R11	Fasa Projek
Rajah R12	Turutan Aktiviti Projek yang Utama
Rajah R13	Urutan Kerja Penambakan
Rajah R14	Kawasan Cadangan Pelupusan
Rajah R15	Kawasan Sumber Pasir dari Kuala Sungai Pahang
Rajah R16	Pelan Induk Konsep Keseluruhan Pembangunan atas Tanah Tambakan
Rajah R17	Peta Batimetri No. 1379
Rajah R18	Tinjauan Batimetri (Jun 2013)
Rajah R19	Lokasi dan Keratan Rentas Lubang Gerudi
Rajah R20	Kawasan Tadahan Air di Kawasan Projek
Rajah R21	Stesen Persampelan Kualiti Air
Rajah R22	Stesen Persampelan Kualiti Sedime
Rajah R23	Stesen Persampelan Kualiti Udara
Rajah R24	Stesen Persampelan Hingar
Rajah R25	Stesen Persampelan Gegaran
Rajah R26	Zon Perikanan di Malaysia (kecuali Kedah, Pulau Pinang, Perak dan Selangor)
Rajah R27	Kawasan Kajian Meliputi 5 km Radius
Rajah R28	Penilaian Responden Terhadap Projek
Rajah R29	Penerimaan Responden terhadap Projek
Figure R30	Kawasan Sensitif Alam Sekitar

# Jadual

Jadual R1	Kronologi Projek
Jadual R2	Pematuhan Projek terhadap Polisi
Jadual R3	Anggaran Peluang Pekerjaan
Jadual R4	Cadangan Pilihan Rekabentuk Penambakan
Jadual R5	Jangkaan Tempoh Projek
Jadual R6	Anggaran Isipadu Bahan Tambakan
Jadual R7	Rumusan Aktiviti Pengerukan
Jadual R8	Anggaran Isipadu Bahan yang akan Dikeruk
Jadual R9	Koordinat lubang gerudi
Jadual R10	Mukim dan Blok Perancangan bagi Daerah Kuantan
Jadual R11	Parameter Kualiti Air
Jadual R12	Parameter Kualiti Sedimen
Jadual R13	Bilangan Kapal Dagang yang Berlabuh di Pelabuhan Kuantan
Jadual R14	Taburan Responden Mengikut Penempatan di Kawasan Cadangan Projek
Jadual R15	Tahap Kesedaran dan Pengetahuan Responden tentang Projek (%)
Jadual R16	Persepsi Responden tentang Kelebihan dan Kekurangan yang akan dibawa oleh Projek (% Setuju)
Jadual R17	Peratusan Persepsi terhadap Kesihatan dan Keselamatan
Jadual R18	Peratusan Persepsi terhadap Estetik dan Budaya (% Setuju)
Jadual R19	Sebab Responden Bersetuju atau Tidak Bersetuju dengan Cadangan Projek (%)
Jadual R20	Persepsi Nelayan terhadap Penambakan
Jadual R21	Senarai Lokasi KSAS di dalam kawasan Projek
Jadual R22	Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Fizikal dan Biologi
Jadual R23	Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Sosio-ekonomi
Jadual R24	Kesan Potensi Khidmat Alam Sekitar
Jadual R25	Cadangan Program Pemantauan Alam Sekitar

# Ringkasan Eksekutif

## 1. Pengenalan

### 1.1 Tajuk Projek

Laporan Penilaian Impak Alam Sekitar (EIA)(Jadual Kedua) yang disediakan ini adalah bagi projek yang bertajuk "**Penilaian Impak Alam Sekitar (Jadual Kedua) bagi Cadangan Penambakan Tanah dan Pengerukan untuk Kuantan Waterfront Resort City (KWRC), Kuantan, Pahang**" (selepas ini dirujuk sebagai "**Projek**" atau "**KWRC**").

### 1.2 Penggerak Projek dan Perunding EIA

Alamat dan butiran mengenai Penggerak Projek adalah seperti berikut:

**Ideal Heights Development Sdn. Bhd.**

No. 1 & 2, Jalan Bukit Idaman 8/1,  
Bukit Idaman, P.O. Box 20,  
68100 Batu Caves,  
Selangor Darul Ehsan.

Nama : Mr. Heap Wei Guan, *Managing Director*  
Alamat email : wg\_heap@yahoo.com  
Telefon : +603 - 6138 6102  
Faksimili : +603 - 6138 7890

Penggerak Projek telah melantik Dr. Nik & Associates Sdn. Bhd. untuk menjalankan kajian EIA. Butiran adalah seperti berikut:

**Dr. Nik & Associates Sdn. Bhd.**

No. 22 & 24, Jalan Wangsa Delima 6,  
Kuala Lumpur Suburban Centre (KLSC),  
Section 5, Pusat Bandar Wangsa Maju,  
53300 Kuala Lumpur.

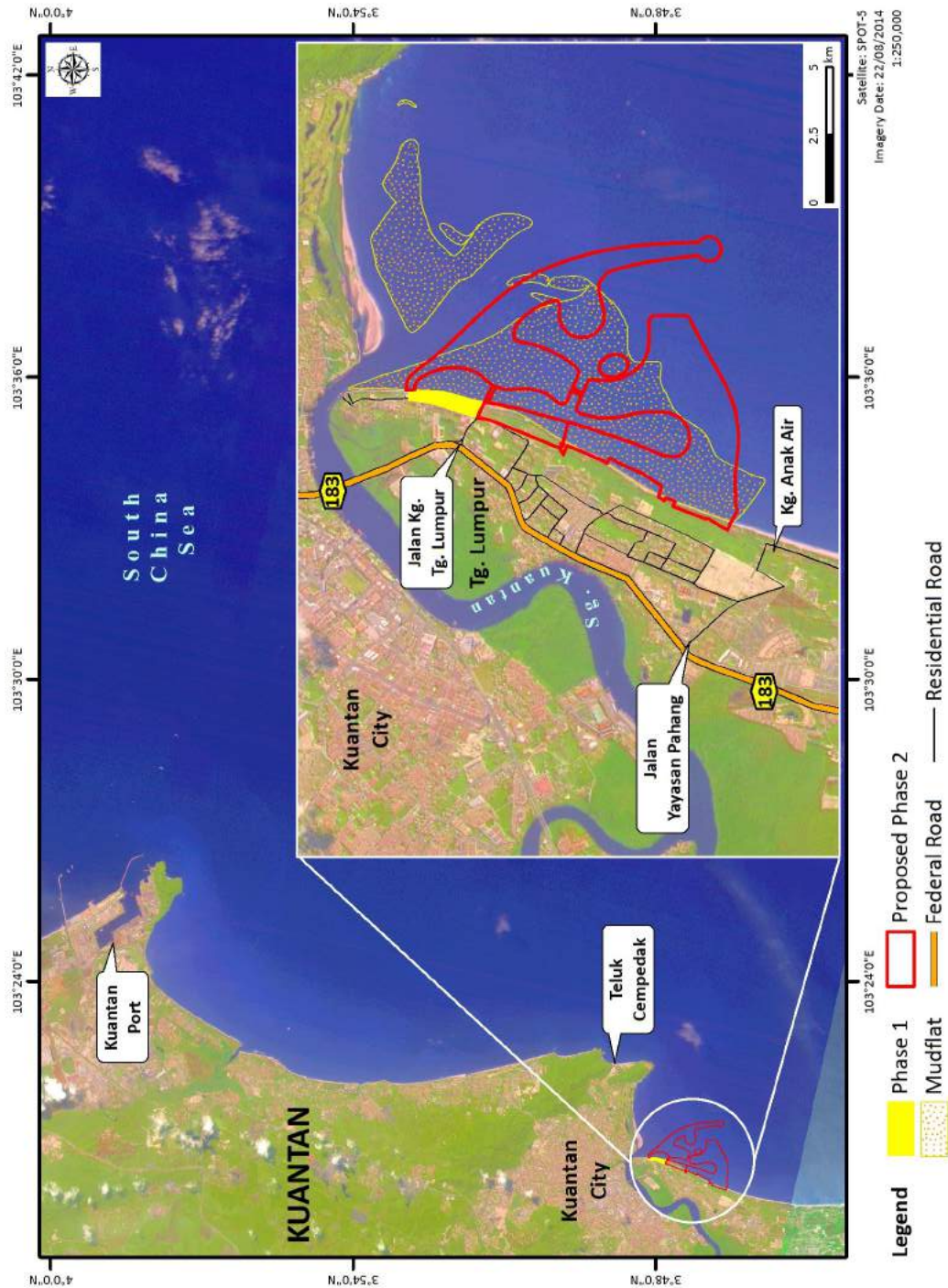
Nama : Rosniza Ramli, *Study Team Leader* (EIA Study)  
Alamat email : rosniza@drnik.com.my  
Telefon : +603 - 4145 8888  
Faksimili : +603 - 4145 8877

### 1.3 Lokasi Projek

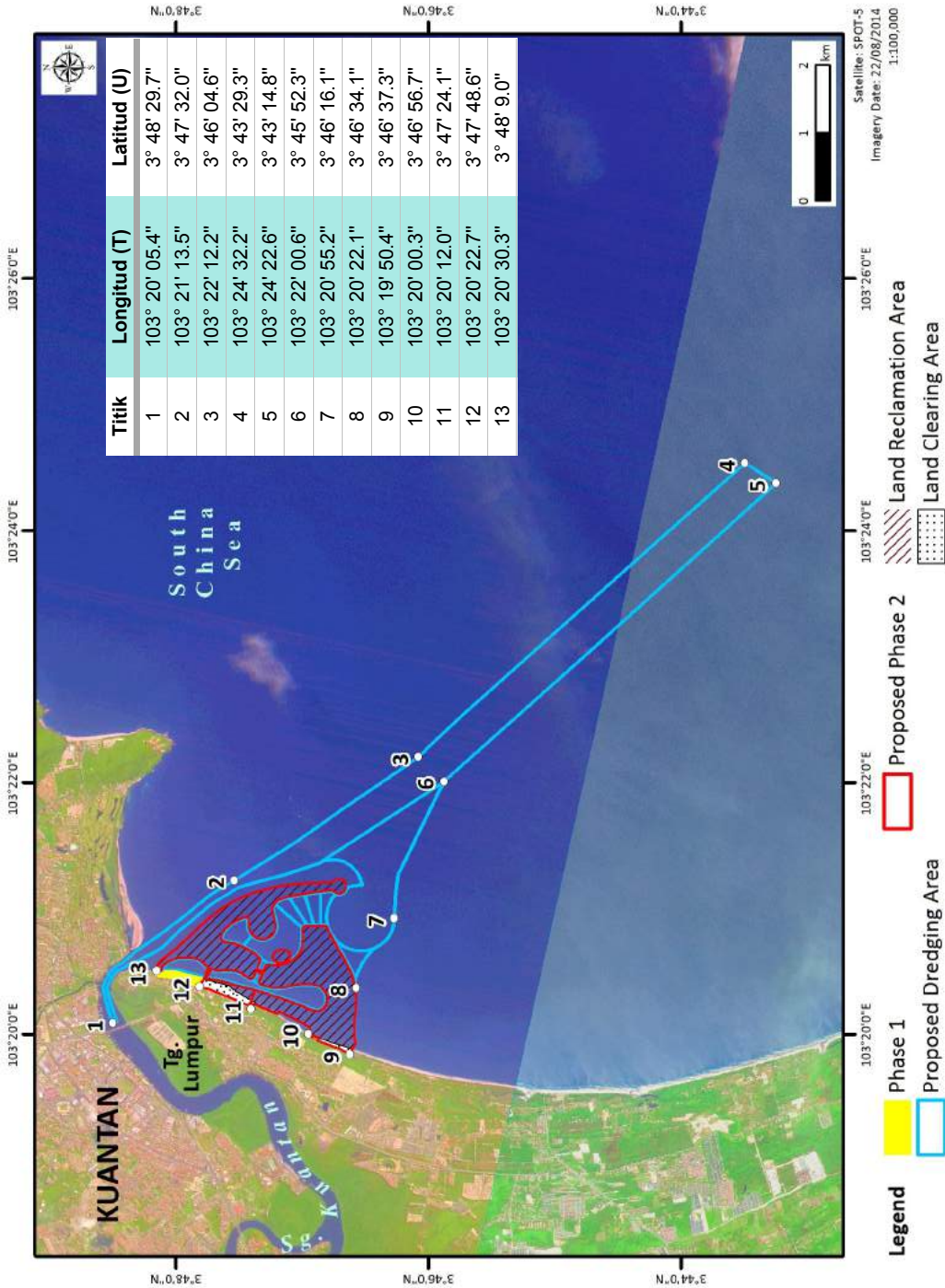
Ideal Heights Development Sdn. Bhd. bercadang untuk melaksanakan pembangunan bercampur yang melibatkan penambakan tanah di Tanjung Lumpur, Kuantan (*Rajah R1*). Projek cadangan ini terletak di atas dataran lumpur iaitu di sepanjang tiga (3) kilometer pantai Tanjung Lumpur. Projek ini bersempadan dengan pembangunan KWRC Fasa 1 di bahagian utara, manakala Kampung Anak Air di selatan Projek (*Rajah R2*). The Projek ini juga terletak 2 km dari arah timur bandar Kuantan dan 4 km di selatan Teluk Cempedak. Pelabuhan Kuantan terletak kira-kira 11 km di arah utara Projek. Lokasi projek juga terletak lebih kurang 300 m dari muara Sungai Kuantan dan alur pelayarannya adalah selari dengan sempadan utara tapak Projek. Koordinat bagi kawasan Projek ditunjukkan dalam *Rajah R3*.



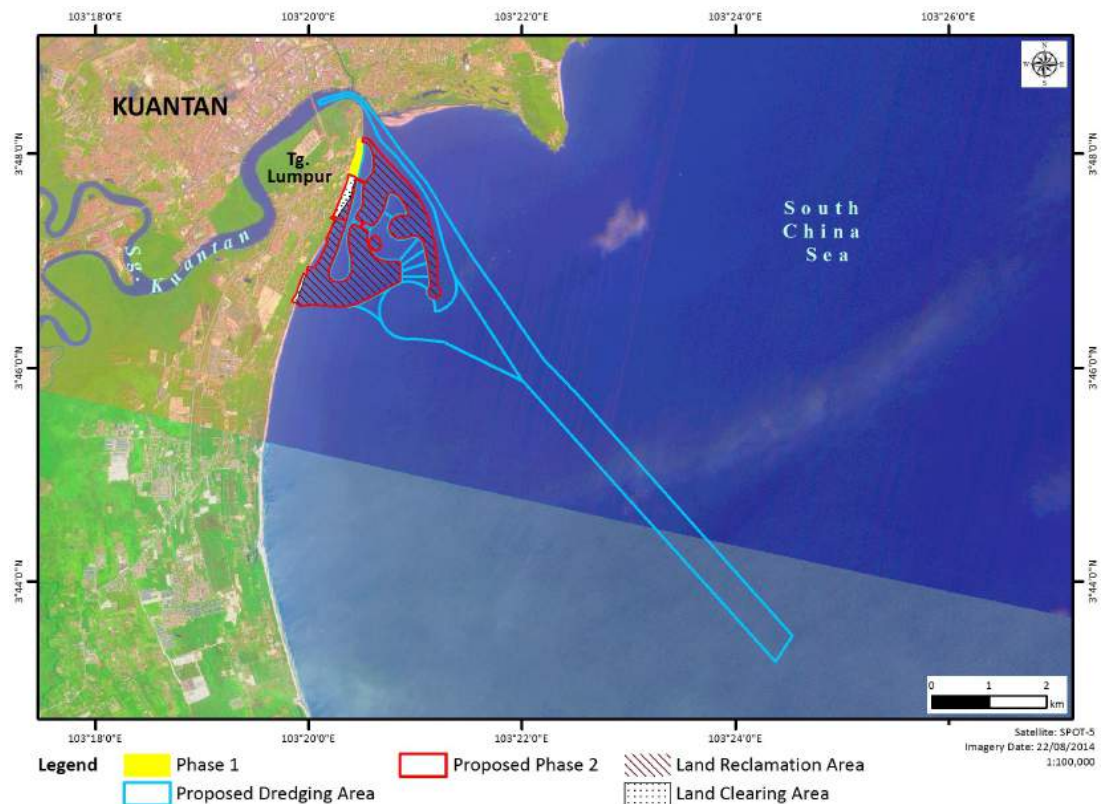
**Rajah R1** ► Lokasi Cadangan Projek di Kuantan, Pahang







Projek yang dicadangkan ini juga akan membawa kepada penambahbaikan muara Sungai Kuantan. Penggerak Projek memberi komitmen untuk mengeruk muara dan alur pelayaran. Bahan kerukan yang sesuai akan digunakan sebagai bahan tambakan. Rekabentuk kawasan penambakan dan pengerukan yang dicadangkan ditunjukkan dalam *Rajah R4*.



**Rajah R4** ► Cadangan Kawasan Penambakan dan Pengerukan

#### 1.4 Kronologi Projek

Oleh kerana projek ini melibatkan penambakan dan pengerukan, projek ini telah dibentangkan kepada beberapa agensi persekutuan dan negeri untuk mendapatkan kelulusan. Kronologi projek adalah seperti dalam *Jadual R1*.

**Jadual R1** ► Kronologi Projek

<b>Tarikh</b>	<b>Perkara</b>
13 Januari 2012	Kerajaan Negeri Pahang telah menganugerahkan kepada Newston International Group Sdn. Bhd. (Newston) untuk menambak kawasan seluas 500 ekar di luar pantai Tanjung Lumpur, Kuala Kuantan.
18 Oktober 2012	Majlis menandatangani perjanjian antara Kerajaan Pahang dan Newston, telah disaksikan oleh DYMM Sultan Pahang.
5 Jun 2013	Pelantikan Perunding Kajian EIA dan Kajian Hidraulik (Dr. Nik & Associates Sdn. Bhd.).
6 November 2013	Kajian PEIA Fasa 1 KWRC telah diluluskan oleh Jabatan Alam Sekitar (JAS) Pahang (Ruj: AS: C50/013/700/022(44).
17 Julai 2014	Kelulusan Penilaian Awal Tapak (PAT) bagi Fasa 2 KWRC.
21 November 2014	Kerajaan Negeri Pahang telah bersetuju untuk merezabkan kawasan seluas 1,168 ekar untuk pembangunan KWRC, dengan keluasan hakmilik tidak melebihi 500 ekar.
Awal 2015	Penambakan bagi KWRC telah dimasukkan ke dalam Rancangan Tempatan Daerah Kuantan 2013-2015.
20 Mei 2015	Mesyuarat dengan JPBD Pahang untuk status MPFN.
27 Ogos 2015	Mesyuarat dengan JPBD Pahang dan agensi teknikal kerajaan negeri untuk status MPFN.
18 Disember 2015	Penyerahan Terma Rujukan (TOR) kepada Jabatan Alam Sekitar (JAS) Putrajaya.
21 Disember 2015	Penyerahan Kajian Hidraulik kepada Jabatan Pengairan dan Saliran (JPS) Kuala Lumpur.
4 Januari 2016	Kebenaran Merancang bagi Pelan Induk KWRC telah diluluskan secara prinsip oleh Majlis Perbandaran Kuantan (MPK).
27 Januari 2016	Lawatan tapak yang melibatkan pegawai JAS, panel pakar, perunding EIA dan Penggerak Projek.
9 Februari 2016	Sesi Perbincangan Kumpulan Sasaran (FGD) bersama nelayan dan penduduk setempat.
12 Februari 2016	Mesyuarat Panel Kajian bagi TOR di JAS Putrajaya.
9 April 2016	Poster Pengumuman Dialog Umum.
11 April 2016	Laporan TOR diluluskan.
18 April 2016	Penyerahan Kajian Hidraulik ( <i>Pindaan 02</i> ) kepada Jabatan Pengairan dan Saliran (JPS) Kuala Lumpur.
23 April 2016	Dialog Umum telah diadakan di Dewan Serbaguna Peramu, Kuantan.
11 Mei 2016	Laporan Kajian Hidraulik diluluskan.
4 Ogos 2016	MPFN telah memberikan kelulusan bersyarat untuk pembangunan KWRC.

## 1.5 Pendekatan Kajian EIA

Skop kerja bagi kajian EIA mengikuti keperluan rangka, polisi, syarat-syarat dan garis panduan. Konsep dan lokasi Projek adalah selaras dan disokong oleh polisi, undang-undang dan garis panduan yang diterbitkan oleh agensi-agensi kerajaan.

### 1.5.1 Polisi

Polisi-polisi berikut telah dirujuk bagi menganalisa pematuhan cadangan Projek seperti yang ditunjukkan dalam Jadual R2.

**Jadual R2** ► Pematuhan Projek terhadap Polisi

Polisi	Pematuhan	Kenyataan
Rancangan Fizikal Negara-2 (RFN-2)	√	Cadangan Projek mengambil kira dan mematuhi segala polisi yang relevan.
Rancangan Fizikal Zon Persisiran Pantai Negara (RFZPPN)	√	Cadangan Projek telah diluluskan oleh Majlis Perancangan Fizikal Negara (MPFN).
Rancangan Struktur Negeri Pahang (RSNP)	√	Cadangan Projek adalah selari dengan strategi yang digariskan oleh Kerajaan Negeri.
Rancangan Tempatan Kuantan (Pindaan) 2013-2015	√	Projek KWRC bermatlamat untuk menarik pelabur bagi meningkat ekonomi Kuantan; oleh itu Projek ini selari dengan rancangan tempatan yang menggazet kawasan Projek sebagai kawasan perniagaan dan perkhidmatan.
East Coast Economic Region (ECER) 2008	√	Pembangunan KWRC adalah selari dengan cadangan kawasan tersebut sebagai kawasan pelancongan.
Dasar Perubahan Iklim Negara 2010	√	Cadangan Projek mengambil kira prinsip-prinsip pembangunan mampan dan memelihara alam sekitar.
Dasar Kepelbagaian Biologi Kebangsaan 1998	√	Cadangan Projek mengambil kira kemampuan kepelbagaian biologi kawasan Projek.
Pelan Pengurusan Persisiran Pantai Bersepadu (ISMP) Pahang	NA	Kajian ISMP tidak digunakan sebagai rujukan disebabkan data yang terlalu lama (2003).

## 2. Terma Rujukan (TOR)

Terma Rujukan (TOR) bagi Projek ini telah dikemukakan untuk kelulusan oleh pihak Jabatan Alam Sekitar (DOE) sebelum Laporan EIA dikemukakan. Satu mesyuarat Panel Ulasan TOR telah dijalankan pada 12 Februari 2016 yang lalu dan TOR Pindaan 1 telah dihantar kemudian. TOR tersebut telah diluluskan oleh DOE pada 11 April 2016.

### 3. Keperluan Projek

Penambahan tanah ini akan meliputi kawasan seluas 273.57 hektar (676 ekar) dan kawasan binaan seluas kira-kira 472.67 hektar (1,168 ekar). Penambahan tanah ini akan dibangunkan merangkumi enam (6) komponen guna tanah utama seperti kemudahan dan destinasi pelancongan, perumahan, komersial dan sebagainya.

#### 3.1 Mempromosikan Sektor Pelancongan

Pembangunan KWRC akan bertindak sebagai pemangkin pertumbuhan ekonomi bukan sahaja di Kuantan malah bagi keseluruhan Pantai Timur Malaysia di bawah pelan Wilayah Ekonomi Pantai Timur (ECER). Lokasi strategik KWRC yang terletak di Laut China Selatan adalah sesuai untuk dibangunkan terutamanya dalam sektor pelancongan. KWRC berhasrat untuk menjadi gerbang pelancongan dinamik ke Kuantan dengan memanfaatkan kelebihan yang bersempadanan dengan laut. Cadangan pembangunan berkonsepkan air yang akan dibina adalah seperti *Indoor Aquaria*, Taman Tema Air, Terminal Kapal Persiaran Antarabangsa, Kemudahan Marina dan Kapal Layar.

#### 3.2 Menyokong Pelan Pembangunan dan Strategi Kerajaan

Pembangunan KWRC adalah selari dan menyokong pelan pembangunan dan dasar-dasar yang ditetapkan oleh Kerajaan antaranya ialah:

##### 3.2.1 Rancangan Tempatan Daerah Kuantan (Pindaan) 2013 - 2015

Berdasarkan Rancangan Tempatan Daerah Kuantan (Pindaan) 2013-2015, tapak projek telah diwartakan dalam Blok Perancangan Kecil (BPK) 2.19 untuk aktiviti penambahan tanah. Cadangan guna tanah untuk BPK 2.19 adalah aktiviti perniagaan dan perkhidmatan. Ini selaras dengan tujuan pembangunan KWRC.

##### 3.2.2 Rancangan Struktur Negeri Pahang 2002 - 2020

Kerajaan Negeri Pahang bercadang untuk membangunkan sektor pelancongan dan perkhidmatan dalam menjadikan ia penyumbang utama kepada Keluaran Dalam Negara Kasar (KDNK) Pahang pada masa akan datang. Pelbagai kemudahan dan prasarana yang diperlukan untuk memenuhi permintaan semasa dan masa depan, dan pembangunan seperti KWRC adalah merupakan salah satu sumbangan ke arah keperluan ini.

##### 3.2.3 Wilayah Ekonomi Pantai Timur (ECER)

Pelbagai jenis peluang pekerjaan dan perniagaan akan diwujudkan semasa peringkat pelaksanaan projek KWRC. Ini termasuklah semasa peringkat kerja asas hingga peringkat pembinaan serta setelah projek itu siap sepenuhnya dan juga semasa projek beroperasi. Peluang-peluang ini akan menggalakkan pertumbuhan ekonomi Kuantan dengan menawarkan pelaburan atau perkongsian

peluang perniagaan yang menarik. Sekaligus, meningkatkan taraf hidup penduduk tempatan dengan kewujudan peluang pekerjaan baru, dan sekaligus menyumbang ke arah merealisasikan visi seperti yang diisytiharkan sebagai projek ECER.

### 3.2.4 Rancangan Fizikal Negara ke-2 (RFN-2)

Salah satu langkah pelaksanaan dan dasar utama di bawah RFN ke-2 adalah Pembangunan Pelancongan Mampan, secara tidak langsung, KWRC berperanan dalam pelaksanaan ini. Ini disokong lagi dengan bandar Kuantan yang telah dikenal pasti sebagai salah satu daripada Konurbasi Pertumbuhan Serantau Negara di bawah RFN ke-2. Pada masa ini, kekurangan unit pembangunan pelancongan di Kuantan akan memberi kesan kepada kemajuannya pada masa akan datang. Oleh itu, projek KWRC akan terbukti menjadi aset penting dalam memenuhi tuntutan permintaan dan keperluan, dan sekaligus menyumbang kepada sektor pelancongan.

### 3.3 Menyumbang kepada Pendapatan Negeri / Persekutuan dan Meningkatkan Taraf Hidup dan Kelestarian

KWRC dijangka akan menggalakkan pembangunan di kawasan sekitar Tanjung Lumpur dengan terwujudnya peluang pekerjaan dan perniagaan baru dalam bentuk latihan, pendidikan dan pekerjaan. Perkara ini boleh dicapai dari peringkat awal pelaksanaan projek seperti kerja-kerja asas dan pembinaan. Peluang ini akan terus berkembang apabila projek itu siap dan beroperasi.

### 3.4 Pembangunan Infrastruktur dan Logistik yang Moden

Pembangunan KWRC akan meningkatkan infrastruktur asas dan logistik di kawasan sekitarnya. Antara komponen pembangunan ialah pembinaan jalan masuk baru dan menaik taraf jalan kampung yang sedia ada contohnya Jalan Tanjung Lumpur dan Lorong Anak Air. Perkhidmatan pengangkutan awam keluar masuk dari KWRC juga akan dinaik taraf, secara langsung akan memberi manfaat kepada penduduk tempatan yang tinggal di sekitar kawasan pembangunan. Pembangunan KWRC akan meningkatkan mod pengangkutan yang sedia ada termasuk darat dan air.

### 3.5 Mewujudkan Peluang Pekerjaan dan Perniagaan yang Baru

Pembangunan KWRC akan mewujudkan peluang pekerjaan dan perniagaan yang baru sejak di awal peringkat pelaksanaannya. Apabila siap sepenuhnya, KWRC dijangka mempunyai pelbagai komponen kediaman dan perniagaan dan menyediakan kira-kira 5,000 peluang pekerjaan baru kepada penduduk tempatan (*Jadual R3*).

**Jadual R3** ► Anggaran Peluang Pekerjaan

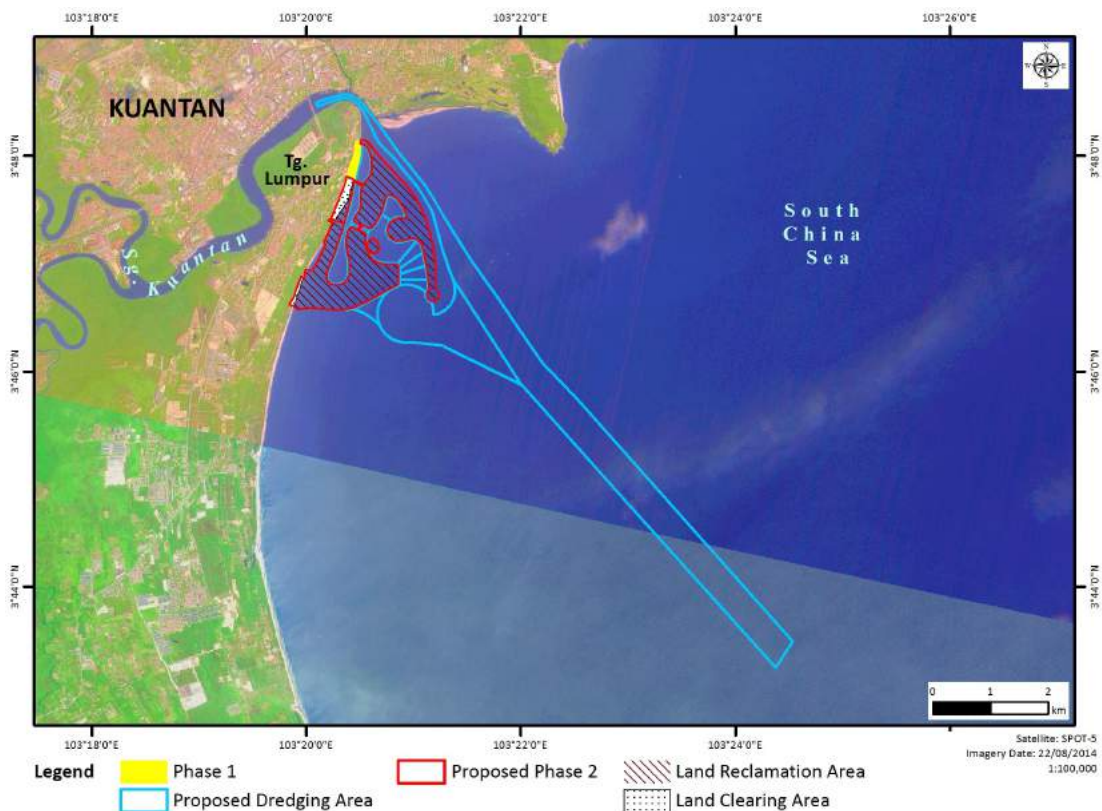
Sektor	Anggaran Peluang Pekerjaan
Tarikan pelancong, hotel, taman tema dan pembangunan komersial	4,050
Pembangunan kediaman	350
Perubatan, pelancongan dan pusat pendidikan	600
<b>Jumlah</b>	<b>5,000</b>

### 3.6 Mengatasi Masalah Hakisan di sepanjang Persisiran Pantai Tanjung Lumpur

Berdasarkan Kajian Hakisan Pantai Negara (UPEN, 1985), persisiran pantai Tanjung Lumpur telah mengalami hakisan dengan ketara sejak beberapa dekad yang lalu. Pantai ini telah diklasifikasikan sebagai Kategori III dan kemudian ianya telah dikelaskan semula sebagai Kategori I. Kategori I menunjukkan kawasan tersebut mempunyai kadar hakisan yang serius dan mempunyai nilai kepentingan ekonomi, pengangkutan, rekreasi dan demografi. Justeru, struktur perlindungan bagi mengatasi masalah hakisan adalah wajar diberi keutamaan. Oleh itu, penambakan tanah ini secara tidak langsung akan mengurangkan isu hakisan di sepanjang pantai Tanjung Lumpur. Konfigurasi penambakan telah direka bentuk berdasarkan keperluan hidraulik seperti perubahan dalam gelombang, arus, dan lain-lain.

### 3.7 Penambahbaikan kepada Sungai Kuantan dan Masalah Pemandapan di Muara Sungai Kuantan

Pelaksanaan KWRC akan menyumbang kepada penambahbaikan muara Sungai Kuantan. Projek ini akan membantu pelbagai pihak dalam mengatasi masalah pemandapan di muara sungai Kuantan dengan penyelesaian secara "menang-menang". Penggerak Projek akan menjalankan kerja-kerja pengerukan sekaligus akan membantu kerajaan dalam mengurangkan bajet yang besar untuk tujuan yang sama. Hasil kerukan ini akan diangkut dan digunakan sebagai bahan pengisian tambakan (*Rajah R5*).



**Rajah R5** ► Kawasan Cadangan Pengerukan

## 4. Pilihan Projek

Beberapa pilihan projek telah diambil kira dan dibincangkan dalam bahagian ini.

### 4.1 Dengan Projek

KWRC akan menaik taraf status Tanjung Lumpur yang berpotensi untuk berkembang menjadi '*Kuantan's First Integrated Leisure, Retail and Entertainment Destination*' dan juga menawarkan gaya hidup berlatarbelakangkan panorama laut. Beberapa rekabentuk penambakan telah dinilai berdasarkan beberapa faktor, terutamanya dari segi kesan terhadap alam sekitar. Susun atur/konfigurasi terkini yang dipilih mengambil kira perkara berikut:

- i) Kawasan Sensitif Alam Sekitar (KSAS) yang berhampiran; dan
- ii) Komponen hidraulik iaitu perubahan gelombang, arus, dan lain-lain.

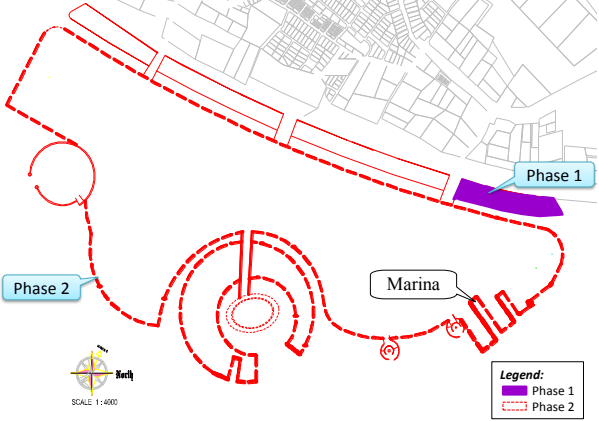
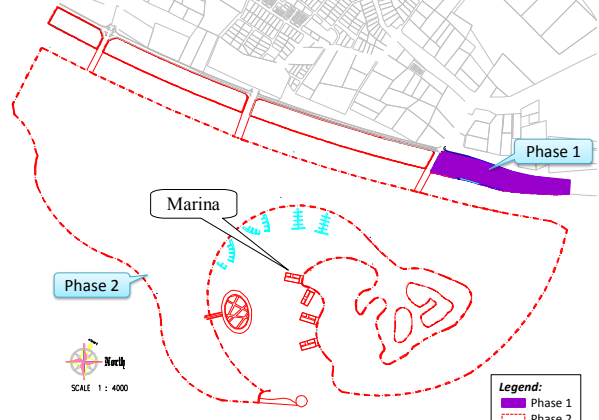
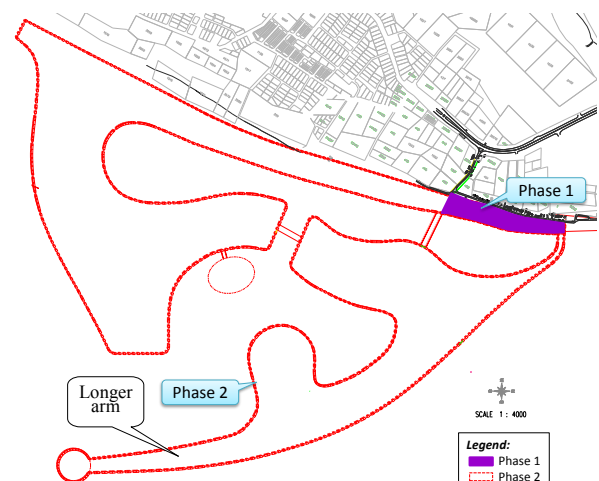
Senarai pilihan rekabentuk penambakan yang dicadangkan adalah seperti dalam *Jadual R4*.

### 4.2 Tanpa Projek

Tanpa pelaksanaan Projek, sebahagian daripada matlamat pembangunan negara dan negeri tidak akan tercapai. Ini adalah kerana Projek yang dicadangkan adalah unik dengan konsepnya yang tersendiri. Jika tanpa projek, aktiviti perniagaan makanan laut dan menangkap ikan yang sedia ada akan kekal dan akan mengurangkan daya tarikan ke kawasan ini dari segi perniagaan dan pelancongan. Sejurus itu, peluang perkembangan ekonomi yang signifikan akan terlepas dan menyebabkan pertumbuhan yang lembap di Kuantan. Keadaan ini akan menjejaskan matlamat untuk menjadikan Kuantan sebagai salah satu pusat perniagaan dan komersial yang utama di negara ini.



Jadual R4 ► Cadangan Pilihan Rekabentuk Penambakan

Pilihan	Huraian
<p><b>Pilihan 1</b></p> 	<p>Pulau buatan manusia telah direka bentuk dengan bentuk separa bulan dan disambungkan ke tanah besar oleh tiga buah jambatan.</p> <p>Berdasarkan kajian hidraulik, pembangunan marina menghadap gelombang timur laut yang dominan. Ini akan mendedahkan marina kepada ombak besar yang bergelora terutamanya pada musim tengkujuh. Oleh itu, rekabentuk ini telah ditolak</p>
<p><b>Pilihan 2</b></p> 	<p>Bentuk sebelumnya telah diolah dan marina terletak di bahagian dalam reka bentuk. Namun, konsep pulau adalah tidak mesra hidraulik kerana terdapat bukaan berhampiran muara Sungai Kuantan. Pemendapan boleh berlaku dan menyebabkan takungan air semasa air surut.</p> <p>Oleh itu, pilihan ini ditolak.</p>
<p><b>Pilihan 3</b></p> 	<p>Rekabentuk terbaharu telah direka di mana penambakan tanah adalah bersempadan dengan pantai.</p> <p>Rekabentuk yang lebih panjang di timur laut yang akan bertindak sebagai struktur pemecah ombak. Struktur perlindungan pantai akan dibina di sepanjang tebing tanah yang akan ditambah.</p> <p>Oleh itu, rekabentuk ini dipilih.</p>

## 5. Keterangan Projek

### 5.1 Kawasan Tapak Projek

Kawasan tapak projek meliputi persisiran pantai utara dan selatan kawasan Projek serta Pantai Tanjung Lumpur dan zon impak (ZOI) dalam lingkungan 5 km seperti dalam *Rajah R6*.

- i) Persisiran pantai utara (Muara Sungai Kuantan - Tanjung Pelindung Tengah);
- ii) Persisiran pantai tengah (Kampung Tanjung Lumpur); dan
- iii) Persisiran pantai selatan (Kampung Anak Air - Kampung Baharu).

#### 5.1.1 Persisiran Pantai Utara (Muara Sungai Kuantan - Tanjung Pelindung Tengah)

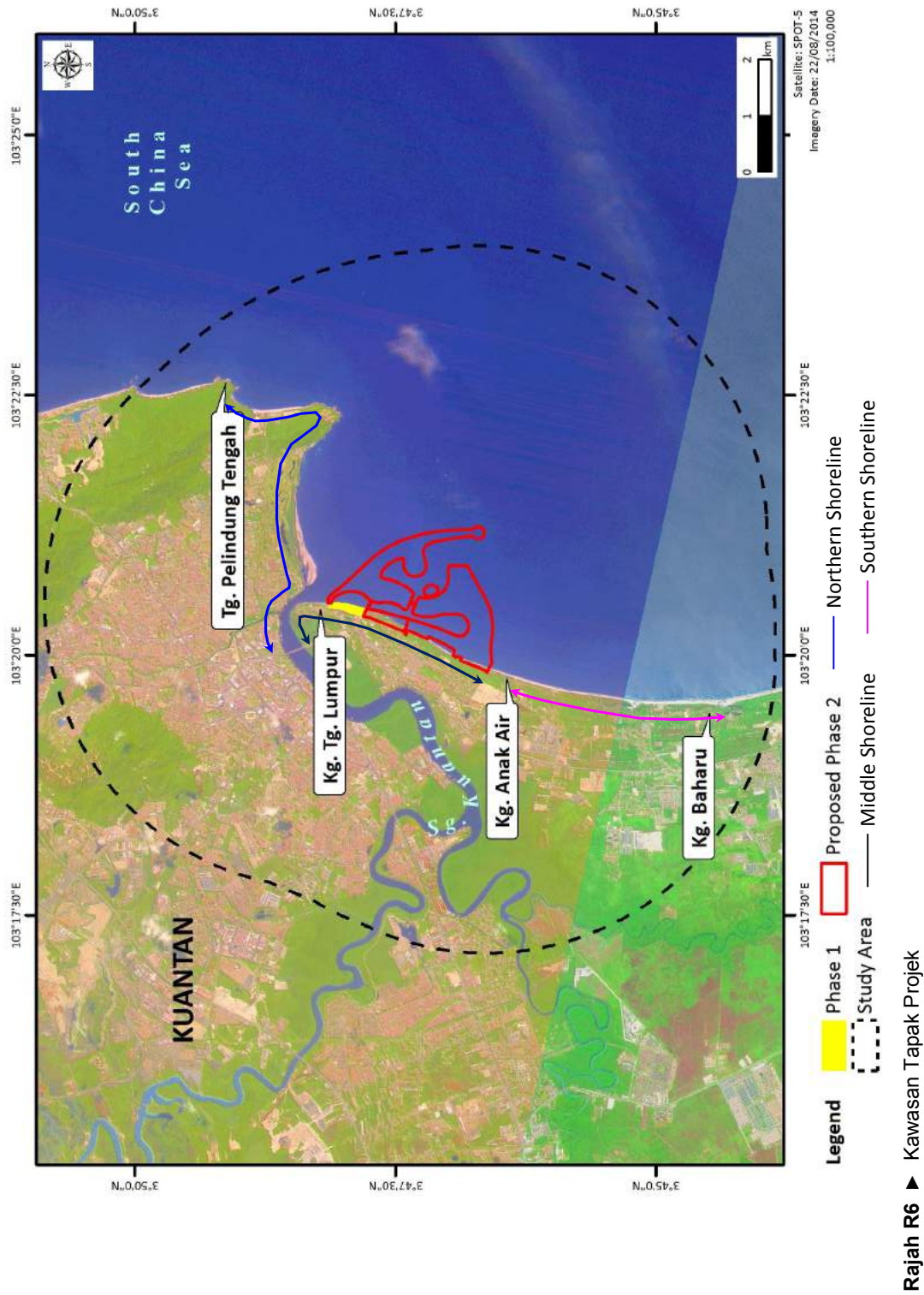
Di kawasan persisiran pantai utara, terdapat kawasan perindustrian, sekolah berasrama, Ibu Pejabat Polis Marin dan kilang pemprosesan ikan. Pelabuhan, jeti dan kampung air juga terdapat di kawasan tersebut. Pasar basah yang terletak perdekatan di tebing sungai di mana nelayan Tanjung Api menjual hasil tangkapan mereka. Taman rekreasi "Esplanade Tanjung Api" terletak jauh sedikit di tengah laut berdekatan muara Sungai Kuantan.

#### 5.1.2 Persisiran Pantai Tengah (Kampung Tanjung Lumpur)

Tanjung Lumpur ialah sebuah perkampungan nelayan yang terletak di muara Sungai Kuantan. Persisiran pantai Tanjung Lumpur adalah landai dengan 1 darjah kecerunan. Bahagian utara Tanjung Lumpur terhakis sebanyak 1 m setahun secara purata dan pemindahan rumah telah dilakukan pada tahun 1990-an. Terdapat beberapa buah rumah lagi yang masih terdedah kepada hakisan. Walaubagaimanapun, ianya tidak memberi kesan kepada jalan pantai disebabkan ciri tanah yang sangat rata. Bakau terdapat di sepanjang Sungai Kuantan. Ianya merupakan sumber penting dalam industri perikanan tempatan. Di tengah Tanjung Lumpur, pembangunan perumahan sudah banyak di sepanjang pantai Tanjung Lumpur.

#### 5.1.3 Persisiran Pantai Selatan (Kampung Anak Air - Kampung Baharu)

Kampung Anak Air terletak kira-kira 4.5 km di selatan Tanjung Lumpur. Persisiran pantai kampung ini terdiri daripada pantai berpasir. Resort hotel kelas pertengahan (Suntiana Resort) terletak di persisiran pantai. Kerja-kerja pembinaan bagi pembangunan perumahan moden sedang dijalankan di Kampung Anak Air.



## 5.2 Konsep Projek

Pembangunan KWRC Fasa 2 akan menjadi pelengkap kepada KWRC Fasa 1 dengan berlatarbelakangkan kawasan pesisiran pantai Tanjung Lumpur. Projek ini melibatkan aktiviti penambakan bagi pembangunan bercampur bersebelahan pantai Tanjung Lumpur yang berdekatan dengan muara Sungai Kuantan. Muara Sungai Kuantan sering menghadapi masalah pemendapan yang menyebabkan kesukaran kepada laluan pelayaran di sungai tersebut. Bagi mengatasi masalah ini, pihak pemaju telah mengambil inisiatif untuk melakukan pengerukan di muara Sungai Kuantan dan alur pelayarannya. Bahan pengerukan yang bersesuaian akan digunakan semula sebagai bahan isian penambakan bagi Projek ini.

## 5.3 Komponen Projek

Projek ini akan dilaksanakan secara berfasa yang merangkumi komponen berikut:

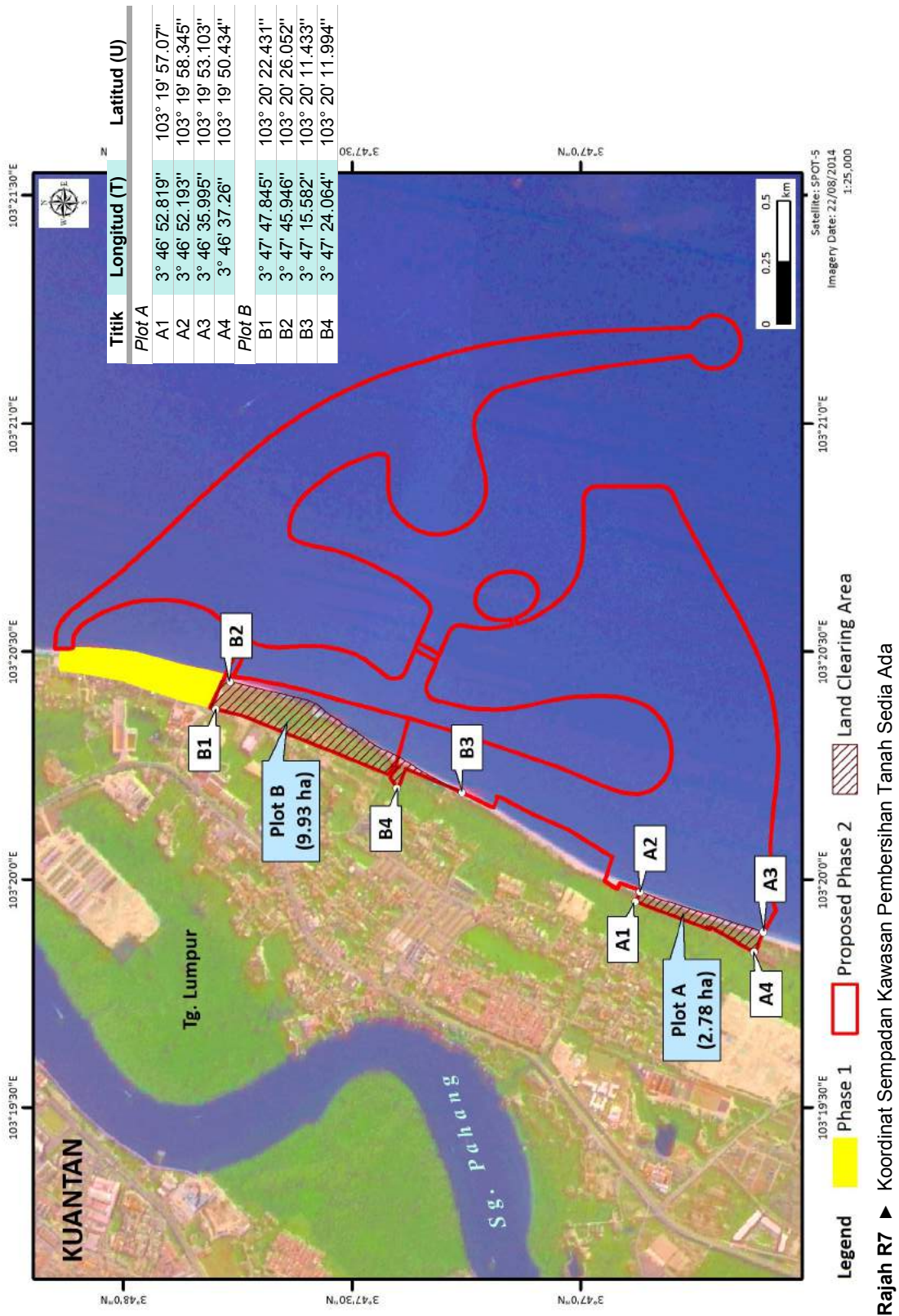
- i) Pembersihan tanah sedia ada;
- ii) Penambakan; dan
- iii) Pengerukan.

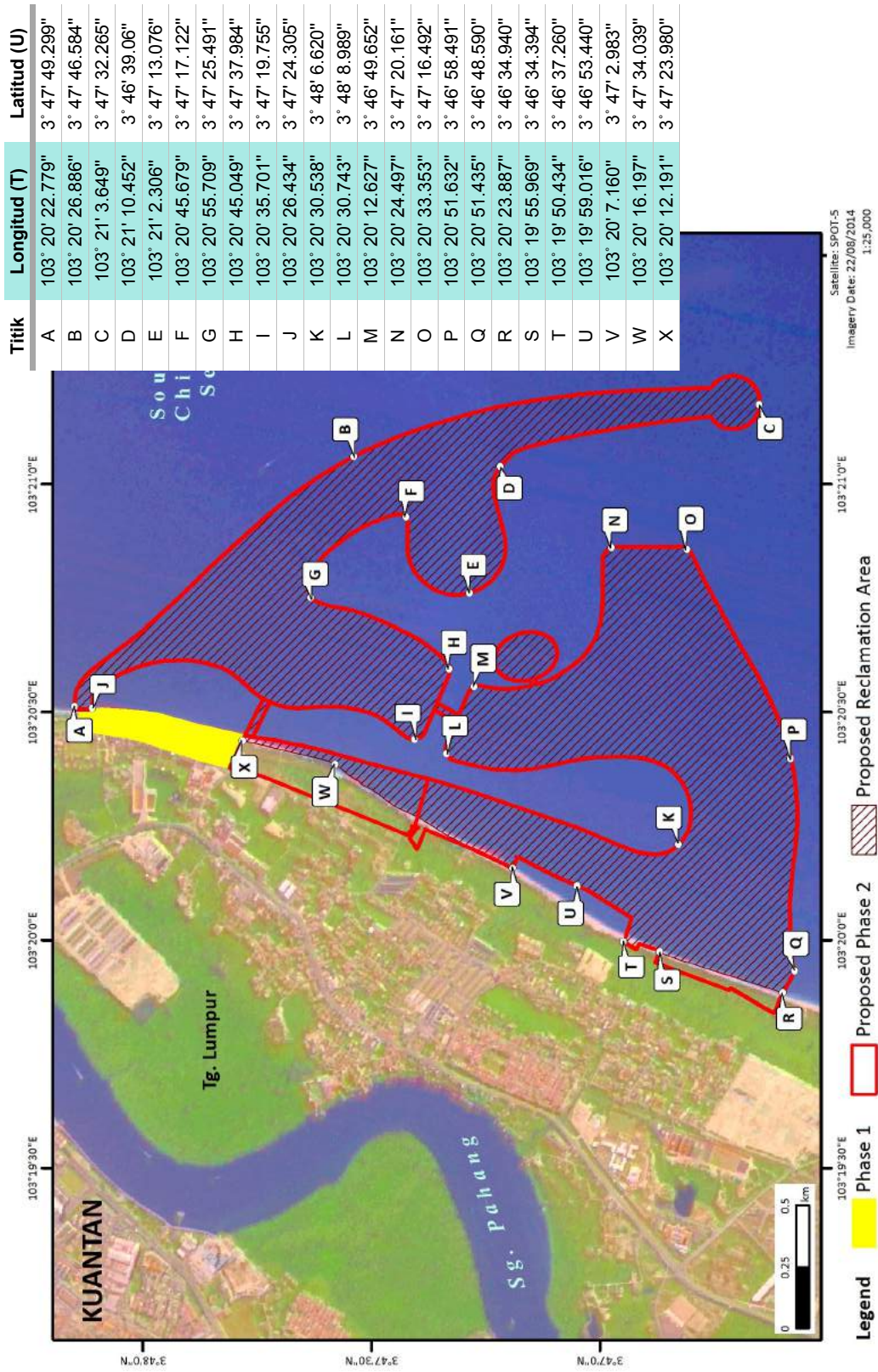
### 5.3.1 Pembersihan Tanah Sedia Ada

Sejumlah 12.71 hektar daripada jumlah kawasan projek itu bertindih di kawasan pantai sedia ada yang terdiri daripada dua plot, iaitu Plot A (2.78 hektar) dan Plot B (9.93 hektar). Kawasan pembersihan tanah untuk kedua-dua plot ditindih pada imej satelit seperti yang ditunjukkan dalam *Rajah R7*.

### 5.3.2 Penambakan

Untuk memastikan kestabilan kawasan yang ditambak, ianya akan ditambak ke paras +5.0 m CD dan berkecerunan 1:3. Koordinat sempadan bagi cadangan kawasan yang akan ditambak ditunjukkan dalam *Rajah R8*.





### 5.3.3 Pengerukan

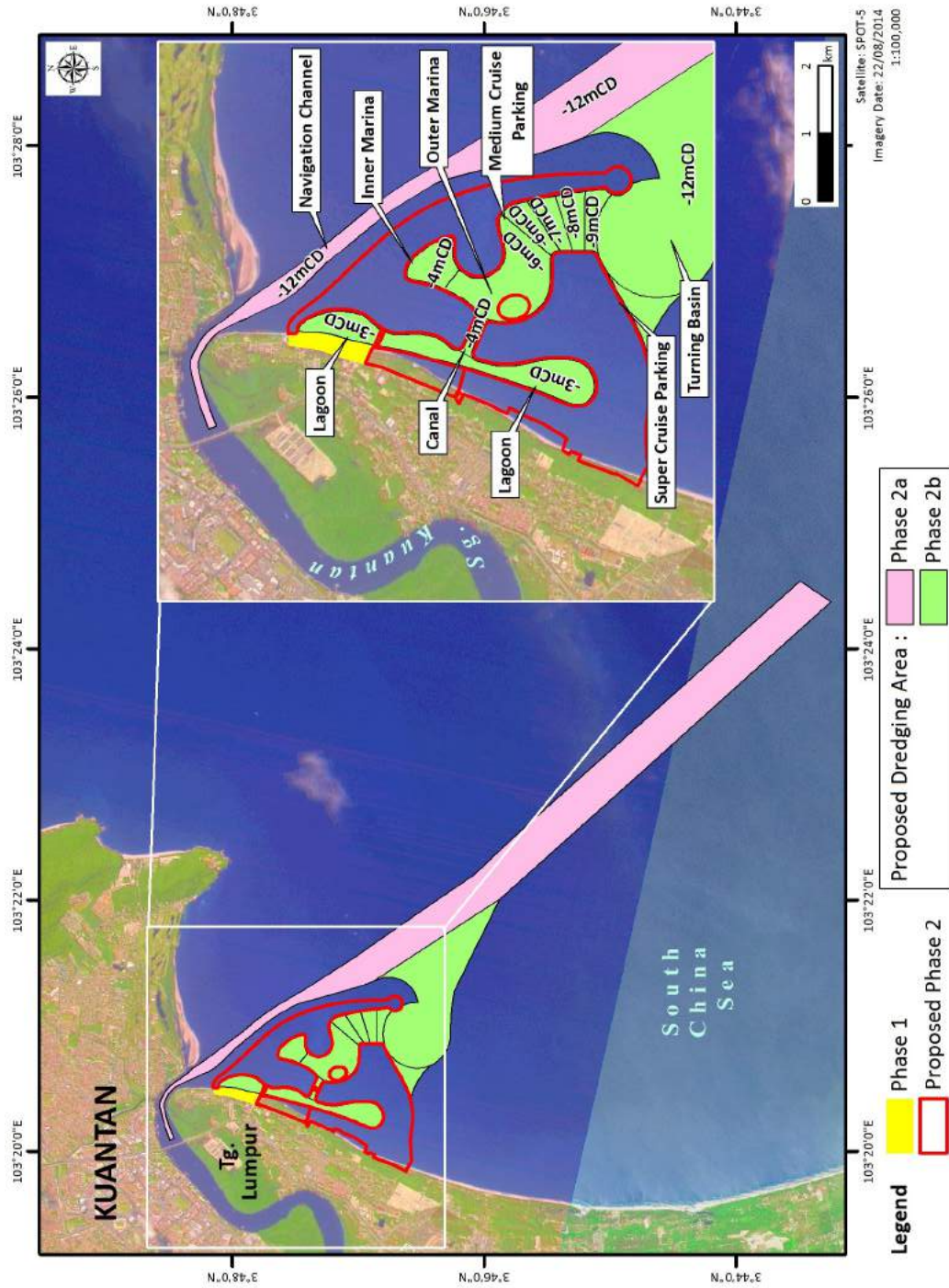
Aktiviti pengerukan akan dilaksanakan di Sungai Kuantan dan muaranya, alur pelayaran dan kawasan pinggir laut di dalam kawasan penambakan. Kerja-kerja pengerukan akan dijalankan dengan menggunakan *Cutter Suction Dredger (CSD)* dan *Trailer Suction Hopper Dredger (TSHD)*. Kerja-kerja ini akan dijalankan secara berfasa, seperti berikut:

- i) Fasa 2a – Aktiviti pengerukan akan dijalankan untuk mendalamkan alur pelayaran hingga ke 12 m CD yang jaraknya bermula kira-kira 100 m dari Jambatan Tanjung Lumpur hingga ke 12 km ke arah laut (tenggara); dan
- ii) Fasa 2b – Aktiviti pengerukan akan dijalankan di:
  - a. Laguna (dikeruk 3 m CD);
  - b. Terusan (4 m CD);
  - c. Marina dalam (4 m CD);
  - d. Marina luar (6 m CD);
  - e. Terminal kapal persiaran (6 to 9 m CD); dan
  - f. Lembangan pusingan (12 m CD).

*Rajah R9* menunjukkan kawasan pengerukan dan kedalaman yang dicadangkan dan *Rajah R10* menunjukkan koordinat sempadan kawasan pengerukan.

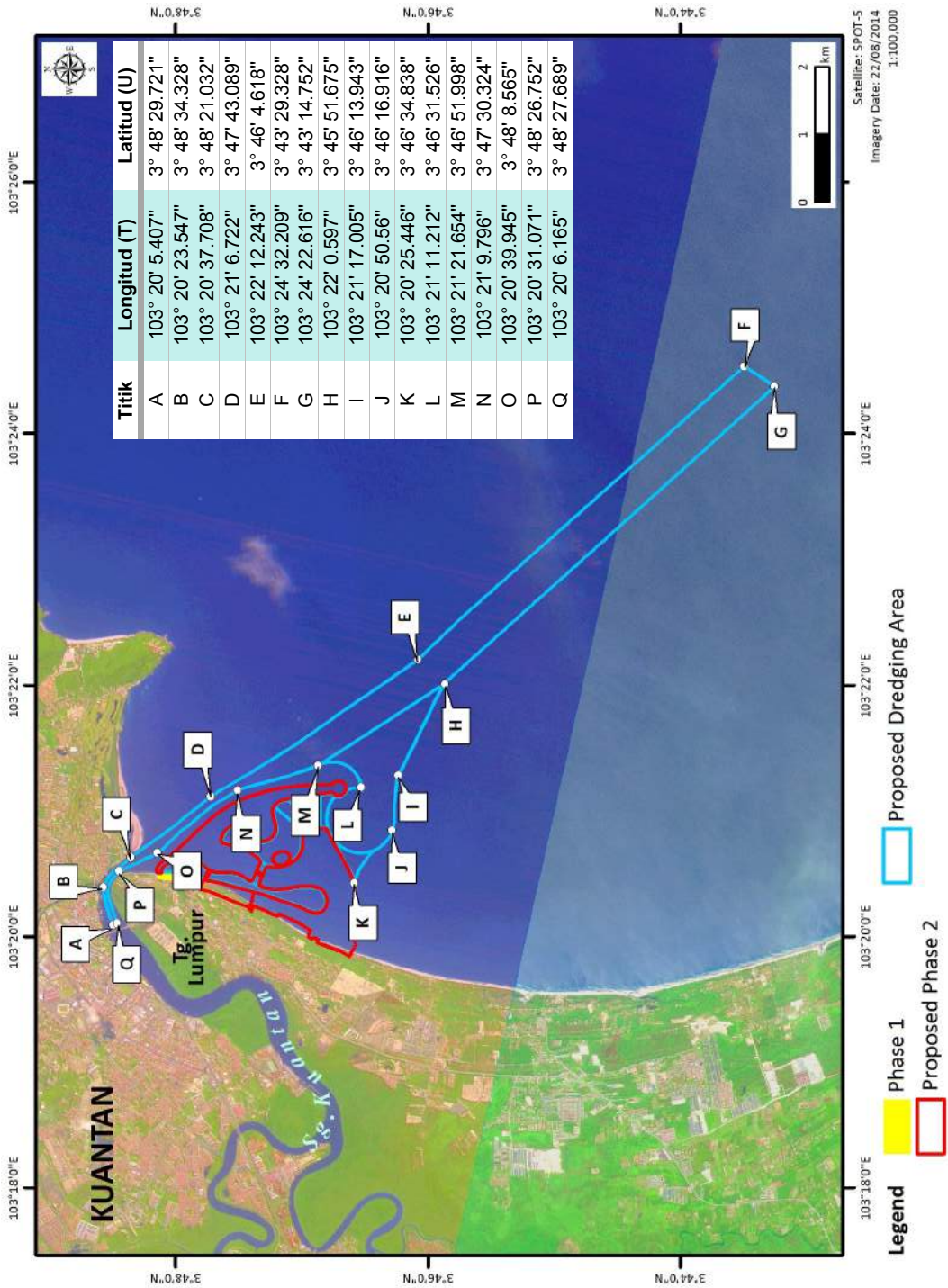
### 5.4 Fasa Projek

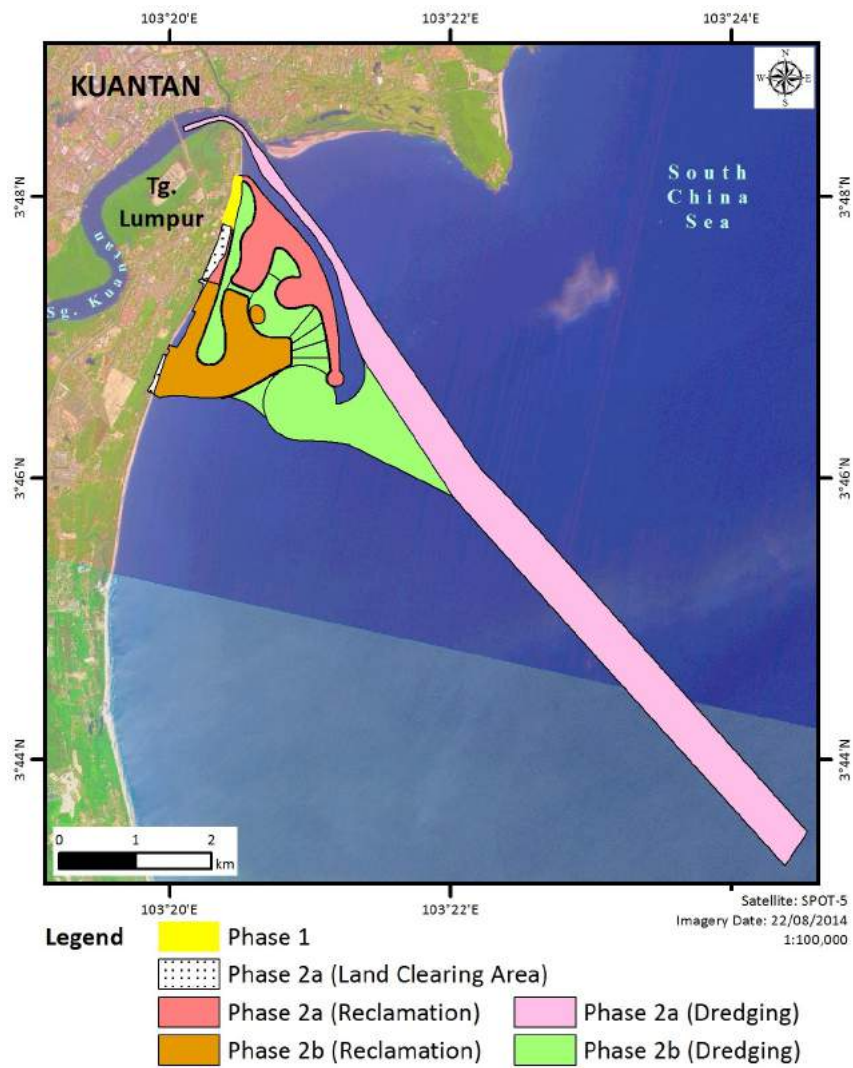
Aktiviti projek akan dibahagikan kepada tiga (3) komponen utama iaitu pembersihan tanah, penambakan dan pengerukan seperti dalam *Rajah R11*. Ringkasan jadual kerja disenaraikan dalam *Jadual R5*. Kerja-kerja peringkat Fasa 2b akan dimulakan setelah selesai Fasa 2a. Tempoh 40 bulan yang dinyatakan hanyalah untuk kerja-kerja pembersihan tanah, penambakan dan pengerukan sahaja dan ianya tidak termasuk pembangunan atas tanah.



Rajah R9 ► Cadangan Kedalaman untuk Kawasan Pengerukan







Rajah R11 ► Fasa Projek

Jadual R5 ► Jangkaan Tempoh Projek

Komponen Projek		Mula	Siap	Tempoh (Bulan)
Fasa 2a	Pembersihan tanah	Bulan 1	Bulan 2	22
	Penambakan Pengerukan	Bulan 1	Bulan 22	
Fasa 2b	Penambakan Pengerukan	Bulan 23	Bulan 40	18
	<b>Jumlah</b>			<b>40</b>

## 5.5 Aktiviti Projek

Turutan aktiviti projek yang utama adalah seperti berikut:



### 5.5.1 Tinjauan Pra-pembinaan

Tinjauan hidrografi ini bertujuan untuk menentukan kedalaman dasar laut yang sedia ada bagi pengiraan kuantiti bahan tambakan yang diperlukan. Tinjauan topografi pula dijalankan untuk menentukan bentuk muka bumi sedia ada seperti persisiran pantai, sungai, perparitan dan sebarang struktur berdekatan.

### 5.5.2 Pembersihan Tanah Sedia Ada

Jentera darat yang akan digunakan untuk aktiviti pembersihan ialah jengkaut, jentolak dan lori. Aktiviti ini hendaklah dilaksanakan berdasarkan amalan pengurusan terbaik untuk mengurangkan kesan terhadap alam sekitar, terutamanya kepada kualiti air. Tumbuh-tumbuhan yang telah dipotong akan dikumpulkan dan dilupuskan oleh kontraktor di tapak pelupusan sampah yang telah diluluskan oleh Majlis Perbandaran Kuantan (MPK).

### 5.5.3 Penambakan dan Pengerukan

Dianggarkan 10 juta m<sup>3</sup> isipadu bahan tambakan diperlukan untuk tujuan penambakan (*Jadual R6*). Umumnya, kerja-kerja penambakan dan pengerukan akan dijalankan secara berperingkat seperti yang dinyatakan dalam bahagian yang berikut.

**Jadual R6** ► Anggaran Isipadu Bahan Tambakan

Fasa Projek	Luas (ha)	Jumlah Bahan Tambakan (m <sup>3</sup> )
Fasa 2a	123.05	4,559,566.63
Fasa 2b	150.52	6,119,358.80
<b>Jumlah</b>	<b>273.57</b>	<b>10,678,925.43</b>

#### 5.5.3.1 Pemasangan Boja Penanda Sempadan

Bagi menjamin keselamatan, pergerakan keluar masuk di kawasan-kawasan tertentu perlu dibatasi di sepanjang tempoh kerja dijalankan. Kawasan yang telah dikenal pasti hendaklah ditanda dengan lampu atau boja penanda sempadan yang berwarna terang. Notis awal akan dikemukakan kepada Jabatan Laut sebelum sebarang kerja dilaksanakan.

#### 5.5.3.2 Pengangkutan Batuan

Batuan akan diangkut dari kuari ke tapak projek melalui jalan laut dengan menggunakan tongkang yang kemudiannya akan ditunda dengan bot tunda atau kapal yang bersesuaian. Kira-kira 3,000 ke 5,000 tan batu akan diangkut setiap hari.

#### 5.5.3.3 Pembinaan Benteng Perimeter Batuan

Sebelum sebarang kerja penambakan dijalankan, benteng perimeter batuan akan dibina di sekeliling tapak projek. Kerja-kerja pembinaan benteng ini akan dimulakan dari kawasan tanah besar menghala ke laut.

#### 5.5.3.4 Pengerukan di Muara Sungai Kuantan, Alur Pelayaran dan Kawasan Pinggiran Laut di Kawasan Tambakan

Aktiviti pengerukan bertujuan untuk mendalamkan alur pelayaran di Sungai Kuantan sedalam -12 m CD yang berjarak 100 m dari jambatan Tanjung Lumpur dan berakhir sejauh 12 km ke arah laut (tenggara). Selain itu, pengerukan juga akan dijalankan di kawasan pinggiran laut berdekatan dengan kawasan tambakan dengan kedalaman -3 m hingga -12 CD. Aktiviti pengerukan ini dirumuskan dalam *Jadual R7*. Jumlah anggaran isipadu bahan yang akan dikeruk seperti dalam *Jadual R8*.

**Jadual R7 ►**

Rumusan Aktiviti Pengerukan

Rekabentuk	Ciri
Kedalaman	-3 m hingga -12 m CD
Jumlah kawasan	845 ha
Isipadu anggaran	49 juta m <sup>3</sup>
Isipadu diperlukan	10 juta m <sup>3</sup>
Cerun sisi	1V: 5H
Jenis bahan kerukan	Pasir dan kelodak
Kapal	CSD and TSHD

**Jadual R8 ►** Anggaran Isipadu Bahan yang akan Dikeruk

Fasa	Lokasi	Purata Kedalaman Sedia Ada (m CD)	Cadangan Kedalaman untuk Dikeruk (m CD)	Keluasan Kawasan Kerukan (m <sup>2</sup> )	Anggaran Isipadu Bahan Kerukan (m <sup>3</sup> )
Fasa 2a	Alur pelayaran	6.74	12	5,228,225	27,496,592.98
	Laguna	0.77	3	491,828	1,096,776.44
	Terusan	0.64	4	31,892	107,157.12
Fasa 2b	Marina dalam	1.20	4	124,030	347,284.00
	Marina luar	1.40	6	349,556	1,814,957.60
	Terminal kapal persiaran	2.64	6 to 9	311,542	1,514,094.12
	Lembangan pusingan	3.00	12	1,858,666	16,727,994.00
<b>Jumlah</b>				<b>8,440,739</b>	<b>49,104,856.26</b>

Nota:

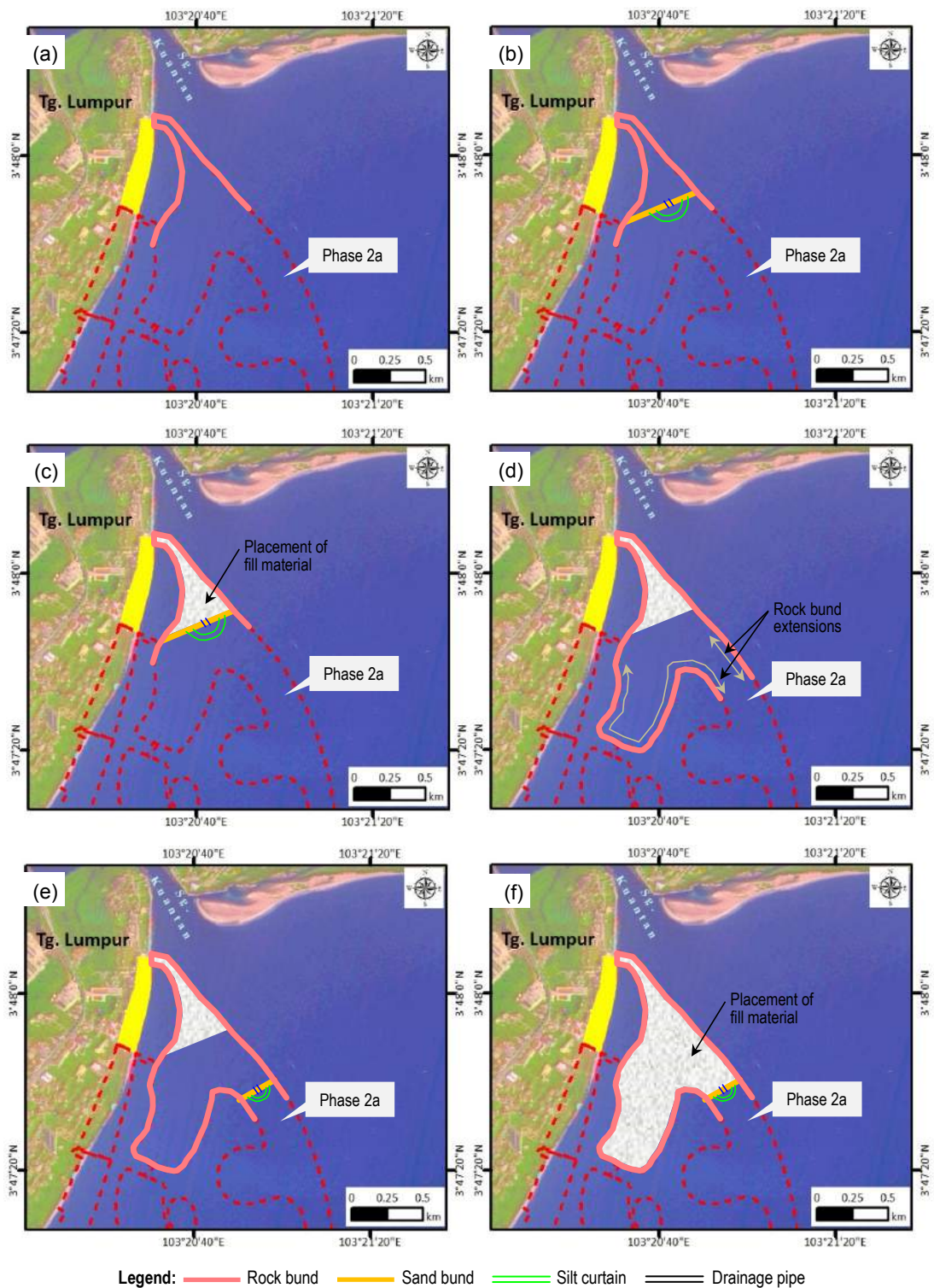
1. Purata kedalaman sedia ada bagi alur pelayaran adalah berdasarkan Peta Batimetri No.: 3445.
2. Anggaran isipadu bahan kerukan dikira berdasarkan cara mengira keluasan kawasan.

### 5.5.3.5 Fill Material Transportation

Dua buah *Trailer Suction Hopper Dredgers* (TSHDs) berkapasiti 10,000 m<sup>3</sup> akan digunakan untuk aktiviti penambakan dan pengerukan. Bagi kawasan yang cetek, sebuah *Cutter Suction Dredger* (CSD) berkapasiti 1,500 m<sup>3</sup> akan digunakan.

### 5.5.3.6 Peletakan Bahan Isian Tambakan

Dengan mengambil kira faktor keluasan penambakan yang agak besar, kerja-kerja penambakan akan dijalankan secara berperingkat iaitu sebanyak 50 ekar kawasan tambakan di setiap peringkat. Urutan kerja penambakan dapat dirujuk di *Rajah R13*.



Rajah R13 ► Urutan Kerja Penambakan

#### 5.5.3.6.1 Pemasangan Tirai Kelodak

Tirak kelodak akan dipasang secara berserenjang dengan arus air dan membentuk lengkungan 'C' untuk mengelakkan air keruh keluar dari kawasan kerja. Kerja-kerja pemasangan tirai kelodak bermula dengan penyediaan sistem tambatan dan batu ladung. Pekerja-pekerja akan menyambungkan tali, rantai dan tambatan kekang. Proses mengangkat batu ladung konkrit akan dijalankan menggunakan kren atau bot. Selepas pemasangan batu ladung selesai, bot kerja akan digunakan bagi menyambung panel tirai kelodak.

#### 5.5.3.7 Rawatan Bahan Isian Tambakan

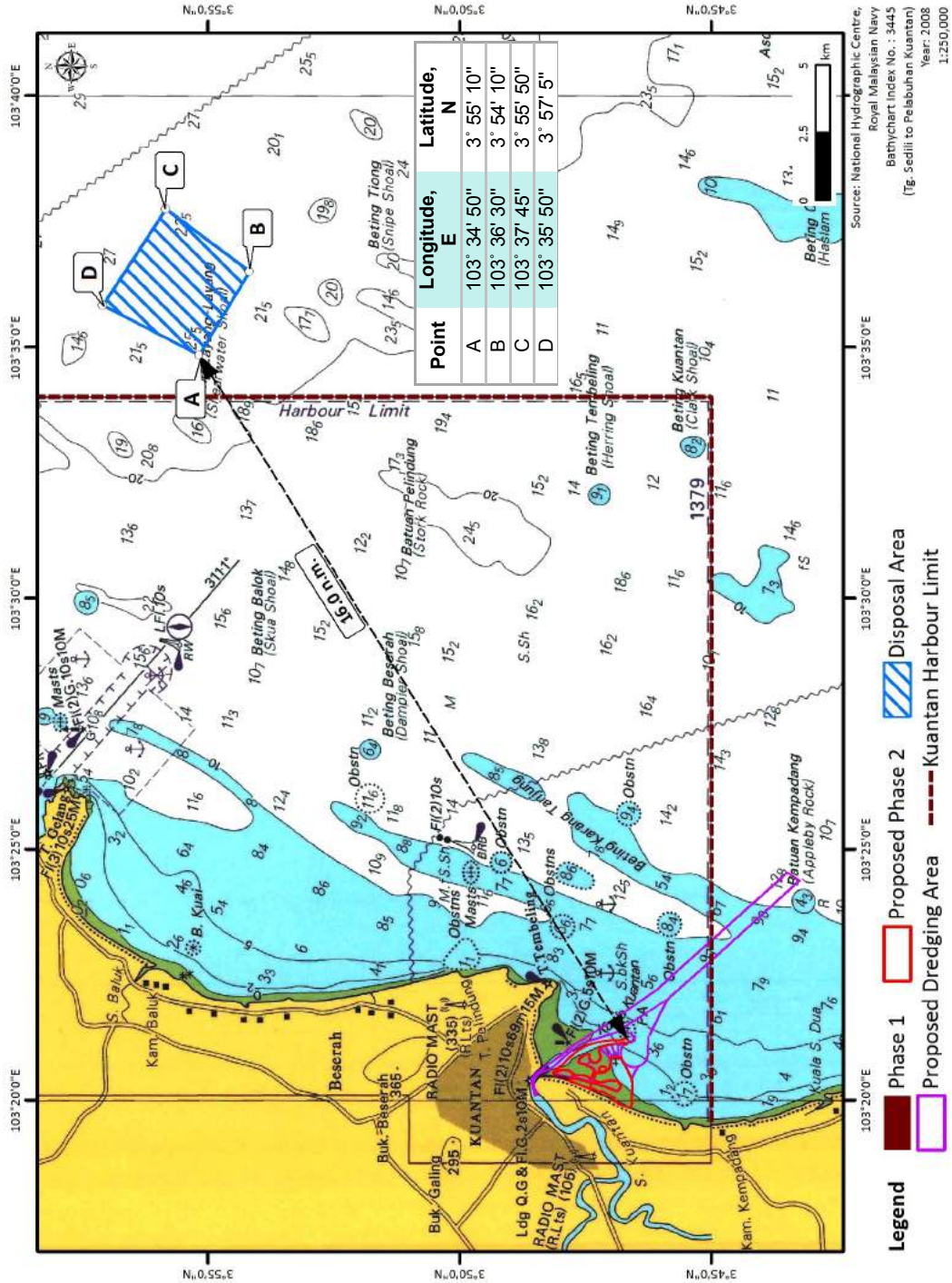
*Prefabricated Vertical Drain* (PVD) merupakan sebahagian daripada rawatan bahan isian tambakan dan dijalankan selepas selesai aktiviti bahan isian tambakan. Kaedah ini digunakan untuk mempercepatkan proses pepadatan tanah. PVD ini dimasukkan ke dalam tanah (jarak dari tengah ke tengah, 1.3 m) untuk membentuk laluan pengairan yang lebih pendek, ini bagi membolehkan lebih air dapat mengalir secara horizontal melalui lubang pada kedua-dua sisi PVD.

#### 5.5.3.8 Pembinaan Struktur Pelindung Pantai

Pembinaan struktur pelindung pantai hanya akan dijalankan setelah kawasan yang ditambah telah diisi pada paras platform yang ditetapkan. Benteng batuan perimeter akan diubahsuai menjadi struktur perlindungan pantai yang kekal.

### 5.5.4 Pelupusan Bahan Kerukan

Bahan kerukan yang tidak sesuai untuk penambahan akan dilupuskan di kawasan pelupusan (1,526.52 ha). Kawasan ini terletak sejauh 16 batu nautika (26.63 km) dari tapak projek (*Rajah R14*). Umumnya, aktiviti pelupusan ini akan dikendalikan dengan menggunakan empat (4) buah *self-propelled split hopper*. Kawasan pelupusan ini telah mengambil kira garis panduan yang telah ditetapkan oleh Jabatan Alam Sekitar (JAS). Walaubagaimanapun, kawasan ini hendaklah mendapat kelulusan dari Jabatan Laut Malaysia (JLM) sebelum sebarang kerja-kerja pelupusan dijalankan.

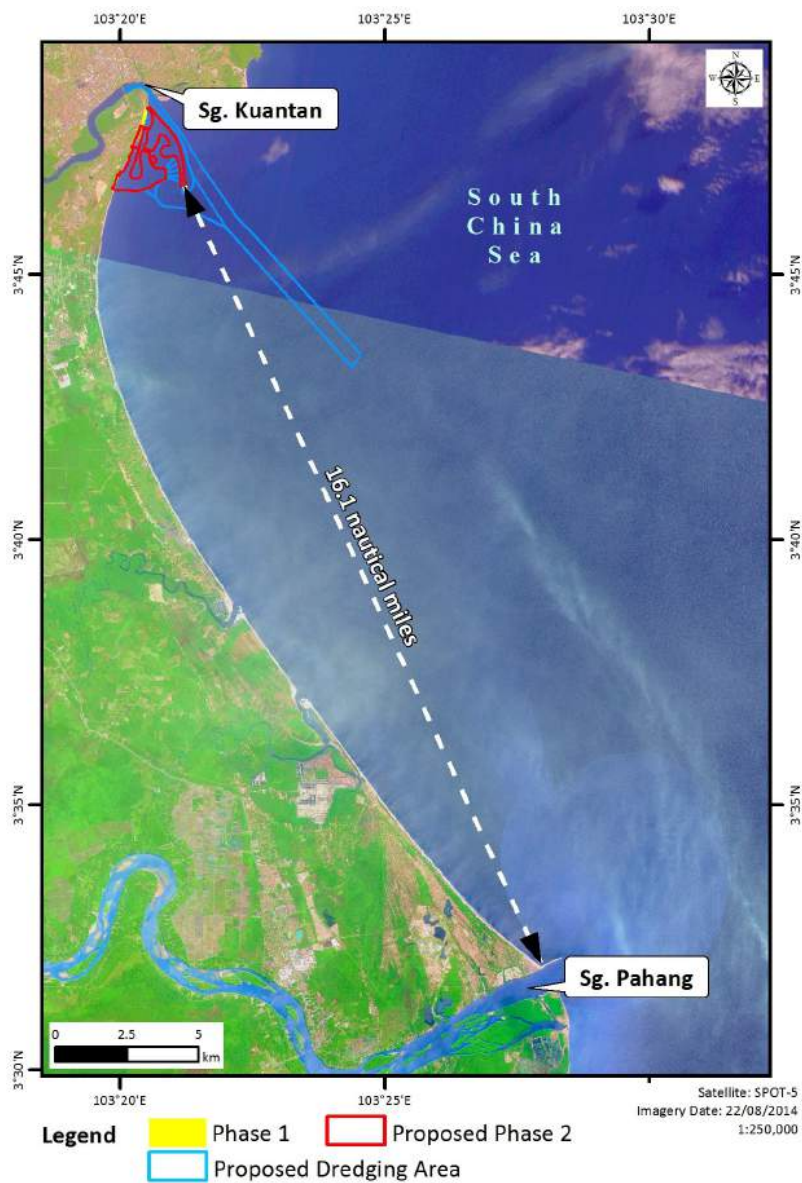


Rajah R14 ▶ Kawasan Cadangan Pelupusan



### 5.5.5 Kawasan Sumber Pasir

Jika bahan yang dikeruk tidak sesuai untuk digunakan sebagai bahan isian tambakan, kawasan sumber pasir alternatif dicadangkan di kawasan Kuala Sungai Pahang (*Rajah R15*). Kawasan ini terletak sejauh 16.1 batu nautika (29.82 km) dari tapak projek dan bahan kerukan akan diangkut dengan menggunakan TSHD. Walaubagaimanapun, aktiviti ini adalah tertakluk kepada kajian EIA yang berasingan di mana ianya perlu dikemukakan kepada JAS Pahang. Ini termaktub dalam Perintah Kualiti Alam Sekeliling (Aktiviti Yang Ditetapkan) (Penilaian Kesan Kepada Alam Sekeliling) 2015 di mana aktiviti pengerukan adalah salah satu aktiviti yang telah ditetapkan untuk kajian EIA.



**Rajah R15** ► Kawasan Sumber Pasir dari Kuala Sungai Pahang

## 5.6 Pasca Penambakan (Pembangunan atas Tanah Tambakan)

Lima (5) pembangunan utama di atas tanah tambakan terdiri daripada 28.39% untuk pelancongan, 7.04% untuk pembangunan komersial, 5.71% untuk pembangunan perumahan, 1.67% untuk pendidikan dan fasiliti kesihatan dan 15.07% untuk pembangunan utiliti

*Rajah R16* menunjukkan pelan induk konsep keseluruhan pembangunan atas tanah tambakan. Kawasan ini bakal diubah daripada sebuah kampung nelayan yang biasa kepada kawasan tarikan pelancong. Ciri utama KWRC adalah keunikan pembangunan bercampur di sepanjang pesisiran pantai Pahang untuk mewujudkan bandar kediaman yang mempunyai pusat perniagaan moden yang dikaitkan dengan pelbagai fasiliti rekreasi dan komuniti.



**Rajah E16** ▶  
 Pelan Induk Konsep Keseluruhan Pembangunan atas Tanah Tambakan

Sumber: SS Planning & Consult (2015)

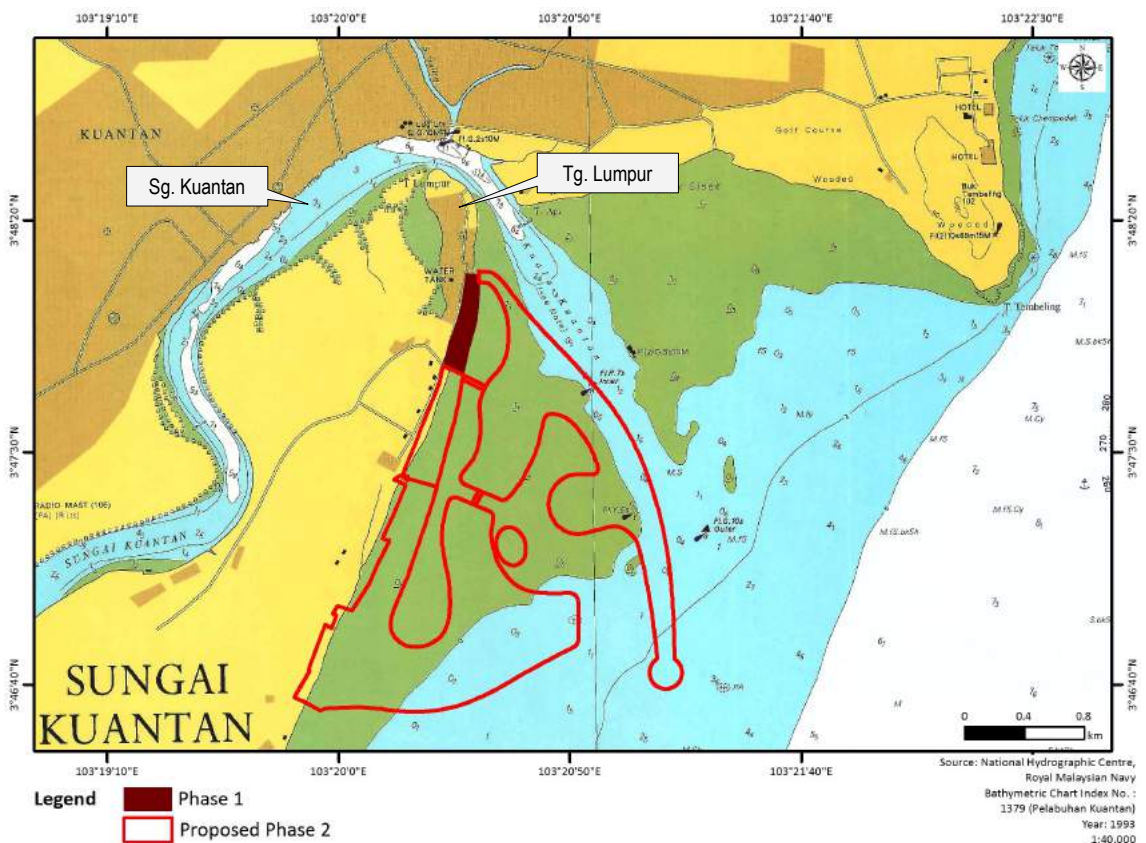
## 6. Persekitaran Fizikal Sedia Ada

### 6.1 Keadaan Fizikal Sedia Ada

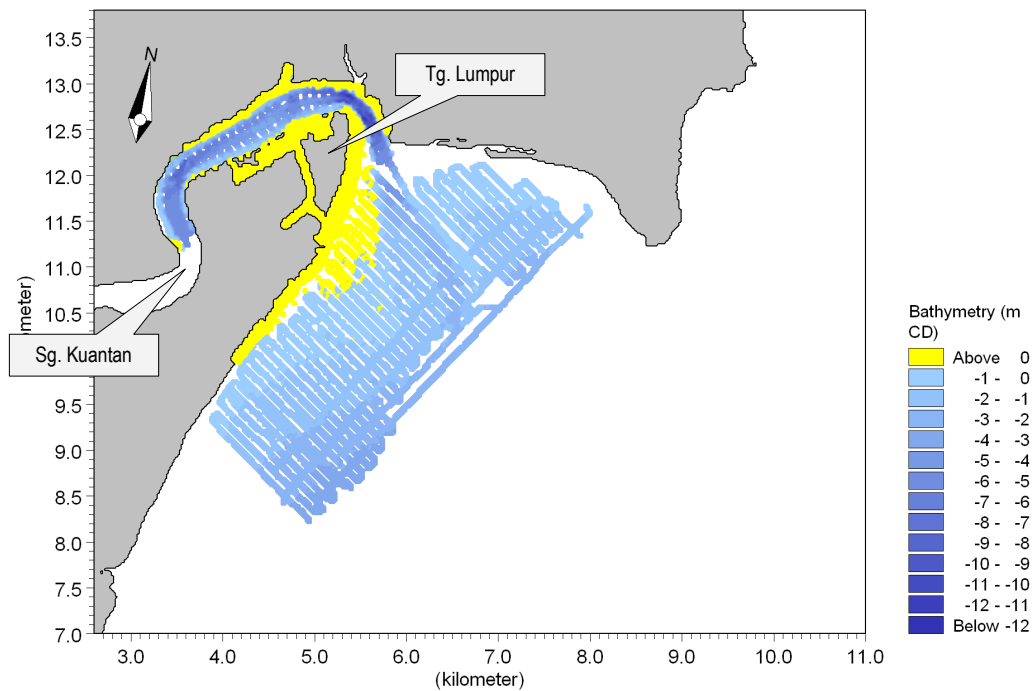
Bahagian ini akan menerangkan tentang keadaan fizikal, biologi dan sosio-ekonomi sedia ada termasuklah kawasan sensitif alam sekitar (KSAS) di kawasan berdekatan kawasan Projek.

#### 6.1.1 Batimetri

Merujuk kepada Peta Batimetri No. 1379 (keluaran tahun 1984 dan edisi baru keluaran tahun 2006) (*Rajah R17*), kawasan kering mempunyai kealaman maksimum sebanyak 1.5 km (dari aras air rendah hingga kedalaman 0 m CD) di antara Teluk Baharu dan muara Sungai Kuantan. Namun begitu, untuk kajian EIA ini, hasil tinjauan yang dijalankan pada bulan Julai 2013 telah digunakan seperti dalam *Rajah R18*.



**Rajah R17** ► Peta Batimetri No. 1379



Rajah R18 ► Tinjauan Batimetri (Jun 2013)

### 6.1.2 Aliran Arus

Kelajuan arus adalah pada tahap maksimum ketika air surut dan air pasang. Aliran arus adalah ke utara ketika air surut dan sebaliknya ketika air pasang. Kelajuan arus adalah berkurang ketika pasang surut anak. Kelajuan arus min dan maksimum adalah masing-masing 0.6 dan 1.7 m/s yang berlaku di hadapan muara Sungai Kuantan. Tiada perubahan arus yang ketara dapat dilihat pada semua monsoon.

### 6.1.3 Ombak

Ombak tertinggi yang menghambat kawasan projek adalah dari arah 90°U dan diikuti dari 60, 120, 150 and 30°N.

### 6.1.4 Pengangkutan Sedimen

Terdapat dua (2) jenis pengangkutan sedimen iaitu pengangkutan sedimen kohesif dan pengangkutan sedimen tidak kohesif.

#### 6.1.4.1 Pengangkutan Kohesif (Lumpur)

Hakisan berlaku di Sungai Kuantan dan di hadapan muara sungai dengan kelajuan arus min ialah 0.4 m/s dan maksimum padakadar 1.3 m/s.

#### 6.1.4.2 Pengangkutan Tidak Kohesif (Pasir)

Pengangkutan sedimen berkapasiti tinggi berlaku pada keadaan Monsun Timur Laut, diikuti dengan keadaan Monsun Barat Daya dan keadaan monsun peralihan.

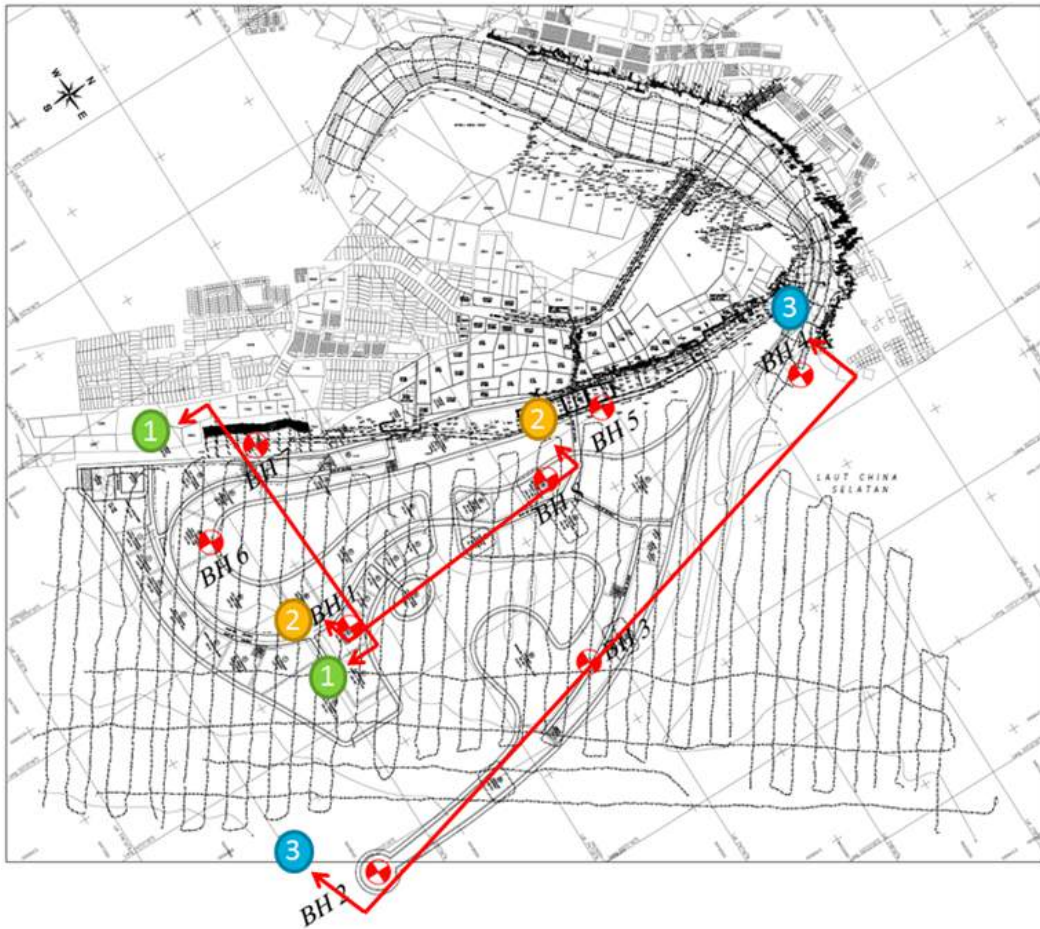
### 6.1.5 Morfologi Persisiran Pantai

Oleh kerana lokasi Kampung Tanjung Lumpur yang berhampiran dengan pantai yang aktif, kawasan ini telah diklasifikasikan sebagai Kategori III di dalam Kajian Hakisan Pantai Negara (UPEN, 1985). Pada 1997, sepanjang 1.2 km kawasan pantai Tanjung Lumpur telah diklasifikasikan sebagai Kategori I kerana bahagian pantai utaranya yang sensitif telah mengalami perubahan besar semasa banjir. Lawatan ke tapak menunjukkan masih terdapat tanda-tanda bahawa aktiviti morfologi masih berlaku. Laporan deraf NCES (JPS, 2016) menunjukkan bahawa kawasan tersebut telah dikategorikan sebagai Kategori I.

### 6.1.6 Ciri-ciri Tanah

Seperti yang dinyatakan dalam peta geologi Semenanjung Malaysia, Projek ini terletak dalam kawasan deposit zaman Kuartener. Kerja tanah telah dijalankan oleh Strata Drill Sdn. Bhd. Lapan (8) lubang gerudi ditunjukkan dalam *Rajah R19* manakala koordinatnya dijadualkan dalam *Jadual R9*.

Titik	Latitud (U)	Longitud (T)	Jadual R9 ► Koordinat lubang gerudi
BH1	3° 46' 47.997"	103° 20' 19.357"	
BH2	3° 46' 59.775"	103° 20' 39.702"	
BH3	3° 47' 37.894"	103° 20' 39.702"	
BH4	3° 48' 14.086"	103° 20' 40.773"	
BH5	3° 47' 28.471"	103° 21' 07.97"	
BH6	3° 46' 42.429"	103° 21' 15.037"	
BH7	3° 47' 02.559"	103° 20' 10.149"	
BH8	3° 47' 50.315"	103° 20' 34.134"	



Rajah R19 ► Lokasi dan Keratan Rentas Lubang Gerudi

#### 6.1.6.1 Seksyen 1: BH1 and BH7

BH1 terdiri daripada tanah liat dengan ketebalan sebanyak 15 m. Ini diikuti oleh lapisan pasir. Batu kerikil juga ditemui di kedalaman 22.5 m.

BH7 terdiri kebanyakan daripada pasir sehingga kedalaman 10.5 m. Ini diikuti oleh pasir mampat sehingga hujung lubang gerudi. Tiada lapisan yang boleh dimampatkan di BH7.

#### 6.1.6.2 Seksyen 2: BH1 and BH8

Di BH8, tanah liat lembut ditemui sehingga kedalaman 4.5 m manakala pasir ditemui di kedalaman 16 m.

### 6.1.6.3 Seksyen 3: BH2, BH3 and BH4

Top layer soil at BH2 and BH3 consisted of 3.0 m thick loose sand. Underlying this layer, soft clay was encountered with a thickness of approximately 6.0 m. At 18.0 m depth, medium to dense sand were encountered at BH2 and BH3. For BH4, soft clay was encountered until depth of approximately 4.5 m. Underlying this layer, medium dense sand was found with a thickness of approximately 7 m.

## 6.1.7 Iklim dan Meteorologi

Secara umumnya, ciri-ciri iklim di tapak Projek adalah lembap dengan suhu yang sekata dan menerima taburan hujan yang banyak. Terdapat empat jenis monsun yang ada iaitu:

- i) Monsun Timur Laut dari bulan Disember hingga Mac;
- ii) Monsun Peralihan dari bulan April hingga Mei;
- iii) Monsun Barat Daya dari bulan Jun hingga September; dan
- iv) Monsun Peralihan dari bulan Oktober hingga November.

### 6.1.7.1 Banjir

Tanjung Lumpur pernah mengalami banjir pada tahun 2009. Banjir terburuk yang pernah berlaku di Kuantan adalah pada Disember 2014 semenjak tahun 2012. Ianya disebabkan oleh hujan lebat dan kenaikan aras air di laut dan sungai; serta keadaan sistem saliran yang tidak baik.

### 6.1.7.2 Angin

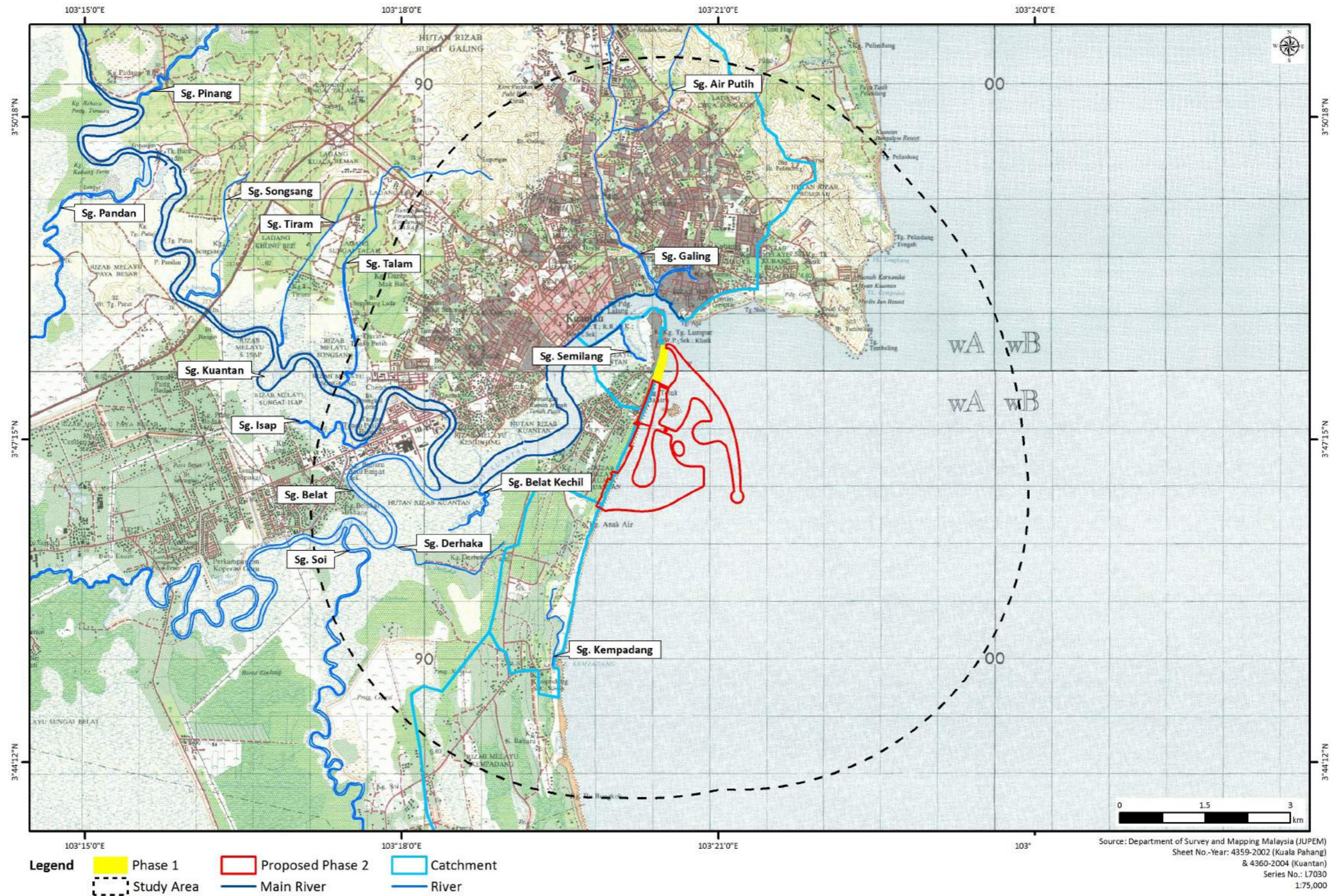
Di kawasan Projek, waktu-waktu tenang (kelajuan angin kurang daripada 1 m/s) pada setiap tahun berlaku kira-kira 1.9% daripada setiap masa. Kelajuan angin mencapai sehingga 10 m/s bagi arah dominan purata angin. Arah dominan angin adalah dari timur laut dan barat daya.

## 6.1.8 Hidrologi dan Saliran

Tapak cadangan projek adalah terletak di Tanjung Lumpur dan berhampiran dengan muara Sungai Kuantan. Kedua-dua kawasan ini dihubungkan oleh Jambatan Tanjung Lumpur.

Di Tanjung Lumpur, air hujan akan mengalir secara langsung ke dalam paya berdekatan, Laut China Selatan atau Sungai Kuantan. Selain itu, air hujan juga akan menyusup ke dalam kawasan yang berpasir. *Rajah R20* menunjukkan kawasan tadahan air di kawasan Projek.





Rajah R20 ► Kawasan Tadahan Air di Kawasan Projek

### 6.1.9 Guna Tanah

Guna tanah di sekitar tapak projek terletak di bawah Rancangan Tempatan Kuantan (2013 – 2015) dan Rancangan Struktur Negeri Pahang (2002-2020). Dalam pelan perancangan tersebut, guna tanah dibahagikan kepada kawasan kawalan perancangan iaitu Blok Perancangan (BP). BP pula terbahagi kepada Blok Perancangan Kecil (BPK). *Jadual R10* menunjukkan perincian bagi BP dan BPK. Projek KWRC terletak dalam BP4: Jaya Gading - Gading.

**Jadual R10** ► Mukim dan Blok Perancangan bagi Daerah Kuantan

BP	Nama	Blok Perancangan Kecil (BPK)	Luas (Ha)	Peratusan (%)
1	Sungai Karang	9	25,365.00	8.57
2	Beserah	12	4,935.00	1.67
3	Bandar Kuantan	15	13,515.00	4.57
4	<b>Jaya Gading - Gambang</b>	<b>18</b>	<b>37,524.00</b>	<b>12.68</b>
5	Penur	6	22,300.00	7.53
6	Kuala Kuantan	2	28,461.00	9.62
7	Ulu Kuantan	4	88,600.00	29.93
8	Ulu Lepar	4	75,300.00	25.44
<b>Total</b>			<b>296,000.00</b>	<b>100.00</b>

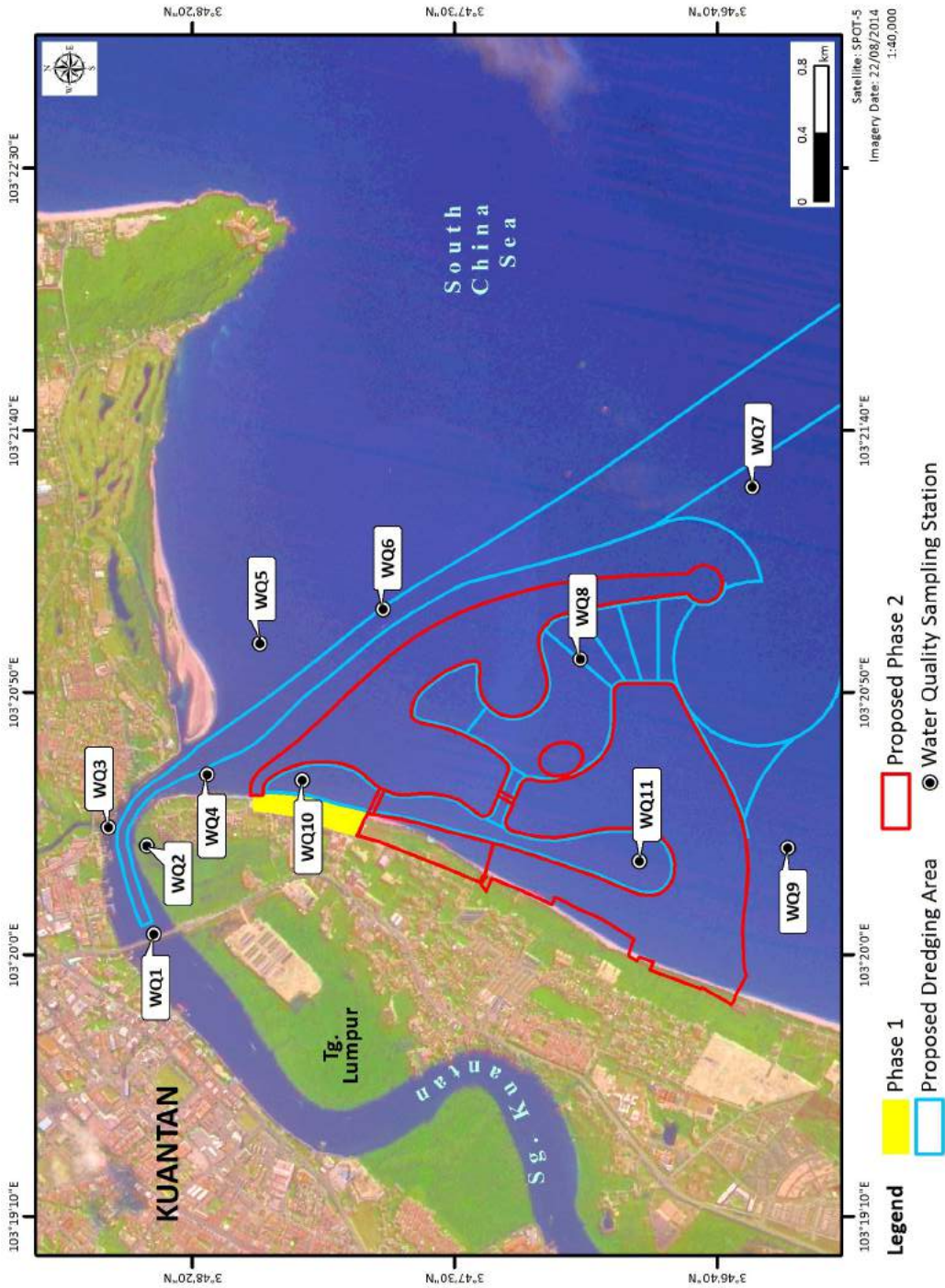
Sumber: Rancangan Tempatan Kuantan (2013 – 2015)

### 6.1.10 Kualiti Air

Persampelan kualiti air yang dijalankan di persekitaran tapak projek termasuklah air sungai dan air laut. Sebelas (11) stesen persampelan kualiti air telah dikenal pasti di kawasan projek (*Rajah R21*). Parameter kualiti air yang dikaji adalah seperti dalam *Jadual R11*.

**Jadual R11** ► Parameter Kualiti Air

Perkara	Parameter
Fizikal	Suhu, kemasinan, pH, konduktiviti, kekeruhan, DO, TSS
Anion	Nitrogen ammonia, fosfat, nitrat
Kations/Logam berat	Cr, Cd, Cu, Ni, Fe, Pb, Mn, As, Hg
Organik	BOD, COD, TOC, minyak dan gris
Mikrob	<i>E.coli</i> , Kolfom najis, Enterococci
Kedalaman	Tiga kedalaman (permukaan, pertengahan, dasar)
Pasang surut	Perbani (air pasang dan air surut)



Rajah R21 ▶ Stesen Persampelan Kualiti Air

Sampel air di stesen WQ 1 hingga WQ 5 telah dibandingkan dengan Class E (sesuai digunakan untuk paya bakau, air payau dan muara sungai) di bawah *Marine Water Quality Criteria and Standard* (MWQCS) manakala stesen WQ 5 hingga WQ 11 telah dibandingkan dengan Class 2 (sesuai digunakan untuk hidupan laut, perikanan, terumbu karang, rekreasi dan marikultur) di bawah MWQCS. Keputusan data sedia ada kualiti air adalah seperti berikut:

#### 6.1.10.1 Kualiti Air Payau

Kualiti air di muara Sungai Kuantan (WQ1) pada umumnya adalah sederhana. Paras BOD kekal kurang dari 6 mg/L, manakala NH<sub>3</sub>-N adalah dalam lingkungan 0.33-0.39 mg/L (bagi kedalaman berbeza). Ianya adalah sepadan dengan nilai TSS dan kekeruhan yang rendah. *Faecal coliform* dan *E.coli* tidak dapat dikesan kecuali pada paras permukaan.

Di Sungai Semilang (WQ2), kualiti air adalah tidak berapa bagus. Nilai BOD adalah antara 7-11 mg/L manakala NH<sub>3</sub>-N antara 0.30-0.57 mg/L dan fosfat antara 0.06-0.25 mg/L. Nilai TSS dan kekeruhan telah meningkat dengan ketaranya pada masa air surut iaitu 269 mg/L dan 200 NTUs masing-masing.

Stesen WQ3 (Sungai Galing) telah menunjukkan nilai yang ketara pada organik, ammonia, fosfat dan bakteria. Nilai BOD<sub>5</sub> adalah antara 4-10 mg/L, fosfat antara 0.21-0.27 mg/L dan *E.coli* dengan jumlah 8000 cfu/100 mL. Nilai *Enterococci* adalah di antara 64 – 174 cfu/100 mL.

Di stesen WQ4, kualiti air Sungai Kuantan menjadi lebih merosot setelah menerima air dari anak sungai terutamanya Sungai Galing. Paras *E.coli* meningkat kepada antara 1,600 – 2,000 cfu/100mL. Peningkatan paras keseluruhan dalam NH<sub>3</sub>-N (0.5 mg/L) dan fosfat (untuk 0.1-0.2 mg/L) turut dikesan.

#### 6.1.10.2 Kualiti Air Marin

Peningkatan paras *faecal coliform* dan *E.coli* telah hilang di zon pantai (WQ5 dan WQ6) kepada kurang daripada 200 cfu/100 mL atau tidak dikesan semasa keadaan air surut dan air pasang. Nilai BOD, NH<sub>3</sub>-N dan TSS juga berkurang di zon pantai. Oleh itu, aktiviti air adalah tidak digalakkan di kawasan ini kerana lokasi muara Sungai Kuantan dan Sungai Galing yang sangat dekat dan wujudnya risiko pencemaran.

Di stesen WQ7 dan WQ9 (laut terbuka), paras kebanyakan bacaan parameter adalah lebih rendah kecuali paras NH<sub>3</sub>-N di WQ7 yang meningkat kepada 0.43 mg/L pada permukaan ketika air surut.

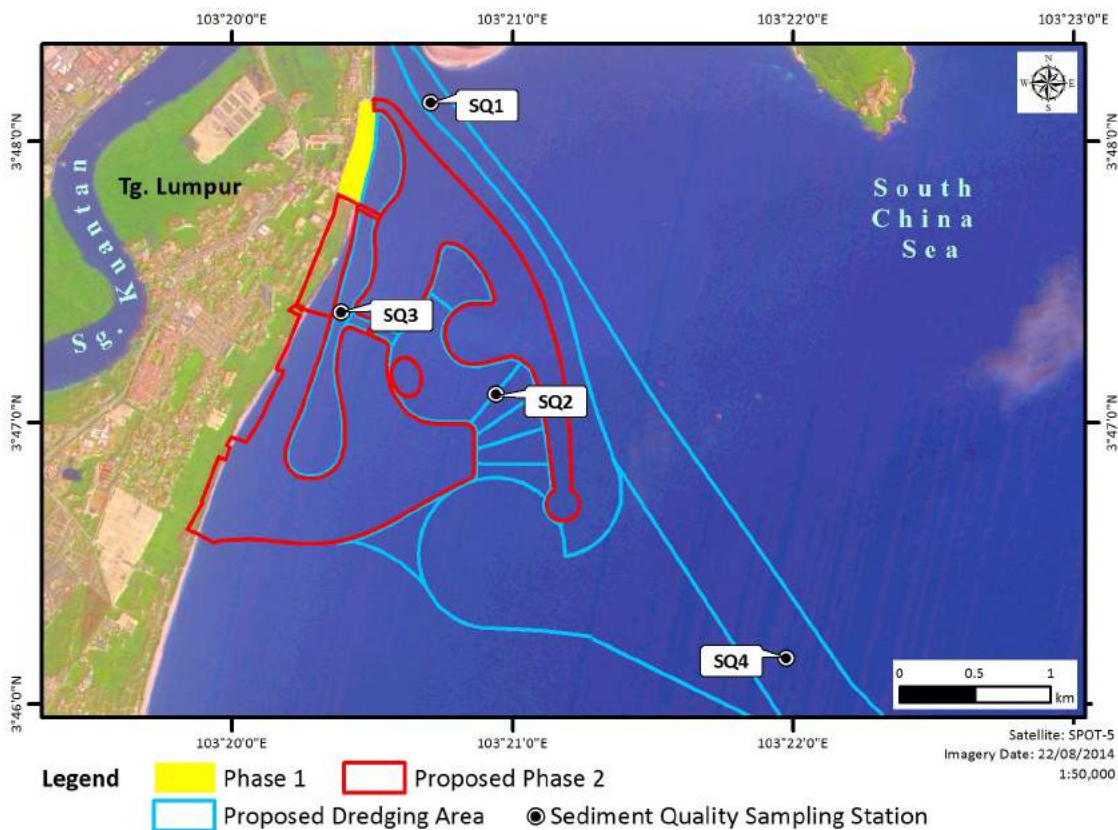
Di kawasan cadangan marina, stesen WQ8, WQ10 dan WQ11 menunjukkan paras bacaan parameter kekal rendah. Walaubagaimanapun, paras NH<sub>3</sub>-N dan fosfat adalah sedikit meningkat di WQ10 dan WQ11 dengan bacaan melebihi 0.3 mg/L dan 0.1 mg/L masing-masing.

Paras TSS adalah tinggi di stesen WQ10 dan WQ11 (semasa air surut iaitu antara 57-62 mg/L). Ini mungkin disebabkan oleh mendapan terampai di kawasan dataran lumpur. Arsenik (AS) juga telah dikesan di dalam air bagi semua stesen persampelan pada paras yang rendah (0.001-0.003 mg/L),

### 6.1.11 Kualiti Sedimen

Stesen persampelan kualiti sedimen adalah seperti dalam *Rajah R22*. Sampel sedimen telah diambil dengan menggunakan alat *Van Veen Grab sampler*. Parameter yang telah dikaji disenaraikan di dalam *Jadual R12*. Keputusan analisis secara kimia telah dijalankan mengikut Piawaian US EPA.

Keputusan analisis sedimen menunjukkan bahawa paras arsenic (AS) adalah melebihi piawaian yang ditetapkan di semua stesen persampelan (nilai antara 3–12 mg/kg). Umumnya, arsenik adalah unsur semulajadi yang terkandung dalam tanah di Malaysia. Aktiviti yang melibatkan gangguan kepada tanah (misalnya perlombongan bauksit) akan mengeluarkan arsenik dalam tanah yang kemudiannya akan diangkut ke dalam sungai atau pantai berdekatan ketika hujan dan akan mendap ke dalam sedimen.

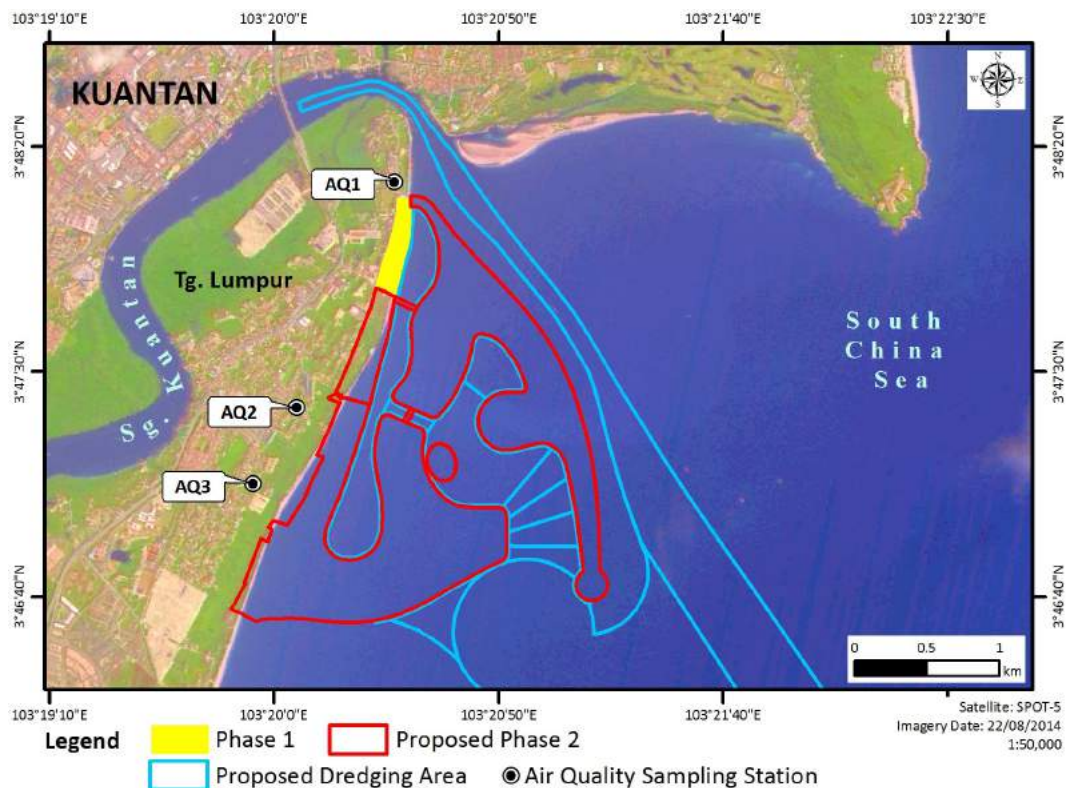


**Jadual R12** ► Parameter Kualiti Sedimen

Parameter	Unit	Kaedah
Zink, Zn	mg/kg	USEPA 3050 B, 6010 B
Nikel, Ni	mg/kg	USEPA 3050 B, 6010 B
Kuprum, Cu	mg/kg	USEPA 3050 B, 6010 B
Kromium, Cr	mg/kg	USEPA 3050 B, 6010 B
Plumbum, Pb	mg/kg	USEPA 3050 B, 6010 B
Arsenik as As	mg/kg	USEPA 3050 B, 6010 B
Kadmium, Cd	mg/kg	USEPA 3050 B, 6010 B
Nitrat	mg/kg	Leaching, APHA 4500 NO <sub>3</sub> -H
Fosforus	mg/kg	USEPA 3050 B, 6010 B
Minyak dan gris	mg/kg	APHA 5520 E

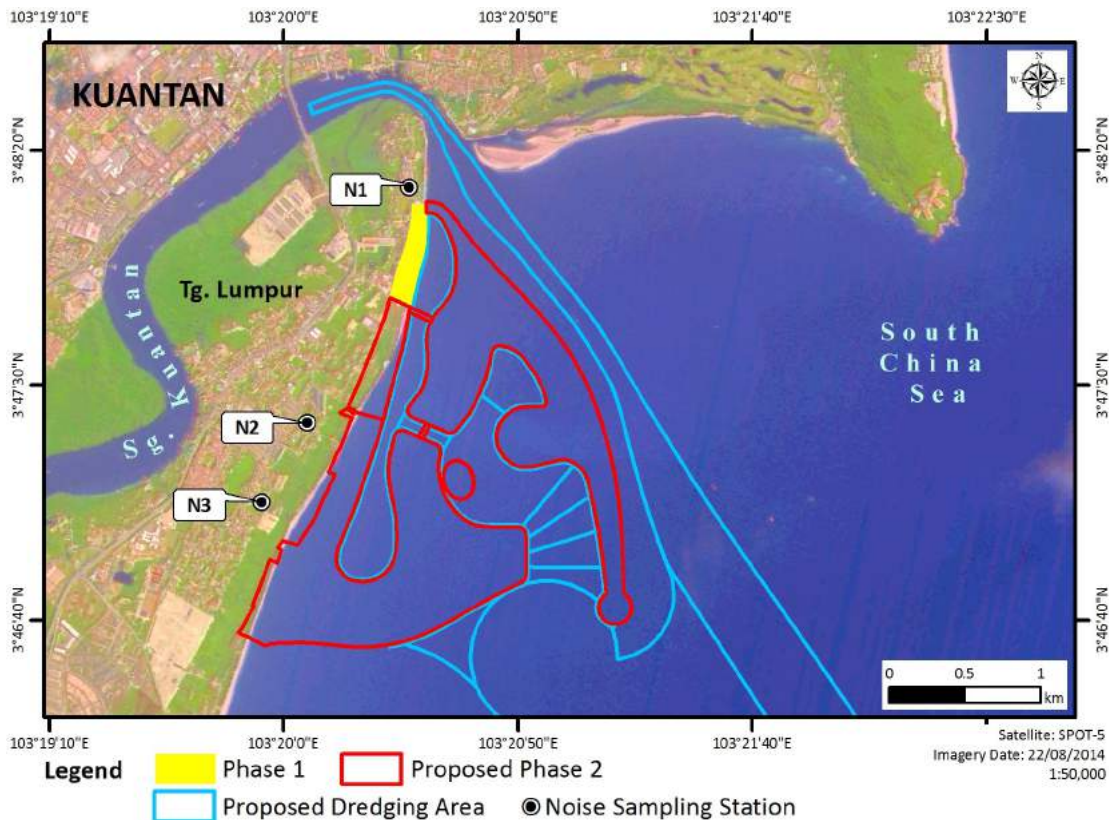
### 6.1.12 Kualiti Udara

Persampelan kualiti udara telah dijalankan di tiga (3) lokasi seperti *Rajah R23*. Keputusan bagi parameter TSP telah dibandingkan dengan Garis Panduan Kualiti Udara Malaysia (RMAQG) manakala bagi PM<sub>10</sub> dan PM<sub>2.5</sub> dibandingkan dengan *Interim Target 2 in 2018; Malaysian Ambient Air Quality Standards 2013*. Keseluruhannya, kepekatan bagi parameter yang dikaji adalah tidak melebihi had yang ditetapkan di dalam Garis Panduan Malaysia.

**Rajah R23** ► Stesen Persampelan Kualiti Udara

### 6.1.13 Hingar

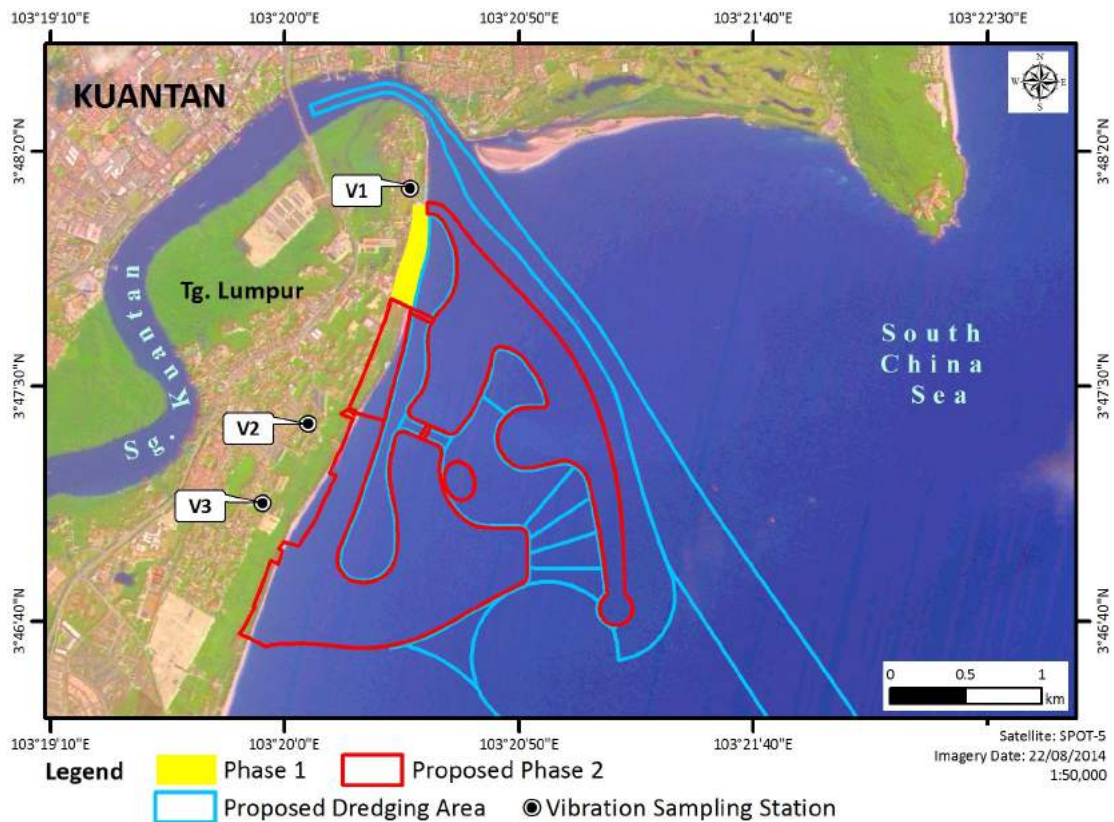
Pengukuran paras hingar telah dijalankan di tiga (3) lokasi seperti *Rajah R24*. Keputusan telah dibandingkan dengan “*Interim Guidelines for Maximum Permissible Sound Levels by Receiving Land Use*” (Jadual 1) terbitan Jabatan Alam Sekitar Malaysia. Secara keseluruhannya, paras hingar yang telah direkodkan adalah di bawah had yang telah ditetapkan. Sumber hingar yang telah dihasilkan adalah dari aktiviti manusia dan pergerakan kenderaan.



Rajah R24 ► Stesen Persampelan Hingar

### 6.1.14 Gegaran

Persampelan paras gegaran sedia ada telah dijalankan di tiga (3) lokasi seperti *Rajah R25*. Nilai tahap gegaran telah dibandingkan dengan “*Planning Guidelines for Vibration Limits and Control in the Environment*” terbitan Jabatan Alam Sekitar Malaysia. Hasil keputusan menunjukkan paras gegaran di semua stesen untuk ketiga-tiga paksi adalah di antara 0.889 mm/s ke 6.223 mm/s.



Rajah R25 ► Stesen Persampelan Gearan

### 6.1.15 Trafik Marin

Kajian trafik marin dan pelayaran telah dijalankan untuk mengenal pasti laluan trafik komersial sedia ada termasuklah bot-bot nelayan dan kapal-kapal lain yang menggunakan perairan dalam kawasan kajian.

Kajian ini tidak termasuk *Marine Traffic Risk Assessment (MTRA)*, isu operasi dan keberkesanan Projek.

#### 6.1.15.1 Laluan Pelayaran Sedia Ada

Muara Sungai Kuantan (Kuala Kuantan) boleh diakses 2.74 km dari arah barat Tanjung Tembeling yang berhadapan dengan tebing sungai. Alur pelayaran sedia ada ditanda dengan boya berlampu hingga ke tebing sungai. Oleh kerana alur pelayaran ini sentiasa berubah terutamanya ketika Monsun Timur Laut, kedudukan boya berlampu yang dipasang juga berubah mengikut keperluan. Sungai Kuantan boleh diakses oleh kapal dengan 3 m draf.



#### **6.1.15.2 Kawasan Berlabuh Sedia Ada**

Kapal dengan draf sehingga 13 m boleh berlabuh di timur laut dan barat daya alur pelayaran. Kawasan ini sesuai berlabuh kerana mempunyai struktur pegangan tanah yang kuat, meskipun terdedah kepada Monsun Timur Laut. Kawasan berlabuh sekunder terletak di muara Sungai Kuantan dan berkedalaman 8.2 hingga 9.2 m. Kawasan ini terletak dalam 1.29 km di arah selatan dan tenggara Tanjung Tembeling. Kawasan berlabuh yang lain juga terdapat pada jarak 3.7 km tenggara Tanjung Tembeling dengan kedalaman 12 m.

#### **6.1.15.3 Aktiviti Marin dan Kemudahan Sedia Ada**

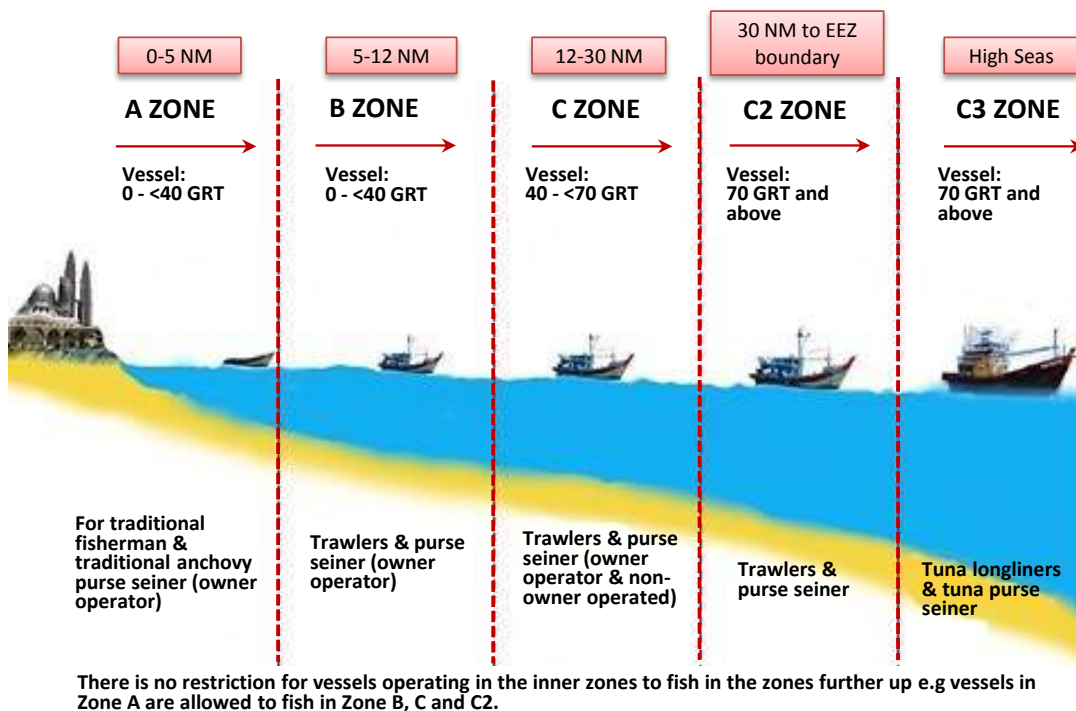
Tapak cadangan projek terletak di selatan muara Sungai Kuantan dan di dalam kawasan Had Pelabuhan Kuantan.

##### **6.1.15.3.1 Aktiviti Perikanan**

Muara Sungai Kuantan merupakan pangkalan perikanan kerana dipenuhi dengan deretan jeti kecil, bot nelayan yang berlabuh di luara pantai dan pantai yang berpasir. Tapak projek ini terletak di dalam Zon A yang berjarak 5 batu nautika (bn) dari pantai. Bot perikanan yang dibenarkan di dalam zon ini adalah bot nelayan tradisional dan alat penangkapan pula ialah pukot jerut ikan bilis sahaja. Kebanyakan nelayan Melayu memiliki bot nelayan tradisional (Zon A) manakala kebanyakan nelayan Cina memiliki pukot tunda (Zon C). Perincian bagi setiap zon perikanan ditunjukkan dalam *Rajah R26*.

##### **6.1.15.3.2 Pelabuhan Kuantan**

Pelabuhan Kuantan terletak 14.2 bn utara dari tapak projek dan menyediakan lebih empat (4) dermaga yang boleh menampung pelbagai jenis kapal kargo. Pelabuhan Kuantan member perkhidmatan bagi beberapa laluan pelayaran utama dunia, termasuklah Pacific Rim, Timur Tengah, Timur Jauh, rantau Asean dan pantai barat Amerika Syarikat. *Jadual R13* menyenaraikan kapal dagang yang berlabuh di Pelabuhan Kuantan.



**Rajah R26** ► Zon Perikanan di Malaysia (kecuali Kedah, Pulau Pinang, Perak dan Selangor)  
 Sumber: Jabatan Perikanan Malaysia

**Jadual R13** ► Bilangan Kapal Dagang yang Berlabuh di Pelabuhan Kuantan

Tahun	Kontena	Kapal Tangki	Pengangkut Pukul	Kapal Kargo	Lain-lain	Jumlah
2010	477	940	367	515	106	2405
2011	460	971	484	422	103	2440
2012	434	1079	458	405	94	2470
2013	336	1062	455	475	78	2406
2014	329	987	433	524	88	2361

Sumber: Jabatan Laut Malaysia (2015)

### 6.1.16 Trafik Darat

Keadaan trafik sedia ada bagi rangkaian jalan raya telah dikaji dan dibincangkan dalam bahagian ini. Bagi menentukan jumlah trafik sedia ada pada waktu kemuncak, kiraan trafik manual telah dijalankan di persimpangan berikut:

- i) JCT1: Simpang keluar masuk Jalan Pantai Sepat dan Jalan Persekutuan 183: Jalan Tanjung Lumpur; dan
- ii) JCT2: Persimpangan-T di Jalan Yayasan Pahang dan Jalan Persekutuan 183: Jalan Tanjung Lumpur.

Kesimpulannya, pada waktu puncak, aliran trafik sedia ada di sekitar kawasan projek beroperasi pada tahap *Level of Service* (LOS) yang baik.

## 6.2 Persekitaran Biologi Sedia Ada

Komponen biologi yang dikaji terdiri daripada hidupan di kawasan darat dan marin. Penerangan tentang komponen ini adalah berdasarkan tinjauan kerja lapangan dan plot kajian yang dijalankan. Data sekunder diperolehi daripada pelbagai institusi dan agensi kerajaan sama ada yang telah diterbitkan dan tidak diterbitkan.

### 6.2.1 Flora Terrestrial (Bakau)

Terdapat tiga (3) kerja lapangan telah dijalankan iaitu pada bulan September 2013 (lawatan tapak), Februari 2014 (tinjauan dari darat) dan pada bulan September 2015 (tinjauan dengan bot). Kajian merangkumi kawasan dari Tanjung Lumpur ke Kampung Anak Air. Tumbuh-tumbuhan yang terdapat di sepanjang persisiran pantai terdiri daripada pokok herba, renek dan kelompok hutan belukar. Beberapa kelompok bakau yang telah terjejas dapat dilihat di Tanjung Lumpur dan Tanjung Api.

Secara keseluruhannya, hutan bakau adalah sihat di sepanjang tebing sungai. Kebanyakan pokok bakau sedang berbunga/berbuah. Di antara spesies yang boleh dilihat adalah *Ceriops zippeliana*, *Kandelia candel*, *Bruguiera sexangula*, *Merope angulata*, dan *Brownlowia argentata*. Spesies-spesies ini adalah antara yang luar biasa / jarang ditemui di Malaysia tetapi banyak ditemui di dalam kawasan kajian, terutamanya *Kandelia candel* dan *Brownlowia argentata*. Spesies *Brownlowia argentata* disenaraikan dalam IUCN Red List sebagai tumbuhan bakau "Kekurangan Data" (Polidoro *et al.* 2010).

Walaupun di Malaysia, spesies *Brownlowia argentata* dikategorikan sebagai spesies "Terancam" (Ong *et al.* 2015).

### 6.2.2 Fauna Terrestrial (Burung)

Objektif kajian ini adalah untuk mendapatkan inventori avifauna di kawasan kajian dengan menggunakan kaedah pemerhatian melalui mata kasar dan pendengaran bunyi serta teknik fotografi. Dari hasil kajian yang diperolehi, sebanyak 72 spesies burung dari 26 famili telah direkodkan di kawasan kajian. Berdasarkan IUCN Red List, status pemuliharaan burung yang direkodkan adalah "Kurang Membimbangkan (LC)", kecuali bagi enam (6) spesies berikut:

- i) Chestnut-bellied Malkoha;
- ii) Cinnamon-headed green Pigeon;
- iii) Jambu Fruit Dove;
- iv) Mangrove Pitta;
- v) White-chested Babbler (kategori hampir terancam); dan
- vi) Chinese Egret (kategori lemah).

### 6.2.3 Persekitaran Biologi Marin

Kerja persampelan biologi marin melibatkan empat (4) fauna marin yang penting iaitu, fitoplankton, zooplankton, makrobentos serta ikan dan sumber perikanan.

#### 6.2.3.1 Fitoplankton

Dari persampelan yang dijalankan, sejumlah 22,946 individu fitoplankton daripada 53 spesies yang berbeza telah disampel dan dikenal pasti. Daripada jumlah keseluruhan, filum Bacillariophyta mempunyai peratusan tertinggi iaitu 62.43% dan terendah adalah Ochrophyta iaitu 0.031%. Umumnya, kepelbagaian dan kekayaan nilai indeks adalah agak tinggi dan baik. Nilai indeks dominan adalah sangat rendah dan ini telah menunjukkan bahawa populasi fitoplankton masih dalam keadaan seimbang dan tiada gangguan.

#### 6.2.3.2 Zooplankton

Daripada data, sejumlah 61 spesies zooplankton telah dikenal pasti. Sebanyak 5,435,306 individu telah disampel. Dengan 80%, filum Arthropoda (Crustacea dan Chelicerata) adalah yang paling dominan. Hasil kajian menunjukkan zooplankton mempunyai kombinasi kepelbagaian yang baik dan tiada gangguan.

#### 6.2.3.3 Makrobentos

Sejumlah 2,088 individu dari 44 taksa yang berbeza telah disampel dan dikenal pasti. Peratusan tertinggi adalah Polychaeta (58.20%) diikuti dengan Crustacea (19.20%) dan kemudiannya moluska dan echinoderma. Hasil kajian menunjukkan kawasan populasi makrobentos di kawasan kajian berkeadaan baik dan tiada gangguan.

#### 6.2.3.4 Ikan dan Sumber Perikanan

Kajian perikanan telah dijalankan di kawasan seluas 5 batu nautika dari pantai. Pukat tunda digunakan untuk mengutip sampel iaitu ikan, krustasia dan moluska. Laluan pukat tunda berada dalam lingkungan koordinat 03° 46' 12.9" N, 103° 21' 21.6" E and 03° 50' 40.7" N, 103° 23' 26.4" E. Beberapa tinjauan visual terhadap hasil tangkapan nelayan dan temubual dijalankan bagi mengukuhkan lagi kualiti kutipan data sampel pukat tunda, terutama sekali di kawasan pendaratan ikan.

Hasil kajian menunjukkan 67 spesies dari 39 famili telah direkodkan. Umumnya, kekayaan spesies ikan yang direkodkan adalah sederhana dan dijangka tinggi jika tempoh kajian dilanjutkan. Tiada spesies ikan yang invasif ditemui dan ikan yang telah direkodkan ini dikategorikan sebagai "Kurang Membimbangkan" yang bermaksud jumlah yang banyak dan

taburannya agak luas. Kajian juga menunjukkan kira-kira 80% hasil tangkapan adalah ikan yang kurang nilai ekonominya. Komponen utama ikan ini adalah dari family Leiognathidae termasuklah *Gaza* spp., *Leiognathus* spp. dan *Secutor* spp. (ikan kekek).

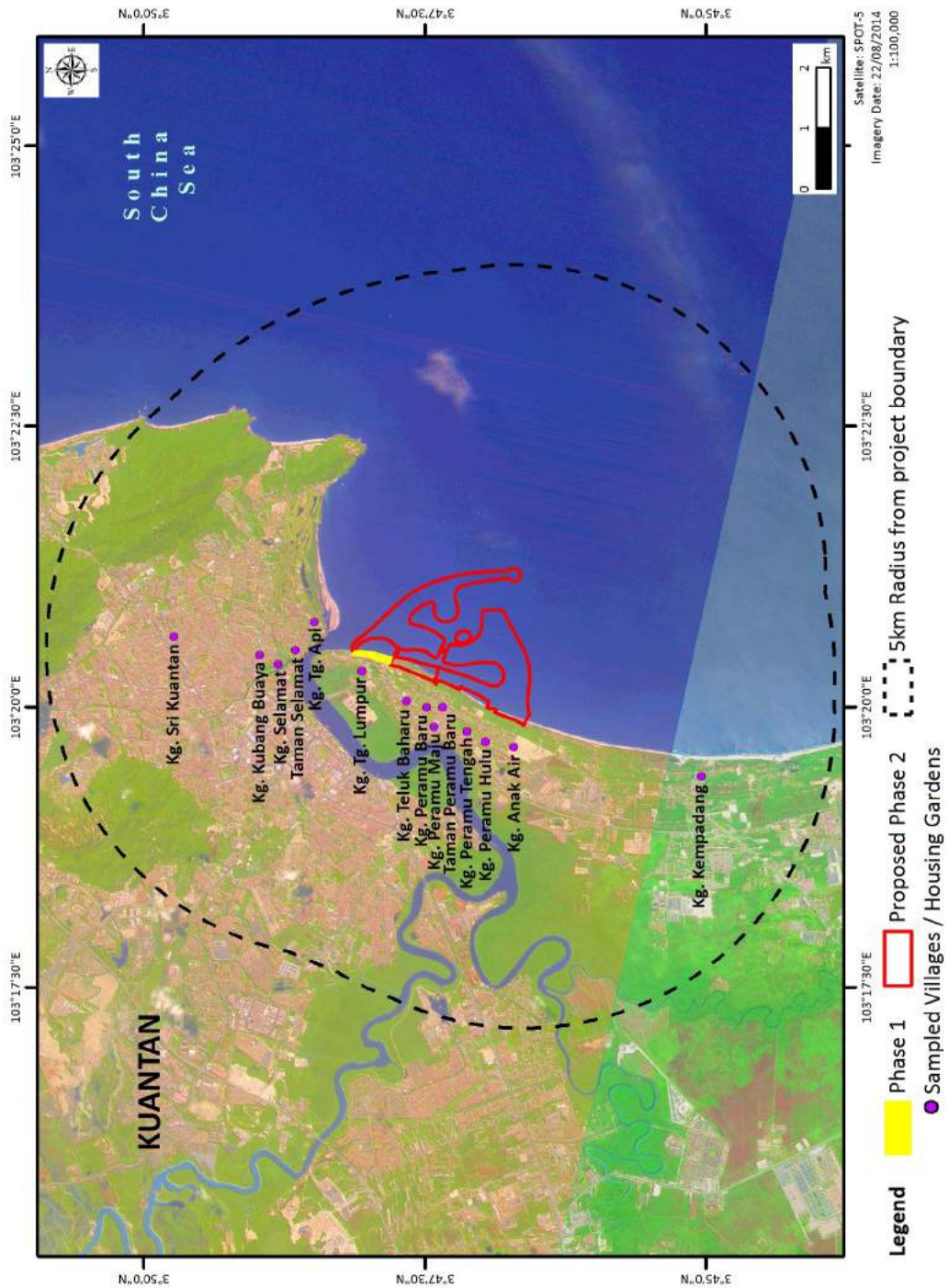
### 6.3 Persekitaran Sosio-ekonomi Sedia Ada

Satu kajian sosio-ekonomi telah dijalankan untuk mendapat persepsi dan mengenal pasti sikap masyarakat terhadap projek yang dicadangkan. Kawasan kajian meliputi kawasan 5 km perimeter dari sempadan kawasan projek. Ianya terletak di dalam Mukim Kuala Kuantan yang merupakan antara enam (6) mukim terbesar dalam daerah Kuantan (*Rajah R27*).

Secara keseluruhan, sejumlah 302 sampel (terdiri daripada ketua isi rumah sebagai responden) dari kawasan perumahan di dalam kawasan kajian telah dipilih secara rawak menggunakan teknik persampelan purposif. Taburan sampel adalah seperti di *Jadual R14*.

**Jadual R14** ► Taburan Responden Mengikut Penempatan di Kawasan Cadangan Projek

Kawasan Kajian	Nelayan	Orang Awam	Peniaga	Pengguna Pantai
Kg. Tg.Lumpur	23	0	24	15
Kg. Teluk Baharu	-	8	-	-
Kg. Peramu Maju	-	16	-	-
Kg. Peramu Tengah	37	15	-	-
Kg. Peramu Baru	-	15	-	-
Kg. Peramu Hulu	-	4	-	-
Taman Peramu Baru	-	11	-	-
Kg. Anak Air	-	6	-	-
Kg. Tanjung Api	20	4	15	15
Kg. Selamat	-	13	-	-
Taman Selamat	-	10	-	-
Kg. Kempadang	35	-	-	-
Kg. Sri Kuantan	-	10	-	-
Kg. Kubang Buaya	-	15	-	-
<b>Jumlah</b>	<b>115</b>	<b>118</b>	<b>39</b>	<b>30</b>
<b>Jumlah Keseluruhan</b>			<b>302</b>	



Selain kajian bancian, dua (2) sesi Perbincangan Kumpulan Sasaran (FGD) telah dijalankan sebelum sesi Dialog Umum. Sesi FGD tersebut diwakili oleh dua kumpulan masyarakat tempatan iaitu nelayan dan orang awam. Tujuan utama sesi FGD adalah untuk mengadakan perbincangan secara interaktif dengan para penduduk mengenai projek yang dicadangkan dan sebagai platform kepada mereka untuk membangkitkan isu-isu yang berkaitan dengan kesan projek terhadap mereka.

Selain itu, sesi Dialog Umum juga telah dijalankan bagi membolehkan perbincangan dua hala di antara pihak berkepentingan dan Penggerak Projek. Ini bagi membolehkan pihak berkepentingan mengetahui sudut perspektif yang lebih jelas dan untuk menyuarakan isu-isu yang penting bagi mereka. Maklum balas dari sesi ini adalah penting bagi pasukan kajian dalam membuat kesimpulan dan mempertimbangkan cadangan yang diutarakan. Sesi Dialog Umum ini telah dijalankan di Dewan Orang Ramai Kampung Peramu pada 23 April 2016 dan telah dihadiri oleh 85 orang yang terdiri daripada penduduk tempatan dan individu yang berminat.

### **6.3.1 Profil Komuniti**

Data analisis yang dikumpul dari kaji soal selidik menunjukkan profil komuniti dari segi demografik, sosial dan ekonomi bagi komponen-komponen yang berlainan dalam masyarakat.

#### **6.3.1.1 Latar Belakang Demografi Responden**

Dari segi umur, antara 50-64% responden pada umumnya adalah matang dewasa dan berumur dari 30 hingga 49 tahun. Purata umur adalah dari 39 ke 47 tahun dan ini menunjukkan bahawa responden adalah agak muda yang dikenali sebagai "orang dewasa matang". Walau bagaimanapun, taburan umur penduduk (jumlah responden ahli isi rumah) adalah lebih kepada struktur usia yang bercampur.

Nisbah jantina adalah tidak seimbang dengan lelaki mengatasi perempuan bagi kumpulan isi rumah nelayan iaitu 133M/100F dan perempuan mengatasi lelaki bagi kumpulan isi rumah orang awam iaitu 88M/100F. Pengurangan bilangan lelaki bagi kumpulan orang awam adalah kerana lelaki berhijrah ke luar kawasan bagi mencari peluang pekerjaan yang lebih baik. Bagi kumpulan isi rumah nelayan, nisbah lelaki adalah lebih kerana penghijrahan keluar perempuan dan kemasukan nelayan luar yang bekerja sebagai awak-awak dan juragan dalam industri perikanan tempatan. Ketidakselarasan nisbah umur dan jantina dalam kawasan kajian dengan corak mukim adalah mungkin disebabkan oleh perbezaan antara keadaan mikro dan agregat.

### 6.3.1.2 Profil Sosio-ekonomi Responden

Latar belakang pendidikan responden adalah berbeza-beza dengan kumpulan nelayan mempunyai tahap pendidikan yang rendah dan kumpulan orang awam dan pengguna pantai mempunyai tahap pendidikan yang lebih baik. Dari segi ekonomi, nelayan dan peniaga bekerja sendiri dalam sektor masing-masing manakala kumpulan orang awam dan pengguna pantai bekerja dalam sektor awam dan swasta. Secara keseluruhannya, profil responden menunjukkan 84% daripada nelayan berpendapatan kurang daripada RM 1,001 sebulan dengan min bulanan RM 1,398 manakala peniaga berpendapatan lebih dengan purata bulanan RM 2,047.

Hampir kesemua responden memiliki rumah yang mereka duduki yang terdiri daripada rumah kampung dan rumah taman. Walaubagaimanapun, daripada kalangan nelayan, hanya 68.7% yang memiliki lot rumah atau tanah di mana 11.3% adalah penyewa sementara 20% lagi tinggal di tanah rizab. Dalam kalangan orang awam, peratusan mereka yang memiliki lot rumah sendiri adalah lebih tinggi iaitu 93.2% dan 6.8% selebihnya adalah penyewa.

Disebabkan sebahagian utama kawasan Projek kini mengalami proses urbanisasi, tidak dapat dinafikan bahawa satu pertiga daripada responden merupakan mereka yang baru sahaja berpindah ke kawasan tersebut, iaitu baru bermastautin kurang daripada 10 tahun. Kebanyakan mereka berasal dari daerah-daerah lain negeri Pahang dan Terengganu. Sebahagian kecil berasal dari Kelantan dan Melaka. Bagi mereka yang baru berpindah, tujuan utama adalah untuk mencari kerja atau memulakan perniagaan baru. Tindakan susulan mereka setelah berpindah dengan membeli rumah dan hartanah memberi gambaran bahawa kawasan tersebut bakal menjadi kawasan dominan yang penting bagi luar Kuantan.

## 6.3.2 Keputusan Kajian Mengenai Pandangan dan Persepsi

### 6.3.2.1 Tahap Kesedaran Terhadap Projek

Tahap kesedaran dan makluman orang awam mengenai KWRC disenaraikan di *Jadual R15*.

### 6.3.2.2 Persepsi Terhadap Pembangunan Cadangan

Analisis data menunjukkan responden sangat bersetuju bahawa projek ini akan memberikan kebaikan kepada mereka, kecuali dalam peluang pemilikan hartanah dan pekerjaan kepada mereka (*Jadual R16*).



**Jadual R15** ► Tahap Kesedaran dan Pengetahuan Responden tentang Projek (%)

Kesedaran dan Pengetahuan	Nelayan	Orang Awam	Peniaga	Pengguna Pantai
<b>Kesedaran:</b>				
Tahu tentang projek	27.8	15.3	17.9	26.7
Tidak tahu tentang projek	70.4	84.7	76.9	66.6
Tidak pasti	1.8	0.0	5.1	6.7
<b>Jumlah</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
<b>Sumber pengetahuan:</b>				
Media massa	3.1	66.7	22.2	75.0
Ketua kampung dan Penghulu	18.8	-	22.2	-
Ahli keluarga	-	11.1	33.4	-
Penduduk kampung/jiran	71.9	22.2	22.2	12.5
Pegawai Daerah	6.2	-	-	12.5
Lain-lain	-	-	-	-
<b>Jumlah</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Sumber: Data lapangan, 2014

**Jadual E16** ► Persepsi Responden tentang Kelebihan dan Kekurangan yang akan dibawa oleh Projek (% Setuju)

Persepsi	Nelayan	Orang Awam	Peniaga	Pengguna Pantai
<b>Kelebihan:</b>				
Peluang pekerjaan kepada ahli keluarga	58.3	50.0	82.1	56.7
Peluang pekerjaan kepada penduduk tempatan	91.3	97.5	94.9	86.7
Meningkatkan kemudahan asas	100.0	100.0	94.9	86.7
Meningkatkan nilai tanah/harta	100.0	100.0	94.9	80.0
Meningkatkan taraf hidup	100.0	100.0	94.9	63.3
Meningkatkan peluang perniagaan	36.5	100.0	94.9	63.3
Meningkatkan peluang kepada pemilikan harta	0.0	11.9	23.1	26.7
<b>Kekurangan:</b>				
Kehilangan pekerjaan	0.0	0.0	100.0	30.0
Kehilangan sumber pendapatan	0.0	0.0	100.0	30.0
Berpindah	0.0	0.0	79.5	40.0
Kehilangan harta benda	0.0	0.0	2.6	40.0
Peminggiran penduduk tempatan sedia ada	47.0	0.0	46.2	53.3
Penyempitan alur pelayaran di muara sungai Kuantan	14.8	78.8	15.4	40.0

Sumber: Data lapangan, 2014

### 6.3.2.3 Persepsi Terhadap Kesehatan dan Keselamatan

Jadual R17 menunjukkan bagaimana persepsi penduduk setempat terhadap kesehatan dan keselamatan.

**Jadual R17** ► Peratusan Persepsi terhadap Kesihatan dan Keselamatan

Ciri-ciri	Nelayan	Orang Awam	Peniaga	Pengguna Pantai
Pertambahan insiden kemalangan bot nelayan	3.5	2.5	2.6	3.3
Pertambahan pencemaran bunyi	5.2	57.6	7.7	13.3
Pertambahan trafik di jalan keluar masuk	85.2	-	71.8	93.3
Pertambahan pencemaran udara	70.4	10.2	56.4	73.3
Pertambahan pencemaran air	49.6	10.2	41.0	53.3
Membahayakan orang awam	30.4	-	43.6	33.3
Mengganggu ketenangan	27.0	-	38.5	23.3
Pertambahan penyakit berjangkit	5.2	-	5.1	6.7

Sumber: Data lapangan, 2014

#### 6.3.2.4 Persepsi Terhadap Estetik dan Budaya

Hasil analisis persepsi terhadap estetik dan budaya menunjukkan bahawa semua responden amat pasti dengan kesan pembangunan ini kepada nilai estetik dan budaya kawasan tersebut seperti yang diringkaskan dalam *Jadual R18*.

**Jadual R18** ► Peratusan Persepsi terhadap Estetik dan Budaya (% Setuju)

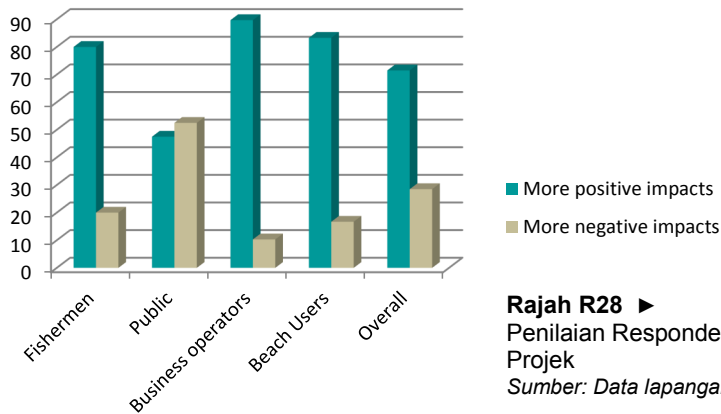
Persepsi	Nelayan	Orang Awam	Peniaga	Pengguna Pantai
Memberi kesan kepada ciri-ciri tanah kawasan	38.3	0.0	53.8	43.3
Memberi kesan kepada kecantikan landkap/pemandangan laut	29.0	0.0	23.1	30.0
Memberi kesan kepada kualiti udara	43.5	0.0	30.8	40.0
Memberi kesan kepada kualiti air	45.2	0.0	33.1	46.7
Memberi kesan kepada ketenangan kawasan	47.0	0.0	35.9	50.0
Memberi kesan kepada integrasi komuniti	5.2	0.0	7.7	10.0
Memberi kesan kepada tradisi setempat	0.0	0.0	2.6	0.0
Memberi kesan kepada kawasan bersejarah	0.0	0.0	2.6	0.0
Memberi kesan kepada tempat-tempat agama	0.0	0.0	2.6	0.0
Memberi kesan kepada bangunan-bangunan penting	0.0	0.0	0.0	0.0

Source: Field data, 2014

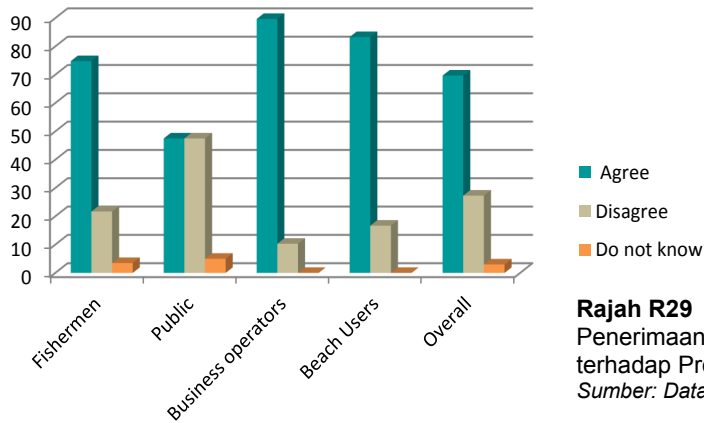
#### 6.3.2.5 Penilaian dan Penerimaan Projek

Kira-kira 71% responden mengatakan projek ini akan membawa lebih kesan positif manakala 29% adalah lain-lain (*Rajah R28*).

Responden yang telah mengetahui tentang projek dan bersetuju bahawa projek ini akan membawa kebaikan didapati telah menyokong pelaksanaannya, manakala responden yang mengetahui tentang projek dan mengatakan projek ini membawa keburukan telah ragu-ragu dalam keputusannya sama ada mahu menyokong atau tidak akan pelaksanaan projek ini (*Rajah R29*). Secara keseluruhannya, 69.7% adalah bersetuju dengan pelaksanaan projek manakala 27.3% tidak bersetuju dan selebihnya adalah tidak pasti, 3%.



**Rajah R28** ►  
 Penilaian Responden Terhadap  
 Projek  
 Sumber: Data lapangan, 2014



**Rajah R29** ►  
 Penerimaan Responden  
 terhadap Projek  
 Sumber: Data lapangan, 2014

Antara sebab-sebab mereka bersetuju adalah responden yakin bahawa projek ini akan meningkatkan peluang pekerjaan kepada masyarakat tempatan dan akan menjadi salah satu tarikan pelancongan di Pahang (*Jadual R19*). Selain itu, projek ini juga berpotensi untuk menambahbaik kemudahan dan servis sedia ada, menjadikan kawasan ini lebih menarik dan akan dibangunkan secara sistematik. Ada juga di antara responden yang berpendapat bahawa projek ini akan meningkatkan peluang perniagaan kepada masyarakat tempatan.

**Jadual R19** ► Sebab Responden Bersetuju atau Tidak Bersetuju dengan Cadangan Projek (%)

Sebab	Nelayan	Orang Awam	Peniaga	Pengguna Pantai
<b>Bersetuju:</b>				
Untuk kemajuan dan pembangunan	22.1	-	14.3	8.0
Peluang pekerjaan kepada penduduk tempatan, peningkatan taraf hidup dan infrastruktur	20.9	42.9	25.8	60.0
Menarik minat pelancong untuk datang dan meningkatkan nilai hartanah	22.1	39.3	28.5	12.0
Memberi manfaat kepada generasi akan datang	12.8	1.8	-	-
Meningkatkan ekonomi Pahang	10.5	1.8	-	4.0
Peluang untuk penduduk tempatan terlibat dan meningkatkan perniagaan	7.0	14.2	28.5	16.0
Kawasan kampung akan berkembang maju	4.7	-	2.9	-
<b>Jumlah</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
<b>Tidak Bersetuju:</b>				
Mengganggu laluan nelayan pantai dan penangkapan ikan	60.0	41.2	-	-
Air laut akan tercemar	20.0	4.8	-	20.0
Aktiviti mengumpul kepah akan terjejas	16.0	1.6	-	-
Pendapatan nelayan pantai akan terjejas	4.0	37.9	-	-
Peminggiran penduduk awam	-	14.5	-	40.0
Lebih banyak mendatangkan keburukan	-	-	25.0	40.0
Rasa takut akan kehilangan tempat untuk berniaga	-	-	75.0	-
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

Sumber: Data lapangan, 2014

### 6.3.3 Komuniti Nelayan dalam Kawasan Kajian

Kumpulan nelayan dalam kawasan kajian terdiri daripada tiga iaitu pemilik operator (38.3%), penyewa operator (29.5%) dan selebihnya adalah sebagai awak-awak (pekerja). Berdasarkan *Jadual R20*, kira-kira dua per tiga daripada kumpulan nelayan ini beranggapan bahawa kesan utama projek akan menurunkan jumlah pendaratan ikan dan meningkatkan kos penangkapan ikan. Selain itu, mereka juga akan menanggung kos yang lebih tinggi dari segi membaiki peralatan menangkap ikan mereka yang rosak dan juga pertambahan jarak untuk mereka keluar menangkap ikan atau tempat berlabuh.

**Jadual R20** ► Persepsi Nelayan terhadap Penambakan

Persepsi Nelayan terhadap Penambakan	Peratusan (%)
Mengganggu aktiviti perikanan	48.7
Menjejaskan pendaratan ikan	60.9
Kerosakan kepada peralatan penangkapan ikan	22.6
Meningkatkan kos penangkapan ikan	63.5

Sumber: Data lapangan, 2014

#### **6.3.4 Maklumbalas daripada Perbincangan Kumpulan Sasaran**

Isu yang dibangkitkan dalam kumpulan nelayan lebih tertumpu pada impak yang bakal mereka hadapi seperti kehilangan sumber pencarian ikan akibat aktiviti penambakan, ketidakselesaian semasa peringkat pembinaan dan operasi. Kehilangan pekerjaan dan sumber pendapatan. Justeru, pampasan dilihat sebagai jalan keluar bagi permasalahan ini dan membantu meringankan beban yang menimpa mereka. Para nelayan juga berpandangan bahawa pendalaman muara Sungai Kuantan juga perlu dilaksanakan. Selain itu, isu yang turut dibangkitkan ialah kemungkinan kehilangan jeti pendaratan ikan terutama yang berdekatan dengan kawasan penempatan mereka. Ini kerana kebanyakan jeti-jeti ini bukan pemilikan kekal. Isu lain yang turut timbul ialah peluang dan harapan bagi generasi masa akan datang untuk mendapatkan keutamaan dan peluang pekerjaan dalam Projek ini.

Bagi penduduk tempatan pula, mereka lebih terkesan dalam isu yang lebih besar iaitu isu estetika dan budaya. Misalnya kehilangan pandangan panorama laut dan kehilangan suasana kampung sedia ada. Mereka juga bimbang sekiranya dipinggirkan oleh orang luar apabila pembangunan projek siap. Ini disebabkan projek ini kelihatan tidak kondusif kepada penduduk tempatan. Isu seperti kualiti air dan pencemaran air laut juga turut dibangkitkan. Antaranya seperti saluran keluar dan kumbahan daripada pembangunan atas tanah. Selain itu juga, isu yang timbul ialah peluang pekerjaan kepada generasi akan datang seperti kesan kepada ekonomi dan latihan menghadapi persaingan kepada penduduk tempatan. Mereka juga memohon agar hak pemilikan perumahan mampu milik dapat diberikan kepada generasi akan datang di kawasan kampung mereka.

#### **6.3.5 Maklumbalas daripada Sesi Dialog Umum**

Sesi Dialog Umum dihadiri oleh 85 orang (81 orang dari kaum Melayu dan 4 orang dari kaum Cina) yang terdiri daripada penduduk tempatan terutamanya nelayan. Secara umumnya, penduduk tempatan tidak menentang projek ini, namun, terdapat beberapa isu yang ingin dibangkitkan iaitu berkaitan dengan aktiviti seharian mereka dan perkara yang dibimbangkan. Terdapat tiga (3) isu yang menjadi perhatian dalam sesi ini iaitu:

- i) Gangguan terhadap aktiviti perikanan dan kehidupan mereka seharian serta tuntutan pampasan;
- ii) Kesan penambakan terhadap kemudahan pendaratan dan pelayaran kapal.
- iii) Sumbangan Projek kepada generasi masa akan datang.

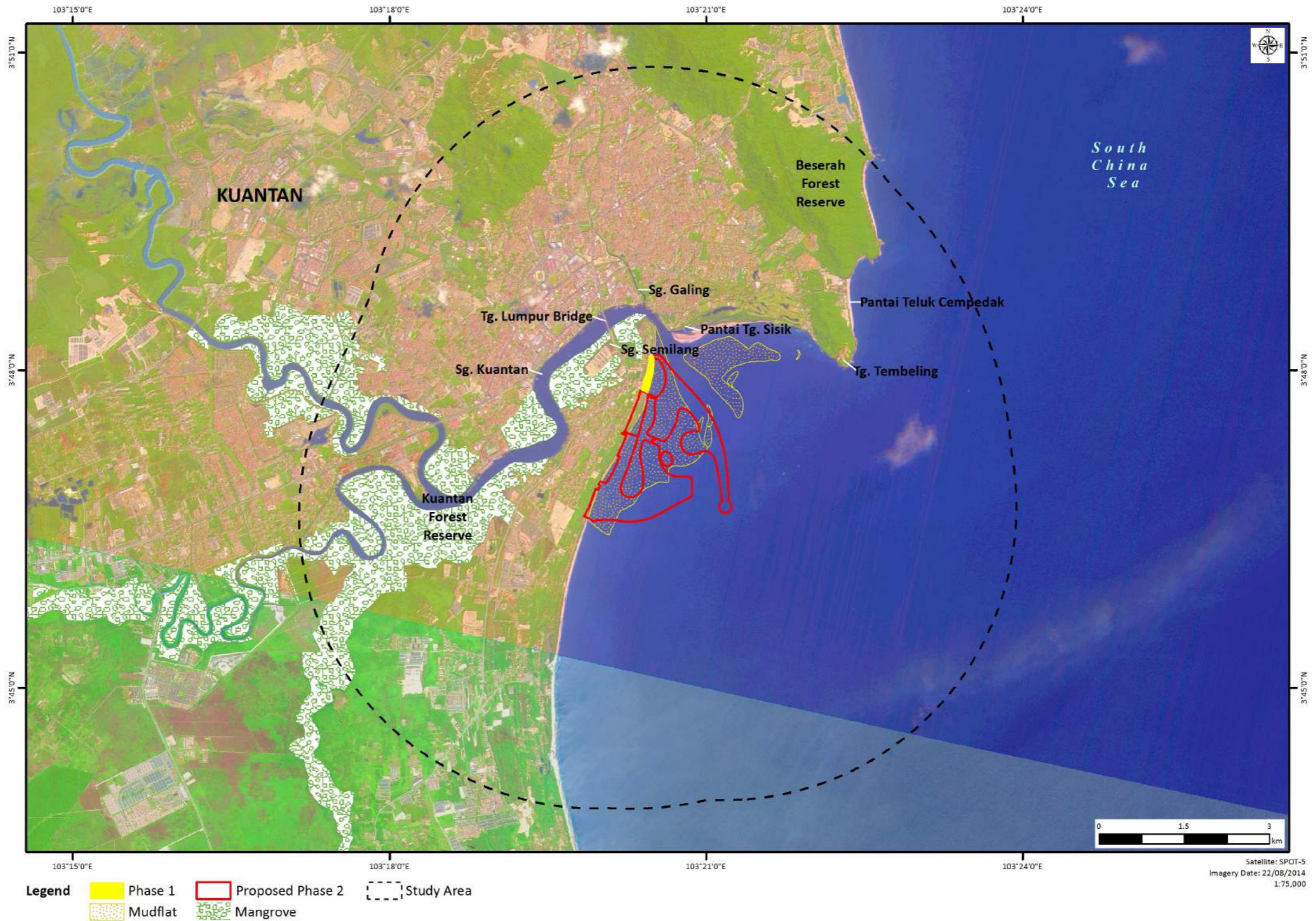
Isu-isu ini telah dibangkitkan oleh komuniti nelayan dan isu ini tidak jauh berbeza dengan isu yang diutarakan oleh responden dalam tinjauan sosial.

#### 6.4 Kawasan Sensitif Alam Sekitar (KSAS)

Seperti yang dinyatakan di dalam Rancangan Fizikal Negara ke-2 (RFN 2), KSAS merujuk kepada kawasan berkepentingan dari segi perkhidmatan dan sistem sokongan hidup. Selain itu, ia juga merujuk kepada kawasan penyimpanan kekayaan biodiversiti negara. Rancangan Tempatan Daerah Kuantan 2002-2020 telah mengenalpasti bahawa KSAS adalah kawasan seperti hutan simpan, hutan rizab dan bakau, tebing sungai, kawasan pantai, kawasan pemuliharaan warisan dan lain-lain. KSAS yang telah dikenal pasti dalam kawasan kajian disenaraikan dalam *Jadual R21* dan *Rajah R30*.

**Jadual R21** ► Senarai Lokasi KSAS di dalam kawasan Projek

Tahap	Jenis KSAS	Lokasi	Jarak Terdekat dari Tapak Projek (km)
Tahap 1	Hutan simpan	Hutan Simpan Kuantan	1.18
		Beserah Forest Reserve	3.52
Tahap 2	Hutan bakau	Sepanjang Sungai Kuantan	0.26
	Pesisiran pantai	Pantai Teluk Cempedak	3.0
		Pantai Tanjung Sisik	0.9
Tahap 3	Muara sungai	Sungai Kuantan	0.26
		Sungai Galing	0.48
		Sungai Semilang	0.71
	Struktur	Jambatan Tanjung Lumpur	0.75
	Tarikan pelancong	Tanjung Tembeling	2.61
Lain-lain	Kawasan penempatan (dalam sempadan kawasan kajian)	Kampung Tanjung Lumpur	0.23
		Kampung Peramu Maju	0.74
		Kampung Peramu Hulu	0.57
		Kampung Anak Air	0.40
		Kampung Tanjung Api	0.51
		Kampung Teluk Baharu	0.44
		Kampung Derhaka	2.47
		Kampung Kempadang	3.04
		Kampung Ru Bongkok	5.10
		Kampung Baharu	4.05
		Kampung Teluk Sisik	2.51
Kampung Padang Lalang	0.83		



Rajah R30 ► Kawasan Sensitif Alam Sekitar

#### 6.4.1 Hutan Simpan Kuantan

Hutan Simpan Kuantan yang berkeluasan 339 hektar mempunyai kedudukan yang strategik di tengah bandar Kuantan dan telah menjadi salah satu tarikan kepada pelancong tempatan dan luar negara. Kerajaan Negeri telah mengambil inisiatif untuk membangunkan hutan ini sebagai Taman Paya Bakau. Spesies bakau seperti *Rhizophora apiculata* dan *Xylocarpus* *Xylocarpus* adalah antara spesies yang ada di taman bakau ini.

#### 6.4.2 Hutan Simpan Beserah

Hutan Simpan Beserah terletak 16 km dari bandar Kuantan melalui Jalan Kuantan-Cherating. Hutan ini terdiri daripada pelbagai spesies pokok seperti meranti dan balau. Antara tarikan yang ada ialah Gua Beserah. Kawasan ini terbuka kepada semua orang awam untuk menikmati aktiviti luar seperti mendaki dan meneroka gua.

#### 6.4.3 Hutan Bakau (Sungai Kuantan)

Muara Sungai Kuantan menampung lebih 1,000 hektar kawasan hutan bakau. Kebanyakan bakau terdapat di bahagian selatan tebing Sungai Kuantan dan anak sungainya iaitu Sungai Belat. Bakau memainkan peranan penting dalam industri perikanan tempatan di mana ianya merupakan kawasan pembiakan ikan dan kawasan sumber carian makanan bagi pelbagai spesies hidupan laut.

#### 6.4.4 Pantai Teluk Cempedak

Pantai Teluk Cempedak terletak lima (5) km dari bandar Kuantan. Pelbagai kemudahan seperti gazebo, kedai serbaneka, restoran dan dataran awam disediakan.

#### 6.4.5 Sungai Kuantan

Sungai Kuantan yang mengalir dari Sungai Lembing akan melalui bandar Kuantan sebelum mengalir keluar ke Laut China Selatan. Ianya mempunyai kawasan tadahan kira-kira 1,684 km<sup>2</sup> dengan panjang 97 km. Sungai Kuantan merupakan kawasan penangkapan ikan bagi bot tunda pantai dan luar pantai. Kawasan ini akan terus menjadi kawasan perikanan yang penting kerana ianya dipenuhi dengan kemudahan seperti jeti, pantai yang berpasir dan bot-bot nelayan berlabuh di luar pantai.

#### 6.4.6 Sungai Galing

Sungai ini mempunyai kawasan tadahan kira-kira 22.65 km<sup>2</sup> dengan panjang 7.7 km. Di sepanjang tebingnya, sungai ini dikelilingi dengan pembangunan yang pesat dengan aktiviti perindustrian di hulu dan bandar Kuantan di hilirnya. Kesannya, sungai ini terdedah kepada pencemaran air, banjir kilat, hakisan dan lain-lain.



#### **6.4.7 Jambatan Tanjung Lumpur**

Jambatan Tanjung Lumpur sepanjang 424 m merupakan salah satu infrastruktur yang utama di pantai timur Semenanjung Malaysia. Jambatan ini juga adalah salah satu komponen penting bagi Jalan Persekutuan 183 (Lebuhraya Tanjung Lumpur). Untuk mengatasi kapasiti trafik marin yang tinggi, jambatan ini telah dibina dengan konkrit tetulang berimpak tinggi untuk mengatasi kemungkinan pelanggaran bot-bot dan kapal-kapal yang lalu di bawahnya. Di bawah jambatan, nelayan menjalankan aktiviti seperti menjahit pukot dan menambat bot mereka.

#### **6.4.8 Tanjung Tembeling**

Tanjung Tembeling merupakan kawasan yang berketinggian 100 m dari aras laut dan terletak kira-kira tiga (3) km dari Tanjung Lumpur dan sebahagian besarnya dilitupi oleh hutan. Kawasan ini cukup terkenal dengan Kuantan Tembeling Resort. Di kawasan pantainya, pantai ini dilindungi oleh batu-batu besar. Semasa air surut, dataran lumpur yang luas akan kelihatan di sepanjang pantainya.

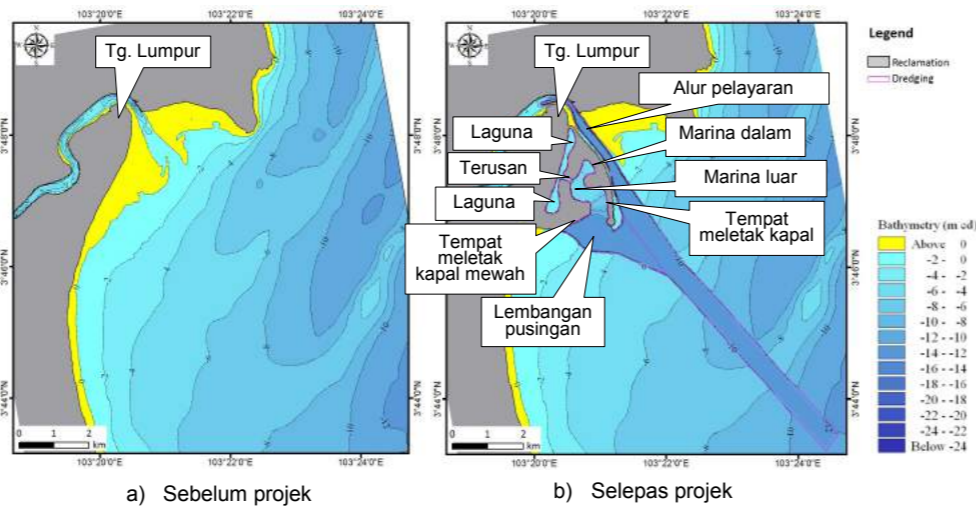
#### **6.4.9 Kawasan Penempatan**

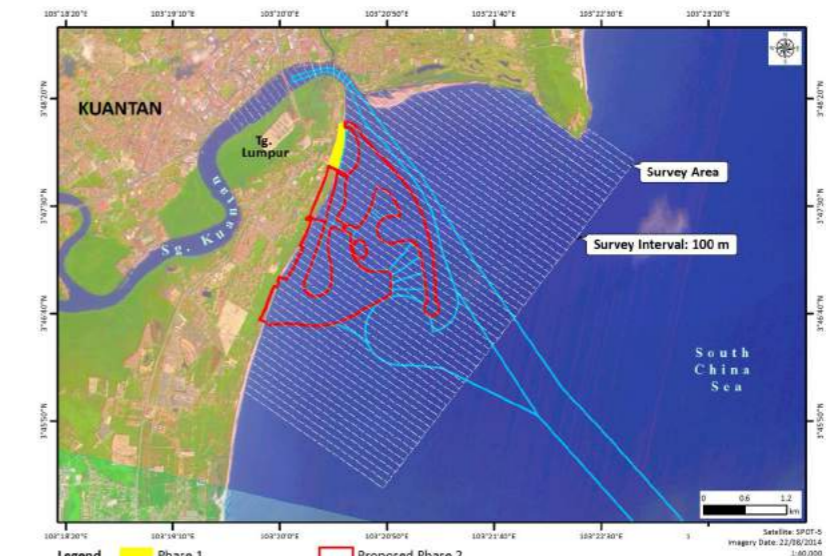
Projek ini dijangka bukan sahaja akan memberi kesan kepada alam sekitar malahan kepada penduduk di kawasan sekitar juga terutamanya dalam persekitaran Tanjung Lumpur. Secara umumnya, masyarakat tempatan di sekitar kawasan projek terlibat dalam industri perikanan, sektor awam atau swasta dan menjalankan perniagaan kecil. Kebanyakan daripada mereka telah menetap selama beberapa dekad.

## **7. Penilaian Impak dan Langkah-Langkah Kawalan bagi Persekitaran Fizikal, Biologi dan Sosio-ekonomi**

Ringkasan bagi penilaian impak bagi persekitaran fizikal, biologi dan sosio-ekonomi serta langkah-langkah kawalan disenaraikan dalam *Jadual R22* dan *Jadual R23*.

Jadual R22 ► Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Fizikal dan Biologi

Komponen Projek	Komponen Alam Sekitar yang Terjejas	Potensi Impak	Magnitud Potensi Impak	Langkah Pencegahan dan Kawalan Pencemaran (P2M2)	Mukasurat																								
1. Pembersihan tanah sedia ada	Kualiti air	i) Kawasan yang akan dibersihkan adalah kawasan tanah rata yang ditumbuhi dengan pokok herba, renek dan kawasan hutan belukar. ii) Kawasan ini terletak berhampiran dengan pantai, keadaan muka bumi yang terdedah boleh mempercepatkan hakisan tanah jika tidak ditangani dengan sewajarnya.	X	i) Kerja pembersihan tanah sedia ada hendaklah dijalankan di dalam kawasan yang telah ditetapkan sahaja dan perlu dijalankan seminima yang mungkin terutamanya pada waktu hujan. ii) Bilangan longkang sementara yang mencukupi di kawasan kerja hendaklah disediakan untuk mengelakkan pengaliran air hujan ke saluran air yang berdekatan. iii) Muatan lori hendaklah ditutup dan jalan berdebu perlu disembur dengan air untuk mengawal habuk. iv) Pagar akan dipasang di sepanjang sempadan tapak kawasan kerja.	7-2																								
2. Penambakan dan pengerukan	a) Batimetri	Aktiviti pengerukan akan mengubah batimetri kawasan yang terlibat. <b>Aras batimetric: Sebelum dan Selepas Aktiviti Penambakan dan Pengerukan</b> <table border="1" style="margin: 10px auto;"> <thead> <tr> <th>Kawasan Pengerukan</th> <th>Sebelum (m CD)</th> <th>Selepas (m CD)</th> </tr> </thead> <tbody> <tr> <td>Alur Pelayaran</td> <td>-2 to -12</td> <td>-12</td> </tr> <tr> <td>Laguna</td> <td>0</td> <td>-3</td> </tr> <tr> <td>Terusan</td> <td>0</td> <td>-4</td> </tr> <tr> <td>Marina dalam</td> <td>-2</td> <td>-4</td> </tr> <tr> <td>Marina luar</td> <td>-2 to -4</td> <td>-6</td> </tr> <tr> <td>Terminal kapal persiaran</td> <td>-2</td> <td>-6 to -9</td> </tr> <tr> <td>Lembangan pusingan</td> <td>-4</td> <td>-12</td> </tr> </tbody> </table> 	Kawasan Pengerukan	Sebelum (m CD)	Selepas (m CD)	Alur Pelayaran	-2 to -12	-12	Laguna	0	-3	Terusan	0	-4	Marina dalam	-2	-4	Marina luar	-2 to -4	-6	Terminal kapal persiaran	-2	-6 to -9	Lembangan pusingan	-4	-12	T / D	i) Periodic Kajian batimetri dan tepi pantai secara berkala akan dijalankan untuk menilai perubahan paras kedalaman tepi pantai dan dasar laut semasa dan selepas projek. ii) Kajian ini akan dijalankan sepanjang garis pantai sehingga 2.5 km ke arah utara projek dengan jarak garisan antaranya adalah 100 m, 1 km ke arah selatan projek dan 1 km ke arah laut. iii) Kajian meliputi 50 m darat aras air tinggi. iv) Kajian akan dijalankan setiap tiga bulan semasa fasa pembinaan dan laporan kajian akan dikemukakan kepada JPS. Kajian akan dijalankan setiap enam bulan selepas fasa pembinaan selama tiga tahun atau selepas mendapat kebenaran daripada JPS untuk menghentikan kajian. v) Maklumat daripada kajian berkala juga boleh digunakan untuk menentukan keperluan dan tahap pengorekan yang dikehendaki selepas projek selesai.	7-3 to 7-4
Kawasan Pengerukan	Sebelum (m CD)	Selepas (m CD)																											
Alur Pelayaran	-2 to -12	-12																											
Laguna	0	-3																											
Terusan	0	-4																											
Marina dalam	-2	-4																											
Marina luar	-2 to -4	-6																											
Terminal kapal persiaran	-2	-6 to -9																											
Lembangan pusingan	-4	-12																											



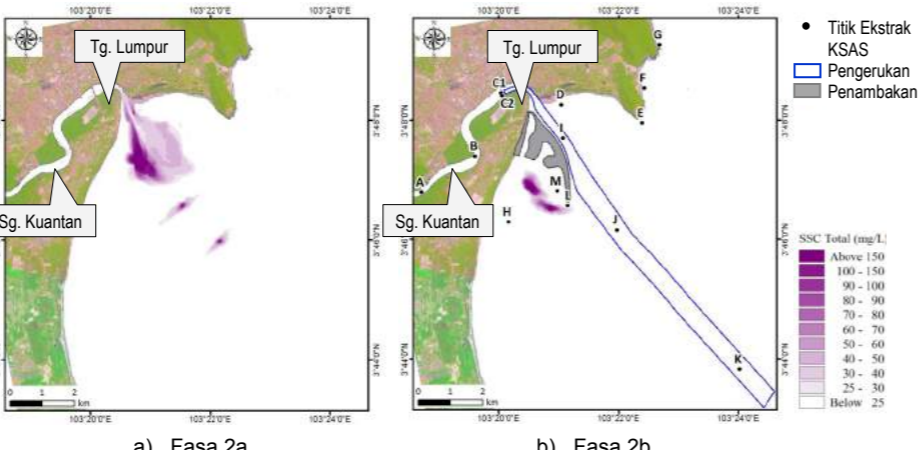
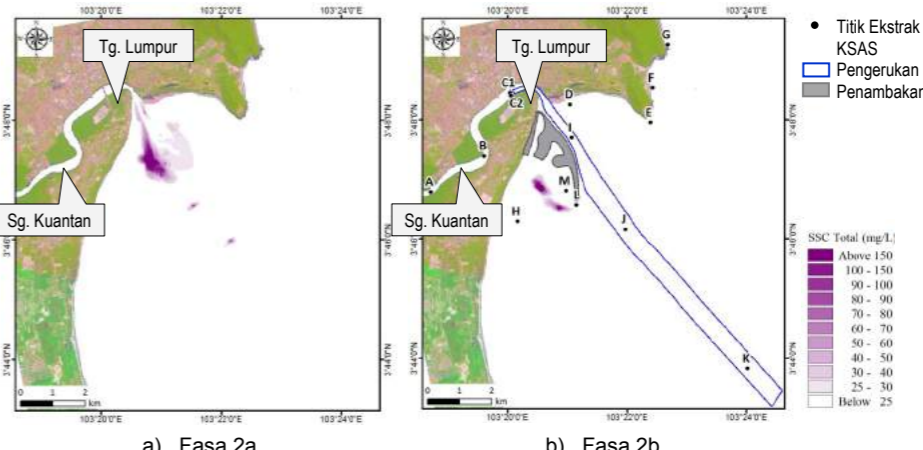
Maklumat Kajian Pemantauan

Petunjuk:

- X Tidak penting dan tidak termasuk dalam matriks.
- T Boleh membawa kesan tetapi bersifat sementara dan akan mencapai keseimbangan selepas tempoh masa tertentu.
- M Boleh membawa kesan yang penting tetapi, kekurangan maklumat menyebabkan kesan tidak dapat diramal dengan lebih tepat. Pemantauan dan pengawalan rapi adalah disyorkan.

- D Boleh membawa kesan negatif dan penyelesaian dalam aspek rekabentuk telah dikenalpasti.
- R Memberi kesan-kesan sisa yang negatif.
- E Memberi kesan yang baik kepada alam sekitar.

Jadual R22 ► Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Fizikal dan Biologi

Komponen Projek	Komponen Alam Sekitar yang Terjejas	Potensi Impak	Magnitud Potensi Impak	Langkah Pencegahan dan Kawalan Pencemaran (P2M2)	Mukasurat
	b) Kestabilan geoteknikal	i) Pengerukan akan dijalankan dengan jarak 100 m menjauhi dari tapak tiang jambatan Tanjung Lumpur. ii) Berdasarkan tebing yang terdedah di Sungai Kuantan, dasar sungai terdiri daripada tanah liat, kelodak dan pasir. iii) Dengan jarak 100 meter dari kawasan pengerukan, kesan daya sisi tidak akan menjejaskan struktur jambatan.	D	Tiada langkah-langkah kawalan diperlukan.	7-3
2. Penambakan dan pengerukan	c) Hidraulik – serakan sedimen	i) Pilihan 1 <ul style="list-style-type: none"> <li>■ Fasa 2a: Pergerakan serakan maksimum dengan kepekatan sedimen terampai melebihi 25 mg/L adalah sejauh 2.5 km (ke arah barat daya) dan 1.5 km (ke arah timur laut) daripada sumber. Serakan sedimen tersebar kira-kira 6 km dari muara menghala ke hulu sungai.</li> <li>■ Fasa 2b: Pergerakan serakan maksimum dengan kepekatan sedimen terampai melebihi 25 mg/L adalah sejauh 1 km (ke arah timur) dan 1.7 km (ke arah barat daya) daripada sumber.</li> </ul>  <p style="text-align: center;"><b>Serakan Maksimum mengikut Kepekatan Sedimen Terampai bagi Pilihan 1: Keadaan Monsun Peralihan</b></p>	M	<b>Keadaan Dikawal</b> i) Pilihan 1 <ul style="list-style-type: none"> <li>■ Fasa 2a: Pergerakan serakan maksimum dengan kepekatan sedimen terampai melebihi 25 mg/L adalah sejauh 1.3 km (ke arah barat daya dan timur laut) daripada sumber. Serakan sedimen tersebar kira-kira 1.3 km dari muara menghala ke hulu sungai.</li> <li>■ Fasa 2b: Pergerakan serakan maksimum dengan kepekatan sedimen terampai melebihi 20 mg/L adalah sejauh 1.5 km (ke arah barat daya) dan 0.7 km (ke arah tenggara) daripada sumber.</li> </ul>  <p style="text-align: center;"><b>Serakan Maksimum mengikut Kepekatan Sedimen Terampai bagi Pilihan 1: Keadaan Monsun Peralihan (Keadaan Dikawal)</b></p>	7-5 to 7-55

Petunjuk:

X Tidak penting dan tidak termasuk dalam matriks.

T Boleh membawa kesan tetapi bersifat sementara dan akan mencapai keseimbangan selepas tempoh masa tertentu.

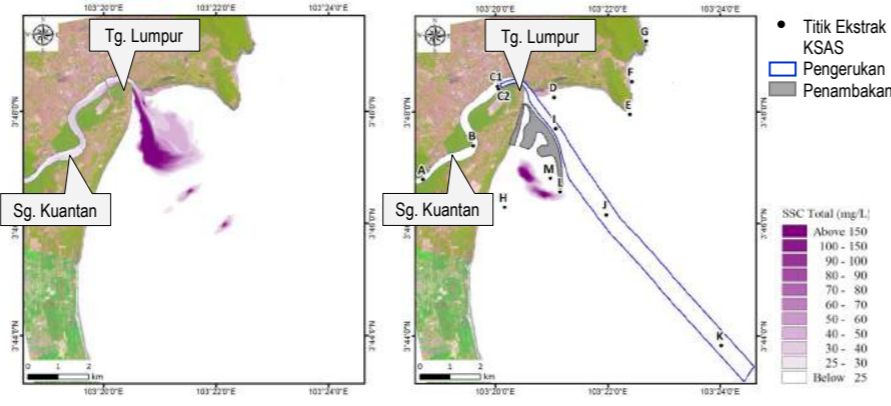
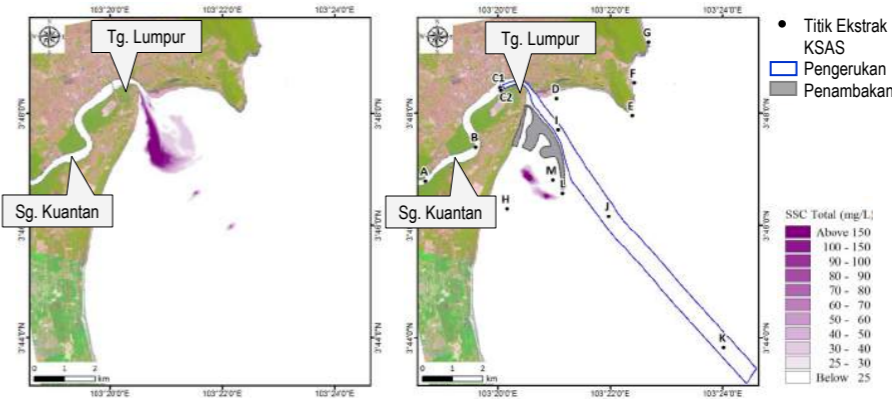
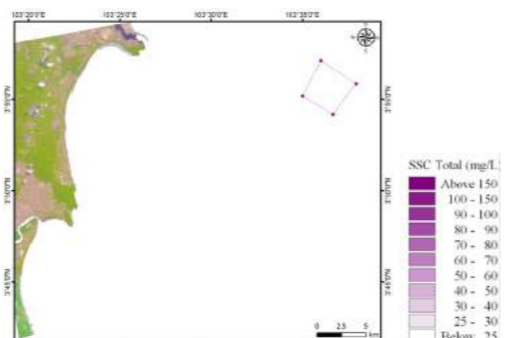
M Boleh membawa kesan yang penting tetapi, kekurangan maklumat menyebabkan kesan tidak dapat diramal dengan lebih tepat. Pemantauan dan pengawalan rapi adalah disyorkan.

D Boleh membawa kesan negatif dan penyelesaian dalam aspek rekabentuk telah dikenalpasti.

R Memberi kesan-kesan sisa yang negatif.

E Memberi kesan yang baik kepada alam sekitar.

Jadual R22 ► Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Fizikal dan Biologi

Komponen Projek	Komponen Alam Sekitar yang Terjejas	Potensi Impak	Magnitud Potensi Impak	Langkah Pencegahan dan Kawalan Pencemaran (P2M2)	Mukasurat
2. Penambakan dan pengerukan	c) Hidraulik – serakan sedimen	<p>ii) Pilihan 2</p> <ul style="list-style-type: none"> <li>Fasa 2a: Pergerakan serakan maksimum bagi kepekatan sedimen terampai melebihi 25 mg/L adalah sejauh 3.5 km (ke arah barat daya dan timur laut) daripada sumber. Serakan sedimen tersebar kira-kira 9 km dari muara menghala ke hulu sungai.</li> <li>Fasa 2b: Pergerakan serakan maksimum bagi kepekatan sedimen terampai melebihi 25 mg/L adalah sejauh 1 km (ke arah timur) dan 1.7 km (ke arah barat daya) daripada sumber.</li> </ul>  <p>a) Phase 2a                      b) Phase 2b</p> <p><b>Serakan Maksimum mengikut Kepekatan Sedimen Terampai bagi Pilihan 2: Keadaan Monsun Peralihan</b></p>	M	<p><b>Keadaan Dikawal</b></p> <p>ii) Pilihan 2</p> <ul style="list-style-type: none"> <li>Fasa 2a: Pergerakan serakan maksimum bagi kepekatan sedimen terampai melebihi 25 mg/L adalah sejauh 2.5 km (ke arah barat daya) dan 2 km (ke arah timur laut) daripada sumber. Serakan sedimen tersebar kira-kira 2 km dari muara menghala ke hulu sungai.</li> <li>Fasa 2b: Pergerakan serakan maksimum bagi kepekatan sedimen terampai melebihi 25 mg/L adalah sejauh 1.5 km (ke arah barat daya) dan 0.5 km (ke arah tenggara) daripada sumber.</li> </ul>  <p>a) Phase 2a                      b) Phase 2b</p> <p><b>Serakan Maksimum mengikut kepekatan sedimen terampai bagi Pilihan 2: Keadaan Monsun Peralihan (Keadaan Dikawal)</b></p>	7-5 to 7-55
		<p>iii) Pelupusan bahan pengerukan</p> <ul style="list-style-type: none"> <li>Pergerakan serakan maksimum bagi kepekatan sedimen terampai melebihi 25 mg/L adalah kurang dari 0.05 km daripada sumber. Apabila bahan kerukan memasuki kolom air, serakan bagi kepekatan sedimen terampai akan berkurang apabila menjauhi daripada sumber.</li> </ul>  <p><b>Serakan Maksimum Kepekatan Sedimen Terampai bagi Aktiviti Pelupusan: Keadaan Monsun Peralihan</b></p>	M	Tiada langkah-langkah kawalan diperlukan.	

Petunjuk:

X Tidak penting dan tidak termasuk dalam matriks.

T Boleh membawa kesan tetapi bersifat sementara dan akan mencapai keseimbangan selepas tempoh masa tertentu.

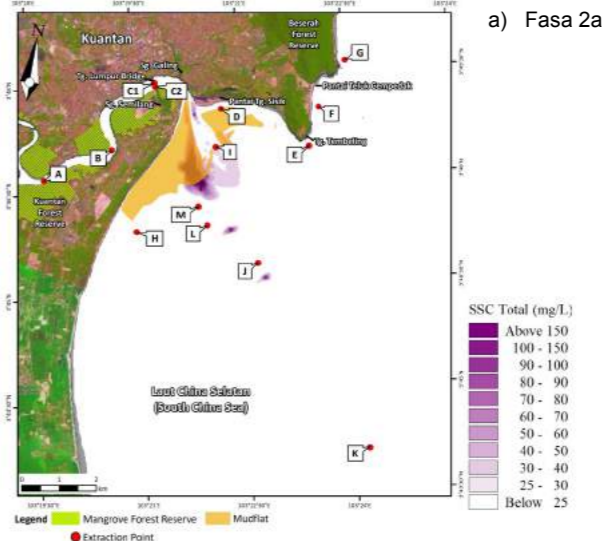
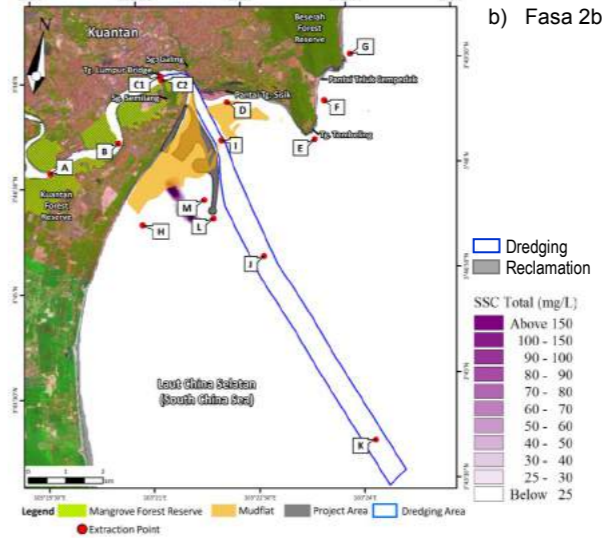
M Boleh membawa kesan yang penting tetapi, kekurangan maklumat menyebabkan kesan tidak dapat diramal dengan lebih tepat. Pemantauan dan pengawalan rapi adalah disyorkan.

D Boleh membawa kesan negatif dan penyelesaian dalam aspek rekabentuk telah dikenalpasti.

R Memberi kesan-kesan sisa yang negatif.

E Memberi kesan yang baik kepada alam sekitar.

Jadual R22 ► Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Fizikal dan Biologi

Komponen Projek	Komponen Alam Sekitar yang Terjejas	Potensi Impak	Magnitud Potensi Impak	Langkah Pencegahan dan Kawalan Pencemaran (P2M2)	Mukasurat																																																																																													
2. Penambahan dan pengerukan	c) Hidraulik – serakan sedimen	iv) Impak Serakan Sedimen ke atas KSAS	M	 <p>a) Fasa 2a</p>  <p>b) Fasa 2b</p>	7-5 to 7-55																																																																																													
		<p><b>Pilihan 1</b></p> <ul style="list-style-type: none"> <li>Kepekatan maksimum sedimen terampai bagi keadaan tanpa tirai kelodak berdekatan Hutan Simpan Kuantan adalah 24 mg/L tetapi berkurangan hingga 15 mg/L dengan pemasangan tirai kelodak.</li> <li>Serakan sedimen secara maksimum didapati berlaku berdekatan Pantai Tanjung Sisek dan Kuantan Tembeling Resort adalah pada kepekatan 6 mg/L (keadaan tidak dikawal) dan 4 mg/L (keadaan dikawal).</li> <li>Tiada serakan sedimen direkodkan di Teluk Cempedak, Hutan Simpan Besaroh dan beting pasir Tanjung Lumpur.</li> </ul> <p><b>Kepekatan Maksimum Sedimen Terampai di KSAS bagi Pilihan 1</b></p> <table border="1"> <thead> <tr> <th rowspan="3">Titik</th> <th rowspan="3">Lokasi</th> <th colspan="2">Fasa 2a</th> <th colspan="2">Fasa 2b</th> </tr> <tr> <th colspan="2">Kepekatan Maksimum (mg/L)</th> <th colspan="2">Kepekatan Maksimum (mg/L)</th> </tr> <tr> <th>Keadaan Tidak Dikawal</th> <th>Keadaan Dikawal</th> <th>Keadaan Tidak Dikawal</th> <th>Keadaan Dikawal</th> </tr> </thead> <tbody> <tr><td>A</td><td>Hutan Simpan Kuantan</td><td>24</td><td>15</td><td>0</td><td>0</td></tr> <tr><td>B</td><td>Hutan Rizab Paya Laut Kuantan</td><td>25</td><td>15</td><td>1</td><td>0</td></tr> <tr><td>C1</td><td>Jambatan Tanjung Lumpur (jeti utara)</td><td>24</td><td>14</td><td>1</td><td>0</td></tr> <tr><td>C2</td><td>Jambatan Tanjung Lumpur (jeti selatan)</td><td>24</td><td>15</td><td>1</td><td>0</td></tr> <tr><td>D</td><td>Pantai Tanjung Sisek</td><td>6</td><td>4</td><td>0</td><td>0</td></tr> <tr><td>E</td><td>Kuantan Tembeling Resort</td><td>6</td><td>4</td><td>0</td><td>0</td></tr> <tr><td>F</td><td>Teluk Cempedak</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>G</td><td>Hutan Simpan Besaroh</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>H</td><td>Beting Pasir Tanjung Lumpur</td><td>1</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>I</td><td>Alur pelayaran (hulu)</td><td>32</td><td>24</td><td>1</td><td>0</td></tr> <tr><td>J</td><td>Alur pelayaran (pertengahan)</td><td>2</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>K</td><td>Alur pelayaran (hilir)</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>L</td><td>Bahagian tenggara pembangunan</td><td>9</td><td>6</td><td>8</td><td>5</td></tr> <tr><td>M</td><td>Laluan masuk marina</td><td>8</td><td>5</td><td>3</td><td>2</td></tr> </tbody> </table> <p><b>Kepekatan Maksimum Sedimen Terampai di KSAS bagi Pilihan 1 (keadaan Dikawal)</b></p>				Titik	Lokasi	Fasa 2a		Fasa 2b		Kepekatan Maksimum (mg/L)		Kepekatan Maksimum (mg/L)		Keadaan Tidak Dikawal	Keadaan Dikawal	Keadaan Tidak Dikawal	Keadaan Dikawal	A	Hutan Simpan Kuantan	24	15	0	0	B	Hutan Rizab Paya Laut Kuantan	25	15	1	0	C1	Jambatan Tanjung Lumpur (jeti utara)	24	14	1	0	C2	Jambatan Tanjung Lumpur (jeti selatan)	24	15	1	0	D	Pantai Tanjung Sisek	6	4	0	0	E	Kuantan Tembeling Resort	6	4	0	0	F	Teluk Cempedak	0	0	0	0	G	Hutan Simpan Besaroh	0	0	0	0	H	Beting Pasir Tanjung Lumpur	1	0	0	0	I	Alur pelayaran (hulu)	32	24	1	0	J	Alur pelayaran (pertengahan)	2	1	0	0	K	Alur pelayaran (hilir)	0	0	0	0	L	Bahagian tenggara pembangunan	9	6	8	5	M
Titik	Lokasi	Fasa 2a		Fasa 2b																																																																																														
		Kepekatan Maksimum (mg/L)		Kepekatan Maksimum (mg/L)																																																																																														
		Keadaan Tidak Dikawal	Keadaan Dikawal	Keadaan Tidak Dikawal	Keadaan Dikawal																																																																																													
A	Hutan Simpan Kuantan	24	15	0	0																																																																																													
B	Hutan Rizab Paya Laut Kuantan	25	15	1	0																																																																																													
C1	Jambatan Tanjung Lumpur (jeti utara)	24	14	1	0																																																																																													
C2	Jambatan Tanjung Lumpur (jeti selatan)	24	15	1	0																																																																																													
D	Pantai Tanjung Sisek	6	4	0	0																																																																																													
E	Kuantan Tembeling Resort	6	4	0	0																																																																																													
F	Teluk Cempedak	0	0	0	0																																																																																													
G	Hutan Simpan Besaroh	0	0	0	0																																																																																													
H	Beting Pasir Tanjung Lumpur	1	0	0	0																																																																																													
I	Alur pelayaran (hulu)	32	24	1	0																																																																																													
J	Alur pelayaran (pertengahan)	2	1	0	0																																																																																													
K	Alur pelayaran (hilir)	0	0	0	0																																																																																													
L	Bahagian tenggara pembangunan	9	6	8	5																																																																																													
M	Laluan masuk marina	8	5	3	2																																																																																													

Petunjuk:

X Tidak penting dan tidak termasuk dalam matriks.

T Boleh membawa kesan tetapi bersifat sementara dan akan mencapai keseimbangan selepas tempoh masa tertentu.

M Boleh membawa kesan yang penting tetapi, kekurangan maklumat menyebabkan kesan tidak dapat diramal dengan lebih tepat.

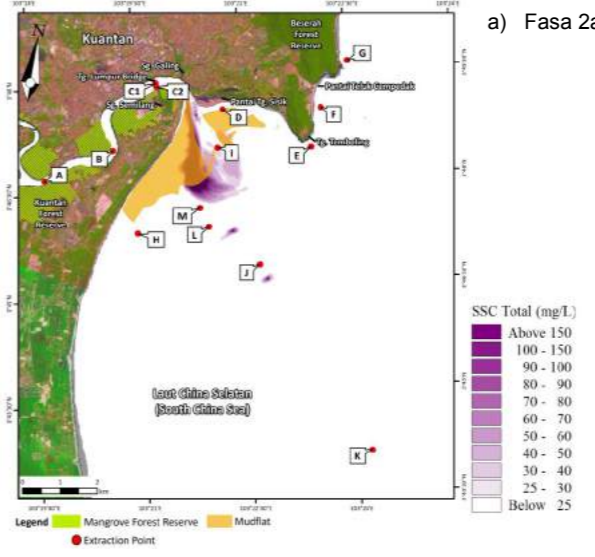
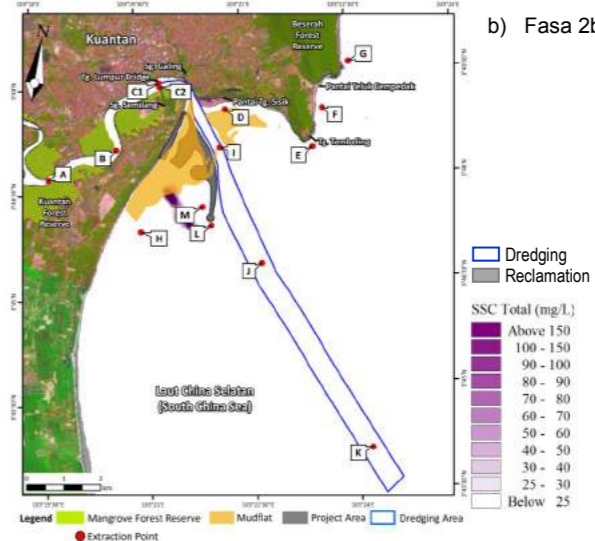
Pemantauan dan pengawalan rapi adalah disyorkan.

D Boleh membawa kesan negatif dan penyelesaian dalam aspek rekabentuk telah dikenalpasti.

R Memberi kesan-kesan sisa yang negatif.

E Memberi kesan yang baik kepada alam sekitar.

Jadual R22 ► Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Fizikal dan Biologi

Komponen Projek	Komponen Alam Sekitar yang Terjejas	Potensi Impak	Magnitud Potensi Impak	Langkah Pencegahan dan Kawalan Pencemaran (P2M2)	Mukasurat																																																																																													
2. Penambahan dan pengerukan	c) Hidraulik – serakan sedimen	iv) Impak Serakan Sedimen ke atas KSAS	M	 <p>a) Fasa 2a</p>  <p>b) Fasa 2b</p>	7-5 to 7-55																																																																																													
		<p><b>Pilihan 2</b></p> <ul style="list-style-type: none"> <li>Kepekatan maksimum sedimen terampai bagi keadaan tanpa tirai kelodak berdekatan Hutan Simpan Kuantan adalah 26 mg/L tetapi berkurangan hingga 15 mg/L dengan adanya tirai kelodak.</li> <li>Serakan sedimen secara maksimum didapati berlaku berdekatan Pantai Tanjung Sisek dan Kuantan Tembeling Resort adalah pada kepekatan 6 mg/L (keadaan tidak dikawal) dan 3-4 mg/L (keadaan dikawal).</li> <li>Serakan sedimen tidak direkodkan di Teluk Cempedak, Hutan Simpan Besarah dan beting pasir Tanjung Lumpur.</li> </ul> <p><b>Kepekatan Maksimum Sedimen Terampai di KSAS bagi Pilihan 2</b></p> <table border="1"> <thead> <tr> <th rowspan="3">Titik</th> <th rowspan="3">Lokasi</th> <th colspan="2">Fasa 2a</th> <th colspan="2">Fasa 2b</th> </tr> <tr> <th colspan="2">Kepekatan Maksimum (mg/L)</th> <th colspan="2">Kepekatan Maksimum (mg/L)</th> </tr> <tr> <th>Keadaan Tidak Dikawal</th> <th>Keadaan Dikawal</th> <th>Keadaan Tidak Dikawal</th> <th>Keadaan Dikawal</th> </tr> </thead> <tbody> <tr><td>A</td><td>Hutan Simpan Kuantan</td><td>26</td><td>15</td><td>0</td><td>0</td></tr> <tr><td>B</td><td>Hutan Rizab Paya Laut Kuantan</td><td>31</td><td>18</td><td>1</td><td>0</td></tr> <tr><td>C1</td><td>Jambatan Tanjung Lumpur (jeti utara)</td><td>30</td><td>18</td><td>1</td><td>0</td></tr> <tr><td>C2</td><td>Jambatan Tanjung Lumpur (jeti selatan)</td><td>40</td><td>24</td><td>1</td><td>0</td></tr> <tr><td>D</td><td>Pantai Tanjung Sisek</td><td>6</td><td>3</td><td>0</td><td>0</td></tr> <tr><td>E</td><td>Kuantan Tembeling Resort</td><td>6</td><td>4</td><td>0</td><td>0</td></tr> <tr><td>F</td><td>Teluk Cempedak</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>G</td><td>Hutan Simpan Besarah</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>H</td><td>Beting Pasir Tanjung Lumpur</td><td>1</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>I</td><td>Alur pelayaran (hulu)</td><td>36</td><td>24</td><td>1</td><td>0</td></tr> <tr><td>J</td><td>Alur pelayaran (pertengahan)</td><td>2</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>K</td><td>Alur pelayaran (hilir)</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>L</td><td>Bahagian tenggara pembangunan</td><td>9</td><td>5</td><td>8</td><td>5</td></tr> <tr><td>M</td><td>Laluan masuk marina</td><td>22</td><td>13</td><td>3</td><td>2</td></tr> </tbody> </table>				Titik	Lokasi	Fasa 2a		Fasa 2b		Kepekatan Maksimum (mg/L)		Kepekatan Maksimum (mg/L)		Keadaan Tidak Dikawal	Keadaan Dikawal	Keadaan Tidak Dikawal	Keadaan Dikawal	A	Hutan Simpan Kuantan	26	15	0	0	B	Hutan Rizab Paya Laut Kuantan	31	18	1	0	C1	Jambatan Tanjung Lumpur (jeti utara)	30	18	1	0	C2	Jambatan Tanjung Lumpur (jeti selatan)	40	24	1	0	D	Pantai Tanjung Sisek	6	3	0	0	E	Kuantan Tembeling Resort	6	4	0	0	F	Teluk Cempedak	0	0	0	0	G	Hutan Simpan Besarah	0	0	0	0	H	Beting Pasir Tanjung Lumpur	1	1	0	0	I	Alur pelayaran (hulu)	36	24	1	0	J	Alur pelayaran (pertengahan)	2	1	0	0	K	Alur pelayaran (hilir)	0	0	0	0	L	Bahagian tenggara pembangunan	9	5	8	5	M
Titik	Lokasi	Fasa 2a		Fasa 2b																																																																																														
		Kepekatan Maksimum (mg/L)		Kepekatan Maksimum (mg/L)																																																																																														
		Keadaan Tidak Dikawal	Keadaan Dikawal	Keadaan Tidak Dikawal	Keadaan Dikawal																																																																																													
A	Hutan Simpan Kuantan	26	15	0	0																																																																																													
B	Hutan Rizab Paya Laut Kuantan	31	18	1	0																																																																																													
C1	Jambatan Tanjung Lumpur (jeti utara)	30	18	1	0																																																																																													
C2	Jambatan Tanjung Lumpur (jeti selatan)	40	24	1	0																																																																																													
D	Pantai Tanjung Sisek	6	3	0	0																																																																																													
E	Kuantan Tembeling Resort	6	4	0	0																																																																																													
F	Teluk Cempedak	0	0	0	0																																																																																													
G	Hutan Simpan Besarah	0	0	0	0																																																																																													
H	Beting Pasir Tanjung Lumpur	1	1	0	0																																																																																													
I	Alur pelayaran (hulu)	36	24	1	0																																																																																													
J	Alur pelayaran (pertengahan)	2	1	0	0																																																																																													
K	Alur pelayaran (hilir)	0	0	0	0																																																																																													
L	Bahagian tenggara pembangunan	9	5	8	5																																																																																													
M	Laluan masuk marina	22	13	3	2																																																																																													

Petunjuk:

X Tidak penting dan tidak termasuk dalam matriks.

T Boleh membawa kesan tetapi bersifat sementara dan akan mencapai keseimbangan selepas tempoh masa tertentu.

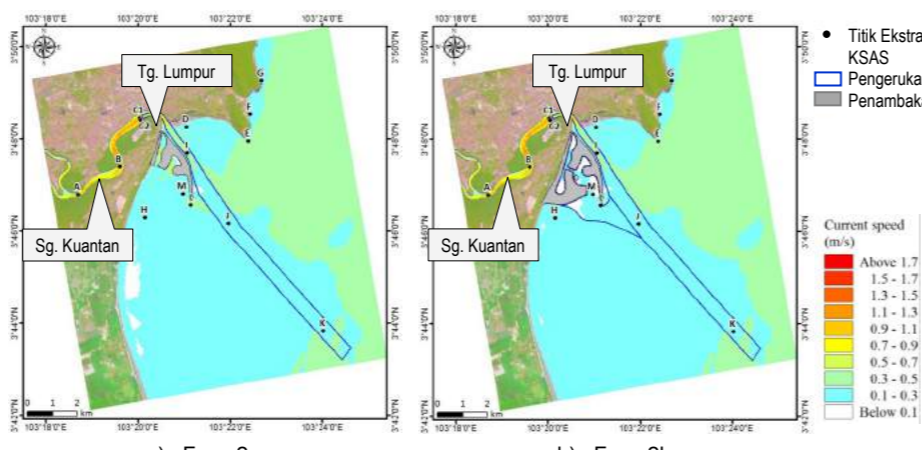
M Boleh membawa kesan yang penting tetapi, kekurangan maklumat menyebabkan kesan tidak dapat diramal dengan lebih tepat. Pemantauan dan pengawalan rapi adalah disyorkan.

D Boleh membawa kesan negatif dan penyelesaian dalam aspek rekabentuk telah dikenalpasti.

R Memberi kesan-kesan sisa yang negatif.

E Memberi kesan yang baik kepada alam sekitar.

Jadual R22 ► Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Fizikal dan Biologi

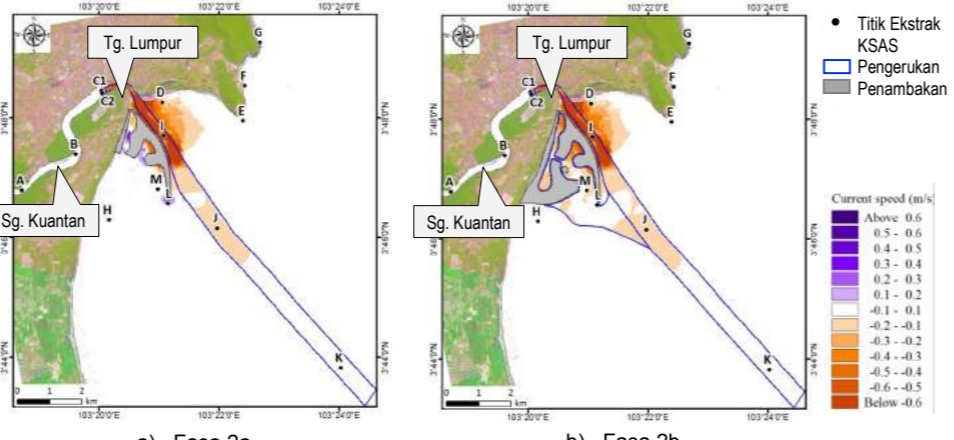
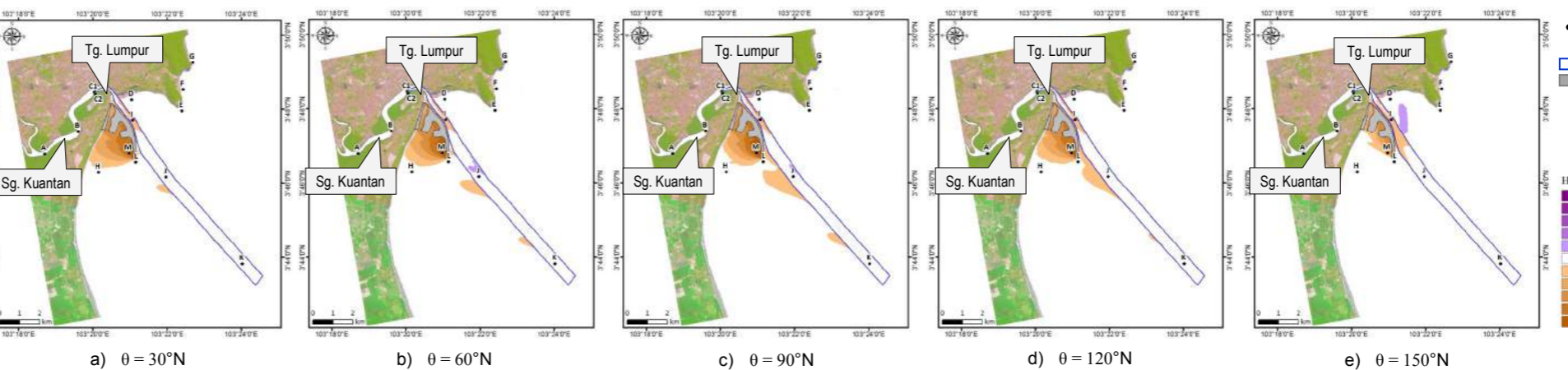
Komponen Projek	Komponen Alam Sekitar yang Terjejas	Potensi Impak	Magnitud Potensi Impak	Langkah Pencegahan dan Kawalan Pencemaran (P2M2)	Mukasurat
	c) Hidraulik – serakan sedimen		M	<p><b>Pembinaan benteng perimeter</b></p> <p>Benteng perimeter akan dibina mengelilingi kawasan penambakan. Ini akan mengurangkan jumlah serakan sedimen yang tersebar oleh arus semasa proses peletakan pasir di kawasan penambakan. Benteng perimeter batuan akan dibina sebagai perlindungan daripada ombak dan arus.</p>	7-5 to 7-55
2. Penambakan dan pengerukan	d) Hidraulik – kelajuan arus	<p>i) Projek yang dicadangkan akan mewujudkan perubahan setempat kepada corak aliran arus.</p> <p>ii) Akan berlaku pengurangan kelajuan arus di kawasan pengerukan alur pelayaran dan dalam kawasan penambakan.</p> <p>iii) Kelajuan akan meningkat di kawasan tenggara penambakan.</p> <p>iv) Penambakan Fasa 2a akan meningkatkan kelajuan arus aruhan dalam air.</p> <p><b>Fasa 2a</b></p> <ul style="list-style-type: none"> <li>■ Peningkatan kelajuan arus maksimum adalah kira-kira 0.34 m/s di bahagian tenggara penambakan dan 0.60 m/s dalam kawasan penambakan.</li> <li>■ Penurunan kelajuan arus maksimum adalah kira-kira 1.28 m/s di kawasan pengerukan dan 0.79 m/s di sekitar kawasan penambakan.</li> <li>■ Walaubagaimanapun, perubahan kelajuan arus pada Fasa 2a adalah sementara sehingga keseluruhan penambakan selesai.</li> </ul> <p><b>Fasa 2b</b></p> <ul style="list-style-type: none"> <li>■ Peningkatan kelajuan arus maksimum adalah kira-kira 0.16 m/s di bahagian tenggara penambakan dan 0.28 m/s dalam kawasan penambakan.</li> <li>■ Penurunan kelajuan arus maksimum adalah kira-kira 1.27 m/s di kawasan pengerukan dan 0.89 m/s di sekitar kawasan penambakan.</li> </ul>  <p style="text-align: center;">a) Fasa 2a                      b) Fasa 2b</p> <p style="text-align: center;"><b>Plot Kelajuan Arus Maksimum (Keadaan Monsun Peralihan)</b></p>	X	Tiada langkah-langkah kawalan diperlukan.	7-56 to 7-82

Petunjuk:

- X Tidak penting dan tidak termasuk dalam matriks.
- T Boleh membawa kesan tetapi bersifat sementara dan akan mencapai keseimbangan selepas tempoh masa tertentu.
- M Boleh membawa kesan yang penting tetapi, kekurangan maklumat menyebabkan kesan tidak dapat diramal dengan lebih tepat. Pemantauan dan pengawalan rapi adalah disyorkan.

- D Boleh membawa kesan negatif dan penyelesaian dalam aspek rekabentuk telah dikenalpasti.
- R Memberi kesan-kesan sisa yang negatif.
- E Memberi kesan yang baik kepada alam sekitar.

Jadual R22 ► Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Fizikal dan Biologi

Komponen Projek	Komponen Alam Sekitar yang Terjejas	Potensi Impak	Magnitud Potensi Impak	Langkah Pencegahan dan Kawalan Pencemaran (P2M2)	Mukasurat	
2. Penambakan dan pengerukan	d) Hidraulik – kelajuan arus	 <p>a) Fasa 2a      b) Fasa 2b</p>	X	Tiada langkah-langkah kawalan diperlukan.		
	<p><b>Impak Kelajuan Arus di KSAS</b></p> <ul style="list-style-type: none"> <li>Perubahan kelajuan arus min dan maksimum adalah setempat dalam kawasan projek.</li> <li>Perubahan kelajuan adalah minima di KSAS.</li> </ul>		X	Tiada langkah-langkah kawalan diperlukan.		
	e) Hidraulik – paras air dan impak banjir	Berdasarkan keputusan simulasi, tiada peningkatan paras air selepas penambakan. Oleh itu, tiada perubahan secara langsung kepada paras air dan banjir di kawasan ini.		X	Tiada langkah-langkah kawalan diperlukan.	7-82 to 7-85
	f) Hidraulik – ombak	<p>i) Perubahan ketinggian ombak adalah setempat dan tidak memberi kesan kepada persisiran pantai di utara dan selatan yang berhampiran.</p> <p>ii) Peningkatan ketinggian ombak yang ketara adalah kira-kira 0.2 m di hadapan muara sungai bagi ombak dari arah 150°U dengan ketinggian sehingga 1.2 m.</p> <p>iii) Penurunan ketinggian ombak kira-kira 1.6 m berlaku dalam kawasan cadangan marina bagi ombak dari arah 90°U.</p> <p>iv) Perubahan ketinggian adalah tidak ketara selepas aktiviti pengerukan di kawasan alur pelayaran.</p>		X	Tiada langkah-langkah kawalan diperlukan.	7-86 to 7-97
		 <p>a) <math>\theta = 30^\circ N</math>      b) <math>\theta = 60^\circ N</math>      c) <math>\theta = 90^\circ N</math>      d) <math>\theta = 120^\circ N</math>      e) <math>\theta = 150^\circ N</math></p> <p><b>Perbezaan Ketinggian Ombak : Fasa 2a</b></p>				

Petunjuk:

X Tidak penting dan tidak termasuk dalam matriks.

T Boleh membawa kesan tetapi bersifat sementara dan akan mencapai keseimbangan selepas tempoh masa tertentu.

M Boleh membawa kesan yang penting tetapi, kekurangan maklumat menyebabkan kesan tidak dapat diramal dengan lebih tepat.

Pemantauan dan pengawalan rapi adalah disyorkan.

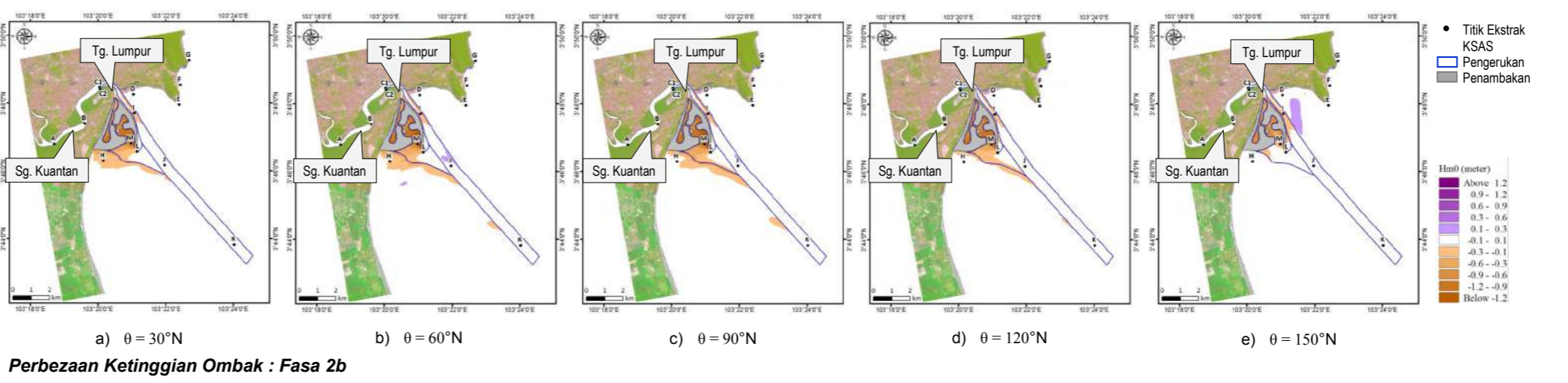
D Boleh membawa kesan negatif dan penyelesaian dalam aspek rekabentuk telah dikenalpasti.

R Memberi kesan-kesan sisa yang negatif.

E Memberi kesan yang baik kepada alam sekitar.



Jadual R22 ► Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Fizikal dan Biologi

Komponen Projek	Komponen Alam Sekitar yang Terjejas	Potensi Impak	Magnitud Potensi Impak	Langkah Pencegahan dan Kawalan Pencemaran (P2M2)	Mukasurat
	f) Hidraulik – ombak	 <p>a) <math>\theta = 30^\circ N</math>      b) <math>\theta = 60^\circ N</math>      c) <math>\theta = 90^\circ N</math>      d) <math>\theta = 120^\circ N</math>      e) <math>\theta = 150^\circ N</math></p> <p><b>Perbezaan Ketinggian Ombak : Fasa 2b</b></p>			7-86 to 7-97
2. Penambakan dan pengerukan		<p><b>Impak Ombak di KSAS</b></p> <ul style="list-style-type: none"> <li>Penurunan ketinggian ombak adalah ketara dalam kawasan penambakan.</li> <li>Penurunan ketinggian ombak yang pelbagai darjah berlaku dalam kawasan cadangan alur pelayaran, marina dan selatan penambakan bagi semua arah ombak.</li> <li>Projek ini akan menurunkan ketinggian ombak sebanyak 98% bagi ombak dari arah 30, 60, 90, dan 120°U dalam kawasan marina. Terdapat impak yang minima kesan daripada ombak dari arah 150°U.</li> <li>Ketinggian ombak yang tertinggi adalah 1.6 m berhadapan dengan bahagian tenggara pembangunan.</li> <li>Ombak dari arah 90°U mempunyai kesan yang paling tinggi diikuti dengan dari arah 60, 120, 30 dan 150°U.</li> </ul>	X	Tiada langkah-langkah kawalan diperlukan.	7-86 to 7-97
	g) Hidraulik – pемendapan dan hakisan	<p><b>i) Enapan Kohesif</b></p> <ul style="list-style-type: none"> <li>Perubahan dasar laut yang dihasilkan oleh projek adalah setempat di dalam kawasan yang berhampiran dengan tapak projek.</li> <li>Perubahan yang agak sama berlaku bagi semua keadaan.</li> </ul> <p><b>Fasa 2a</b></p> <ul style="list-style-type: none"> <li>Hakisan akan berlaku sehingga kira-kira 0.6 m/tahun dalam laguna dan 0.4 m/tahun dalam marina sebelum kerja-kerja pengerukan dijalankan.</li> <li>Pemendapan sehingga 0.1 m/tahun dijangka terbentuk di dalam saluran tapak projek dan 1.2 m/tahun di muara sungai yang bersempadanan dengan kawasan penambakan.</li> <li>Hakisan akan berlaku kira-kira 3 km dari jambatan hingga ke hulu sungai.</li> <li>Hakisan kira-kira 0.6 m/tahun akan berlaku kira-kira 2 km dari hulu alur pelayaran yang dicadangkan.</li> </ul>	T	<ul style="list-style-type: none"> <li>Projek ini akan menjalankan pengerukan penyelenggaraan tahunan bagi memastikan draf kapal yang mencukupi.</li> <li>Program pengerukan penyelenggaraan akan melibatkan pelupusan 100,000 m<sup>3</sup> bahan setiap tahun.</li> <li>Bahan yang dikorek semasa pengerukan penyelenggaraan di alur pelayaran dan kawasan dalam projek akan ditempatkan di sepanjang persisiran pantai.</li> <li>Penyuburan pantai akan dijalankan di sepanjang selatan pantai tapak projek yang berpotensi untuk terhakis (<i>rujuk gambar di bawah</i>).</li> </ul>	7-101 to 7-116

Petunjuk:

X Tidak penting dan tidak termasuk dalam matriks.

T Boleh membawa kesan tetapi bersifat sementara dan akan mencapai keseimbangan selepas tempoh masa tertentu.

M Boleh membawa kesan yang penting tetapi, kekurangan maklumat menyebabkan kesan tidak dapat diramal dengan lebih tepat. Pemantauan dan pengawalan rapi adalah disyorkan.

D Boleh membawa kesan negatif dan penyelesaian dalam aspek rekabentuk telah dikenalpasti.

R Memberi kesan-kesan sisa yang negatif.

E Memberi kesan yang baik kepada alam sekitar.

Jadual R22 ► Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Fizikal dan Biologi

Komponen Projek	Komponen Alam Sekitar yang Terjejas	Potensi Impak	Magnitud Potensi Impak	Langkah Pencegahan dan Kawalan Pencemaran (P2M2)	Mukasurat
2. Penambakan dan pengerukan	g) Hidraulik – pemedapan dan hakisan	<p><b>Unjuran Perubahan Paras Dasar Laut (Keadaan Monsun Peralihan): Keadaan Sedia Ada berbanding dengan Fasa 2a</b></p> <p><b>Fasa 2b</b></p> <ul style="list-style-type: none"> <li>■ Pemedapan sehingga 1 m/tahun dijangka akan berlaku di kawasan air sekitar projek.</li> <li>■ Pemedapan sehingga 0.6 m /tahun berlaku di lembangan pusingan.</li> <li>■ Pemedapan sehingga kira-kira 1.2 m/tahun terbentuk di hadapan muara sungai.</li> <li>■ Hakisan akan berlaku kira-kira 3 km dari jambatan ke hulu sungai.</li> <li>■ Hakisan kira-kira 0.6 m/tahun akan berlaku kira-kira 2 km dari hulu alur pelayaran yang dicadangkan.</li> </ul> <p><b>Unjuran Perubahan Paras Dasar Laut (Keadaan Monsun Peralihan): Keadaan Sedia Ada berbanding dengan Fasa 2b</b></p>	T	<p><b>Cadangan Langkah Kawalan di Selatan Tapak Projek</b></p> <p>v) Kajian batimetri dan tepi pantai secara berkala akan dijalankan untuk menilai perubahan paras kedalaman tepi pantai dan dasar laut semasa dan selepas projek. Kajian ini akan dijalankan sepanjang garis pantai sehingga 2.5 km ke utara projek dengan jarak garisan antaranya adalah 100 m, 1 km ke selatan pembangunan dan 1 km ke arah laut. Kajian meliputi 50 m ke arah darat semasa aras air tinggi.</p>	7-101 to 7-116

Petunjuk:

- X Tidak penting dan tidak termasuk dalam matriks.
- T Boleh membawa kesan tetapi bersifat sementara dan akan mencapai keseimbangan selepas tempoh masa tertentu.
- M Boleh membawa kesan yang penting tetapi, kekurangan maklumat menyebabkan kesan tidak dapat diramal dengan lebih tepat. Pemantauan dan pengawalan rapi adalah disyorkan.
- D Boleh membawa kesan negatif dan penyelesaian dalam aspek rekabentuk telah dikenalpasti.
- R Memberi kesan-kesan sisa yang negatif.
- E Memberi kesan yang baik kepada alam sekitar.

Jadual R22 ► Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Fizikal dan Biologi

Komponen Projek	Komponen Alam Sekitar yang Terjejas	Potensi Impak	Magnitud Potensi Impak	Langkah Pencegahan dan Kawalan Pencemaran (P2M2)	Mukasurat																																																																								
2. Penambakan dan pengerukan	g) Hidraulik – pemendapan dan hakisan	<p><b>Impak Pemendapan dan Hakisan di KSAS (Enapan Kohesif)</b></p> <ul style="list-style-type: none"> <li>Hakisan kira-kira 0.1 m / tahun akan berlaku di jeti Jambatan Tanjung Lumpur dan berdekatan Hutan Rizab Paya Laut setelah kerja-kerja pengerukan selesai.</li> <li>Pemendapan kira-kira 0.1 m/ tahun akan berlaku dalam kawasan alur pelayaran bersempadanan dengan projek.</li> </ul>	T	Sila rujuk mukasurat ES-68 hingga ES-69	7-101 to 7-116																																																																								
		<p><b>Purata Kadar Pemendapan bagi Enapan Kohesif di KSAS</b></p> <table border="1"> <thead> <tr> <th rowspan="2">Titik</th> <th rowspan="2">Lokasi</th> <th colspan="2">Purata Kadar Pemendapan (m/tahun)</th> <th rowspan="2">Purata Kadar Pemendapan bagi Enapan Kohesif di KSAS</th> </tr> <tr> <th>Fasa 2a</th> <th>Fasa 2b</th> </tr> </thead> <tbody> <tr><td>A</td><td>Hutan Simpan Kuantan</td><td>0.0</td><td>0.0</td><td></td></tr> <tr><td>B</td><td>Hutan Rizab Paya Laut Kuantan</td><td>-0.1</td><td>-0.1</td><td></td></tr> <tr><td>C1</td><td>Jambatan Tanjung Lumpur (jeti utara)</td><td>-0.1</td><td>-0.1</td><td></td></tr> <tr><td>C2</td><td>Jambatan Tanjung Lumpur (jeti selatan)</td><td>-0.1</td><td>-0.1</td><td></td></tr> <tr><td>D</td><td>Pantai Tanjung Sisek</td><td>0.0</td><td>0.0</td><td></td></tr> <tr><td>E</td><td>Kuantan Tembeling Resort</td><td>0.0</td><td>0.0</td><td></td></tr> <tr><td>F</td><td>Teluk Cempedak</td><td>0.0</td><td>0.0</td><td></td></tr> <tr><td>G</td><td>Hutan Simpan Beserah</td><td>0.0</td><td>0.0</td><td></td></tr> <tr><td>H</td><td>Beting Pasir Tanjung Lumpur</td><td>0.0</td><td>0.0</td><td></td></tr> <tr><td>I</td><td>Alur pelayaran (hulu)</td><td>0.1</td><td>0.1</td><td></td></tr> <tr><td>J</td><td>Alur pelayaran (pertengahan)</td><td>0.0</td><td>0.0</td><td></td></tr> <tr><td>K</td><td>Alur pelayaran (hilir)</td><td>0.0</td><td>0.0</td><td></td></tr> <tr><td>L</td><td>Bahagian tenggara pembangunan</td><td>0.0</td><td>0.0</td><td></td></tr> <tr><td>M</td><td>Laluan masuk marina</td><td>0.0</td><td>0.0</td><td></td></tr> </tbody> </table> <p><i>Nota: Nilai negatif menunjukkan hakisan; Nilai positif menunjukkan pemendapan</i></p>				Titik	Lokasi	Purata Kadar Pemendapan (m/tahun)		Purata Kadar Pemendapan bagi Enapan Kohesif di KSAS	Fasa 2a	Fasa 2b	A	Hutan Simpan Kuantan	0.0	0.0		B	Hutan Rizab Paya Laut Kuantan	-0.1	-0.1		C1	Jambatan Tanjung Lumpur (jeti utara)	-0.1	-0.1		C2	Jambatan Tanjung Lumpur (jeti selatan)	-0.1	-0.1		D	Pantai Tanjung Sisek	0.0	0.0		E	Kuantan Tembeling Resort	0.0	0.0		F	Teluk Cempedak	0.0	0.0		G	Hutan Simpan Beserah	0.0	0.0		H	Beting Pasir Tanjung Lumpur	0.0	0.0		I	Alur pelayaran (hulu)	0.1	0.1		J	Alur pelayaran (pertengahan)	0.0	0.0		K	Alur pelayaran (hilir)	0.0	0.0		L	Bahagian tenggara pembangunan	0.0	0.0	
Titik	Lokasi	Purata Kadar Pemendapan (m/tahun)		Purata Kadar Pemendapan bagi Enapan Kohesif di KSAS																																																																									
		Fasa 2a	Fasa 2b																																																																										
A	Hutan Simpan Kuantan	0.0	0.0																																																																										
B	Hutan Rizab Paya Laut Kuantan	-0.1	-0.1																																																																										
C1	Jambatan Tanjung Lumpur (jeti utara)	-0.1	-0.1																																																																										
C2	Jambatan Tanjung Lumpur (jeti selatan)	-0.1	-0.1																																																																										
D	Pantai Tanjung Sisek	0.0	0.0																																																																										
E	Kuantan Tembeling Resort	0.0	0.0																																																																										
F	Teluk Cempedak	0.0	0.0																																																																										
G	Hutan Simpan Beserah	0.0	0.0																																																																										
H	Beting Pasir Tanjung Lumpur	0.0	0.0																																																																										
I	Alur pelayaran (hulu)	0.1	0.1																																																																										
J	Alur pelayaran (pertengahan)	0.0	0.0																																																																										
K	Alur pelayaran (hilir)	0.0	0.0																																																																										
L	Bahagian tenggara pembangunan	0.0	0.0																																																																										
M	Laluan masuk marina	0.0	0.0																																																																										

Petunjuk:

X Tidak penting dan tidak termasuk dalam matriks.

T Boleh membawa kesan tetapi bersifat sementara dan akan mencapai keseimbangan selepas tempoh masa tertentu.

M Boleh membawa kesan yang penting tetapi, kekurangan maklumat menyebabkan kesan tidak dapat diramal dengan lebih tepat. Pemantauan dan pengawalan rapi adalah disyorkan.

D Boleh membawa kesan negatif dan penyelesaian dalam aspek rekabentuk telah dikenalpasti.

R Memberi kesan-kesan sisa yang negatif.

E Memberi kesan yang baik kepada alam sekitar.

Jadual R22 ► Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Fizikal dan Biologi

Komponen Projek	Komponen Alam Sekitar yang Terjejas	Potensi Impak	Magnitud Potensi Impak	Langkah Pencegahan dan Kawalan Pencemaran (P2M2)	Mukasurat																																																																									
2. Penambakan dan pengerukan	g) Hidraulik – pemendapan dan hakisan	<p>ii) <b>Enapan Tidak Kohesif</b></p> <ul style="list-style-type: none"> <li>Kapasiti pengangkutan enapan berkurang di kawasan alur pelayaran, dalam kawasan penambakan dan alur marina yang dikorek.</li> <li>Kapasiti pengangkutan enapan meningkat di pinggir utara alur pelayaran dan tertumpu di hujung tenggara penambakan.</li> <li>Perubahan pengangkutan enapan yang ketara bagi kedua-dua fasa adalah ketika keadaan Monsun Timur Laut.</li> </ul> <p><b>Fasa 2a</b></p> <ul style="list-style-type: none"> <li>Sebahagian enapan dari Tanjung Tembeling akan terhalang oleh penambakan dan ianya dijangka akan termendap di kawasan pengerukan.</li> <li>Pemendapan kira-kira 1.1 m/tahun dijangka akan berlaku.</li> <li>Kapasiti pengangkutan yang berkurang dalam kawasan pengerukan adalah kesan dari kelajuan arus yang perlahan dan terlindung dari ombak.</li> <li>Pemendapan di laluan masuk marina adalah kira-kira 0.6 m/tahun.</li> <li>Persisiran pantai sepanjang 1 km di selatan penambakan akan terhakis kira-kira 0.2 m/tahun kerana pergerakan enapan dari Tanjung Tembeling yang terhalang.</li> <li>Terdapat peningkatan kapasiti pengangkutan pasir di bahagian hujung tenggara penambakan dan di pinggir timur laut alur pelayaran yang dikeruk di mana hakisan kira-kira 0.4 m/tahun dijangka akan berlaku.</li> </ul> <p><b>Fasa 2b</b></p> <ul style="list-style-type: none"> <li>Sebahagian enapan dari Tanjung Tembeling akan terhalang dengan adanya Fasa 2a.</li> <li>Enapan ini akan termendap di dalam kawasan pengerukan dengan pemendapan kira-kira 1.1 m/tahun.</li> <li>Pemendapan di laluan masuk marina adalah kira-kira 0.6 m/tahun.</li> <li>Persisiran pantai sepanjang 1 km di selatan penambakan akan terhakis kira-kira 0.1 m/tahun kerana pergerakan enapan dari Tanjung Tembeling yang terhalang.</li> <li>Terdapat sedikit peningkatan kapasiti pengangkutan pasir di bahagian hujung tenggara penambakan dan di pinggir timur laut alur pelayaran yang dikeruk di mana hakisan kira-kira 0.5 m/tahun dijangka akan berlaku.</li> </ul>	T	Sila rujuk mukasurat ES-68 hingga ES-69	7-101 to 7-116																																																																									
		<p><b>Impak Pemendapan dan Hakisan di KSAS (Enapan Tidak Kohesif)</b></p> <ul style="list-style-type: none"> <li>Perubahan kapasiti pengangkutan enapan adalah setempat.</li> </ul> <table border="1"> <thead> <tr> <th rowspan="2">Titik</th> <th rowspan="2">Lokasi</th> <th colspan="2">Purata Kadar Pemendapan (m/tahun)</th> <th rowspan="2">Purata Kadar Pemendapan bagi Enapan Tidak Kohesif di KSAS</th> </tr> <tr> <th>Fasa 2a</th> <th>Fasa 2b</th> </tr> </thead> <tbody> <tr><td>A</td><td>Hutan Simpan Kuantan</td><td>0</td><td>0</td><td></td></tr> <tr><td>B</td><td>Hutan Rizab Paya Laut Kuantan</td><td>0</td><td>0</td><td></td></tr> <tr><td>C1</td><td>Jambatan Tanjung Lumpur (jeti utara)</td><td>0</td><td>0</td><td></td></tr> <tr><td>C2</td><td>Jambatan Tanjung Lumpur (jeti selatan)</td><td>0</td><td>0</td><td></td></tr> <tr><td>D</td><td>Pantai Tanjung Sisek</td><td>0</td><td>0</td><td></td></tr> <tr><td>E</td><td>Kuantan Tembeling Resort</td><td>0</td><td>0</td><td></td></tr> <tr><td>F</td><td>Teluk Cempedak</td><td>0</td><td>0</td><td></td></tr> <tr><td>G</td><td>Hutan Simpan Beserah</td><td>0</td><td>0</td><td></td></tr> <tr><td>H</td><td>Beting Pasir Tanjung Lumpur</td><td>-0.1</td><td>-0.1</td><td></td></tr> <tr><td>I</td><td>Alur pelayaran (hulu)</td><td>1.1</td><td>1.1</td><td></td></tr> <tr><td>J</td><td>Alur pelayaran (pertengahan)</td><td>0</td><td>0</td><td></td></tr> <tr><td>K</td><td>Alur pelayaran (hilir)</td><td>0</td><td>0</td><td></td></tr> <tr><td>L</td><td>Bahagian tenggara pembangunan</td><td>-0.4</td><td>-0.5</td><td></td></tr> <tr><td>M</td><td>Laluan masuk marina</td><td>0.6</td><td>0.6</td><td></td></tr> </tbody> </table> <p><i>Nota: Nilai negatif menunjukkan hakisan; Nilai positif menunjukkan pemendapan</i></p>	Titik			Lokasi	Purata Kadar Pemendapan (m/tahun)		Purata Kadar Pemendapan bagi Enapan Tidak Kohesif di KSAS	Fasa 2a	Fasa 2b	A	Hutan Simpan Kuantan	0	0		B	Hutan Rizab Paya Laut Kuantan	0	0		C1	Jambatan Tanjung Lumpur (jeti utara)	0	0		C2	Jambatan Tanjung Lumpur (jeti selatan)	0	0		D	Pantai Tanjung Sisek	0	0		E	Kuantan Tembeling Resort	0	0		F	Teluk Cempedak	0	0		G	Hutan Simpan Beserah	0	0		H	Beting Pasir Tanjung Lumpur	-0.1	-0.1		I	Alur pelayaran (hulu)	1.1	1.1		J	Alur pelayaran (pertengahan)	0	0		K	Alur pelayaran (hilir)	0	0		L	Bahagian tenggara pembangunan	-0.4	-0.5		M	Laluan masuk marina
Titik	Lokasi	Purata Kadar Pemendapan (m/tahun)		Purata Kadar Pemendapan bagi Enapan Tidak Kohesif di KSAS																																																																										
		Fasa 2a	Fasa 2b																																																																											
A	Hutan Simpan Kuantan	0	0																																																																											
B	Hutan Rizab Paya Laut Kuantan	0	0																																																																											
C1	Jambatan Tanjung Lumpur (jeti utara)	0	0																																																																											
C2	Jambatan Tanjung Lumpur (jeti selatan)	0	0																																																																											
D	Pantai Tanjung Sisek	0	0																																																																											
E	Kuantan Tembeling Resort	0	0																																																																											
F	Teluk Cempedak	0	0																																																																											
G	Hutan Simpan Beserah	0	0																																																																											
H	Beting Pasir Tanjung Lumpur	-0.1	-0.1																																																																											
I	Alur pelayaran (hulu)	1.1	1.1																																																																											
J	Alur pelayaran (pertengahan)	0	0																																																																											
K	Alur pelayaran (hilir)	0	0																																																																											
L	Bahagian tenggara pembangunan	-0.4	-0.5																																																																											
M	Laluan masuk marina	0.6	0.6																																																																											

Petunjuk:

X Tidak penting dan tidak termasuk dalam matriks.

T Boleh membawa kesan tetapi bersifat sementara dan akan mencapai keseimbangan selepas tempoh masa tertentu.

M Boleh membawa kesan yang penting tetapi, kekurangan maklumat menyebabkan kesan tidak dapat diramal dengan lebih tepat. Pemantauan dan pengawalan rapi adalah disyorkan.

D Boleh membawa kesan negatif dan penyelesaian dalam aspek rekabentuk telah dikenalpasti.

R Memberi kesan-kesan sisa yang negatif.

E Memberi kesan yang baik kepada alam sekitar.

Jadual R22 ► Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Fizikal dan Biologi

Komponen Projek	Komponen Alam Sekitar yang Terjejas	Potensi Impak	Magnitud Potensi Impak	Langkah Pencegahan dan Kawalan Pencemaran (P2M2)	Mukasurat
2. Penambakan dan pengerukan	h) Kualiti air	<ul style="list-style-type: none"> <li>i) Minyak dan gris daripada kapal yang digunakan akan menyebabkan tumpahan minyak ke dalam laut dan menyebabkan pencemaran.</li> <li>ii) Pembuangan sisa yang tidak terancang daripada kapal akan memberi impak negatif kepada kawasan perairan.</li> <li>iii) Aktiviti pengerukan akan mengganggu lapisan permukaan dasar laut dan pepejal terampai di dalam air dan seterusnya akan mengeruhkan air.</li> <li>iv) Pelupusan bahan kerukan yang tidak terancang akan mengeruhkan air di kawasan berdekatnya.</li> </ul>	M	<ul style="list-style-type: none"> <li>i) Aktiviti penambakan dan pengerukan akan dijalankan dengan beberapa langkah kawalan seperti pengerukan secara terkawal dan langkah kawalan pelbagai peringkat untuk mencapai pengerukan 'zero plume';</li> <li>ii) Tirai kelodak akan dipasang dilokasi tertentu di kawasan projek seperti yang dinyatakan dalam Bab 5. Tirai kelodak ini hendaklah dipantau secara berkala dan diselenggara dengan baik;</li> <li>iii) Pengurusan sistem pepejal di atas kapal hendaklah diuruskan dengan baik. Semua sisa pepejal hendaklah dikutip menggunakan tong khusus. Tong ini kemudiannya akan dipunggah di darat dan dilupuskan di kawasan bahan buangan yang ditetapkan;</li> <li>iv) Pelan Tindakan Kecemasan (ERP) menyeluruh hendaklah disediakan yang merangkumi langkah mencegah dan respon kepada tumpahan minyak. Pelan ini perlu digubal mengikut keperluan dan diluluskan oleh pihak berkuasa yang berkaitan;</li> <li>v) Adalah dicadangkan agar program pemantauan kualiti air secara bulanan dijalankan pada tiga kedalaman: permukaan, tengah dan dasar;</li> <li>vi) Pemantauan satelit bagi kepulan sedimen amat digalakkan;</li> <li>vii) Semua kapal hendaklah beroperasi dengan kapasiti yang telah ditetapkan sahaja. Muatan berlebihan adalah dilarang. Semasa cuaca buruk, kelajuan kapal hendaklah dikurangkan untuk mengelakkan tumpahan;</li> <li>viii) Semua kapal yang mengangkut bahan kerukan hendaklah dipantau dengan teliti. Pelepasan bahan kerukan hanya dibenarkan di kawasan penambakan sahaja; dan</li> <li>ix) Sekiranya tumpahan berlaku, operasi kapal hendaklah segera dihentikan dan palam kebocoran dipasang untuk mengelakkan pencemaran kepada alam sekitar marin. Hal ini hendaklah dimaklumkan kepada pihak berkuasa dengan segera.</li> </ul>	7-116 to 7-117
	i) Persekitaran biologi marin	<ul style="list-style-type: none"> <li>i) Serakan sedimen boleh menyebabkan kekeruhan dalam air jika tidak dilaksanakan dengan terancang. Ini boleh memberi kesan kepada hidupan marin (terutamanya ekosistem di dasar laut).</li> <li>ii) Aktiviti pengerukan akan melepaskan sedimen ke dalam air semasa penggalian dan semasa mengangkut bahan dari kapal ke tongkang.</li> </ul> <p><b>Plankton dan Bentos</b></p> <ul style="list-style-type: none"> <li>i) Impak ini adalah minima dalam perairan berhampiran dengan projek kerana kehidupannya yang dinamik dan sebahagian besar dipengaruhi oleh pergerakan pasang surut harian.</li> </ul> <p><b>Perikanan</b></p> <ul style="list-style-type: none"> <li>i) Walaupun aktiviti penambakan dan pengerukan akan memberikan impak sementara kepada kualiti air, tiada populasi ikan yang berkepentingan ekonomi di kawasan sekitar projek.</li> <li>ii) Walaubagaimanapun, ikan adalah dinamik dan berenang menjauhi kawasan pengerukan.</li> </ul>	T	<ul style="list-style-type: none"> <li>i) Amalan aktiviti pengerukan yang terancang mestilah diamalkan pada setiap masa untuk memastikan impak kepada alam sekitar adalah minimum.</li> <li>ii) Bagi kehilangan komuniti benthik, tiada langkah kawalan dicadangkan. Walaubagaimanapun, setelah selesai aktiviti pengerukan, komuniti ini akan terbentuk semula secara semulajadi.</li> </ul>	7-117 to 7-120

Petunjuk:

X Tidak penting dan tidak termasuk dalam matriks.

T Boleh membawa kesan tetapi bersifat sementara dan akan mencapai keseimbangan selepas tempoh masa tertentu.

M Boleh membawa kesan yang penting tetapi, kekurangan maklumat menyebabkan kesan tidak dapat diramal dengan lebih tepat. Pemantauan dan pengawalan rapi adalah disyorkan.

D Boleh membawa kesan negatif dan penyelesaian dalam aspek rekabentuk telah dikenalpasti.

R Memberi kesan-kesan sisa yang negatif.

E Memberi kesan yang baik kepada alam sekitar.

Jadual R22 ► Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Fizikal dan Biologi

Komponen Projek	Komponen Alam Sekitar yang Terjejas	Potensi Impak	Magnitud Potensi Impak	Langkah Pencegahan dan Kawalan Pencemaran (P2M2)	Mukasurat
2. Penambakan dan pengerukan	j) Trafik marin dan keselamatan pelayaran	<ul style="list-style-type: none"> <li>i) Terdapat pertambahan bilangan kapal seperti kapal tunda, CSD, TSHD dan lain-lain yang akan berulang-alik di sekitar tapak projek.</li> <li>ii) Pergerakan kapal yang kerap akan mengganggu bot-bot nelayan kecil yang ditambat di kawasan berhampiran.</li> <li>iii) Laluan pelayaran sedia ada akan terganggu dan alat bantuan navigasi sementara perlu disediakan.</li> <li>iv) Terdapat kemungkinan akan berlaku risiko pelanggaran dengan bot nelayan.</li> </ul>	M / T	<ul style="list-style-type: none"> <li>i) Penggerak Projek hendaklah memastikan kontraktor mematuhi semua prosedur dan peraturan yang telah ditetapkan oleh pihak berkuasa yang berkaitan;</li> <li>ii) Rondaan keselamatan yang kerap hendaklah dijalankan bagi memastikan tiada kegiatan menangkap ikan dijalankan di dalam atau berhampiran dengan kawasan kerja projek;</li> <li>iii) Kawasan larangan perlu diisytiharkan yang merangkumi keseluruhan kawasan kerja projek dan kawasan ini ditandakan dengan boya penanda berlampu;</li> <li>iv) Semua pihak berkuasa yang berkaitan seperti Ketua Pegawai Marin Pelabuhan Kuantan dan operator pelabuhan, Kuantan Port Consortium, Pegawai Pelabuhan, Pegawai Jabatan Laut, Jabatan Perikanan dan lain-lain hendaklah dimaklumkan terlebih dahulu sebelum sebarang kerja dimulakan dan untuk permohonan permit, lesen dan lain-lain.</li> <li>v) Pembuangan sisa, bahan lebihan dan serpihan lain ke dalam perairan adalah dilarang sepanjang tempoh projek.</li> </ul>	7-120
	k) Kualiti udara	<ul style="list-style-type: none"> <li>i) Pada puncak aktiviti penambakan dan pengerukan, habuk yang dihasilkan akan merendahkan kualiti udara di kawasan sekitarnya;</li> <li>ii) Pelepasan asap dari kapal marin dan jentera seperti jengkaut, lori dan jentolak;</li> <li>iii) Impak ini adalah sementara dan setempat.</li> </ul>	X	<ul style="list-style-type: none"> <li>i) Kapal dan jentera yang beroperasi hendaklah diselenggara secara berkala.</li> <li>ii) Sistem pengendalian dan penyimpanan bahan hendaklah disediakan.</li> <li>iii) Pemantauan kualiti udara hendaklah dijalankan secara berkala bagi memastikan tahap kualiti udara tidak melepasi had yang telah ditetapkan oleh JAS.</li> </ul>	7-120
	l) Hingar	<ul style="list-style-type: none"> <li>i) Peningkatan tahap hingar akan berlaku semasa aktiviti pemadatan dan rawatan tanah dijalankan.</li> <li>ii) Walaubagaimanapun, impak ini adalah minimum.</li> </ul>	X	<ul style="list-style-type: none"> <li>i) Kapal dan jentera yang beroperasi hendaklah diselenggara secara berkala.</li> <li>ii) Pemantauan tahap hingar hendaklah dijalankan secara berkala bagi memastikan tahap hingar tidak melepasi had yang telah ditetapkan oleh JAS.</li> </ul>	7-121
3. Pasca Penambakan	a) Persekitaran biologi terestrial	<ul style="list-style-type: none"> <li>i) Penambakan tanah yang baru tidak akan memberikan kesan kepada persekitaran biologi terestrial. Ini adalah kerana ianya telah pun tiada semasa aktiviti pembersihan tanah sedia ada dan penambakan.</li> <li>ii) Beberapa spesies komensal seperti merpati, pipit (<i>Anthus sp.</i>), merpati, bulbul, burung tiung, gagak dan lain-lain akan terus hidup di kawasan tersebut.</li> </ul>	X	<ul style="list-style-type: none"> <li>i) Penanaman semula spesies bakau yang cepat membiak seperti Api-Api (<i>Avicennia sp.</i>), Bakau (<i>Rhizophora sp.</i>), Perepat (<i>Sonneratia sp.</i>), dan lain-lain hendaklah digalakkan di kawasan yang terjejas (jika ada).</li> <li>ii) Penanaman semula dan landskap yang teratur akan meningkatkan kualiti estetika di kawasan projek.</li> <li>iii) Struktur kekal perlindungan pantai perlu diselenggara dengan baik untuk melindungi kawasan penambakan. Dataran lumpur di kawasan projek akan pulih dan menjadi habitat kepada burung-burung pantai (spesies bermaustatin).</li> </ul>	7-121
	b) Persekitaran manusia – komuniti nelayan	Tanah yang ditambak akan menambahkan kos dan bahan api yang ditanggung oleh para nelayan tempatan kerana perjalanan mereka akan menjadi lebih jauh daripada biasa.	D	<ul style="list-style-type: none"> <li>i) Sebuah jawatankuasa yang terdiri daripada pihak berkuasa (iaitu LKIM, Jabatan Perikanan), Penggerak Projek, Kerajaan Negeri dan wakil-wakil daripada komuniti nelayan hendaklah ditubuhkan.</li> <li>ii) Sebuah formula perlu diusahakan oleh jawatankuasa ini dalam menyediakan pampasan yang sewajarnya kepada nelayan yang terjejas.</li> </ul>	7-121
4. Fasa Operasi	a) Kualiti air	<ul style="list-style-type: none"> <li>i) Dua (2) buah loji rawatan kumbahan (STP) akan dibina dan dirawat mengikut Piawaian A dan kemudiannya akan dilepaskan ke Laut China Selatan.</li> <li>ii) Penambakan akan mengurangkan flushing di sekitar tapak projek.</li> </ul>	D	Langkah kawalan yang sesuai akan direka bentuk untuk mengurangkan pelepasan pencemaran ke dalam perairan terbuka (Laut China Selatan).	7-122
	b) Trafik marin	<ul style="list-style-type: none"> <li>i) Apabila terminal marina beroperasi, bilangan kapal pelayaran dan kapal layar yang memasuki dan berhenti akan meningkat.</li> <li>ii) Marina ini terletak di luar laluan trafik marin yang utama dan agak terlindung daripada ombak dan arus.</li> </ul>	D	<ul style="list-style-type: none"> <li>i) Semua kapal yang akan menggunakan kemudahan marina perlu mematuhi Undang-Undang Tempatan dan Antarabangsa yang berkaitan dengan Pencegahan Pencemaran Laut.</li> <li>ii) Memastikan semua kapal yang ingin berlabuh diperiksa dengan teliti sebelum panggilan dibuat ke marina.</li> <li>iii) Menjalankan operasi latihan dan keselamatan secara rutin dan melatih kakitangan memahami prosedur kecemasan.</li> <li>iv) Perjumpaan antara Penggerak Projek dan komuniti nelayan perlu dijalankan secara berkala. Ini bertujuan untuk mendidik dan memaklumkan kepada nelayan bahawa aktiviti penangkapan ikan di kawasan projek boleh menimbulkan risiko. Maklum balas daripada kedua-dua belah pihak adalah digalakkan.</li> </ul>	7-122

Petunjuk:

X Tidak penting dan tidak termasuk dalam matriks.

T Boleh membawa kesan tetapi bersifat sementara dan akan mencapai keseimbangan selepas tempoh masa tertentu.

M Boleh membawa kesan yang penting tetapi, kekurangan maklumat menyebabkan kesan tidak dapat diramal dengan lebih tepat. Pemantauan dan pengawalan rapi adalah disyorkan.

D Boleh membawa kesan negatif dan penyelesaian dalam aspek rekabentuk telah dikenalpasti.

R Memberi kesan-kesan sisa yang negatif.

E Memberi kesan yang baik kepada alam sekitar.

Jadual R22 ► Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Fizikal dan Biologi

Komponen Projek	Komponen Alam Sekitar yang Terjejas	Potensi Impak	Magnitud Potensi Impak	Langkah Pencegahan dan Kawalan Pencemaran (P2M2)	Mukasurat
4. Fasa Operasi	c) Trafik darat	i) Jumlah penjana perjalanan pada waktu pagi adalah 10,725 dan waktu petang adalah 14,922. ii) Rangkaian jalan raya sedia ada tidak dapat menampung permintaan trafik masa depan.	D	i) Persimpangan 1 akan dilebarkan kepada dua lorong dua hala menjelang tahun 2021 dan kemudiannya akan dinaik taraf kepada persimpangan lampu isyarat 3 fasa pada tahun 2025. ii) Persimpangan 2 akan dilebarkan kepada dua lorong dua hala. Lorong Anak Air 2 dan Lorong Anak Air 4 akan dilebarkan kepada satu lorong satu hala menjelang tahun 2025.	7-122 to 7-125
	d) Penjana sisa pepejal	i) Sisa pepejal mungkin berpunca daripada aktiviti komersial dan perniagaan seperti sampah daripada pembungkusan bahan-bahan. ii) Pembuangan sisa ke dalam laut akan menimbulkan risiko kepada hidupan marin. Ianya juga akan memberi ancaman kepada kapal laut yang menggunakan perairan tersebut.	M	i) Bilangan tong sampah bertutup yang mencukupi hendaklah disediakan di kawasan yang sesuai. ii) Jadual kutipan sampah yang terancang hendaklah disediakan dan dilaksanakan di kawasan pembangunan projek.	7-125
	e) Halangan pemandangan laut	Pemandangan laut adalah ciri unik yang kini dinikmati oleh penduduk tempatan Tanjung Lumpur. Penduduk tempatan hendaklah menerima seadanya pembangunan yang dicadangkan.	D	Laluan pejalan kaki akan disediakan di sepanjang tepi laut bagi membolehkan para pengunjung menikmati pemandangan laut.	7-125
	f) Infrastruktur dan utiliti	Pembangunan di atas tanah tambak akan menyokong pelbagai aktiviti seperti komersial, kediaman, rekreasi, institusi, pusat kesihatan dan kemudahan infrastruktur. Pembangunan ini dijangka akan menyokong kira-kira 25,000 orang.	X	Tiada langkah-langkah kawalan diperlukan.	7-125 to 7-126
5. Pelan Penutupan Projek	a) Penutupan sementara	i) Penutupan sementara aktiviti penambakan dan pengerukan adalah dengan tujuan aktiviti projek akan diteruskan pada masa hadapan. ii) Kegagalan reka bentuk, cabaran kewangan dan keadaan cuaca yang buruk adalah antara sebab-sebab penutupan sementara dilaksanakan.	X	i) Semua jentera pembinaan dan peralatan serta kapal hendaklah dialihkan daripada kawasan tapak projek. ii) Struktur binaan yang tidak stabil dan sisa pepejal hendaklah dilupuskan dengan terancang. iii) Papan tanda keselamatan hendaklah diletakkan di tempat yang strategik dan dapat dilihat dengan jelas oleh nelayan dan pelaut yang lain terutamanya pada waktu malam. iv) Laluan laut dalam kawasan penambakan hendaklah ditanda untuk kemudahan para pelaut. v) Notis penutupan pelan projek hendaklah dimaklumkan kepada pengguna perairan terutamanya nelayan dan pelaut.	7-126 to 7-127
	b) Penutupan kekal	Penggerak Projek tiada hasrat untuk meneruskan aktiviti penambakan dan pengerukan. Oleh itu, sebahagian tanah yang telah ditambak akan kekal seperti seadanya.	X	i) Penggerak Projek hendaklah memaklumkan kepada Jabatan Laut dan Lembaga Pelabuhan Kuantan untuk memberikan notis kepada pengguna perairan tentang tanah yang ditambak. ii) Semua struktur kekal yang tidak selamat hendaklah dialihkan atau dirobohkan. iii) Pembinaan banteng batuan perimeter hendaklah disiapkan sepenuhnya. Sebarang kerosakan pada banteng batuan perimeter hendaklah dibaiki. iv) Sebarang permukaan yang terdedah hendaklah dilindungi daripada hakisan permukaan seperti penanaman pokok dan rumput.	7-126 to 7-127

Petunjuk:

X Tidak penting dan tidak termasuk dalam matriks.

T Boleh membawa kesan tetapi bersifat sementara dan akan mencapai keseimbangan selepas tempoh masa tertentu.

M Boleh membawa kesan yang penting tetapi, kekurangan maklumat menyebabkan kesan tidak dapat diramal dengan lebih tepat. Pemantauan dan pengawalan rapi adalah disyorkan.

D Boleh membawa kesan negatif dan penyelesaian dalam aspek rekabentuk telah dikenalpasti.

R Memberi kesan-kesan sisa yang negatif.

E Memberi kesan yang baik kepada alam sekitar.

Jadual R23 ► Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Sosio-ekonomi

Komponen Projek	Komponen Alam Sekitar yang Terjejas	Potensi Impak	Magnitud Potensi Impak	Langkah Pencegahan dan Kawalan Pencemaran (P2M2)	Mukasurat
1. Penambakan dan pengerukan	a) Buruh	Aktiviti penambakan memerlukan jumlah tenaga pekerja yang besar di mana aktiviti tersebut melibatkan pembinaan di daratan dan laut. Memandangkan aktiviti penambakan dijalankan secara berfasa, jumlah keperluan tenaga pekerja semasa waktu puncak aktiviti penambakan adalah sebanyak 500 orang. Kesan projek ini terhadap buruh adalah signifikan apabila sekurang-kurangnya 30% daripada jumlah pekerjaan ini dipenuhi oleh penduduk tempatan. Walau bagaimanapun, peluang pekerjaan ini adalah bersifat sementara iaitu diperlukan dalam tempoh pembinaan sahaja.	D	<ul style="list-style-type: none"> <li>i) Peruntukan bagi buruh perlu diberikan dalam kalangan penduduk tempatan bagi menjana peluang pekerjaan buat mereka;</li> <li>ii) Pengambilan buruh dalam kalangan penduduk tempatan yang tidak bekerja atau buruh baru ke pasaran buruh lebih menguntungkan daripada pengambilan orang yang mempunyai pekerjaan lain.</li> <li>iii) Proses pemilihan kontraktor dan sub-kontraktor juga perlu diberi keutamaan kepada penduduk tempatan.</li> </ul>	7-127 to 7-128
	b) Pendapatan	<ul style="list-style-type: none"> <li>i) Pengangkutan bahan kerukan ke tapak pelupusan yang telah ditetapkan berpotensi untuk menjadi punca kepada kerosakan jaring dan perangkap ikan di laut dalam. Ini juga akan mempengaruhi dan mengurangkan jumlah tangkapan ikan laut dalam memandangkan majoriti nelayan mencari sumber rezeki di kawasan ini.</li> <li>ii) Pertambahan populasi akan meningkatkan permintaan terhadap barangan keperluan dan perkhidmatan di kawasan Projek ini.</li> </ul>	D	<ul style="list-style-type: none"> <li>i) Pemasangan tirai kelodak;</li> <li>ii) Sempadan aktiviti penambakan dan laluan kapal perlu ditanda dengan penanda boya;</li> <li>iii) Pembayaran pampasan perlu diberikan mengikut keperluan dan kepada yang terlibat melalui wakilnya; dan</li> <li>iv) Penglibatan penduduk tempatan perlu diberikan perhatian.</li> </ul>	7-128 to 7-129
	c) Keselamatan	<ul style="list-style-type: none"> <li>i) Kemalangan industri berpotensi berlaku sekiranya pekerja tidak diseliasa dan diurus dengan baik.</li> <li>ii) Pertambahan trafik marin daripada pengangkutan jentera dan bahan tambakan akan memberikan tekanan kepada trafik marin.</li> <li>iii) Alur pelayaran merupakan laluan utama bot nelayan untuk keluar dan masuk ke Sungai Kuantan dan juga tempat bot berlabuh di muara Sungai Kuantan.</li> <li>iv) Para nelayan akan berhadapan dengan isu keselamatan jika sebarang aktiviti pengerukan dijalankan berhampiran kawasan mereka.</li> </ul>	D	<ul style="list-style-type: none"> <li>i) Keselamatan haruslah sentiasa diutamakan;</li> <li>ii) Laluan kapal hendaklah ditandakan dengan boya dan dinyalakan pada waktu malam;</li> <li>iii) Komuniti nelayan tempatan perlu diberitahu mengenai jadual perjalanan kapal dengan memberi maklumat kepada mereka secara terus atau mempamerkan jadual di tempat yang strategik; dan</li> <li>iv) Pengangkutan bahan tambakan keluar masuk dari tapak penambakan perlu dijalankan pada waktu siang sahaja.</li> </ul>	7-129 to 7-130
	d) Penempatan Pekerja	<ul style="list-style-type: none"> <li>i) Kem pekerja kerap kali menjadi punca kepada permasalahan kesihatan dan keselamatan. Kesusakan bukan sekadar berlaku dalam bilik tetapi juga boleh berlaku dalam susunan keseluruhan blok penempatan yang saling berdekatan.</li> <li>ii) Lambakan buruh luar melebihi buruh tempatan akan merubah keseimbangan budaya dan perkauman di sini. Ini sekali gus akan mengubah rupa bentuk sosial setempat kepada entiti kosmopolitan.</li> <li>iii) Masalah lain yang berkaitan ialah masalah kesihatan dan sosial.</li> </ul>	X	<ul style="list-style-type: none"> <li>i) Keadaan penempatan pekerja perlu selesa dan tidak terlalu padat seperti ruang pengudaraan, kemudahan asas dan kebersihan yang baik;</li> <li>ii) Kesan kepada masalah sosial dan budaya boleh dikurangkan dengan memisahkan penempatan pekerja yang mempunyai latar belakang yang berbeza, namun, kemudahan umum boleh dikongsi bersama untuk menggalakkan integrasi sosial;</li> <li>iii) Konflik etnik dan masalah sosial boleh dielakkan sekiranya kebajikan pekerja, hubungan dua hala, kefahaman budaya dan toleransi dititikberatkan; dan</li> <li>iv) Penularan wabak penyakit yang sering dikaitkan dengan pekerja asing boleh diatasi dengan menjalankan prosedur pengambilan pekerja yang sesuai dan pemeriksaan kesihatan sebelum dibenarkan bekerja.</li> </ul>	7-130 to 7-131

Petunjuk:

X Tidak penting dan tidak termasuk dalam matriks.

T Boleh membawa kesan tetapi bersifat sementara dan akan mencapai keseimbangan selepas tempoh masa tertentu.

M Boleh membawa kesan yang penting tetapi, kekurangan maklumat menyebabkan kesan tidak dapat diramal dengan lebih tepat. Pemantauan dan pengawalan rapi adalah disyorkan.

D Boleh membawa kesan negatif dan penyelesaian dalam aspek rekabentuk telah dikenalpasti.

R Memberi kesan-kesan sisa yang negatif.

E Memberi kesan yang baik kepada alam sekitar.



Jadual R23 ► Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Sosio-ekonomi

Komponen Projek	Komponen Alam Sekitar yang Terjejas	Potensi Impak	Magnitud Potensi Impak	Langkah Pencegahan dan Kawalan Pencemaran (P2M2)	Mukasurat
1. Penambakan dan pengerukan	e) Estetika dan Ketenteraman	i) Aktiviti pengerukan pula akan menyebabkan suasana menjadi tidak menarik apabila kapal pengorek Cutter Suction Dredger berada di permukaan air dan melakukan kerja pengerukan. ii) Keadaan air juga akan menjadi lebih keruh dan memburukkan pemandangan. Namun, impak suasana ini bersifat sementara sehingga kerja pembinaan selesai. iii) Panorama semula jadi menghadap laut dari Kampung Tanjung Lumpur (KWRC Fasa 1) sehingga Kampung Anak Air (hujung sempadan projek ini) akan hilang selamanya.	X	i) Pencemaran hingar dapat dikurangkan dengan penggunaan dan penyelenggaraan kenderaan dan jentera yang baik dan menguatkuasakan tempoh kerja adalah tidak melebihi 8 malam. ii) Kawasan kering yang terdedah hendaklah disembur dengan air bagi mengelakkan permukaannya ditiup angin.	7-131
	a) Pekerjaan	i) Peluang pekerjaan yang ditawarkan akan memberikan impak yang signifikan dan bergantung kepada kadar pengambilan pekerja sama ada dari dalam atau luar kawasan, dengan kelebihan pengambilan diberikan kepada masyarakat tempatan. ii) Selain itu, impak pengambilan pekerja dari luar mungkin berbeza mengikut jumlah yang berpindah ke kawasan berhampiran projek termasuk keluarga mereka atau sebaliknya.	D	i) Penggerak Projek perlu memastikan nisbah yang sesuai bagi pengambilan pekerja tempatan. ii) Sasaran pengambilan pekerja tempatan hendaklah ditetapkan. Kebiasaannya, sekurang-kurangnya 30% pekerja adalah dari kalangan masyarakat tempatan dan mereka lebih berpotensi jika diberikan program latihan yang bersesuaian.	7-133
2. Pasca Penambakan dan Operasi	b) Pendapatan dan Hasil	i) Pekerjaan yang ditawarkan akan menjamin pendapatan daripada gaji yang diperolehi. Bagi menjamin pulangan yang positif, pemberian sumbangan tambahan wajar diberikan kepada mereka yang berbelanja di kawasan tempatan. ii) Pelaburan secara kapital ke dalam projek cadangan akan memberi kesan yang signifikan kepada agensi terlibat. Pertumbuhan ekonomi tempatan akan meningkat sekiranya peratusan pelaburan diperuntukkan untuk keperluan dan perkhidmatan (tidak termasuk buruh) di kawasan tersebut. iii) Terdapat juga cukai seperti kadar taksiran, cukai tanah, yuran dan royalti yang akan dibayar dan mewujudkan tukaran bersih kepada penyata penguatkuasa tempatan dengan lebih atau pulangan yang besar.	D	Untuk membolehkan kawasan tempatan meraih manfaat ekonomi daripada projek sepenuhnya, pekerja akan berulang-alik ke tempat kerja. Oleh itu, satu kawasan pusat yang terancang dan perkhidmatan sokongan hendaklah dibangunkan bagi menampung penduduk yang berkerja. Impak ekonomi boleh dimanfaatkan sepenuhnya.	7-133 to 7-134
	c) Kesan Penggandaan secara Menyeluruh	i) Tenaga kerja yang diberi bayaran yang setimpal boleh menjana perbelanjaan harian di kawasan tempatan dalam bentuk keperluan barangan runcit dan perkhidmatan. ii) Pembangunan projek yang dicadangkan memerlukan pelbagai bekalan yang terdiri daripada produk pelancongan dan kesihatan yang akan dibekalkan oleh syarikat tempatan serta untuk kantin. Ini sekaligus akan melonjakkan ekonomi tempatan dan juga menawarkan peluang pekerjaan. iii) Pertambahan tenaga pekerja ini akan meningkatkan lagi permintaan perkhidmatan seperti sektor pembinaan, kesihatan, pendidikan dan perumahan. iv) Kesan penggandaan secara menyeluruh ini boleh memberi keuntungan dalam jangka masa panjang	X	Tiada langkah-langkah kawalan diperlukan.	7-133 to 7-134
	d) Demografi, Perumahan dan kemudahan lain	i) Kehadiran mereka akan meningkatkan populasi penduduk dan mengubah profil struktur umur dan jantina sedia ada. ii) Mereka memerlukan tempat kediaman dengan jarak yang berpatutan dengan kawasan projek. iii) Permintaan terhadap perkhidmatan tempatan termasuk fasiliti sekolah, kesihatan dan rekreasi, perkhidmatan polis dan kecemasan akan meningkat. iv) Penambahan kos bagi menyediakan perkhidmatan akan memberikan implikasi kepada pihak berkuasa tempatan.	D	i) Menggalakkan pengambilan pekerja secara maksimum bagi mereka yang menetap di dalam jarak yang berpatutan dengan kawasan projek. Oleh itu, dapat mengurangkan pemindahan masuk pekerja luar dan keluarganya ke dalam zon impak; ii) Menyediakan kediaman tambahan bagi tenaga pekerja atau menggalakkan penggunaan kediaman yang tidak berpenghuni atau berpenghuni dalam zon impak, ini bergantung kepada keadaan rumah dan juga polisi Penggerak Projek dan pihak berkuasa tempatan; dan iii) Penggerak Projek hendaklah menyediakan perkhidmatan seperti pusat kesihatan, kemudahan pemadam api dan kemudahan rekreasi.	7-134

Petunjuk:

X Tidak penting dan tidak termasuk dalam matriks.

T Boleh membawa kesan tetapi bersifat sementara dan akan mencapai keseimbangan selepas tempoh masa tertentu.

M Boleh membawa kesan yang penting tetapi, kekurangan maklumat menyebabkan kesan tidak dapat diramal dengan lebih tepat.

Pemantauan dan pengawalan rapi adalah disyorkan.

D Boleh membawa kesan negatif dan penyelesaian dalam aspek rekabentuk telah dikenalpasti.

R Memberi kesan-kesan sisa yang negatif.

E Memberi kesan yang baik kepada alam sekitar.

Jadual R23 ► Ringkasan Impak, Magnitud dan Cadangan Langkah Pencegahan dan Kawalan Pencemaran bagi Persekitaran Sosio-ekonomi

Komponen Projek	Komponen Alam Sekitar yang Terjejas	Potensi Impak	Magnitud Potensi Impak	Langkah Pencegahan dan Kawalan Pencemaran (P2M2)	Mukasurat
2. Pasca Penambakan dan Operasi	e) Sosio-budaya	Dengan adanya saiz populasi yang baru di kawasan tersebut, projek ini dijangkakan memberi kesan impak yang sangat besar. Konflik sosial dan budaya serta pergeseran bakal berlaku sekiranya kehidupan yang harmoni ini diabaikan.	X	<ul style="list-style-type: none"> <li>i) Masalah integrasi dan perbezaan gaya hidup boleh menyumbang kepada kegagalan dan kekecewaan. Ini boleh dielakkan sekiranya kawasan kediaman yang disediakan tidak tertutup bagi memberi peluang keterbukaan kepada semua untuk menjalankan aktiviti harian di kawasan setempat atau zon impak.</li> <li>ii) Peranan pihak berkuasa tempatan dan badan pengurusan sangat penting dalam memastikan kemudahan yang disediakan mencukupi. Perasaan kekitaan perlu dipupuk bagi menzahirkan hubungan kebersamaan.</li> <li>iii) Bagi isu peminggiran kelompok tempatan, ia boleh dikawal dengan mengenal pasti golongan tempatan yang boleh diambil dan diasah bakat kemahiran mereka bagi tujuan pembangunan di kawasan ini.</li> <li>iv) Pengasingan juga boleh diatasi dengan memastikan integrasi populasi persekitaran dengan pembangunan baru melalui pemantauan laluan yang baik, infrastruktur dan tahap perhubungan yang baik masuk atau keluar kawasan.</li> </ul>	7-134
	f) Gaya hidup	<ul style="list-style-type: none"> <li>i) Projek ini dijangkakan akan membangunkan masyarakat bipolar iaitu pekerja makan gaji dan pekerja bukan makan gaji dalam kawasan pembangunan dan sekitarnya.</li> <li>ii) Selain itu, gaya hidup dengan tahap sosial yang berbeza juga akan wujud dalam kawasan pembangunan.</li> <li>iii) Namun demikian, jika kehidupan yang harmoni wujud antara satu sama lain, kestabilan sosial akan kekal.</li> </ul>	D	Peranan badan pengurusan KWRC adalah penting dalam melaksanakan dan menganjurkan sebarang majlis dengan melibatkan semua penduduk dalam kawasan pembangunan KWRC.	7-135
	g) Estetika	<ul style="list-style-type: none"> <li>i) Panorama semulajadi pemandangan laut di Kampung Tanjung Lumpur akan hilang. Struktur bangunan baru yang mempunyai nilai estetika berhadapan laut akan menjari tarikan kepada pengunjung.</li> <li>ii) Walaubagaimana, kewujudan tanah tambakan baru ini akan mengubah peta pantai di Pahang terutamanya di sekitar muara Sungai Kuantan.</li> </ul>	X	Tiada langkah-langkah kawalan diperlukan.	7-135

## Petunjuk:

X Tidak penting dan tidak termasuk dalam matriks.

T Boleh membawa kesan tetapi bersifat sementara dan akan mencapai keseimbangan selepas tempoh masa tertentu.

M Boleh membawa kesan yang penting tetapi, kekurangan maklumat menyebabkan kesan tidak dapat diramal dengan lebih tepat. Pemantauan dan pengawalan rapi adalah disyorkan.

D Boleh membawa kesan negatif dan penyelesaian dalam aspek rekabentuk telah dikenalpasti.

R Memberi kesan-kesan sisa yang negatif.

E Memberi kesan yang baik kepada alam sekitar.

## 7.1 Sisa-sisa Impak

Sisa-sisa impak didefinisikan sebagai kesan alam sekitar yang dijangka akan kekal selepas langkah-langkah kawalan dijalankan. Antara sisa-sisa impak yang dijangkakan adalah seperti berikut:

- i) Pemendapan dan hakisan;
- ii) Penambahan trafik marin;
- iii) Penambahan trafik darat;
- iv) Perubahan pemandangan; dan
- v) Impak ke atas sosio-ekonomi.

## 7.2 Penilaian Projek

### 7.2.1 Penilaian Perubahan Khidmat Alam Sekitar

Daripada lapan (8) komponen perubahan servis alam sekitar yang disenaraikan dalam *Jadual R24*, terdapat tiga (3) komponen penting yang dipertimbangkan untuk penilaian iaitu:

- i) Kehilangan dataran lumpur disebabkan oleh penambakan;
- ii) Kehilangan dataran lumpur disebabkan pengerukan induk dan penyelenggaraan; dan
- iii) Kehilangan akses kawasan menangkap ikan ke laut (kos yang tinggi untuk menangkap ikan).

### 7.2.2 Penilaian Keseluruhan

Apabila diskaun diberikan pada kadar 8%, kerugian nilai sedia ada adalah sebanyak RM 28.9 juta bagi tempoh 50 tahun. Pada kadar diskaun 6% dan 4%, nilai masing-masing adalah RM 36.5 juta dan RM 48.8 juta. Kajian ini menjelaskan bahawa nilai sedia ada tidak boleh dikira sebagai penunjuk kepada kebolehlaksanaan Projek ini. Sebaliknya, ia memberi petunjuk dalam istilah kewangan sebagai pengurangan servis alam sekitar yang berlaku akibat daripada pelaksanaan Projek.

Jadual R24 ► Kesan Potensi Khidmat Alam Sekitar

No.	Komponen Alam Sekitar	Kesan Khidmat Alam Sekitar	Lokasi dan Pihak Berkepentingan	Had Jarak	Huraian
1.	<b>Biologi Marin</b> - Kehilangan dataran lumpur disebabkan oleh aktiviti penambakan.	Kehilangan kekal dijangka akan melibatkan keseluruhan dataran lumpur di kawasan penambakan. Dataran lumpur ini berfungsi sebagai kawasan makanan bagi krustasea dan habitat makrobentos. Aktiviti ini akan mengakibatkan kehilangan sumber penting yang menyokong hidupan laut kerana kawasan ini merupakan habitat bagi bentos dan kawasan makanan untuk ikan.	Lokasi sempadan penambakan ditunjukkan dalam <i>Bab 5 (Rajah 5.5)</i> dalam laporan EIA ini. Nelayan dan penduduk tempatan yang mendapat faedah daripada sumber laut mungkin akan terjejas.	Sejumlah 273.57 hektar akan ditambah dan sebahagian daripadanya (kira-kira 156.2 hektar) melibatkan dataran lumpur seperti dalam <i>Rajah 7.46</i> .	Kehilangan kekal dataran lumpur. Kaedah kehilangan produktiviti digunakan bagi menilai kehilangan khidmat dan fungsi alam sekitar.
2.	<b>Biologi marin</b> - Kehilangan dataran lumpur disebabkan oleh aktiviti pengerukan induk dan penyelenggaraan.	Kehilangan sementara dijangka akan melibatkan seluruh dataran lumpur yang akan dikeruk. Dataran lumpur ini berfungsi sebagai kawasan makanan bagi krustasea dan habitat makrobentos. Aktiviti ini akan mengakibatkan kehilangan sumber penting yang menyokong hidupan laut kerana kawasan ini merupakan habitat bagi bentos dan kawasan makanan untuk ikan.	Lokasi sempadan penambakan dan pengerukan ditunjukkan dalam <i>Bab 5 (Rajah 5.5 dan 5.7)</i> masing masing) dalam laporan EIA ini. Umumnya, dataran lumpur ini terletak di alur pelayaran, lagun, terusan, marina dalaman, marina luar, terminal pelayaran dan lembangan. Nelayan dan penduduk tempatan yang mendapat faedah daripada sumber laut mungkin akan terjejas.	Sejumlah 845 hektar akan dikeruk dan sebahagian daripadanya (kira-kira 80.8 hektar) melibatkan dataran lumpur seperti dalam <i>Rajah 7.46</i> .	Kehilangan awal habitat dataran lumpur semasa aktiviti pengerukan. Keputusan pemodelan hidraulik menunjukkan bahawa kekerapan penyelenggaraan pengerukan adalah kira-kira setahun sekali. Oleh itu, adalah dijangkakan bahawa organisma marin tidak dapat pulih sepenuhnya dalam tempoh ini. Tempoh pemulihan yang diperlukan adalah tiga tahun. Walaubagaimanapun, kekerapan aktiviti pengerukan yang memberikan gangguan kepada habitat dataran lumpur, kehilangan khidmat alam sekitar ini dianggap kekal dan menyeluruh. Kaedah kehilangan produktiviti digunakan bagi menilai kehilangan khidmat dan fungsi alam sekitar.
3.	<b>Biologi terrestrial</b> - Potensi kehilangan dalam khidmat alam sekitar yang diperolehi daripada kawasan bakau disebabkan oleh pemendapan dan hakisan.	Kehilangan kawasan bakau dan menyebabkan beberapa kehilangan sumber penting yang menyokong hidupan laut. Kawasan hutan bakau dikenali untuk memberikan servis alam sekitar termasuklah: <ul style="list-style-type: none"> <li>■ Pengeluaran arang dan kayu;</li> <li>■ Memberi tapak makanan dan pembiakan untuk udang, ikan, ketam dan moluska;</li> <li>■ Memberikan barangan tradisional;</li> <li>■ Berfungsi sebagai penyerapan karbon;</li> <li>■ Perlindungan pesisir pantai, dan</li> <li>■ Nilai pilihan sedia ada dan biodiversiti.</li> </ul>	Hutan Bakau Kuantan di tebing selatan Sungai Kuantan. Nelayan dan penduduk tempatan yang mendapat faedah daripada sumber marin serta populasi am yang mendapat manfaat daripada penyerapan karbon.	Keputusan pemodelan hidraulik menunjukkan bahawa tiada impak yang disebabkan oleh pemendapan dan hakisan.	Oleh kerana tiada impak, penilaian adalah tidak diperlukan.
4.	<b>Sosio-ekonomi</b> - Kehilangan kawasan tangkapan ikan dan akses ke laut terhalang.	Pengurangan saiz kawasan tangkapan ikan kerana kawasan yang telah ditambah. Penambakan akan memaksa nelayan untuk mencari kawasan tangkapan ikan alternatif dan meningkatkan kos operasi mereka. Tanah tambakan dan terminal akan menghalang perjalanan terus kapal-kapal nelayan. Oleh itu, sebahagian nelayan akan mengalami pertambahan kos untuk pergi dan balik ke kawasan tangkapan ikan.	Kawasan tambakan adalah seperti yang dinyatakan dalam <i>Bab 5 (Bahagian 5.3.2)</i> dalam laporan EIA ini. Pihak berkepentingan yang terlibat secara langsung adalah nelayan pantai (Zon A) yang beroperasi dari enam jeti iaitu Kampung Tanjung Lumpur, Kampung Tanjung Api, Kampung Peramu, Kampung Selamat, Kampung Anak Air dan Kampung Kempadang. Sejumlah 110 buah kapal nelayan yang digunakan oleh nelayan-nelayan pantai ini.	Di seluruh kawasan penambakan.	Nelayan yang menggunakan kawasan tersebut perlu mencari lokasi yang lain. Pertambahan kos tangkapan ikan meliputi peningkatan kos perjalanan pergi dan balik ke kawasan alternative tangkapan ikan. Nelayan perlu pergi ke tempat yang lebih jauh kerana konflik akan terjadi sekiranya mereka memasuki kawasan tangkapan ikan mereka sedia ada.

Jadual R24 ► Kesan Potensi Khidmat Alam Sekitar

No.	Komponen Alam Sekitar	Kesan Khidmat Alam Sekitar	Lokasi dan Pihak Berkepentingan	Had Jarak	Huraian
5.	<b>Kualiti air</b>	Peningkatan sedimen terampai semasa aktiviti penambakan dan pengerukan yang mengurangkan kualiti air dan produktiviti habitat marin.	Persisiran pantai yang ditambah dan kawasan aktiviti pengerukan	Dengan pemasangan tirai kelodak semasa aktiviti penambakan dan pengerukan, impaknya adalah terhadap antara tirai kelodak dan ban perimeter (bagi penambakan) dan kawasan aktiviti pengerukan yang dijalankan secara berfasa.	Langkah kawalan melalui pemasangan tirai kelodak semasa aktiviti penambakan dan pengerukan akan menyebabkan impak yang tidak ketara. Pelagik dan ikan demersal dapat bergerak menjauhi keadaan yang tidak menggalakkan. Oleh itu, penilaian adalah tidak diperlukan. Walau bagaimanapun, sila rujuk kepada impak aktiviti penambakan dan pengerukan ke atas biologi marin.
6.	<b>Morfologi persisiran pantai</b>	Hakisan dan pemendapan di kawasan persisiran pantai sedia ada yang disebabkan oleh penambakan.	Keputusan pemodelan hidraulik menunjukkan hakisan dan pemendapan akan berlaku di dalam kawasan tapak projek seperti di alur pelayaran, lagun dan kawasan marina. Di luar tapak projek, pemendapan dijangka akan berlaku di hadapan muara Sungai Kuantan sebanyak 1.2 m/tahun dan hakisan pula dijangka akan berlaku di sepanjang 1 km kawasan pantai selatan tapak projek.	Perubahan paras dasar laut yang disebabkan oleh Projek adalah setempat atau berhampiran dengan kawasan projek.	Pemendapan di muara Sungai Kuantan boleh diatasi dengan menjalankan aktiviti penyelenggaraan pengerukan tahunan di alur pelayaran. Hakisan yang dijangkakan akan berlaku di sepanjang pantai 1 km dapat diatasi dengan melaksanakan program penyuburan pantai seperti yang dicadangkan dalam Bab 8 (Rajah 8.24). Oleh itu, penilaian adalah tidak diperlukan.
7.	<b>Perkhidmatan rekreasi</b>	Impak ke atas kawasan tertentu yang akan mengurangkan nilai perkhidmatan rekreasi.	Kawasan berpotensi yang menerima impak termasuklah Teluk Cempedak dan Tanjung Tembeling. Impak secara langsung adalah pihak berkepentingan adalah pengunjung yang mendapat manfaat daripada perkhidmatan rekreasi.	Kawasan pantai Teluk Cempedak dan Tanjung Tembeling.	Keputusan pemodelan hidraulik menunjukkan bahawa kedua-dua kawasan tidak akan terjejas oleh peningkatan dalam sedimen terampai, hakisan atau pemendapan. Oleh itu, penilaian adalah tidak diperlukan.
8.	<b>Estetika</b>	Perubahan dalam bentuk gangguan oleh struktur binaan manusia ke dalam pemandangan selepas projek siap.	Kawasan di sekitar tanah penambakan. Penduduk yang tinggal di tepi pantai dan pengunjung dimana penambakan akan dijalankan akan menerima impak. Impak juga akan terkesan kepada nelayan berhampiran dengan kawasan tambak dan infrastruktur yang dibina.	Kawasan pesisir pantai yang kelihatan tanah penambakan dan infrastruktur yang dibina.	Impak kepada estetika adalah tidak pasti kerana ia adalah sukar untuk berhujah dengan pasti bahawa projek ini akan menimbulkan kesan negatif. Apabila projek siap, adalah tidak hairan jika projek ini dapat meningkatkan nilai estetika di kawasan itu.

## 8. Pelan Pengurusan Alam Sekitar (EMP)

Program pelan pengurusan alam sekitar boleh dibahagikan kepada empat (4) jenis pemantauan iaitu:

- i) Langkah Kawalan dan Pencegahan Pencemaran untuk Tanah Terganggu (LDP2M2);
- ii) Pemantauan prestasi (PM);
- iii) Pemantauan pematuhan (CM);
- iv) Pemantauan impak (IM); dan
- v) Audit alam sekitar.

### 8.1 Langkah Kawalan dan Pencegahan Pencemaran untuk Tanah Terganggu (LDP2M2)

Amalan Pengurusan Terbaik atau *Best Management Practice* (BMP) yang dicadangkan mesti menyediakan saluran atau perparitan sementara yang cukup untuk menampung kawasan kerja. Pemantauan BMP perlulah dilakukan dengan pemeriksaan visual bagi memastikan bahawa ianya dilakukan dan diselenggara dengan baik; sekaligus menilai sama ada tambahan BMP perlu atau tidak.

### 8.2 Pemantauan Prestasi (PM)

Pemantauan prestasi (PM) adalah untuk menghalang kegagalan fungsi sistem dan juga untuk memastikan ianya berfungsi dengan betul dan optimum. Untuk projek ini, PM yang dicadangkan adalah dalam mengekalkan fungsi tirai kelodak dan operasi kapal.

### 8.3 Pemantauan Pematuhan (CM)

Program pemantauan pematuhan (CM) untuk projek ini termasuklah air, sedimen, udara dan hingar. CM akan dijalankan secara bulanan atau suku tahun.

### 8.4 Pemantauan Impak (IM)

Pemantauan impak iaitu kajian batimetri akan dijalankan semasa dan selepas siap projek untuk menilai perubahan aras dasar laut kesan daripada aktiviti penambakan dan pengerukan.

### 8.5 Audit Alam Sekitar

Audit alam sekitar akan dijalankan berdasarkan Garis Panduan Manual Audit Alam Sekitar yang diterbitkan oleh JAS. Audit akan dijalankan oleh juruaudit pihak ke-3 yang berdaftar dengan JAS serta Certified Erosion, Sediment and Storm Water Inspector (CESSWI).

Keseluruhan ringkasan bagi cadangan program pemantauan alam sekitar adalah seperti dalam *Jadual R25*.

Jadual R25 ► Cadangan Program Pemantauan Alam Sekitar

Perkara	Parameter	Stesen Pemantauan	Kekerapan Persampelan	Kriteria Kualiti Alam Sekitar	Keperluan Laporan
Kualiti air	Suhu, kemasinan, pH, konduktiviti, kekeruhan, oksigen terlarut, BOD, TOC, TSS, dan minyak dan gris, AN, Fosfat, nitrat, Logam berat, Koliform Najis, <i>E.coli</i> , <i>Enterococci</i> .	Seperti dalam <i>Jadual 6.4 dan Rajah 6.30, Bab 6 – Persekitaran Sedia Ada</i>	Setiap bulan	Keputusan akan dibandingkan dengan data asas dan <i>Malaysia Marine Water Quality Criteria and Standard (MWQCS)</i>	Laporan akan dikemukakan kepada JAS setiap bulan dan setiap tiga (3) bulan sekali
Kualiti sedimen	Zink, nikel, kuprum, kromium, plumbum, arsenik, kadmium.	Seperti dalam <i>Jadual 6.8 dan Rajah 6.31, Bab 6 – Persekitaran Sedia Ada</i>	Setiap tiga (3) bulan sekali	Keputusan akan dibandingkan dengan data asas dan Piawai US EPA bagi sediment marin	Laporan akan dikemukakan kepada JAS setiap tiga (3) bulan sekali
Kualiti udara	TSP, PM <sub>10</sub> , PM <sub>2.5</sub> .	Seperti dalam <i>Jadual 6.12 dan Rajah 6.32, Bab 6 – Persekitaran Sedia Ada</i>	Setiap tiga (3) bulan sekali	Keputusan akan dibandingkan dengan data asas dan <i>Recommended Malaysian Air Quality Guidelines (RMAQG)</i> .	Laporan akan dikemukakan kepada JAS setiap tiga (3) bulan sekali
Hingar	L <sub>min</sub> , L <sub>max</sub> , L <sub>10</sub> , L <sub>50</sub> , L <sub>90</sub> , L <sub>eq</sub> (24 hours profile).	Seperti dalam <i>Jadual 6.17 dan Rajah 6.33, Bab 6 – Persekitaran Sedia Ada</i>	Setiap tiga (3) bulan sekali	Keputusan akan dibandingkan dengan data asas dan DOE's <i>"Interim Guidelines for Maximum Permissible Sound Levels by Receiving Land Use"</i> (Schedule 1).	Laporan akan dikemukakan kepada JAS setiap tiga (3) bulan sekali

Jadual R25 ► Cadangan Program Pemantauan Alam Sekitar

Perkara	Parameter	Stesen Pemantauan	Kekerapan Persampelan	Kriteria Kualiti Alam Sekitar	Keperluan Laporan
Audit Alam Sekitar	Pematuhan syarat kelulusan EIA dan peraturan dan garis panduan alam sekitar yang berkaitan.	Sepanjang tempoh pelaksanaan keseluruhan Projek dan aktiviti Projek	Setiap tiga (3) bulan sekali	Audit Alam Sekitar perlu dijalankan oleh pihak ketiga Juruaudit Alam Sekitar (yang berdaftar dengan JAS).	Laporan akan dikemukakan kepada JAS setiap tiga (3) bulan
Tinjauan Batimetri	Perubahan pesisiran pantai dan dasar laut.	Seperti <i>Rajah 8.1</i> .	<ul style="list-style-type: none"> <li>▪ Setiap tiga (3) bulan semasa fasa pembinaan</li> <li>▪ Setiap enam (6) bulan selepas fasa pembinaan</li> </ul>	Keputusan akan dibandingkan data keadaan sedia ada	Laporan perlu dikemukakan kepada JPS tidak lebih daripada 3 bulan selepas setiap kajian selesai



## 9. Kesimpulan

Berdasarkan penilaian secara keseluruhan, pelaksanaan Projek ini dijangka akan menyebabkan kesan yang minimum kepada alam sekitar, terutamanya dari segi persekitaran sosial. Walau bagaimanapun, komitmen berterusan daripada Penggerak Projek dalam melaksanakan semua langkah-langkah kawalan yang dicadangkan adalah perlu agar pembangunan ini akan memberi manfaat bukan sahaja kepada Penggerak Projek malah kepada penduduk tempatan dan juga kemajuan Negeri Pahang.