

Executive Summary

1.0 INTRODUCTION

- 1.1 This Schedule 2 Environmental Impact Assessment (EIA) Report has been prepared for **The Proposed “Penambakan Kawasan Laut Seluas 400 Ekar Untuk Cadangan Pembangunan Bercampur-Campur, Kawasan Bandar XLVI, Daerah Melaka Tengah, Melaka Secara Penswastaan”** for Messrs. Yayasan Melaka.
- 1.2 The proposed Project is a prescribed activity that falls under **Activity 7(a)** i.e. coastal reclamation or land reclamation along river banks involving an area of 50 hectares or more in the **Second Schedule, Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015**. The Project initiator is required to prepare and submit an Environmental Impact Assessment (EIA) report to ensure the Environmental Impact Assessment is undertaken, consonant with the protocols established by the Director General of the Department of Environment (DOE), Malaysia. With reference to the *Rancangan Tempatan Daerah Melaka Tengah 2015*, *Rancangan Struktur Negeri Melaka 2035* and *Laporan Cadangan Pemajuan (LCP)* prepared by the appointed project planner, the proposed project is in line with the State Planning.
- 1.3 The proposed project is initiated by **Yayasan Melaka**. Any enquiries regarding the project may be directed to:

YAYASAN MELAKA

No.40 - 48 & 52, Jalan BKD 27,

Taman Bukit Katil Damai 2,

75450 Bukit Katil, Melaka, Malaysia

(Attn: En. Ahamad Kamel bin Ismail)

Tel / Fax : 06-2311822 / 06-2311307

- 1.4 An environmental study team comprising of multi-discipline specialists has been appointed to carry out the Environmental Impact Assessment (EIA) Study. The team

will be led by **Mr. Gopinath Nagaraj**, an EIA Consultant registered with the Department of Environment (DOE Reg. No. CS0474). Enquiries and correspondence pertaining to this report can be made to:

CIRI SELASIH SDN. BHD. (Co. Reg. No.: 592462-V)

No. 40, Jalan TU 40,

Taman Tasik Utama,

75450 Ayer Keroh, Melaka.

(Attn : Datuk Ir. Othman Abdul Rahim)

Tel : 06 – 253 4005

Fax : 06 – 231 0895

E-mail : ciriselasih@gmail.com

1.5 **Table 1** shows the list of team members who are involved in the EIA study.

Table 1 : List of EIA Team Members

Name	Qualification	Registration With DOE				Proposed Study Area
		Category	Area/ Field	ID. No.	Valid Date	
EIA TEAM LEADER						
Gopinath Nagaraj	Certificate in Fish Hatchery Management, BSc (Aquatic Biology), Master in Aquaculture	EIA Consultant	<ul style="list-style-type: none"> • Fisheries • Ecological Studies (Marine & Freshwater Ecology) • Aquaculture 	CS0474	31 May 2021	<ul style="list-style-type: none"> • Fisheries & Aquaculture
EIA CONSULTANT / SUBJECT CONSULTANT						
Datuk Ir. Othman bin Abdul Rahim	B.Sc (Hons) Civil Engineering Professional Engineer with the Board of Engineers (BEM)	EIA Consultant	<ul style="list-style-type: none"> • Hydrology • Water Quality 	C0006	31 July 2019 (in renewal process)	<ul style="list-style-type: none"> • Hydrology • Water Quality • Construction Activities
Puvanesuri Sandera Sagaren	Master of Environment B.Sc (Hons.) Aquatic Biology	EIA Consultant	<ul style="list-style-type: none"> • Ecological Studies (Freshwater & Marine Ecology) • Fisheries & Aquaculture 	CS0956	30 November 2020	<ul style="list-style-type: none"> • Aquatic Ecology
Ms. Ng Shu Chin	M.Sc (Sanitary and Environmental Engineering), Certified	EIA Consultant	<ul style="list-style-type: none"> • Hydrology • Water Quality 	C0270	31 July 2019 (in renewal process)	<ul style="list-style-type: none"> • Water Quality

Name	Qualification	Registration With DOE				Proposed Study Area
		Category	Area/ Field	ID. No.	Valid Date	
	Professional in Erosion & Sediment Control (CPESC No. 6585)					
Prof. Dr. Mohd Shahwahid Haji Othman	BS (Forestry), MA (Economics), MS (Resource Management & Policy), PhD (Resource Management & Policy)	Subject Consultant	<ul style="list-style-type: none"> • Economic Valuation / Economic Analysis • Social Impact Assessment 	SS0523	9 April 2021	<ul style="list-style-type: none"> • Social Impact Assessment • Economic Valuation
Prof. Dr. Capt. Mohd Ibrahim Hj. Mohamed	PhD (Marine), M.(Marine Affairs)	Subject Consultant	<ul style="list-style-type: none"> • Maritime Studies • Marine Studies 	SS1054	31 March 2020	<ul style="list-style-type: none"> • Marine Traffic Assessment
EIA ASSISTANT						
Norhayati Sabudin	B.Sc (Fishery Science)	Assistant Consultant	<ul style="list-style-type: none"> • Ecological Studies (Marine & Freshwater Ecology) • Aquaculture 	AC1050	Not applicable	<ul style="list-style-type: none"> • Fisheries & Aquaculture
Faizah binti Othman	B. Eng (Hons) (Chemical Engineering)	Assistant Consultant	<ul style="list-style-type: none"> • Water Quality • Wastewater • Chemical & Industrial Processes 	AC1321	Not applicable	<ul style="list-style-type: none"> • Hydrology • Water Quality • Construction Activities

2.0 TERMS OF REFERENCE (TOR)

- 2.1 The TOR of the project has been submitted to Department of Environment (DOE) Putrajaya. The TOR has been endorsed on 3rd September 2018.
- 2.2 The potential impacts to be studied and detailed out in the EIA report are Erosion of coastal / reclaimed banks, hydrological regime, solid waste, scheduled waste, water quality, air quality, noise level, land traffic, marine traffic, socio-economy, aquatic environment, fisheries and aquaculture, and abandonment. The landuse surrounding the project shall cover a radius of 5km from the project site. The study shall also cover the impact from the project to the neighbouring area / activities as well as the impact from the neighbouring area / activities to the project.
- 2.3 The methodologies and assessment standards that is used to assess the potential impacts as mentioned in the TOR are summarised in **Table 2**.

Table 2: Summary of Assessment Standards & Methodologies

No.	Items	Assessment Standards & Methodologies
1.	Landuse, Topography & Geological Character and Meteorology	<ul style="list-style-type: none">• Site visit.• Secondary resources (topography maps, Google Earth / Map, Local Plans etc.)• Meteorological data from Batu Berendam Meteorological Station.• Study on the geology of the site will only be done using secondary resources. However, registered geologists have already been appointed by the Civil Engineering consultant to study the settlement behaviour of the reclaimed land. This more detail study shall be done later during the Soil Investigation (SI) and is not part of the EIA Study. The appointed registered geologists for the proposed project are Muhammad Farhad bin Ramli (Contact No.: 012-3790384) and Muhamad Aidil bin Mustafa (Contact No.: 017-3966732).
2.	Coastal Erosion & Hydrology	<ul style="list-style-type: none">• Site visit.• Secondary resources (topography maps, Google Earth / Map, Local Plans, <i>Manual Saliran Mesra Alam</i> (MSMA) etc.)• Hydraulic study findings.
3.	Solid Waste &	<ul style="list-style-type: none">• DOE and SWCorp guidelines / regulations.

No.	Items	Assessment Standards & Methodologies
	Scheduled Waste	
4.	Water Quality Assessment	<ul style="list-style-type: none"> • Sets of water samples taken will be used as reference to establish the baseline profiles. • Parameter analysed will be based on <i>Malaysia Marine Water Quality Criteria and Standard (MWQCS)</i> and <i>National Water Quality Standard For Malaysia (NWQSM)</i>. • Calculation of Marine Water Quality Index (MWQI) to indicate the classes of existing marine water quality.
5.	Air quality	<ul style="list-style-type: none"> • Data collection i.e. air quality sampling. The measurement of Total Suspended Particulate (TSP) shall be carried out in accordance to the ASTM D4096 method. • The monitoring results will then be compared to the standard as specified in Malaysian Recommended Environmental Air Quality Guidelines.
6.	Noise level	<ul style="list-style-type: none"> • Data collection i.e. noise level measurement. The parameters to be tested include L_{eq}, L_{Max}, L_{Min} and L_N of the A – weighted sound level. The results will then be compared with the standard as specified in Schedule 1 in Annex A of The Planning Guidelines For Environmental Noise Limits and Control.
7.	Land traffic	<ul style="list-style-type: none"> • Traffic count survey will be conducted to determine the existing traffic volume and to analyse the road capacity nearby the project site.
8.	Marine traffic	<ul style="list-style-type: none"> • Site visit • Primary and secondary data collection including vessel traffic data, type of vessel and traffic density data, vessel traffic in related ports and harbours, fishing traffic and vessel accident data. • Data analysis of marine vessel activity along route, traffic volume, vessel traffic volume for the past 5 years (if available).
9.	Social Impact Assessment (SIA)	<ul style="list-style-type: none"> • Site visit • Involve both secondary data and surveys to be conducted to identify the key stakeholders and their socio-economic profile as well as to gather their initial feedback, opinions or views about the development proposal. • Public Stakeholders Consultation Meetings with targeted groups via public meetings and discussions will also be conducted as part of the study. • Secondary resources to be used to study health impacts.
10.	Aquatic Environment, Fisheries and Aquaculture	<ul style="list-style-type: none"> • Site appreciation. • Primary data collection including assessment of: <ul style="list-style-type: none"> - Marine biological resources (plankton, macrobenthic, fish fauna and coral reefs)

No.	Items	Assessment Standards & Methodologies
		<ul style="list-style-type: none"> - Coastal vegetation particularly mangroves - Marine fauna particularly turtle landings - Capture fisheries, aquaculture and recreational fisheries • Meeting and discussion with officers from Melaka State Department of Fisheries. • Secondary data collection from various sources, including literature review of existing data, reports (published and unpublished), records and other secondary sources with respect to the study area.

3.0 STATEMENT OF NEED

3.1 The economic growth rate for Melaka was recorded at 8.1% in 2017 which was more than the national Growth Domestic Product (GDP) of 5.9%. In line with the economic growth, demand for mixed developments in Melaka is expected to be robust, underpinned by new township developments. To meet the demand for sea front land for commercial and tourism development, the Melaka coastline has been extensively reclaimed in a belt from Tanjung Kling in the north to Kg. Portugis in the south of the city centre primarily in around Melaka city and its northern fringes (up to Sg. Lereh).

3.2 The southern fringes of the city beyond Padang Temu, however, have not enjoyed a similar development scenario and remain largely rural. Thus the communities have not seen the same level of economic development as in the north of Melaka City. Given the continuing demand for sea front land for tourism and commercial activity, it is inevitable that much of this would now have to be on the southern fringes of Melaka City.

3.3 The reclamation is expected to spur development areas in the southern fringes of the Melaka Tengah district, which is currently primarily rural. In addition to spurring the economy of the State, the proposed project is expected to generate more business opportunities which will enhance the economic value of the State and will benefit the local populace. The proposed project has been conceived to achieve the following objectives :-

- a) To provide a new additional land for the purpose of development;
- b) To create employment opportunities which will benefit the local populace;
- c) To generate higher income to the State.

4.0 PROJECT OPTION

4.1 The project options which have been taken into consideration for this project are no-project option, sand source option, structural measures for coastal protection option, reclamation method.

4.2 In general, the criteria used to select the most suitable site are as follows:

Table 3: Site Selection Criteria

No.	Reference	Evaluation Factors	Deliberation
1.	National Physical Plan, Structural Plan, Local Plan	Sensitive areas	There is presence of mangroves at the northeastern part of the site.
		Coastal erosion	The project site is located within an area with medium rate of coastal erosion.
2.	<i>Akta Warisan Kebangsaan 2005</i>	Protected zones	The project site is not located within the protected zone under <i>Akta Warisan Kebangsaan 2005</i> . Nevertheless, it is situated near Pulau Besar (within 5km radius from the project site) which is a protected zone. <i>(Remarks: Jabatan Warisan Negara (JWN) requires the project proponent to conduct multibeam survey, sub-bottom profile survey and magnetometer survey before the commencement of the physical works at site. The written comments from JWN are available in Appendix III of the EIA).</i>
3.	<i>Rancangan Fizikal Zon Persisiran Pantai Negara 2010</i>	Turtle landing spot, coral reef, seagrass	The project site is not located within any turtle landing spot, coral reef and seagrass area.

Based on the evaluation above, the project site can be considered as acceptable. However, proper mitigation measures have to be made available to ensure minimal impact to the environment.

- 4.3 No-Project option mainly examines the social, economical and environmental aspects that may be derived from the proposed project. The comparison of “No – Project” option and “With – Project” option is summarised in **Table 4**.

Table 4: Comparison Of “No – Project” and “With – Project” Options

No	No – Project Option	With – Project Option
1.	No new reclaimed land.	A reclaimed land will be established to cater for commercial / tourism etc. development.
2.	No income to the State.	Higher income to the State derived from taxation of land and business activities on the reclaimed land.
3.	Existing noise level remains the same.	Noise levels will increase due to an increase in vehicular traffic during construction and urbanisation after completion.
4.	Existing ambient air quality will remain the same.	Short-term increase of suspended particulate during the construction and increase of air pollutants due to urbanisation, viz., additional vehicle volume and population.
5.	Marine water quality remains the same.	Marine water quality will decrease during reclamation works. Nevertheless, the impact can be controlled with proper mitigation measures.
6.	Marine ecology at the proposed area remains the same.	Some impacts on the marine ecology of the site are expected to happen.
7.	Socio-economy of the area remains the same.	The development will generate increased business and employment that will benefit the regional economy and local populace.

- 4.4 There are two sand source options which can be considered i.e. getting the sand from an onshore location or sand sourced from offshore. The nearest onshore sand source in Melaka can be found at the outskirts of Melaka Tengah, at the central part of Melaka, which is quite far from the project site. Getting the fill material from this area will involve long-distance haulage activities and it is expected that 567,000 trips are required to bring the total amount of sand needed to reclaim the entire site.

As for offshore sand source, the nearest sand source area is located approximately 16.5km seaward to the southwest of the project site and the sand mining concessionaire for this area happens to be the project proponent i.e. Yayasan Melaka. This sand source area is believed to be able to provide 18,000m³ of sand per day. Since more sand can be transported from this area to the project site daily, shorter time for haulage activities can be expected. Due to the nearer location and shorter haulage distance and time, it is only wise to choose the offshore sand source for the proposed project.

- 4.5 There are a few structural measures for coastal protection option i.e. groyne, seawall, offshore breakwater, artificial headland and rock revetment. For this project, rock revetment is chosen as the coastal protection.
- 4.6 There are a number of available reclamation methods, depending upon suitability of fill material, sand source location, availability of equipment etc. Some of the reclamation method options are dry method, hydraulic reclamation (direct dumping), rehandling pit method, hydraulic filling and sand spreading. Based on the initial information received from the project proponent, the reclamation method to be used for the proposed project might consist of combinations of two or more methods mentioned above. Detail reclamation method statement will be provided by the appointed contractor and will be included in the EMP later.

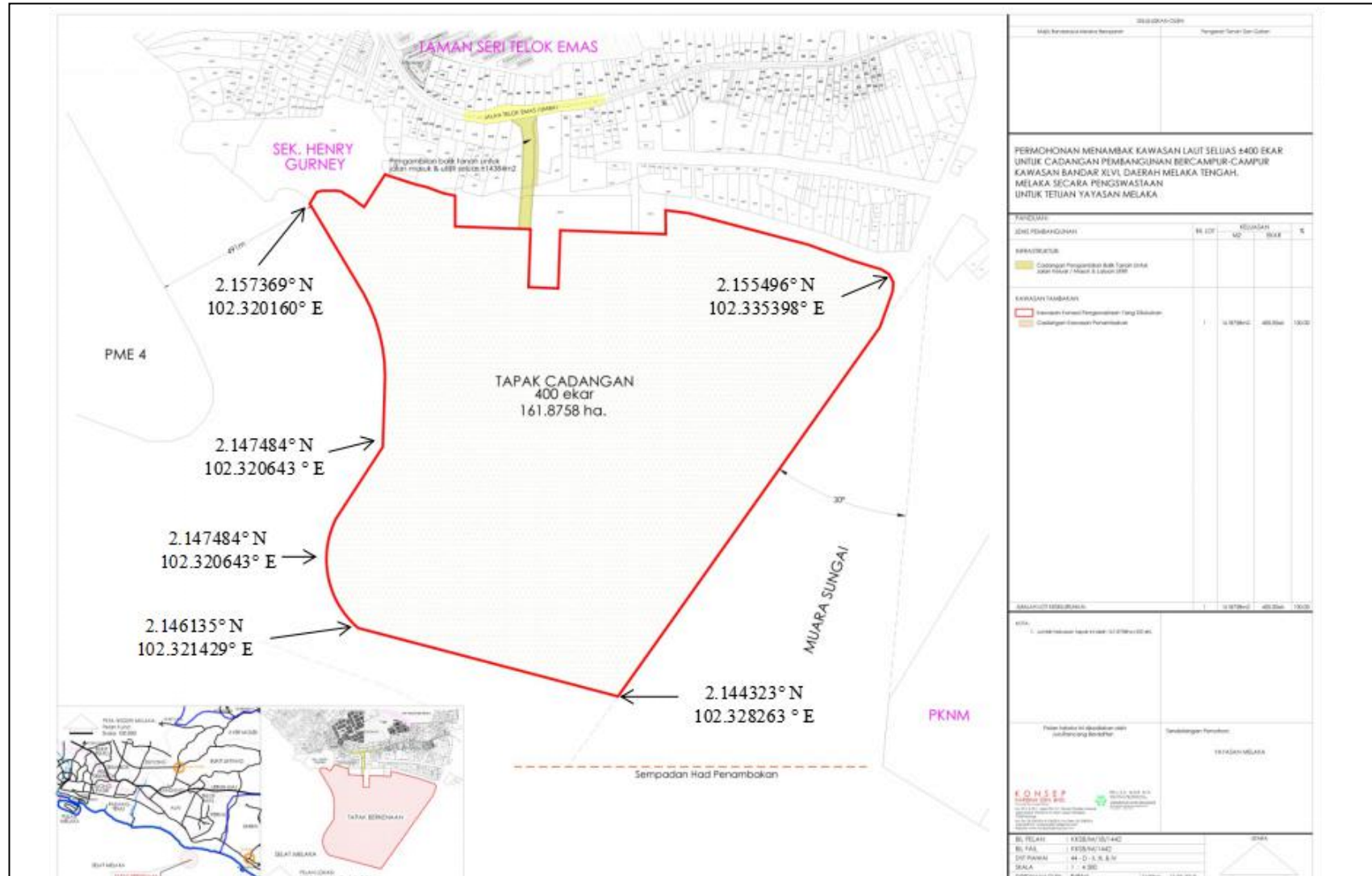
5.0 PROJECT DESCRIPTION

- 5.1 The project is located at Kawasan Bandar XLVI, District of Melaka Tengah, Melaka. The nearest landmark is Sekolah Henry Gurney, located at the northwest of the site. **Figure 1** shows the location of the project site. Yayasan Melaka intends to reclaim 400 acres (161.87 hectares) of the sea at the proposed location. The overall layout is as shown in **Figure 2**.

Figure 1: Location of the Project Site

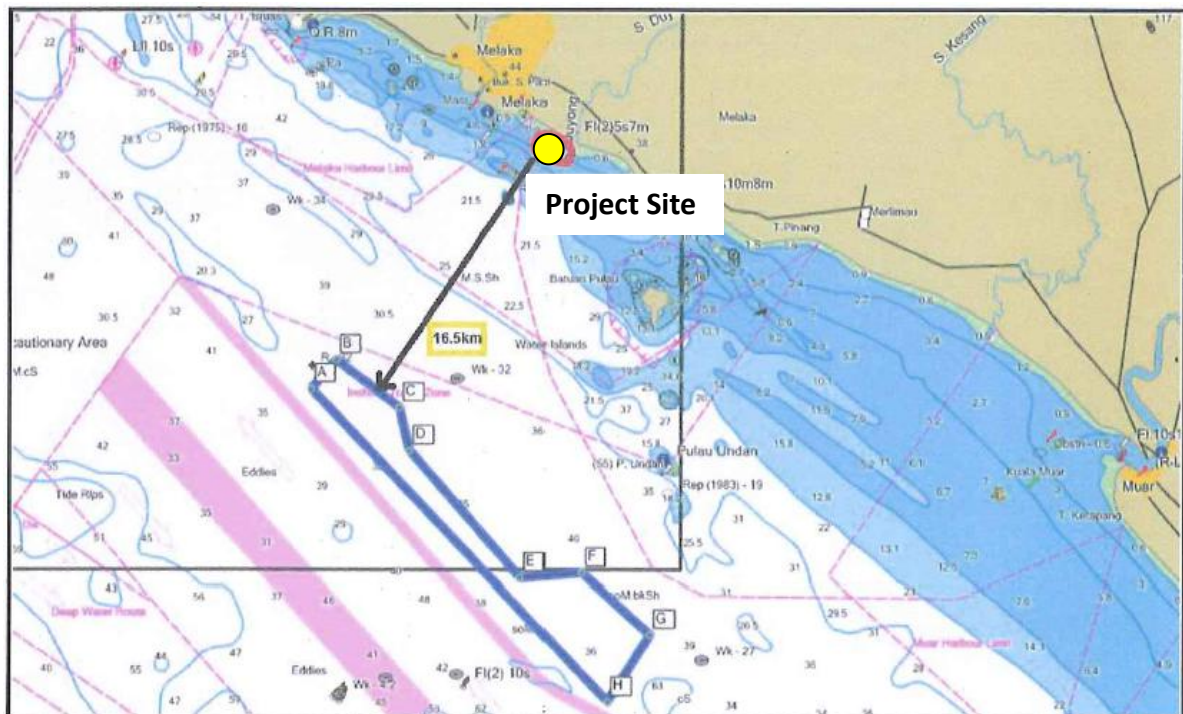


Figure 2: Project Layout



- 5.2 The works that will be involved in realising the proposed project include pre-survey works and site preparation, land acquisition for access, environmental mitigation works, reclamation works, revetment works and post survey works.
- 5.3 A total of about 17,000,000m³ of sand is anticipated to be required for the purpose of reclaiming the 400-acre project. There are a number of marine sand mining areas in Melaka. However, since the quantity of fill material needed for this project is quite huge, it is important to identify suitable fill material supplier that can supply 17,000,000m³ of sand. In this case, the most suitable borrow area is located approximately 16.5km offshore of the project site, as shown in **Figure 3**. Apparently, the sand mining concessionaire for this borrow area is also the project proponent i.e. Yayasan Melaka.

Figure 3: Sand Source Location

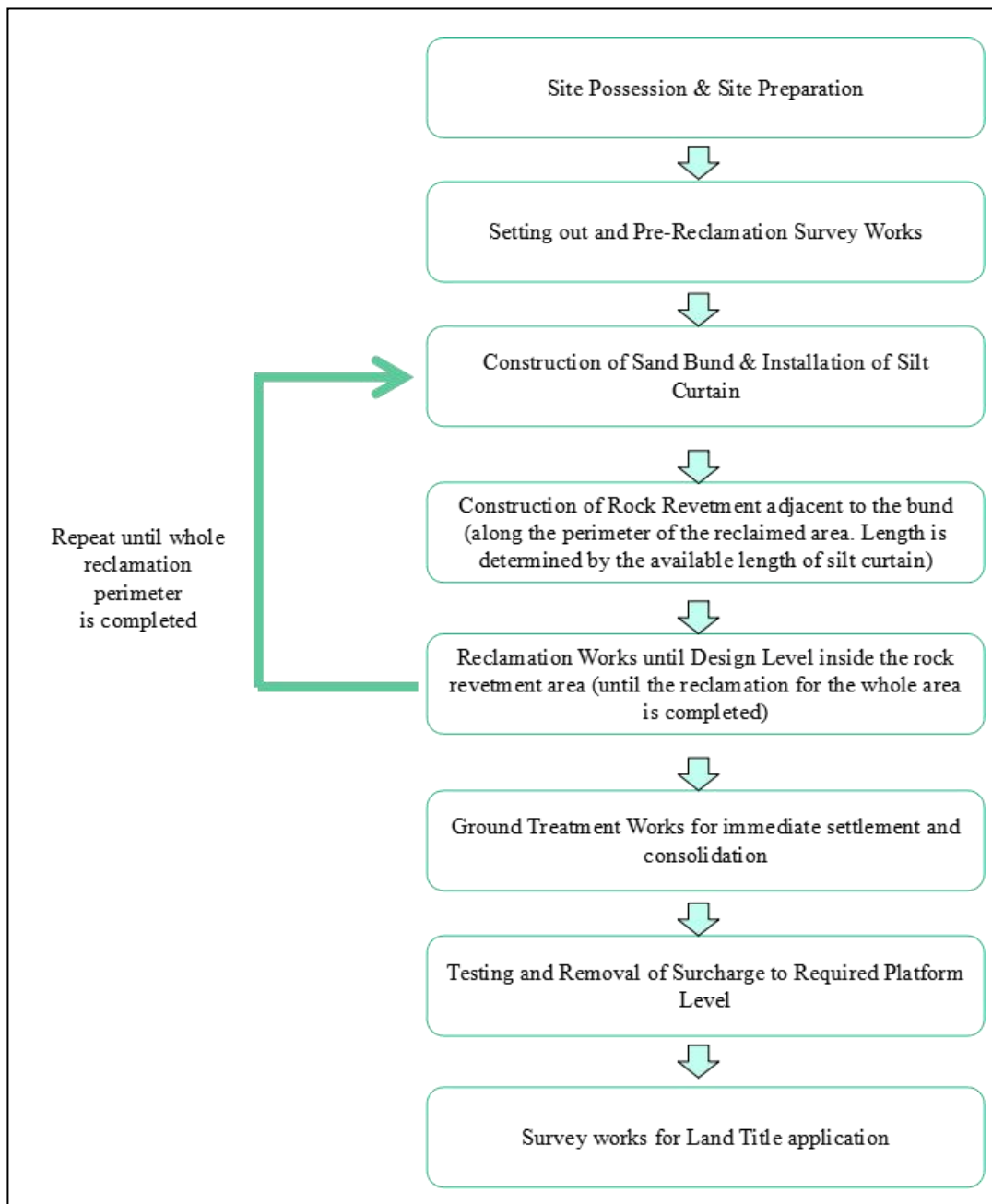


Based on the approval and permit for the sand mining activities at this borrow area (as attached in **Appendix X of the EIA**), the total volume of sand to be mined at this area is 30,000,000m³. This amount is sufficient to cater for the 17,000,000m³ needed to reclaim the 400 acres project area. Details on the sand mining activity at the proposed

sand source area are available in the approved EIA report entitled “*Permohonan Melombong Pasir Di Bawah Seksyen 4 Akta Pelantar Benua 1966 P.U 2009 Oleh Yayasan Melaka*”. Based on the approved EIA, this sand source is capable of providing about 18,000m³/day of sand.

5.4 The typical construction sequence for land reclamation works is shown in **Figure 4**.

Figure 4: Sequence for Land Reclamation Works



5.5 The proposed project can be accessed via Jalan Melaka Muar.

- 5.6 Due to the location of the site fronting the sea, the runoff from the project site will directly flow into the Straits of Melaka. Permanent drainage system will only be planned and implemented later once there is any proposed development on the reclaimed land.
- 5.7 Water and electricity supply as well as telecommunication services will only be estimated later for future development on top of the reclaimed land.
- 5.8 Waste i.e. solid waste, scheduled waste and wastewater can be expected during the construction phase especially if there is any workers camp at site. No waste is expected to be generated upon completion of the reclamation works.
- 5.9 The physical works at site is expected to commence at the end of 2019 after all relevant approvals have been obtained. All the physical works at site are planned to be completed within 24 months. A more detailed schedule will be provided later by the appointed contractor.

6.0 EXISTING ENVIRONMENT

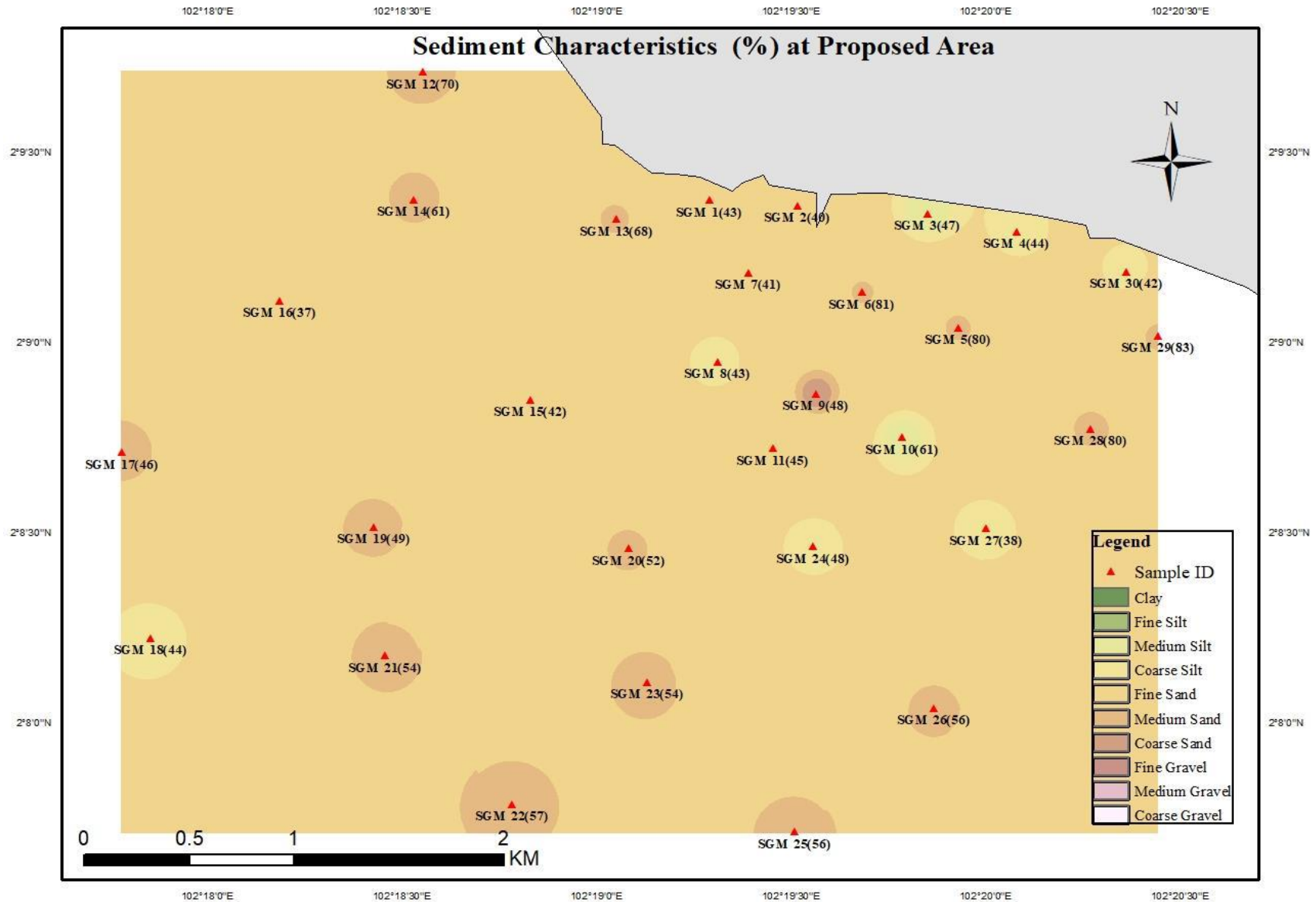
- 6.1 The mean annual wind speed for Northeast monsoon and Southwest monsoon are 3.2m/s and 2.85m/s respectively. The wind direction for Northeast monsoon and Southwest monsoon are Northwest and South respectively.
- 6.2 The mean annual wave heights for the Northeast monsoon and Southwest monsoon are 0.17m and 0.14m respectively.
- 6.3 The tide at the project site is semi-diurnal, i.e. two high water levels and low water levels in a tidal day with comparatively little diurnal inequality. The nearest standard port from the project site is Tanjung Keling.
- 6.4 The meteorological data was obtained from Batu Berendam Airport Principal Station (No. Station: 48665 – N 02°16', E 102°15') of the Malaysian Meteorological Service

Department and from secondary resources. Based on the rainfall data from 1968 - 2014, the annual mean rainfall for Melaka is about 1,965.6mm with the annual mean raindays of 171 days.

However, it is observed that there have been some changes to the weather pattern within the past few years. Hence, it is wise that the latest weather conditions be highlighted in this report. The meteorological data for the year 2015 to 2018 is extracted from a secondary source. Based on the secondary source, the highest average rainfall amount throughout the years is during November 2018 with an average rainfall of 257.4mm, while the lowest average rainfall amount is during February 2018 with an average rainfall amount of 15.24mm. The highest rainy day amount is in May 2017 with 30 rain days, while the lowest rainy day amount is in February 2018 with 10 rain days.

- 6.5 The current measurements were performed by two Acoustic Doppler Current Profilers (ADCP) deployed (Station 1 and Station 2). For Station 1, the recorded maximum current speed is around 0.84 m/s, while the maximum current speed in Station 2 has reached up to 0.92 m/s.
- 6.6 The water level were also measured by using the ADCP. The water level at Station 1 is between -0.96m to 1.14m, while the water level at Station 2 is between -0.99m to 1.14m.
- 6.7 The locations and results of the seabed sampling is shown in **Figure 5**.

Rajah 5: The Locations and Results of the Seabed Sampling



- 6.8 Total Suspended Sediment (TSS) sampling analysis were carried out at 20 locations. Based on the sampling, the TSS at the project site range from 14mg/l to 62mg/l.
- 6.9 Coastal and river field sampling was conducted to collect seawater and river water to determine the existing physico-chemical as well as biological characteristics of the surrounding area of the project site. The field sampling was carried out from 25th to 26th October 2018. A total of thirteen (13) and six (6) sampling stations was established for seawater and river water monitoring respectively. The details of the sampling is as follow:

Table 5: Details of Water Quality Sampling

Sampling Location	Details of Sampling	Coordinates
Seawater		
WM1	1 depth (0-0.3m) during high tide and low tide respectively	N 2°10'01.4" E 102°18'14.2"
WM2	1 depth (0-0.3m) during high tide and low tide respectively	N 2°09'49.1" E 102°18'42.4"
WM3	1 depth (0-0.3m) during high tide and low tide respectively	N 2°09'29.9" E 102°19'02.5"
WM4	3 depths (0-0.3m, 1m & 5m) during high tide and low tide respectively	N 2°08'53.0" E 102°19'12.6"
WM5	3 depths (0-0.3m, 1m & 5m) during high tide and low tide respectively	N 2°08'31.4" E 102°18'35.5"
WM6	1 depth (0-0.3m) during high tide and low tide respectively	N 2°09'07.4" E 102°20'05.8"
WM7	3 depths (0-0.3m, 1m & 5m) during high tide and low tide respectively	N 2°08'44.1" E 102°20'08.6"
WM8	3 depths (0-0.3m, 1m & 5m) during high tide and low tide respectively	N 2°07'52.9" E 102°20'31.9"
WM9	3 depths (0-0.3m, 1m & 5m) during high tide and low tide respectively	N 2°07'47.3" E 102°19'30.8"
WM10	1 depth (0-0.3m) during high tide and low tide respectively	N 2°07'03.9" E 102°19'32.0"

Sampling Location	Details of Sampling	Coordinates
WM11	1 depth (0-0.3m) during high tide and low tide respectively	N 2°08'56.1" E 102°20'34.6"
WM12	1 depth (0-0.3m) during high tide and low tide respectively	N 2°08'27.0" E 102°21'22.3"
WM13	1 depth (0-0.3m) during high tide and low tide respectively	N 2°07'56.1" E 102°21'31.5"
Stream Water		
WR1	1 sample during high tide and low tide respectively	N 2°10'19.5" E 102°18'29.0"
WR2	1 sample during high tide and low tide respectively	N 2°10'16.0" E 102°18'24.3"
WR3	1 sample	N 2°09'34.0" E 102°19'02.0"
WR4	1 sample	N 2°09'31.0" E 102°19'43.5"
WR5	1 sample during high tide and low tide respectively	N 2°09'22.4" E 102°20'11.1"
WR6	1 sample during high tide and low tide respectively	N 2°09'27.4" E 102°20'14.5"

The marine water quality and the river water quality surrounding the project site is represented in Marine Water Quality Index (MWQI) and Water Quality Index (WQI) as shown in **Chart 1** to **Chart 4**.

Chart 1 : Marine Water Quality Index (MWQI) – Top Layer of Seawater

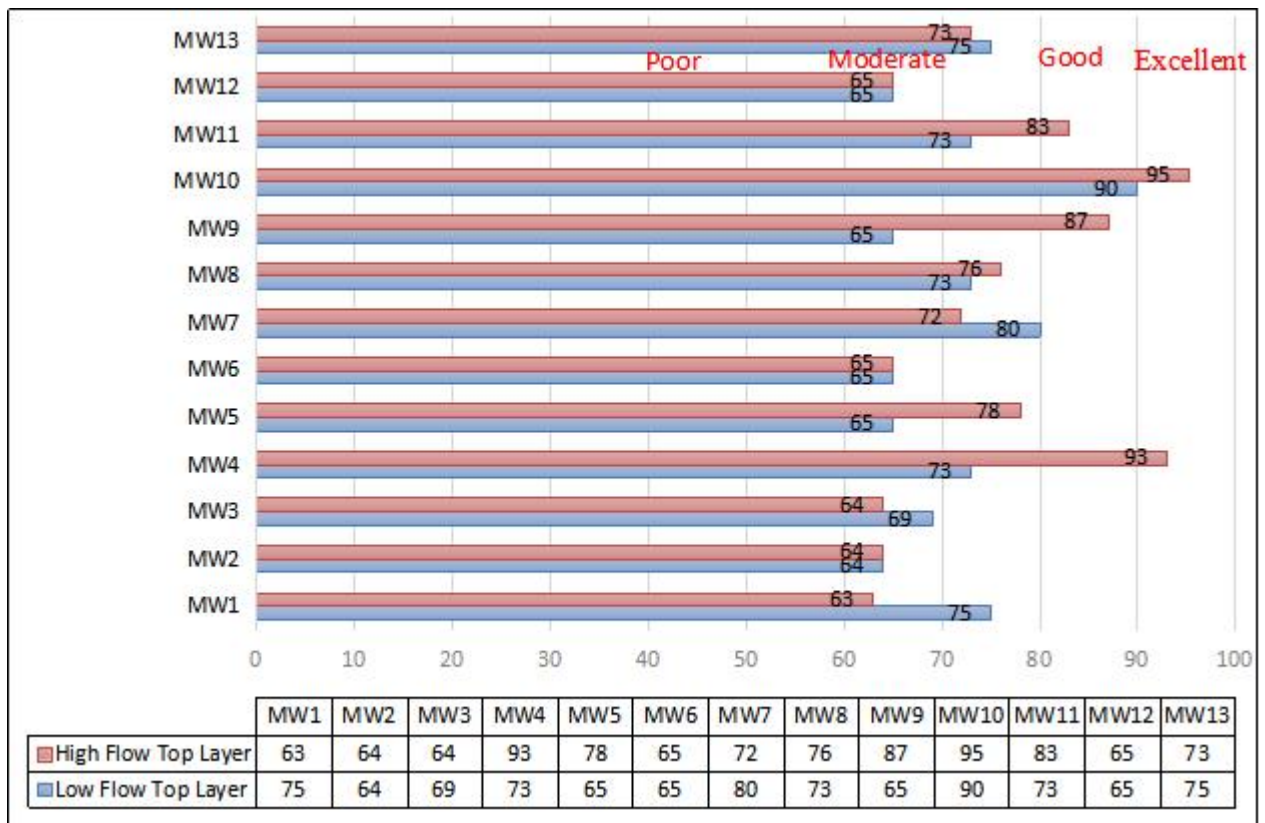


Chart 2 : Marine Water Quality Index (MWQI) – Middle Layer of Seawater

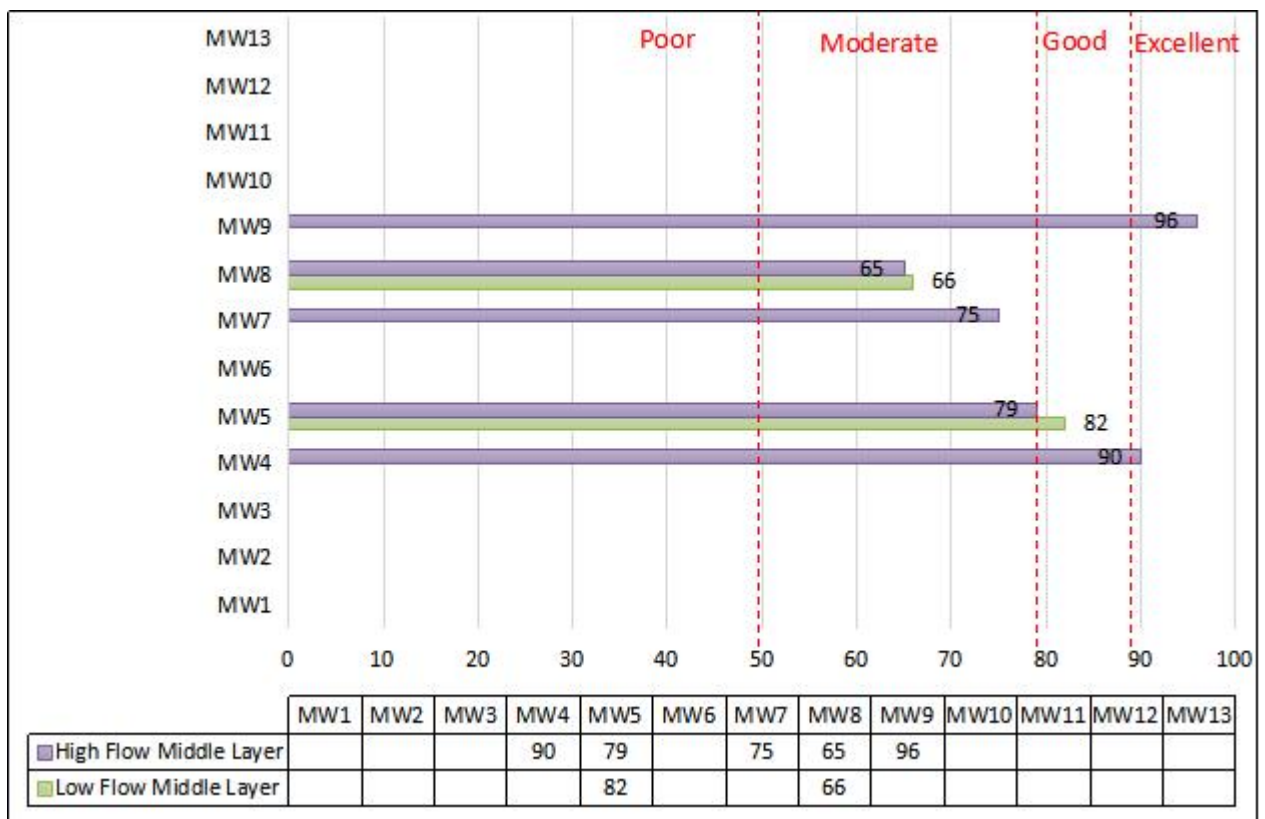


Chart 3: Marine Water Quality Index (MWQI) – Bottom Layer of Seawater

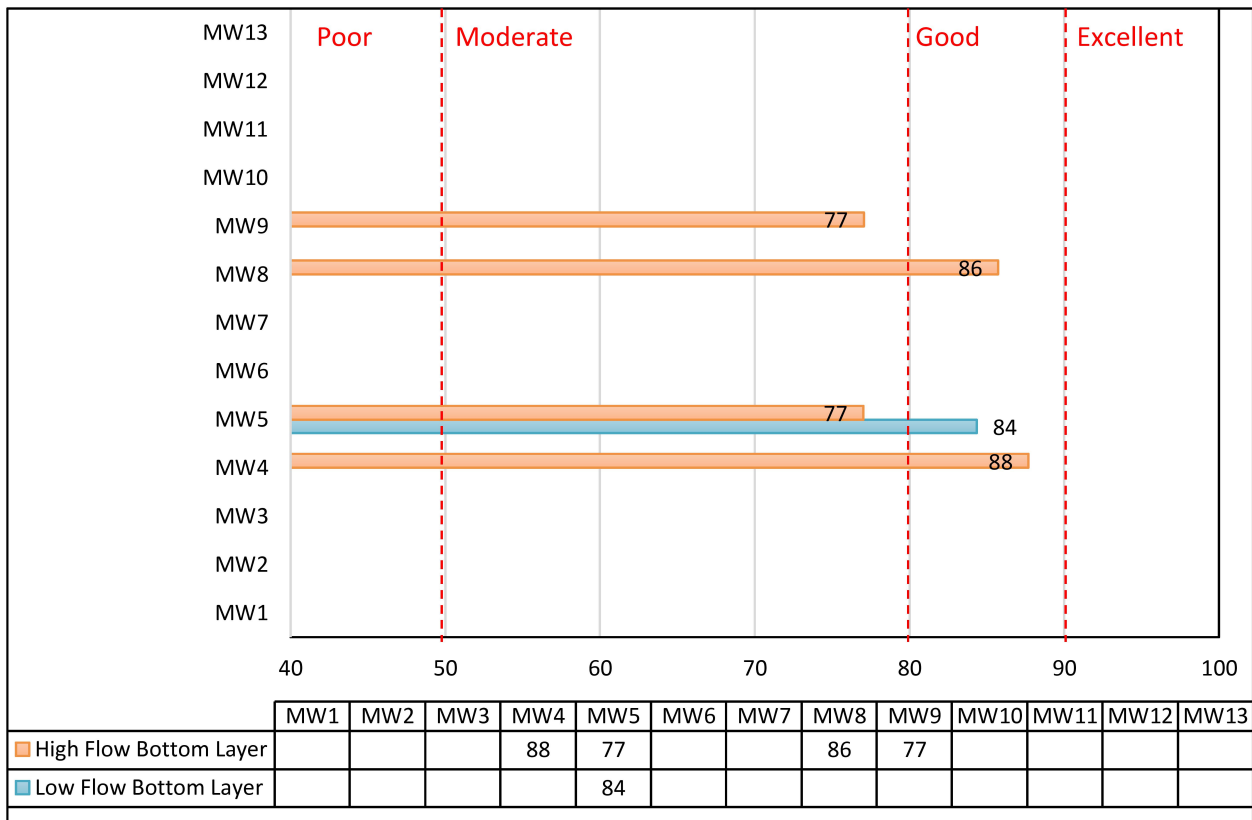
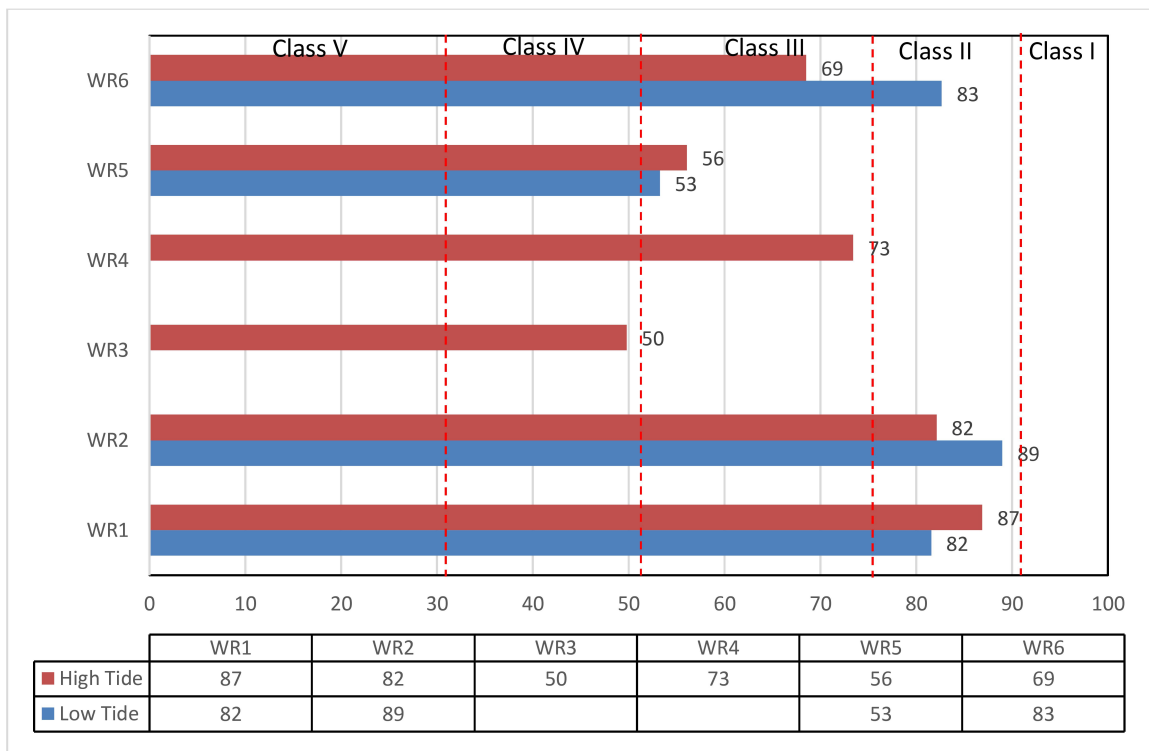


Chart 4: River Water Quality Index (WQI)



The Malaysian Marine Water Quality Indices (MMWQI) denoted that the marine water within 5 km radius of the project site were within Classes of Moderate to Excellent under the Malaysian Marine Water Quality Standards (MMWQS).

In general, the river water quality in the Project vicinity was under the status of clean to slight polluted except water quality at Parit I.S.K.K (WR3) which was polluted.

- 6.10 The baseline ambient air quality monitoring was carried out by a *SAMM accredited laboratory which is Spectrum Laboratories Sdn. Bhd. (SAMM No.: 062) from 22nd October 2018 to 28th October 2018. The parameter tested is Total Suspended Particulate (TSP). Based on the sampling, the results obtained are well below the Malaysia Recommended Air Quality Guidelines limit of 260 µg/m³ (24 hours averaging time).
- 6.11 Noise level measurements were carried out at six (6) locations (N1 - N6) near to the boundary of the Project. The parameters tested is LAeq. Based on the sampling, the results show that the noise level that has exceeded the limit are at N1 during night time and N4 and N5 during day time and night time.
- 6.12 The socio-economic study was conducted by relying on:
- Analysing secondary data on the socio-economic and demographics of the districts and mukim located within and surrounding the project site
 - Conducting a general community survey within the 5 km of Zone of Impact (ZOI)
 - Detailed interview with local community leaders and Focus Group Discussion (FGD) with relevant stakeholders.

The community survey was conducted on 2nd to 6th February 2018. The respondents consisted of 241 local communities including 35 fishermen and 45 visitors/ tourists. The results of the community survey is tabulated in the following table.

Table 66: Socio-economics Characteristics of the Local Communities Surveyed

		%
Working Household Members	0	0.83
	1	41.49
	2	31.95
	3 - 4	15.35
	5 - 6	6.64
	7 - 8	3.73
	Occupation	Fishermen
Businessmen		29.46
Government employee		14.11
Private sector employee		20.75
Contractor		0.83
Own employment		3.32
Pensioner		7.47
Children contribution & government / NGO welfare		2.90
Student		0.41
Unemployed		2.49
Personal Income Level	<RM500	5.46
	RM501 - RM1,000	7.56
	RM1,001 - RM2,000	26.89
	RM2,001 - RM3,000	30.25
	RM3,001 - RM4,000	18.07
	RM4,001 - RM5,000	7.14
	RM5,001 - RM7,500	2.10
	RM7,501 - RM10,000	0.84
	RM10,001 - RM15,000	1.68
Household Income Level	<RM500	1.24
	RM501 - RM1,000	1.66
	RM1,001 - RM2,000	11.20
	RM2,001 - RM3,000	22.41
	RM3,001 - RM4,000	26.14
	RM4,001 - RM5,000	17.01
	RM5,001 - RM7,500	12.03
	RM7,501 - RM10,000	5.81
	RM10,001 - RM15,000	1.66
	RM15,001 - RM20,000	0.00
RM20,001 - RM30,000	0.83	
Type of House Ownership	Own Home	75.10
	Rental Home	18.26
	Living in Family Home	2.07
	Government Quarters	4.56
Type of House Living In	Single house / bungalow	75.10
	Terrace	18.26
	Shop Lot	2.07
	Government Quarters	4.56
Housing Materials	Brick and cement	71.78
	Wood and cement	20.75
	Wood	7.47
Vehicle Ownership	Car	47.14
	Motorcycle	47.80
	Bicycle	3.96
	Trishaw	1.10

- 6.13 The disease vector data at the surrounding of the project site is obtained from Pejabat Kesihatan Daerah Melaka Tengah. The only disease vector recorded is dengue.
- 6.14 There is no maritime traffic in the Proposed Project area. The whole area is shallow. During low tide, fishermen and villagers go to the site to collect shell fish for home consumption and sale. The marine traffic concern are vessels from nearby jetties i.e. Umbai Jetty and Anjung Batu Jetty which consist of ferries and speed boats that provide services to and from Pulau Besar Melaka, and fishermen boats that call at these jetties.

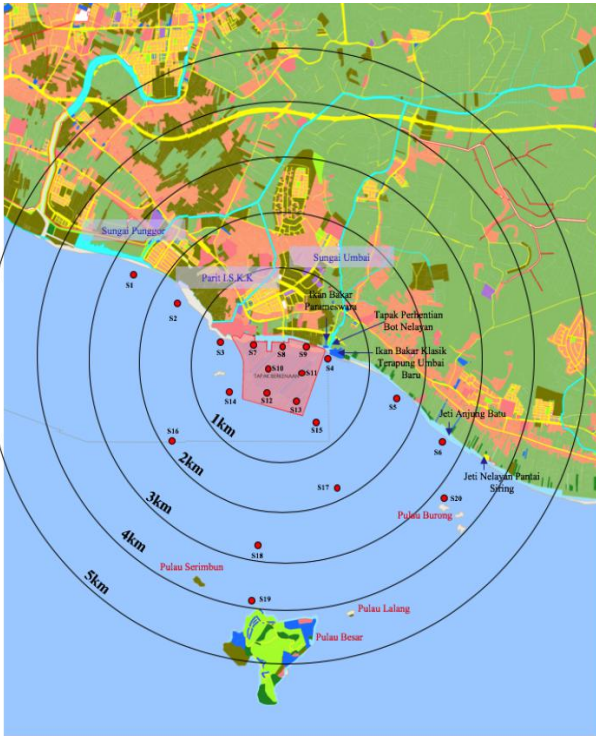
The project location is located approximately 25 km from Melaka Port, which is still within Melaka Port limit. It was indicated that there will not be any impact of the project activities to the port operation. The expected movement of 2 dredges and barges per day will not cause any traffic congestion of the waterway. There is no records of vessel accident in the area.

There are 892 of inshore fishermen from Melaka Tengah and Jasin area operating and traversing the area to and from their fishing grounds and jetties. There are a total of 394 fishing vessels in the area. Their operation will be affected and their fishing grounds will be curtailed by the reclamation operation.

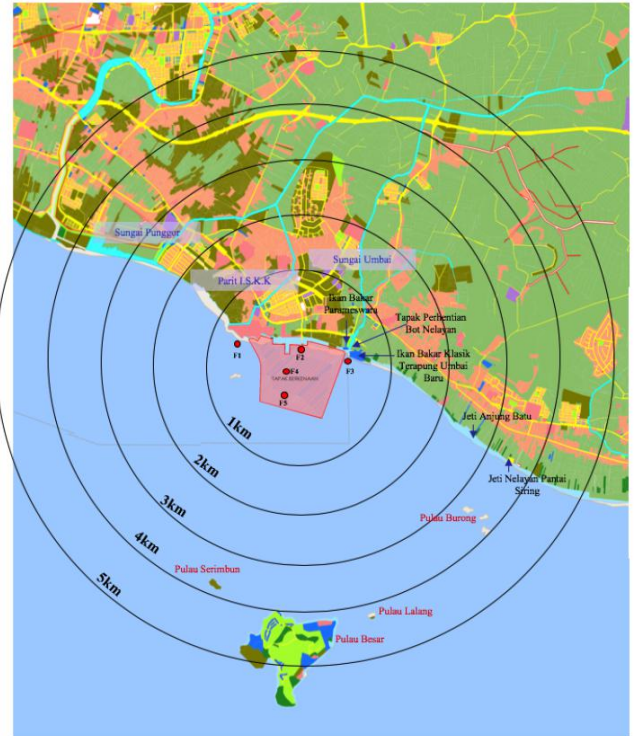
- 6.15 The assessment for marine ecology, fisheries and aquaculture were conducted on marine biological resources (plankton, macrobenthos, fish fauna) and marine habitats (mangrove and coral reefs) within the impact zone (5km radius) of the proposed project sites. relevant baseline information on fisheries and aquaculture activities within the impact zone were also collected. The sampling locations is shown in **Figure 6** and the findings from the assessment is shown in **Table 7**.

Figure 6: Sampling Location For Marine Ecology, Fisheries And Aquaculture Assessment

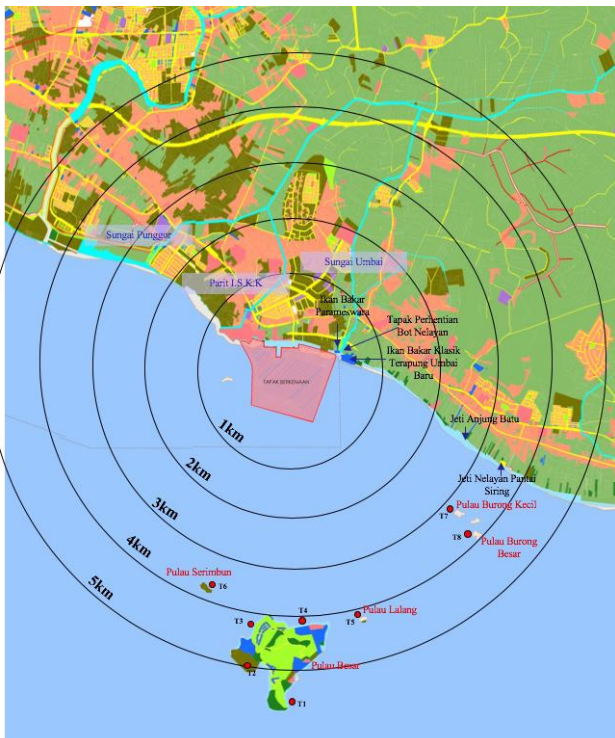
Marine Biological Resources (Plankton, Macrobenthos, Zooplankton) Assessment



Fish Fauna Assessment



Coral Reef Assessment



Mangrove Assessment

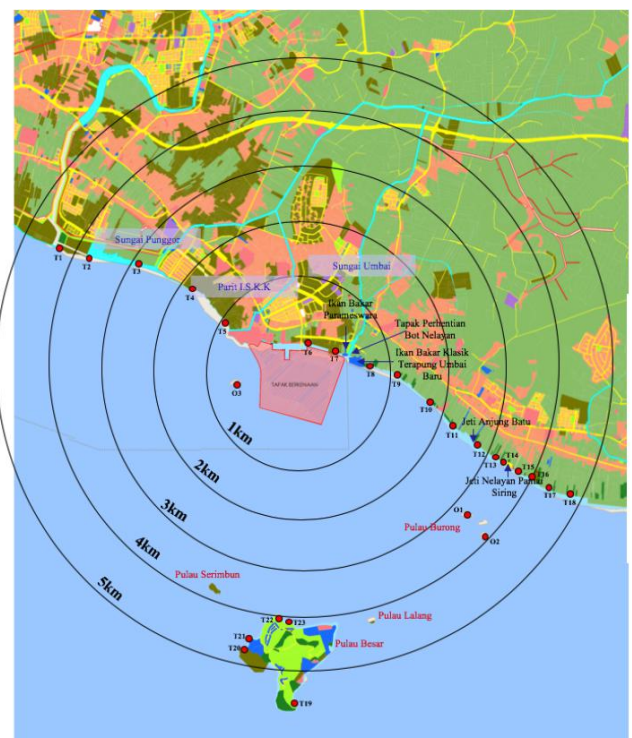


Table 7: Finding Summary for the Assessment of Marine Ecology, Fisheries and Aquaculture

No.	Assessment	Finding Summary
1.	Phytoplankton	<ul style="list-style-type: none"> • Mean Density: 51.26 cells/mL, ranged 11.56 – 180.58 cells/mL • Diversity Index: ranged 0.34 – 1.77, 9 stations showed low diversity pattern & 11 stations showed moderate diversity pattern • Dominant phylum: Bacillariophyta, 21 taxa - dominancy indicates good marine water quality • Abundant taxa: Nitzschia, mean density of 42.07±38.58 cells/mL, ranged 1.00 - 161.74 cells/mL (found in all survey areas)
2.	Zooplankton	<ul style="list-style-type: none"> • Mean Density: 30.16 ind./L, ranged 2.54 – 201.50 ind./L • Diversity Index: ranged 1.10 – 2.09, most stations showed moderate diversity pattern • Dominant phylum: Arthropoda, 14 taxa • Dominant group: Copepoda, 99.7% from Arthropoda, commonly have wide distribution in seawater • Abundant taxa: Eucalanus (Copepoda), common reported in high abundance in Malaysian waters
3.	Macrobenthos	<ul style="list-style-type: none"> • Mean Density: 209 ind./m², ranged 100 – 390 ind./m² • Diversity Index: ranged 1.17 – 2.23, most stations showed moderate diversity pattern • Dominant phylum: Annelida & Arthropoda (Crustacea) – normal phenomenon for Malaysian coastal • Phylum Annelida: 16 families & 33 species, most abundant Nephtyidae & Spionidae – known to have high tolerance to organic pollution & natural perturbation • Phylum Arthropoda (Crustacea): 6 orders, most abundant Amphipoda – sensitive to contaminants, pesticide & pollution • Mean density per area between Annelida & Arthropoda showed opposite trend, foreshore area receive daily inputs of land-based pollutant flows could be main reason for lower density in foreshore & within reclamation footprint area during the study
4.	Fish Fauna	<ul style="list-style-type: none"> • Most abundant: • Demersal: Sciaenidae (25.4%)- common caught in Malaysian waters • Pelagic: Clupeidae (24.6%) –commonly form school in coastal water • Total individual: 153 (18 families, 28 species)

No.	Assessment	Finding Summary
		<ul style="list-style-type: none"> • Total weight caught: 11,220 g • CPUE : • No: 0.268 no./m2/hour • Biomass: 19.684 g/m2/hour
5.	Mangroves	<ul style="list-style-type: none"> • 14 families, 26 species • Dominant family: Rhizophoraceae, 7 species • Mainland coastal: No specific species zonation, seaward dominated by archetypal true mangrove (Rhizophora, Avicennia & Sonneratia) • Islands (Pulau Besar): Rhizophora stylosa dominated • Total: 1,401 mangrove trees, 782 saplings & 279 shrubs recorded • Presence of saplings = natural regeneration = restocking of forest stands • Mangrove tree: DBH (2 – 120cm), height (4 – 15m)
6.	Coral Reef	<ul style="list-style-type: none"> • Hard coral – 26 species • Abundant family: Faviidae (8 species) • Commonly found within Melaka Straits • Soft coral – 6 species • Gorgonians - 8 species • Degradation of coral reefs with sedimentation & covered with sand and silt recorded at most transect lines • The existing reef still considered rich & diverse, need to ensure not to exacerbate current levels of degradation
7.	Turtle landing	<ul style="list-style-type: none"> • Eretmochelys imbricata (Hawksbill Turtle/Penyu Karah@Penyu Sisek) nest along the sandy beaches on Melaka coastline – 19 nesting sites • Main nesting season: April – October, peak during June – August • No landings recorded in areas within impact zone in 2017 (Pulau Burong/Pulau Lalang) • Listed as Endangered in IUCN Red List
8.	Marine capture fisheries	<p>1) Fisherman population 2017 at Sg. Duyong, Alai, Telok Mas, Umbai and Pantai Siring</p> <ul style="list-style-type: none"> • Total: 348 fishermen (Malay: 288, Chinese: 48, Indian: 2, Others: 0) <p>2) Fishing vessels 2017 at Sg. Duyong, Alai, Telok Mas, Umbai and Pantai Siring</p>

No.	Assessment	Finding Summary
		<ul style="list-style-type: none"> • Outboard powered vessel: 246 • Inboard powered vessel: 30 • Fishing gears used outboard & inboard vessels: drift nets, long lines and portable traps • Licensed fishing gear: 393 (drift net: 276, long lines: 96, portable traps: 21) • Push nets only for collecting live shrimps as fishing baits (previously used to harvest Acetes shrimp) • Major fish caught: Duri (<i>Arius</i> spp.), Gelama (<i>Johnius</i> spp.), Pari (<i>Himantura</i> spp./ <i>Gymnura</i> spp./ <i>Myliobatis</i> spp./ <i>Dasyatis</i> spp.), Parang (<i>Chirocentrus</i> dorab) and Tenggiri (<i>Scomberomorus</i> spp.)
9.	Aquaculture	<ul style="list-style-type: none"> • Main aquaculture – mussel farming • Area – Operation along the coastal area off Telok Mas to Anjung Batu • In 2017, 10 culturist with 10 farms (panggar), approx. 5 acres • 1 panggar – at least 200 stilts • Major species: Asean Green Mussel (<i>Perna viridis</i>) • Production: Jan 2017 - April 2018, est. 9 tonnes (RM57,600)
10.	Recreational fisheries	<ul style="list-style-type: none"> • Study area – not commercially popular as recreational fisheries hotspot but still have some activities • Angling activities: <ul style="list-style-type: none"> - Shore-based angling – use line casting - Boat-based angling – use trolling & line casting - Kelong-based angling – use line casting • Fishing Effort <ul style="list-style-type: none"> - Use model develop by Nagaraj et al. (2013) – taken time input into account - Total fishing effort: 10,091 person-days per year - Total economic value: RM1.153 million/year

6.16 The existing traffic volume for the road network of the project site and the annual traffic growth rate are sourced from the Road Traffic Volume Malaysia (RTVM) 2015, acquired from Kementerian Kerja Raya Malaysia. The nearest census station selected is MR 108 (Jalan Melaka-Muar).

Based on the RTVM, the LOS at the traffic census station is F and it has exceeded the acceptable limit of LOS D. The annual traffic growth rate is decreasing

7.0 EVALUATION OF IMPACTS AND MITIGATING MEASURES

7.1 The Project activities expected to have potential impact on the environment were broadly classified into four categories, viz., pre-construction, construction, post-construction / post-reclamation and impacts arising from abandonment of the project. The environmental components which are likely to induce potentially significant impacts are identified for analysis, discussion and assessment. In arriving at decisions on environmental impacts, the relevant guidelines published by the DOE were used as references.

7.2 The potential significant impacts and mitigating measures are described in **Table 8**.

Table 8: Potential Impact and Mitigating Measures

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
Hydraulic and hydrodynamic	<p>1) Impact on hydrodynamic condition</p> <ul style="list-style-type: none"> - Two different scenarios were selected under this study to assess the impact of the proposed reclamation works i.e. Scenario A – Baseline condition and Scenario B – with proposed reclamation. - Impacts on current speed, water level, wave condition, and mud transport were assessed. <p>a) Impact on current speed</p> <ul style="list-style-type: none"> • Current speeds are mainly induced by the tidal forcing and the bathymetry characteristics as well as by the wind action on the water surface. • In general, current speeds are lower in the shallow areas and the model prediction shows that the mean difference read approximately -0.405m/s and maximum difference is 0.105m/s in the vicinity of the reclamation site <p>b) Impact on water level</p> <ul style="list-style-type: none"> • Based on the modelling done, it is evident that the change in maximum water level is very minimal <p>c) Impact on wave condition</p> <ul style="list-style-type: none"> • Wave modelling was carried out for the existing condition and different scenarios in this section. • Two different scenarios were carried out for the reclamation purposes. 	<p>1) During construction</p> <ul style="list-style-type: none"> - Installation of silt curtain - Coastal monitoring programme <p>2) During post reclamation</p> <ul style="list-style-type: none"> - Coastal monitoring programme - to be conducted every 6 months for 3 years period after the completion of the reclamation works 	7-2 to 7-6 8-1 and 8-2

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
	<ul style="list-style-type: none"> • The results indicate that wave heights ranges between 0.24m to 0.42m depending on the wave directions <p>d) Impact on mud transport</p> <ul style="list-style-type: none"> • Impact on bed thickness change is assessed for two different scenarios. • The scenarios show the bed thickness change is only between 0.0m/year to +0.04588m/year. • It is found that the project site may experience minimal impact of erosion and deposition even after the reclamation has been completed. • It is clear from the model results that not much impact on the morphology of the area even with the presence of the proposed reclaimed land <p>2) Sediment plume dispersion pattern</p> <ul style="list-style-type: none"> - The levels of suspended sediment concentration are assessed to determine potential impact to the surroundings. - Sediment plumes originating from the reclamation operation were simulated. Two scenarios were investigated, with silt curtain and without silt curtain during reclamation works. - The spill rate and the total spill will be highly dependent upon work procedures, scheduling and reclaimed material characteristics. - Each conveyor barge with a capacity of 1,250 m³ is 		

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
	<p>assumed to operate for 12 hrs (from 7 am to 6 pm) on a daily basis. Each barge has a pumping rate of 0.1 m³/s.</p> <ul style="list-style-type: none"> - The spill concentration is 4.0 kg/m³ for without silt curtain condition and 0.8 kg/m³ for with silt curtain condition. - Results from the spill are presented in mean suspended sediment concentrations showing the extent and concentration over the simulation period for spring and neap tide at four different points or sources. - The plume patterns indicate that excess suspended sediment concentrations generated from the reclamation work are only at the project site and nearby area. - The mean plume extents approximately up to 3.5km and 3km during neap tide with and without silt curtain respectively. On the other hand, the maximum plume extent approximately up to 6.8km during spring tide with and without silt curtain. <p>3) Cumulative hydraulic impact assessment with all other proposed reclamation projects nearby</p> <ul style="list-style-type: none"> - In conjunction to overall impact assessment study, several approved projects that are expected to kickoff near to the proposed reclamation area are considered into the simulation in terms of hydrodynamic evaluation. - Four projects are considered to be included into the evaluation process 		

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
	<ul style="list-style-type: none"> - The assessment factors are based on current speed, water level and significant wave heights. - Current speed pattern shows slight increment of about - 0.035 m/s + 0.215m/s for mean current pattern. Approved projects show higher pattern of current speed due to the uneven reclamation plot base on the developers' proposal, where else the Yayasan Melaka project just showing very minimal changes. Both simulated model for various Northeast monsoon and Southwest monsoon show no changes in current speed. - Water level pattern variation was compared at minimum and maximum level between proposed and approved reclamation layout. However, there are no changes in minimum and maximum water level. - Significant of wave heights and wave direction were also considered for both Yayasan Melaka and the approved project areas. Bathymetry differences between both areas show various results at both sites. The Northeast monsoon range of wave heights comparison between the projects for scenario A shows range from 0.0 m to + 0.1 m and for the scenario B after project implementation varies from + 0.02 to + 0.04 m. There are slight changes in wave direction pattern for all projects for Northeast monsoon. Scenario A varies from 15 to 20 degree while for Scenario B, it is 5 degree changes in mean wave direction. 		

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
	<p>4) Impact on Pulau Menatang</p> <ul style="list-style-type: none"> - The hydrodynamic assessment for Pulau Menatang indicates that there will not be any major hydraulic changes to Pulau Menatang with the presence of the proposed project. - Cumulative assessment of hydraulic impact on Pulau Menatang also shows no major implication on Pulau Menatang Island. 		
Hydrology	<p>1) Impact to nearby rivers (Sg. Punggor and Sg. Umbai)</p> <ul style="list-style-type: none"> - Based on the frequency analysis done in the Hydraulic Study, flow from Punggor-Umbai catchment for different ARI was calculated. - The model was simulated for 100 ARI, 50 ARI, 25 ARI, 10 ARI and 5 ARI flow conditions at the upstream. At the downstream, usual tidal fluctuation was considered as there are tidal gates at both the outfall. - All the scenarios were simulated and maximum water level along the Sg. Punggor and Sg. Umbai has been calculated. It is found from the figures that maximum water level varies from 2.95 mMSL to 2.67 mMSL at the upstream of Punggor river whereas at the upstream of Umbai river it varies from 1.81 mMSL to 1.64 mMSL. 	<p><u>During construction</u></p> <ul style="list-style-type: none"> - Ensure that any existing outlet channel at the site and its surrounding is not blocked during both the construction and operation phases. - Kg. Pernu outlet be maintained and that a channel is provided between the project site and the existing coastline. - Rock revetment will be constructed as the slopes of this channel. - Periodic maintenance dredging to be conducted every 6 months at the proposed channel throughout the construction period. <p><u>During post reclamation</u></p> <ul style="list-style-type: none"> - Maintenance dredging is proposed to be done to ensure sufficient depth and width of the channel. 	7-6 to 7-11 8-3

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
	<p>2) Kg. Pernu drainage assessment before and after reclamation.</p> <ul style="list-style-type: none"> - Kampung Pernu is one of the residential areas which is located between Kampung Punggor and Kampung Umbai. This residential area is located near to the proposed reclamation area where one of the discharge outlets is flowing. - Kampung Pernu catchment area is estimated to be 163 ha. Area A is estimated to be 25 ha and Area B is estimated to be 138 ha. - The discharge of the outlet totally depends on the flow to the sea. Considering the importance of the outlet, the project proponent has decided to remain the channel flow. - The Kg. Pernu discharge outlet design is calculated based on the ARI 100 years. The drainage design is also designated to cater the discharge level for future as well. - The hydraulic modelling considers the maximum ARI 100 to be 31.97 m³/s. Hydraulic modelling is developed to analyse impact of the flow before and after the reclamation. - Based on the results, the discharge value of the channel is estimated to be 31.97 m³/s for all the estimated four points chosen to be analysed. All the results show that the current/discharge flow and water level from Kg. Pernu indicated almost the same flow level. This current 	<p>Once the Defects Liability Period has ended, the channel maintenance shall be done by the relevant authorities.</p> <ul style="list-style-type: none"> - A disposal site for the dredged material would also have to be identified. 	

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
	<p>flow indicates that changes of the flow is very minimal. This allowances of the flow are important and ensure that back flow of the current do not happen in the channel.</p>		
Solid Waste	<ul style="list-style-type: none"> - Waste from the labour camps (if any) would comprise mainly of domestic waste that, if not collected and disposed properly would result in unsanitary conditions giving rise to health hazards to the workers and residents / visitors at the neighbouring residential and commercial areas. - If the hazardous wastes from construction waste / surplus from construction activity is not re-used or properly disposed off-site, it will cause adverse impacts such as providing habitats for disease vectors, creation of fire hazards, leaching of toxic matter and creating eyesore. Should this happen, it will jeopardise the public's safety and the ecosystem of the surrounding areas. - No solid waste will be generated upon completion of the reclamation works. 	<ul style="list-style-type: none"> - Waste generated by the workers camp should be collected and disposed at any approved landfill site. - Waste generated should be sorted out and reuse of usable material should be taken into consideration to reduce the volume of waste. Liquid wastes such as oil and grease, chemical solutions etc. shall be separated from other solid waste before disposal at the designated landfill site. - A policy on waste reduction and waste recycle should be adopted by the contractors in line with the National Solid Waste Policy. 	7-11 and 7-12 8-4 and 8-5
Schedule Waste	<ul style="list-style-type: none"> - Maintenance of machineries / heavy vehicles on-site / boats and ocean transportation during the construction stage will generate spent oil (SW305 and SW306) and appear as the prominent contaminants that could cause a significant detrimental impact to the water quality at the nearby area. 	<ul style="list-style-type: none"> - The waste oils shall be stored in 200 L drums and shall be collected by licensed scheduled waste contractor approved by DOE for recycling or disposal. - Temporary storage of the scheduled waste shall have 	7-12 to 7-14 8-5 and 8-6

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
	<ul style="list-style-type: none"> - Spent oil will release HAPs and VOC once exposed to extreme temperature, which will cause health hazard. - The use of chemical will pose a threat to the surrounding soil. - No schedule waste will be generated upon completion of the reclamation works. 	<p>an impermeable floor, bunded and covered with a simple structure of roofing to protect the container from the weather. The capacity of the containment shall be able to accommodate 110% of the volume of the largest container or 20% by volume of the scheduled waste stored in that area, whichever is the greatest. All containers must be labelled and routinely inspected for leaks in a regular interval.</p> <ul style="list-style-type: none"> - The storage area for scheduled wastes shall be enclosed on at least 3 sides, have adequate ventilation, be covered to prevent rainfall entering, be arranged so that incompatible materials are appropriately separated and a signboard should be set up with the word DANGER, painted with a letter size of 30 cm on a bright yellow background. 	
Water Quality	<p>1) Turbidity.</p> <p>Activities that can cause high turbidity during reclamation are:</p> <ul style="list-style-type: none"> • During sourcing of sand and dredging - the seabed disturbances will cause dispersion of sediment, thus turbid the surrounding water bodies. • During transportation of fill material - during transportation of fill material, accidental spillage of fine materials or oils along the way may occur unexpectedly. Seawater pollution is anticipated as the sand carrier used for transportation is able to transport a large batch of fill material per trip. This volume of fine material may cause spread of sediment plume along the route if any 	<p>1) Turbidity</p> <ul style="list-style-type: none"> - Construction of proper containment structure prior to the disposal of fill material. - Controlled operations with more environmental friendly and latest technology of dredgers. - Install silt curtain to enclose the sand source and reclamation area where necessary. - Regular water quality monitoring is essential to monitored the efficiency of silt curtain. 	7-14 to 7-20 8-6 to 8-8

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
	<p>accidental spillage happens.</p> <ul style="list-style-type: none"> • During filling process <ul style="list-style-type: none"> - The simulation of sedimentation dispersion pattern has been conducted in the hydraulic study using MIKE 21 models. - Sediment plumes originating from the reclamation operation were simulated in two scenario viz with silt curtain and without silt curtain during reclamation works. - The sediment plume patterns indicate that excess suspended sediment concentrations generated from the reclamation work found only at the project site and nearby. - The mean plume extent approximately up to 2.0km and 2.8km during neap tide with and without silt curtain at all sources respectively. - During spring tide, mean extent of sediment plume is 3.0km within and without silt curtain at all sources. - The maximum plume extent approximately up to 6.8km during spring tide with and without silt curtain; 3-3.5km during neap tide without and with silt curtain respectively. - The mean excess spill are expected to affect Pulau Menatang at about 500m to the west of the project site during neap tide. While during spring tide, estuary of Sg Umbai will experience higher excess spill concentration. - Contrarily, the mean spill concentration at others ESAs (Pulau Besar, Pulau Serimbun, Pulau Burong, Pulau Lalang, Estuary of Sg Punggor, Anjung Batu Jetty etc.) are generally insignificant. • Placement of rock revetment - will cause re-suspension 	<ul style="list-style-type: none"> - At the post reclamation stage, removal of the silt curtain shall be conducted by professional. Fine sediment must be removed before removal of silt curtain. - Placement of rock revetment shall be carried out with proper operating procedures. 	

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
	<p>of the bottom material resulting in increase in turbidity.</p> <p>2) Oil and grease.</p> <ul style="list-style-type: none"> - Oil and grease can cause lethal effects on fish; asphyxiation of benthic life forms; and adverse aesthetic effects of fouled shorelines. - Increase in oil and grease in water would be expected due to oily wastewater discharge from tugboats and sea vehicles, accidental oil spillage, discharge of bilge water from machinery spaces, fuel oil sludge and oily ballast water from fuel tanks. <p>3) Wastes (solid wastes, effluents and wastewater).</p> <ul style="list-style-type: none"> - Generally, base camp will only affect water quality if sewage, sullage and garbage are improperly discharged. - Sewage is characterised by high levels of biochemical oxygen demand (BOD), ammonia and E.coli count which will cause damage to river and sea life, foul smell and diseases, depletion of DO and algal eutrophication. - Small workforce of about 50 PE will produce 11.25m³ wastewater containing 2.8 kg/day and 3.4 kg/day of BOD₅ and SS. 	<p>2) Oil and grease</p> <ul style="list-style-type: none"> - In the event of oil spill, badly contaminated soil should be collected and properly disposed according to the Environmental Quality (Scheduled Wastes) Regulations, 2005. - No effluent or wastewater from the base camp shall be discharged into the sea without prior treatment. - Discharge of oily wastewater from sea vehicles engine room should be channelled into the oil separator. The waste oil should then be stored in slop tanks and managed as scheduled waste according to Environmental Quality (Scheduled Wastes) Regulations, 2005. <p>3) Wastes (solid wastes, effluents and wastewater).</p> <ul style="list-style-type: none"> - Providing sufficient number of mobile toilets and treating the effluent from the toilets and the sullage in self-contained septic tank system. - Leftover wastes should be collected by contractor and properly disposed off in landfill site approved by the local authority. Project management must handle garbage collection if outside the municipal area. - The wastewater discharges should comply with Standard A of Environmental Quality (Sewage) 	

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
	<ul style="list-style-type: none"> - Effluent treated to Standard A - 0.225 kg/day BOD₅ and 0.563 kg/day SS. - Improper disposal of various solid wastes will lead to the increase of debris in surface run-off, resulting in pollution of the receiving water bodies, the river or drain and eventually to the sea. <p>4) Nutrient</p> <ul style="list-style-type: none"> - Dislodging of soil sediments will lead to sudden release of products from biochemical breakdown of organics to the water bodies such as ammonia, phosphates and nitrates. - The release of chemically reducing compounds will exert an immediate oxygen demand which cause low DO and has the potential to cause some damage to the ecosystem. - Nitrogen, silicates and phosphates released to the water bodies will become available to promote algal growth and have prolonged effect compared to suspended sediment as nutrients may disperse longer in the water bodies. <p>5) Heavy metal</p> <ul style="list-style-type: none"> - Dredged material used as material filling will release heavy metal into the sea. - As the sediment is submerged, the concentration in 	<p>Regulations, 2009.</p> <p>4) Nutrients</p> <ul style="list-style-type: none"> - Frequent seawater quality monitoring during operation shall be conducted as to assist in identifying any adverse conditions resulted from unpredictable conditions and drastic increase of nutrients. - Unsuitable dredged materials should be disposed off at the designated dumping area only. The application of a reliable global position system (GPS) device will ensure exact positioning of vessels while releasing the dredged materials. 	

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
	water should already be in equilibrium with the concentration of heavy metal in the sediment.		
Air quality	<ul style="list-style-type: none"> - The machineries / equipments use for the reclamation works which emit gases such sulphur dioxide, carbon monoxide and hydrocarbons from the exhausts will produce particulate matter which may cause health impact to human and environment. - Release of black smoke due to incomplete combustion of fuels (especially solid fuels) and dust derived from various sources have significant visual effects on the environment. - No impact on air quality after completion of the reclamation works. 	<ul style="list-style-type: none"> - Water dampening operation - Speed limit of the moving traffic - Tyre washing operation - Proper approach on transporting construction material - Regular maintenance of equipment / machineries 	7-20 and 7-21 8-8 to 8-10

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
Noise level	<ul style="list-style-type: none"> - Noise generated during the works is mainly due to machineries and equipment. - Noise emission from the equipment is intermittent and exposure times are short. Hence the risk of hearing damage is insignificant. - Noise impacts during construction are mainly short term and confined to the period of works. - When completed, the main source of noise will be from the marine traffic / fishing vessels. Nevertheless, this impact is not expected to be significant. 	<ul style="list-style-type: none"> - Limit on the working hours - Vehicles speed limit restriction - Provision of proper hoarding 	7-21 and 7-22 8-10 and 8-11
Land traffic	<ul style="list-style-type: none"> - Construction activities will generate an increase in road traffic in the area during the construction especially at Jalan Melaka - Muar. - The comfort of the road users might also be affected with the implementation of this project. - Nevertheless, the impact is only temporarily during the construction phase and there will not be any increase to land traffic after completion of the reclamation works 	Movement of the construction vehicles at the nearby roads be scheduled away from peak hours to avoid traffic congestion	7-22 8-11
Marine traffic	<p><u>During pre-reclamation stage</u></p> <p>This phase is expected to draw only the occasional vessel for</p>	<p><u>During pre-reclamation stage</u></p> <ul style="list-style-type: none"> - The Project Proponent and the contractors shall 	7-23 to 7-25 8-12 to 8-16

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
	<p>survey, bathymetric and other preparatory requirement prior to the pre-reclamation stage. Therefore, there is little increase of vessel traffic due to the project activities.</p> <p><u>During reclamation stage</u></p> <p>1) Maritime traffic</p> <ul style="list-style-type: none"> - Reclamation works will probably draw barges, supporting vessels and tugs to the site. 	<p>communicate with Marine Department Melaka Tengah, Melaka Port Authority, Department of Fisheries Melaka and Persatuan Nelayan Melaka on project activities (especially marine spread activities) within the port limit and Proposed Project areas. At the same time, they shall send out early notification (2 weeks before commencement) of their activities to the Marine Department so that “Notice to Mariners” can be issued in a timely manner.</p> <ul style="list-style-type: none"> - Physical presence of permanent anchorage or platforms are to be registered and marked on Admiralty Chart to ensure mariners are aware of the project. - Mitigation measures are also in the form of good site practices shall be carried out to avoid encroachment and any further disturbance to sensitive marine species. - Highly visible and lighted buoys are to be stationed at the project site to warn other users particularly fishermen of the project site and activities to avoid encroachment. <p><u>During reclamation stage</u></p> <p>1) Maritime traffic</p> <ul style="list-style-type: none"> - All involved vessels shall get permission from Marine Department Malaysia and the Project Proponent and its contractors shall send out at least 2 	

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	<ul style="list-style-type: none"> - It is expected that there will be an additional traffic movement of about 4 to 8 vessels per day. - Directly impact the operation of Umbai jetty and the fishermen jetty and cause marine traffic congestion and increase the risk of collisions or close quarter's situation. <p>2) Fisheries activities</p> <ul style="list-style-type: none"> - Reclamation work may cause sedimentation and deposition of total suspended solid that will smother the seabed, causing change in the ecology of the seabed and its living organism. - Fisheries activities in the vicinity may be affected and there will be partial loss of fishing ground within the project area - Once the operation started, it may dissipate school of fish and there will be risk to the nets like cut by passing vessels. - The additional vessels in the project area may cause 	<ul style="list-style-type: none"> weeks early notification of their activities to the Marine Department so that "Notice to Mariners" can be issued in a timely manner. - It is compulsory for vessels to install Automatic Identification System (AIS) and Dredging & Dumping Monitoring System (DDMS) to record traversing path. - Vessels shall be maintained frequently to prevent unnecessary break down. - Dredgers and supporting vessels (if any), shall follow planned route to minimize disturbance to normal traffic in the area. <p>2) Fisheries activities</p> <ul style="list-style-type: none"> - Project proponents will liaise with the Dept. of Fishery and LKIM on the project to warn fishermen in good time (2weeks) not to encroach into the project vicinity. - Alternative arrangement to be discussed with the fishing community to assist with the loss of fishing opportunity. - Vessels passing fishing boats to do so at slow speed to avoid toppling these boats. - Project vessel will not cut fishing nets and avoid them 	

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
	<p>congestion and the movement of working vessels may limit the fishing ground.</p> <ul style="list-style-type: none"> - Therefore, local communities who depend on fish and other marine life for their source of income may be forced to find alternative fishing ground and it will increase their operational cost. <p>3) Anchoring - physical environment</p> <ul style="list-style-type: none"> - Will cause anchor scour which typically remain evident on seabed for a considerable period of time. - Anchoring operation may occasionally result in creations of larger craters/depression in seabed if anchor raising operations disturb seabed to such an extent as to cause defluidation (release of shallow liquid or gas). <p>4) Anchoring - underwater noise</p> <ul style="list-style-type: none"> - Disturbs marine animal behaviour or psychology (very loud noise source). - Affects native marine mammal population. - Underwater noise includes typical supply vessels and guard vessels even though they are semi-continuous noise sources <p>5) Activities using tugboats and barge positioning – noise</p> <ul style="list-style-type: none"> - Long exposure to high noise level (> 60 dBA) could 	<ul style="list-style-type: none"> - As a last resort some form of compensation will be appropriate to cover the loss of fishing ground, opportunity, catch and extra distances to get to other fishing grounds. <p>3) Anchoring - physical environment</p> <ul style="list-style-type: none"> - The Project Proponent should monitor the detailed route planning of vessels movement and the anchorage activities to prevent any damage to the environment. <p>4) Anchoring - underwater noise</p> <ul style="list-style-type: none"> - The Project Proponent and contractors must adhere to related guidelines to ensure fish and other marine life are absent from the immediate vicinity of the project area <p>5) Activities using tugboats and barge positioning – noise</p>	

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
	<p>possibly cause temporary noise induced hearing loss and could lead to becoming permanent hearing loss if continuous exposure is sustained.</p> <p>6) Activities using tugboats and barge positioning – air pollution</p> <ul style="list-style-type: none"> - Burning process in marine diesel engines and boilers of supporting vessels will produce air pollutants which will give health impact, deplete the ozone layer, enhance the greenhouse effect and produce acid rain. <p>7) Activities using tugboats and barge positioning – hydrocarbon spills</p> <ul style="list-style-type: none"> - Spills of fuels, lubricants and hydraulic fluids may result in visible surface sheen on sea surface which further pose a threat to the locality and mortality of marine organisms. - They might face breathing problems as oxygen cannot dissolve into the water that is covered by oil slicks. - The extent of the pollution depends largely on the size of leak and durations. <p><u>During Post-Reclamation and Development Phase</u></p> <p>It is expected that there will be an increase of recreational</p>	<ul style="list-style-type: none"> - It is advisable for workers to use sound protection gear or ear muffs in order to avoid any negative impact to them. - Regular maintenance is necessary to ensure the instruments and machines are in good condition. <p>6) Activities using tugboats and barge positioning – air pollution</p> <ul style="list-style-type: none"> - Constant monitoring of air pollutants emissions and the regular servicing of engines, generators and compressors shall be carried out. <p>7) Activities using tugboats and barge positioning – hydrocarbon spills</p> <ul style="list-style-type: none"> - All the required equipment that will be used to follow the Local Emergency Oil Spill Response Plan and the National Emergency and Oil Spill Contingency Plans during operation. <p><u>During Post-Reclamation and Development Phase</u></p> <p>Project proponent and the related authorities should be</p>	

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	boating with the existence of residential, commercial, light industrial properties and resorts along the coastline of Umbai area.	well trained in handling catastrophic incidents.	
Social impact assessment	<p><u>Local Community Perception On The Impacts of the Project During Construction</u></p> <ul style="list-style-type: none"> - Declining fishermen's income - Destruction of clam culturing - Degradation to the ecosystem - Environmental pollution - Risk to fishing activities - Loss in natural aesthetic beauty of coastal landscape - Influx of foreign workers - Locals have to compete for employment opportunities - Employment opportunities for all <p><u>Local Community Perception On The Impacts of the Project During Project Operation Phase</u></p> <ul style="list-style-type: none"> - Loss of fishermen's income will continue - Destruction of clam culturing 	<p><u>Mitigation Measures for Job and Business Opportunities to Local Communities</u></p> <ul style="list-style-type: none"> - The boost in local economy would only be effective if a portion of the labour required is recruited from the local communities. - Local contractors and sub-contractors should be given similarly some priority in project construction. <p><u>Mitigation Measures for Livelihood Security</u></p> <ul style="list-style-type: none"> - Compensation shall be to the affected parties. - To facilitate grievance resolution, particularly among the fishing communities, representatives each from the local Persatuan Nelayan Units within the ZOI should be appointed by the Project Proponent during the reclamation duration to act as liason with the fishing community. - It is proposed that a meeting between the local fishermen association units, the state fishermen's association, LKIM and other related agencies with the project proponent be held to work up a plan of monitoring of reclamation works, long term compensation scheme for loss of fishing areas, and 	7-25 to 7-34 8-15 to 8-16

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
	<ul style="list-style-type: none"> - Locals have to compete for employment opportunities - Employment opportunities for all - Increase in visitors and tourist - Expectation of rise in real estate values - Villagers' felt that they be marginalised - Housing and accomodation project beyond means of local community - Influx of foreign residents - Predominance presence of Chinese citizens - Local culture and norms will disintegrate - Negative influence on local cultural values - Increase in crime rate - Increase in social problems 	<p>job and business opportunities.</p> <ul style="list-style-type: none"> - Local communities should be prioritised for undertaking business ventures such as operating worker's canteen or the general sales of local produce and prepared food in proper kiosks at strategic points nearby the construction area during the construction period. - The activities that could cause nuisance to the public such as noise pollution emitted from vessels and boats, heavy machinery and piling works should be avoided or minimized. 	

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
<p>Marine ecology, fisheries and aquaculture</p>	<p>1) Impact on marine productivity</p> <ul style="list-style-type: none"> - Based on hydraulic study: <ul style="list-style-type: none"> • No significant changes in mean current speeds during both northeast and southwest monsoon - impacts negligible • Mean sediment plume dispersion of 150mg/L to 2.8km during neap tide & 3km during spring tide, 240 – 1,500mg/L within vicinity of proposed reclamation area – exceeded recommended safe limit of <80mg/L - Potency for fish fauna to be disturbed by noise & vibration of motors or heavy construction work & vessels movement during dredging works 	<p>1) Marine productivity</p> <ul style="list-style-type: none"> - Installation of Fish Aggregating Devices (FADs) for artisanal and recreational fishing - Installation of habitat enrichment infrastructure - deployment of artificial reefs and construction of eco-engineered structures for habitat enhancement & creation - Sea ranching to enhance coastal food chain/web - Fisheries Research Fund - the Project Proponent shall make contributions to the Fisheries Research Fund to be utilized by Department of Fisheries and/or LKIM for the advancement of the fishing industry in 	<p>7-64 to 7-80 8-16 to 8-25</p>

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
	<p>2) Impact on marine habitat</p> <ul style="list-style-type: none"> - Loss of foreshore area & mudflat as fisheries habitat <ul style="list-style-type: none"> • Permanent lost of original physical and biological resources - Mangrove: <ul style="list-style-type: none"> • Based on hydraulic study - High sedimentation is expected to occur in mangrove area particularly at Pernu (T6 & T7) and Umbai (T8 & T9) • Erosion may cause destabilization of the river bank - Coral Reef: <ul style="list-style-type: none"> • Based on hydraulic study – The extent of sediment plume does not reach all the islands within 5km radius • Movement of boats and barges carrying materials into reclamation site potentially create wake (induce turbidity) - Marine Turtle Landing <ul style="list-style-type: none"> • Potency to be affected by noise & vibrations generated from the reclamation activities • Confusion due to artificial light from barges & earthwork machinery • Confusion due to the shifting of topography horizons • Confusion of plastics bag from potential of discharge solid wastes (litter) into receiving waters as foods 	<p>Melaka</p> <p>2) Marine habitat</p> <ul style="list-style-type: none"> - Mangrove replanting and monitoring programme - Installation of habitat enrichment devices for coral reefs - Funds for turtle-related research or conservation efforts should be allocated by the project proponent 	

Significant Potential Impact	Magnitude of Significant Potential Impact	Pollution Prevention and Mitigating Measures (P2M2)	Reference Page
	<p>3) Impact on fisheries and aquaculture</p> <ul style="list-style-type: none"> - Loss of fishing and nursery grounds <ul style="list-style-type: none"> • Potency to affect fishery activities – decrease in fish landings • Increasing risk of collisions & boat and fishing nets damages due to continuous movement of dredgers & barges and pipeline location on seabed • Increasing fishing cost & fishing effort • Possibility of conflict of interest between fishermen - Mussel farming <ul style="list-style-type: none"> • Potency to be affected by high sedimentation especially those operated within reclamation footprint - Recreational fisheries <ul style="list-style-type: none"> • Potency of affecting the angling activities especially boat-based angling at coastal area & shore-base angling at Umbai 	<p>3) Fisheries and aquaculture</p> <ul style="list-style-type: none"> - Suitable compensation/ex-gratia for fisherman - Ensuring that fishermen access to sea will not be obstructed at any time - Provision of employment opportunities - Encourage recreational fishing by providing designated areas for anglers 	
Abandonment	<ul style="list-style-type: none"> - The abandonment of the proposed project will cause the situation to be as it is presently - If the reclamation works has started, some of the sea bed would have been touched and affect the aquatic life. 	<ul style="list-style-type: none"> - A proper abandonment plan shall be prepared appropriately to ensure all measures are taken care off. - If the abandonment occurs during construction, all equipments shall be removed from the site. - For any scheduled wastes and solid / liquid wastes available at the site, they must be disposed off in the correct manner at the specified approved areas. 	7-81and 8-25

7.3 Based on the economic evaluation impact finding, **Table 9** summarised the economic loss due to the proposed project.

Table 9: Economic Loss

Description	Estimated number of years of impact	RM/year
Loss of mudflat	Permanent	(8,279)
Incremental fuel cost-fishermen	At least 10 years	(2,122,093)
Total incremental cost of nets repair/replace (RM/year)-fishermen	At least 10 years	(122,111)
Total incremental cost of boat/engine maintenance (RM/year)-fishermen	At least 10 years	(172,778)
The Opportunity Loss from Increment of Working Hour by Fishermen	At least 10 years	(3,358,110)
Annual Incremental cost of transportation-middlemen	At least 10 years	(391,930)
Net total income loss of mussels aquaculture per year (RM/year)	50 years	(83,904)
The net economic loss for restaurant owners	At least 10 years	(226,748)
Reduction in anglers 'consumer surplus'	During 2 years construction	(3,707)
Local willingness to pay (WTP)	During 2 years construction	(634,183)

8.0 ENVIRONMENTAL MANAGEMENT PLAN (EMP)

8.1 The main objective of the EMP is to outline and to ensure that the mitigating measures recommended in the EIA report are incorporated into the final project planning and implemented on the ground.

8.2 Normally, an EMP will require the project proponent and the implementing body to undertake the following actions and responsibilities.

8.3 An EMP shall consist of an Environmental Monitoring Programme, Environmental Management Unit and Emergency Response Plan. The main function of these components is to allocate the responsibility of each party for planning, monitoring and undertaking the mitigating measures proposed during the construction and operation stages.

8.4 The proposed monitoring programme during the construction phase and operational phase are shown in **Table 10**.

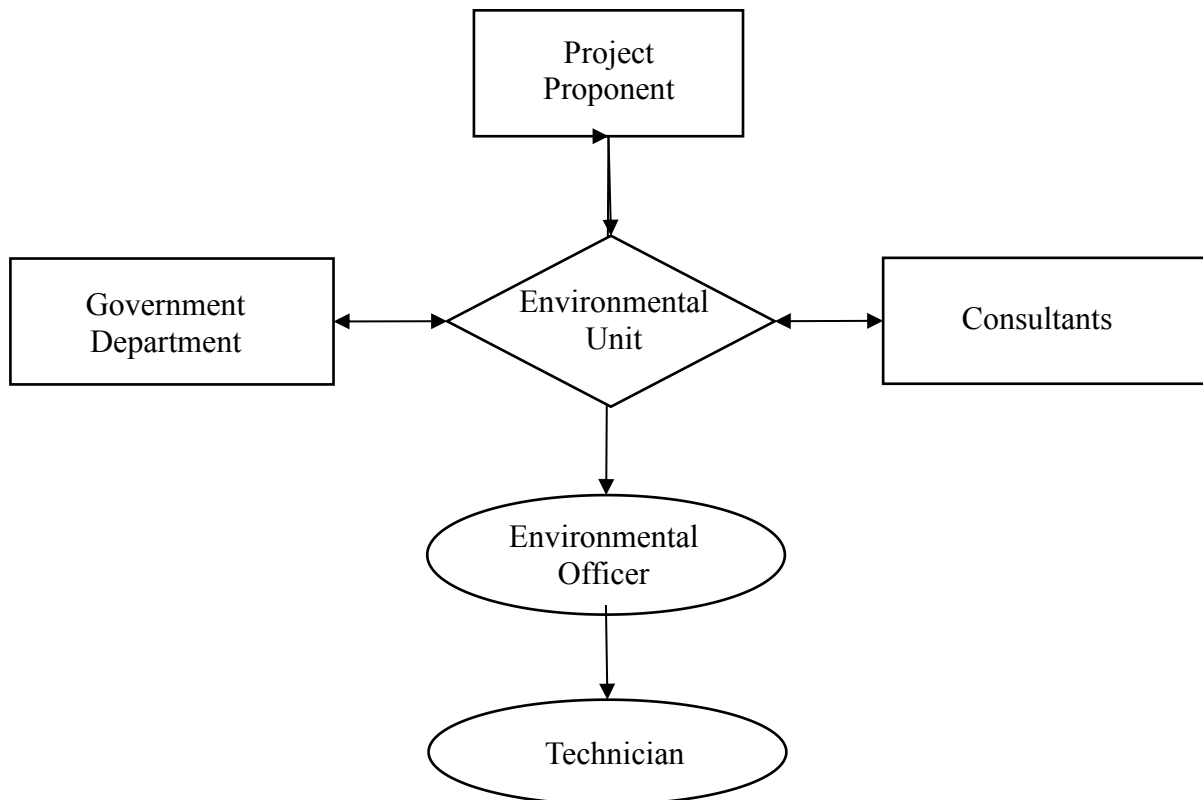
Table 10: Details of the Monitoring Programme

Pre-Construction Phase	During Construction Phase	Post Reclamation Phase
<ul style="list-style-type: none"> - Shoreline monitoring has to be conducted prior to the start of the reclamation works as required by the DID. - The results of this exercise will be the baseline data which will be used as an indication to determine the effectiveness of the mitigation measures implemented during the construction phase later. 	<ul style="list-style-type: none"> i. Marine Water Quality Monitoring <ul style="list-style-type: none"> - To be taken only at the area where there are works on-going. One grab sample should be taken by the project proponent for every 100m of working area, inside and outside of the silt curtain. - Frequency: once a month throughout the construction period - Parameter: temperature, DO, TSS, oil and grease, Hg, Cd, Cr, Cu, Ar, Pb, Zn, CN, NH₃, nitrite, nitrate, phosphate and faecal coliform. ii. River Water Quality Monitoring <ul style="list-style-type: none"> - To be conducted monthly - The parameters to be tested shall be in accordance to the Interim National Water Quality Standards (INWQS) iii. Air Quality Monitoring <ul style="list-style-type: none"> - Sampling works is proposed to be taken at quarterly interval or earlier should it be required by the DOE - Parameter: TSP iv. Noise Level Monitoring <ul style="list-style-type: none"> - Sampling works is proposed to be taken at quarterly interval or earlier should it be required by the DOE - Parameter: Leq, Lmax, Lmin and Ln v. Periodic Shoreline Monitoring <ul style="list-style-type: none"> - Every three (3) months throughout the construction period. vi. Biological Monitoring <ul style="list-style-type: none"> - Quarterly during the reclamation phase - Parameter: density and diversity of 	<ul style="list-style-type: none"> - Shoreline monitoring is required to be carried out every six (6) months after the project completion. The monitoring can be discontinued if the survey profile is found to be stable for three (3) years after completion of the project (subject to agreement by the DID). - Upon completion, fisheries monitoring shall be continuously monitored for at least another two quarters.

Pre-Construction Phase	During Construction Phase	Post Reclamation Phase
	phytoplankton, zooplankton, macrobenthos and fish fauna vii. Fisheries Monitoring - Quarterly during the reclamation phase - Shall examine landings in terms of volume and speciation. This shall be undertaken through interviews with selected fishermen as well as data collected from the Department of Fisheries.	

8.5 The proposed Environmental Management Unit (EMU) is shown in **Figure 7**.

Figure 7: Environmental Management Unit (EMU)



8.5 The Emergency Response Plan for the project is detailed in **Appendix IV** of the EIA report. It will be further enumerated in the EMP following the approval of the EIA of this project as standard procedure.

8.6 The Safety Plan is prepared particularly for vessels involved in the project. This plan provides a layout of the vessel, the location of all safety appliances (e.g. fire extinguishers, life jackets, life rafts and first aid boxes) on board the vessel. All personnel are required to be familiar with the safety plan. The safety plan is posted at several locations on board the vessel frequented by the crew (e.g. the mess room, corridor and staircase).

9.0 STUDY FINDINGS

9.1 The EIA study has identified the likely impacts on the environment as well as various measures to mitigate or control these impacts. Various alternatives for the project development have been considered in **Chapter 4** including the ‘No-Project option’ as detailed in **Table 4**.

9.2 In a nutshell, based on the study done, the main environmental impacts that need high attention are the water quality, the hydraulic and hydrodynamics as well as the marine habitats and fisheries. These impacts are foreseen to be critical during the project implementation which involves reclamation works. Nevertheless, with proper mitigation measures in place, the impacts shall be able to be controlled and alleviated.

9.3 The completion of the project will have a positive impact especially to the commercial and tourism industries of the State. With careful planning and good construction and management practices, the proposed project is not expected to result significant adverse economic environmental impacts to the surroundings but rather its implementation will contribute to the development of the State in general