#### **Biological Environment** 6.3

#### 6.3.1 **Terrestrial Ecology**

Areas surrounding the Project site are already developed and urbanized with industrial establishments, mixed development, recreational establishments and various infrastructures. This establishment has taken over most of the surrounding areas along Pantai Pengorak and all the way towards Jalan Tanjung Gelang, hence not much areas are left with natural vegetation.

Nonetheless, notable locations still covered with vegetation were observed during site visit where natural vegetation was still intact, even though very much in disturbed form. With the stretch of coastline affected by the proposed Project is estimated about 4 km long, the adjacent areas with natural vegetation are as follow:

- Fringing beach vegetation at Pantai Pengorak
- Remnants of mangrove at river mouth of Sg Pengorak (about 1.4 ha) .
- Secondary forest at Bukit Tanjung Gelang (about 122.0 ha)

Site visit was carried out in December 2016 to observe flora and fauna found along the stretch of coastlines within the vicinity of the Project site. Due to the nature of the Project, there is no necessity for the removal of vegetation except for some of the beach vegetation.

Observations mainly focused on the immediate area around the Project site. Generally, the floral and faunal species found within the proposed site are commonly found at coastlines of Malaysia. Floral and faunal species reported are tabulated in Table 6.3.1 to Table 6.3.4.

#### 6.3.1.1 Fringing beach vegetation at Pantai Pengorak

The floral species observed were those immediate to the Project area. Most abundance were the beach shrubs, among noted are Scaevola taccada (merambong) and Pemphis acidula (mentigi). Also observed were Terminalia catappa, Casuarina sp, Cocos nucifera, several palm species and broad leaf coastal vegetation. Other vegetation were dense shrubs and grasses including Melastoma malabathricum, Dillenia sufruicosa, Vitex pubescens, Imperata cylindrica, and Ischaemum magnum.

No faunal species was observed at the beach area except for some stray dogs.

#### 6.3.1.2 Mangroves

The frequency of tidal inundation is a vital factor that influences the substrate conditions and also the species composition in mangrove forest. Short strip mangrove vegetation can be found at the river mouth of Sg Pengorak. Due to development along Sg Pengorak, most of the mangrove along the river has been cleared and filled hence making the mangrove area concentrated within the river mouth. Among the mangrove species found here are Avicennia sp. (api-api), Sonneratioa alba (perepat) and



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*Rhizaphora apiculatta* (bakau minyak). *Nypa fruticans* can also be observed. *Sonneratia alba* is a pioneer mangrove species. *Sonneratia* can tolerate wide fluctuations in salinity and often grow on exposed but stable mud banks low on the tidal mudflats. Being among the first trees to grow on the tidal mudflats, *Sonneratia* stabilize the riverbanks and coasts, providing more favourable ground for other types of tree and plants. Being able to tolerate saltwater, *Avicennia* are among the first mangrove trees to colonise mud and sandbanks which are regularly flooded by seawater / brackish water. Thus the trees stabilise the shores and banks, preventing erosion and allowing other plants to grow. *Rhizophora* grow best in wet, muddy and silty sediments.

During site visit, a few locals were seen collecting their traps at the mangrove area of Sg Pengorak. The catch observed was common Myna hill, *Gracula religiosa*. Also observed was a monitor lizard hunting for food at the river mouth of Sg Pengorak. On the mud-flats, fidler crab-species such as *Uca* spp. and also the mudskippers (*Bolephthalmus* sp.) and *Poleophthalmus scholosseri* were observed.

Though not observed during site visit, it is expected that long-tailed macaques (*Macaca fascicularis*) can be found here. On a more stiff clay soil of the mangrove floor, mud crabs such as *Sesarma* spp., *Chiromanthes* spp. mud lobsters (*Thalassina anomala*) are quite common.

### 6.3.1.3 Bukit Tanjung Gelang

Being a secondary forest near to the shoreline, the commonly faunal species expected in the area (include small mammals such as the common treshrew (*Tupaia glis*), *p*lantain squirrel (*Callossciurus notatus*), slender squirrel (*Sundasciurus tenuis*). Other mammals include common palm civet (*Paradoxurus hermaphrodites*), primates (*Macaca sp.*) and wild pig (*Sus scrofa*).

From the result of the survey, it can be summarized that this area has been much disturbed. The habitats and its floral and faunal species composition in this area can be well represented in many other areas of similar ecological system in Pahang and other parts in Malaysia.

Location	Malay Name	Scientific Name
Mangrove along Sg Pengorak	Ara	Ficus sp.
	Ambong-ambong	Scaveola frutescens
	Api-api	Avicenia alba
	Bakau Minyak	Rhizopora apiculata
	Batai Laut	Albizzia retusa
	Bedara Laut	Ximenia americana
	Beluntas	Ageratum conzoides
	Beringin	Ficus benjamina
	Berembang	Sonneratia alba
	Bidara	Colubrina asiatica
	Buta-buta	Exocaria agollocha

Table 6.3.1: Malay and Scientific Names of Plant Species found at Project Site



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Location	Malay Name	Scientific Name
	Jering Liar	Pithecellobium clyperia
	Kelapa	Cocus nucifera
	Kelat Laut	Eugenia grandis
	Ketapang	Termanalia catappang
	Mempat	Cratoxylon formosum
	Menasi	Planchonella obovala
	Mengkudu	Morcrida citrifolia
	Mensirah	llex cymosa
	Otak Udang	Buchanania lucida
	Pandan Laut	Pandanus littoralis
	Pari-pari	Pongamia pinnata
	Penaga Laut	Callophyllum inophyllum
	Pong-pong	Cerbera odullum
	Pulai	Alstonia angustifolia
	Putat	Baringtonia asiatica
	Simpoh	Dellenia excelsa
	Teban Putih	Palaquium obovata
	Teruntum	Lumitzere littorea
	Xyireh	Xylocarpus malaccencis
Along the beach area	lalang	Imperata cylindrica
	pulut-pulut	Urena lobata
	kemuncut	Chrysopogon aciculatus
	pokok kapal terbang	Eupatorium odoratum
	Pokok Kipas	Livistonia chinensis
	Paku jarum	Pyrrosia longifolia
	Rhu	Casuarina sumatrana
	Ketapang	Termanalia catappang
Secondary forest, fronting the	Ambong-ambong	Scaveola frutescens
beach area	Akasia	Akasia filiformis
	Baru-baru	Hibiscus tiliaceus
	Buas-buas	Premna corymbosa
	Hujan-hujan	Enternolobium saman
	Kacang-kacang	Aegiceras corniculatum
	Kelapa	Cocus nucifera
	Ketapang	Termanalia catappang
	Pari-pari	Pongamia pinnata
	Rhu	Casuarina sumatrana

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Location	Malay Name	Scientific Name
	Riang Batu	Begonia maxwelliiana
	Rumput Gajah	Panicum maximum

# Table 6.3.2: Birds Around Proposed Project Site

Scientific Name	Local Name	Status
Corvus enca	Crow	С
Gracula religiosa	Common myna hill	С
Steptopelia chinensis	Spotted dove	С
Chalcophaps indica	Green-winged pigeon	Р
Amourornis phoenicurus	White-breasted water hen	Р
Acridotheres tristis	Common myna	С
Ploceous philipinus	Baya weaver	С
Spilornis cheela	Crested serpent eagle	Р
Gallus gallus	Red junglefowl	Р
Prinia flaviventris	Yellow-bellied prinia	С
Copsychus saularis	Magpie robbin	С

# Table 6.3.3: Wildlife around at Bukit Tanjung Gelang

Scientific Name	Local Name	Status
Sus scrofa	Wild pig	Р
Paradoxurus hermaphroditus	Common palm civet	Р
Tupaia glis	Common treeshrew	С
Callosciurus tenuis	Plantain squirrel	С
Sundasciurus tenuis	Slender squirrel	С
Macaca fascicularis	Long-tailed maccaque	С
Phyton reticulatunas	Phyton	Р
Naja naja	Common cobra	С
Dryophis prasinus	Racer	С
Varanus salvator*	Monitor lizard	Р
Mabuya multififasciata	Sun lizard	С



Scientific Name	Common Name	Status
Boleopthalamus sp.*	Mudskipper	С
Centropus sinesis	Common coucal (But-but Carik Anak)	С
Chiromanthes sp.	Mudcrab	С
Cpoyschus saularis*	Magpie robin	С
Halycom chloris	White-collared Kingfisher	Р
Lutra sumatrana	Hairy-nosed otter	Р
Macaca fascicularis	Long-tailed maccaque	С
Nectarinia sp.	Sun-bird	С
Poleophthalamus scholasseri	Giant mudskipper	С
Presbytis cristata	Silvered leaf-monkey	Р
Scylla serrata	Ketam Bakau	С
Sesarma sp.	Mudcrab	С
Streptopelia chinensis	Punai	С
Thalassina anomata	Mud lobster	С
Uca spp.*	Fiddler crab	С
Varanus sp.	Monitor lizard	С

### Table 6.3.4: Faunal species at Mangrove Area

Note: \* Observed

Note: Status according to the Protection of Wildlife Act (1972)

P - Protected species

C - Common and/or abundant species

## 6.3.1.4 Potential Impact

As the nature of the proposed Project does not involve any removal of vegetation, except for beach vegetation near Pengorak Beach, insignificant impact can be anticipated on the ecological components for both flora and fauna around the Project site. The fringing vegetation at the beach is commonly found and also there is no rare flora and fauna species involved. For the mangrove at the river mouth of Sg Pengorak to thrive, negligible impact in which less than 5% of the area would be affected, is expected during operation as drainage will be provided to ensure the salinity concentration as well as tidal flow between the upstream of the river and the adjacent sea is maintained. During reclamation and construction, it vital to ensure no blockage of the flow between the Sg Pengorak and the sea to ensure the tidal flow is maintained. Also based on the hydraulic report, insignificant impact to the sedimentation and erosion is expected at Sg Pengorak river mouth hence negligible impact is expected on the mangrove.



# 6.3.2 Marine Ecology

# 6.3.2.1 Benthic Community

Macrobenthos are classified as marine invertebrates that retained by 500 micron mesh size of sieve include annelids, molluscs, crustaceans, echinoderms, cephalochordates and nemerteans (Eleftheriou and Moore, 2005). The benthic fauna live in or on the bottom substrates, and play important role in the food chain of marine ecosystem. Macrobenthos have also significant role in sediment stability and geochemistry thus regarded as useful tool for biological assessments of marine environment (Thompson & Lowe, 2004; Ping, 2000).

Macrobenthic fauna were collected from six (6) sampling points (see **Figure 6.2.9** and **Table 6.3.5**). Bottom substrates of the sampling points comprised silt and sand.

Station	Coordinates	Description
ME1	3° 56' 2.24"N 103° 23' 5.62"E	Near estuary of Sg. Balok
ME2	3° 57' 25.83"N 103° 26' 42.26"E	Near to Kuantan Port
ME3	3° 55' 25.57"N 103° 26' 54.95"E	Open sea about 3km east of the proposed reclamation area, anticipated to be outside the zone of influence
ME4	3° 56' 28.09"N 103° 25 45.34"E	Open sea at 2km distance from the proposed reclamation area
ME5	3° 57' 35.79"N 103° 24' 45.79"E	At the reclamation area
ME6	3° 57' 53.17" N 103° 24' 45.79"E	Near estuary of Sg Pengorak

Table 6.3.5: Benthic and Plankton Monitoring Locations

Macrobenthos were collected by using a 40-kg Van Veen grab sampler that captures an area of 0.1 m<sup>2</sup>. The sampler was operated manually from the anchored boat. Three samples were collected from each sampling point and they were composited into one sample. The samples were screened using a 500 micron sieve, and subsequently put into containers containing 5% buffered formalin. Few drops of Rose Bengal solution were added into the samples for staining of macrobenthos to facilitate sorting and specimen identification. Macrobenthos were identified to the practical taxonomic level using the following guides; annelids (Fauchald, 1977; Ping, 2000), molluscs (Oliver, 2004; Hardy, 2013), crustaceans (Brusca *et al.*, 2001; Lowry & Springthorpe, 2001; Keable *et al.*, 2002), and echinoderms (Ruppert & Barnes, 1994). Nonetheless, some studies noted that identification at family-level is sufficient for assessment of the effects of pollution and disturbance on benthic communities (Ferraro & Cole, 1990; Somerfield, & Clarke, 1995; Gesteira *et al.*, 2003; Mendes *et al.*, 2007).

Species diversity of macrobenthos at each sampling point was measured using Shannon's index, Margalef's index and evenness index (Ludwig & Reynolds, 1988; Hammer *et al.*, 2001). Number of taxa and abundance recorded in 1994 (preliminary data) were compared with the present data using independent t-test (Zar, 1999).

# **Findings and Discussion**

In total, 39 species from 29 families and 6 classes of macrobenthos comprising annelids, arthropoda, molluscs, echinoderm and chorrdata were recorded. No species is listed in the Threatened Species of International Union for the Conservation of Nature Red List (IUCN). Polychaetes, malacostraca and ophiuroidea constituted 58.6%, 24.1% and 7.1% of the total taxa collected, respectively (**Table 6.3.6**). The polychaete (Cirratulidae and Spionidae) were the most abundant with the percentage of 19.5% and 9%, respectively. In comparison, other taxa were less abundant and found only at a few sampling points. Some studies showed that polychaetes, crustaceans and molluscs are also dominant in most marine habitats (Warwick & Ruswahyuni, 1987; Denisenko *et al.*, 2003; Barrio Froján *et al.*, 2005).

Class	Number of taxa (%)	Abundance (individuals/m <sup>2</sup> )
Polychaeta	17 (58.6%)	466 (72.8%)
Malacostraca	7 (24.1%)	104 (16.2)
Ophiuroidea	2 (7.1%)	23 (3.7%)
Clitellata	1 (3.4%)	29 (4.5%)
Bivalvia	1 (3.4%)	12 (1.9%)
Chordata	1 (3.4%)	6 (0.9%)
Total	29	640

Table 6.3.6: Composition and abundance of macrobenthos from 6 monitoring points.

Total number of taxa at 6 monitoring points was ranging from 4 at ME6 to 18 at ME1, whereas the abundance was in the range of 41 individuals/m<sup>2</sup> at ME4 to 205 individuals/m<sup>2</sup> at ME3 (**Figure 6.3.1**). The two metrics were incorporated into Shannon's diversity index, which ranging from 1.025 at ME6 to 2.753 at ME1. Values of evenness index (range: 0.661 - 1) at each sampling point are showed in **Table 6.3.7**.

The results indicated that taxa richness of macrobenthos within and around the propose reclamation area was low, and the distribution of each taxa was patchy. In term of fauna composition, the result is similar to other past studies conducted in the region. For example, marine habitats in northern Straits of Malacca are dominated by polycheates, whereas habitats between Penang Island and Selangor waters are dominated by amphipods and ostracods (Ryon Siew, 2007). The most dominant macrobenthos recorded from Karah Island in Terengganu are also the polychaetes and crustaceans (Ibrahim *et al.*, 2006).

Generally, the species richness as indicated by Shannon-Wiener diversity index were comparable between stations with highest diversity at ME1 (H'=2.753) and lowest diversity at ME6 (H'=1.025). Overall, diversity of communities were very high (H'>2.00) with exception of ME6 (H'=1.025), ME3 (H'=1.522) and ME4 (H'=1.759) which were less diverse (**Figure 6.3.1**). Similar consistency between station was also shown in the evenness of species distribution as indicated by Pielou's index with highest index value at ME5 (J=1.0) and lowest at ME3 (J=0.66). Generally, the communities can be



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considered evenly distributed with most stations having index value close to 1. Lower evenness of distribution as in ME3 (J=0.66) and ME6 (J=0.74) may have been caused by disproportionate abundance of some taxa particularly the higher abundance of Annelida (Cirratulidae and Spionidae) and Arthropoda (Paguridae) relative to the much lower abundance of taxa from other phyla. Overall diversity was 3.00 which was higher than diversity at control station (H'=2.60). Diversity study is often met with taxonomic difficulty. Therefore, the diversity of macrobenthos in this survey may have been underestimated as many specimens were not able to be identified to species level, nonetheless, these data are useful for spatial comparison between stations and may serve as future reference and baseline information for ongoing survey at the site.





Figure 6.3.1: Charts show total number of taxa, abundance (individuals/m<sup>2</sup>) and Shannon's diversity index recorded from 6 sampling points.

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Phylum/Class	Family	Species	ME1	ME2	ME3	ME4	ME5	ME6
Annelida/ Polychaete	Aphroditidae	Harmothoe sp.	0	6	0	0	0	0
Annelida/ Polychaete	Pilargidae	Synelmis albini	0	0	0	6	0	0
Annelida/ Polychaete	Pilargidae	Sigambra tentaculata	6	0	6	6	6	0
Annelida/ Polychaete	Hesionidae	Syllidia armata	0	0	0	0	6	0
Annelida/ Polychaete	Syllidae	<i>Syllis</i> sp.	6	0	0	0	0	0
Annelida/ Polychaete	Nereidae	Platynereis sp.	0	0	0	0	6	0
Annelida/ Polychaete	Nephtyidae	Nephtys cirrosa	0	0	28	6	0	0
Annelida/ Polychaete	Lacydoniidae	Paralacydonia paradoxa	0	11	0	0	0	0
Annelida/ Polychaete	Glyceridae	<i>Glycera</i> sp.	6	0	6	0	0	0
Annelida/ Polychaete	Eunicidae	Marphysa adenensis	0	0	0	0	6	0
Annelida/ Polychaete	Eunicidae	Dorvillea sp.	6	6	0	6	0	0
Annelida/ Polychaete	Eunicidae	Drilonereis sp.	11	0	0	0	6	0
Annelida/ Polychaete	Spionidae	<i>Spio</i> sp.	11	0	0	0	0	0
Annelida/ Polychaete	Spionidae	Prionopsio malmgreni	28	6	0	6	0	0
Annelida/ Polychaete	Spionidae	Laonice cirrata	0	6	0	0	0	0
Annelida/ Polychaete	Magelonidae	Magelona cincta	6	6	0	0	0	0
Annelida/ Polychaete	Cirratulidae	Cirratulus sp.	0	6	119	0	0	0
Annelida/ Polychaete	Orbiniidae	Scoloplos sp.	17	11	0	0	6	0
Annelida/ Polychaete	Paraonidae	Paraonis gracilis	6	6	0	0	0	0
Annelida/ Polychaete	Capitellidae	Notomastus sp.	0	0	0	0	0	6
Annelida/ Polychaete	Capitellidae	Heteromastus sp.	0	17	0	0	0	0
Annelida/ Polychaete	Capitellidae	Capitella capitata	0	0	11	0	0	0
Annelida/ Polychaete	Maldanidae	Maldane sp.	6	0	0	0	6	6
Annelida/ Polychaete	Sternaspidae	Sternaspis scutata	0	11	11	0	0	0

#### Table 6.3.7: List of Macrobenthos from 6 Monitoring Points

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Phylum/Class	Family	Species	ME1	ME2	ME3	ME4	ME5	ME6
Annelida/Clitellata	Tubificidae	Tubificoides Sp.	0	6	6	11	6	0
		Subtotal Annelida	109	98	187	41	48	12
		Percentage of Annelida	65.66	94.23	91.22	100.00	66.67	23.08
		No. of Species	11	12	7	6	8	2
	T				1	1	r	1
Arthropoda/ Malacostraca	Ampeliscidae	Ampelisca sp.	11	6	0	0	0	0
Arthropoda/ Malacostraca	Photidae	Gammaropsis sp.	6	0	0	0	0	0
Arthropoda/ Malacostraca	Aoridae	Grandidierella sp.	6	0	0	0	0	0
Arthropoda/ Malacostraca	Oedicerotidae	Monoculodes sp.	0	0	0	0	6	0
Arthropoda/ Malacostraca	Bodotriidae	<i>Cumopsis</i> sp.	6	0	0	0	0	0
Arthropoda/ Malacostraca	Penaeidae	Penaeus sp.	0	0	6	0	0	0
Arthropoda/ Malacostraca	Paguridae	Pagurus sp.	11	0	0	0	6	34
Arthropoda/ Malacostraca	Paguridae	Crab Species 1	0	0	6	0	0	0
		Subtotal Arthropoda	40	6	12	0	12	34
		Percentage of Arthropoda	24.10	5.77	5.85	0.00	16.67	65.38
		No. of Arthropoda	5	1	2	0	2	1
	T			1		1		1
Mollusca/ Bivalvia		Bivalvia Species A	6	0	0	0	0	0
Mollusca/ Bivalvia		Bivalvia Species B	0	0	0	0	0	6
		Subtotal Mollusc	6	0	0	0	0	6
		Percentage of Mollusc	3.61	0.00	0.00	0.00	0.00	11.54
		No. of Species	1	0	0	0	0	1
	I			1				
Echinodermata/ Ophiuroidea	Amphiuridae	Amphioplus sp.	0	0	0	0	6	0
Echinodermata/ Ophiuroidea	Ophionereididae	<i>Ophionereis</i> sp.	0	0	6	0	0	0

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Phylum/Class	Family	Species	ME1	ME2	ME3	ME4	ME5	ME6
Echinodermata/ Ophiuroidea		Brittle star	11	0	0	0	0	0
		Subtotal Echinodermata	11	0	6	0	6	0
		Percentage of Echinodermata	6.63	0.00	2.93	0.00	8.33	0.00
		No. of Species	1	0	1	0	1	0
Chordata	Branchiostomidae	Branchiostoma sp.	0	0	0	0	6	0
		Subtotal Others	0	0	0	0	6	0
		Percentage of Others	0.00	0.00	0.00	0.00	8.33	0.00
		No. of Species	0	0	0	0	1	0
		Total Individual/m <sup>2</sup> (N)	166	104	205	41	72	52
		Total No. of Species (S)	18	13	10	6	12	4
Diversity Index (H')			2.753	2.490	1.522	1.759	2.485	1.025
		Evenness Index (J')	0.952	0.971	0.661	0.982	1.000	0.740
		Total Percentage	100	100	100	100	100	100

### 6.3.2.2 Planktonic Community

Planktonic microscopic organisms are those live suspended in the water column with little swimming ability. Distribution of plankton is controlled by physical processes of waters such as current and mixing. Autotrophic phytoplankton depends on light and chlorophyll to fix carbon dioxide into organic molecules, whereas heterotrophic zooplankton grazes on the phytoplankton. Both phytoplankton and zooplankton are important components in the food web of the marine ecosystem. Autotrophic phytoplankton also play important role in the carbon sink in marine environment with fixation of inorganic carbon.

### **Phytoplankton**

Phytoplankton samples were collected in October 2016 at six (6) sampling stations in coastal waters near to the Project site (**Figure 6.2.9** and **Table 6.3.5**). Phytoplankton samples were collected using a 20  $\mu$ m-mesh plankton net by vertical hauling. Samples were preserved using acidic Lugol's solution and brought back to the laboratory for species identification. Identification of the phytoplankton samples was performed to the lowest possible taxa using a light microscope and available reference materials.

### Zooplankton

Zooplankton samples were collected at the same location for macrobethos and zooplankton sampling using a 70 µm-mesh plankton net with 0.3 m mouth diameter by vertical hauling. The samples were preserved in buffered 4% formalin and brought back to the laboratory for identification. Identification was carried out based on relevant literatures.

### **Findings and Discussions**

### **Phytoplankton**

A total of 19 taxa of phytoplankton were observed from the samples collected from the proposed project site, with 15 taxa of diatom, 3 taxa of dinoflagellates and 1 taxa of cyanobacteria as tabulated in **Table 6.3.8**. Phytoplankton assemblages composed predominantly the diatom. Number of taxa recorded at each station ranged from 12 to 18 taxa. Common diatom found in the area includes while dinoflagellates species was the minor component in phytoplankton composition. Highest number of taxa was observed at station ME2. Dominant species varied from station to stations and the dominant taxa are Oscillatoriaceae, Rhizosoleniaceae and Coscinodiscaceae.

In terms of species, Bacillariophyta was recorded the highest species diversity with 15 different families consist of 64 species. Palmer (1969) has reported that the genera like Naviculla and Nitzschia were found organically polluted water and similar genera were recorded during present study, especial at ME2 and E6. Station ME2 and ME6 are located at estuary area which contact high level of organic polluted. Pearsall (1932) show clear correlation between organic pollution with Bacillariophyta member. In terms of species diversity, the Shannon Weiner Diversity Index (H') from 1.92 - 2.75.



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Generally, phytoplankton community in the tropical waters was dominated by diatom (Shamsuddin, 1990). In 2013, dominant phytoplanktons in coastal water of Kuantan were reported by Mohammed-Noor *et al.*, (2013) are belongs mainly to diatom and followed by dinoflagellates. Smaller phytoplankton groups such as picoplankton and nanoplankton (<5 micron) contributed to smaller percentage of phytoplankton community and chlorophyll *a* (Gin *et al.*, 2000). Phytoplankton community varied by locations and fluctuated throughout the year due to nutrient surge from river outflow, monsoon and level of coastal eutrophication



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Phylum	Family	Species	ME1	ME2	ME3	ME4	ME5	ME6
Bacillariophyta	Leptocylindraceae	Leptocylindrus sp.	0	7316	7879	0	0	0
		Dactyliosolen sp	2814	3658	0	4221	0	0
	Meloosiraceae	Skeletonema sp.	0	36581	0	21105	0	0
	Thalassiosiraceae	Thalassiosira sp	14070	0	0	0	0	8611
		Guinardia sp.	0	0	0	33767	5065	0
		Lauderia sp	0	10974	19698	25326	5065	0
	Coscinodiscaceae	Coscinodiscus sp.	53465	0	66972	25326	53184	57405
		Coscinodiscus astrolampra	0	0	0	16884	0	0
		Coscinodiscus ecentricus	0	0	0	4221	2533	43053
		Coscinodiscus janischii	0	0	3940	25326	0	0
		Coscinodiscus perforatus	0	0	7879	8442	0	0
		Coscinodiscus wailesii	317977	58530	15758	42209	63314	143512
		Cyclotela sp	0	18291	0	0	0	0
		Hemidiscus sp.	47837	3658	0	8442	2533	0
	Rhizosoleniaceae	Rhizosolenia alata	2814	124377	82730	101302	2533	0
		Rhizosolenia acuminata	0	47556	0	21105	5065	0
		Rhizosolenia arafurensis	8442	40240	27577	29547	10130	2870
		Rhizosolenia bergonii	0	7316	11819	21105	2533	0
		Rhizosolenia calcaravis	16884	3658	7879	33767	2533	0
		Rhizosolenia clevei	140698	585302	319102	780872	164616	0
		Rhizosolenia imbricata	0	7316	7879	21105	5065	0
		Rhizosolenia robusta	5628	0	3940	0	0	0
		Rhizosolenia setigera	0	0	3940	12663	0	0
		Rhizosolenia storterforthii	0	3658	3940	0	0	0

Table 6.3.8: Relative abundance of Phytoplankton at the study area in October 2016
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#### ENVIRONMENTAL IMPACT ASSESSMENT FOR PROPOSED DEVELOPMENT OF KUANTAN MARITIME HUB AT MUKIM SUNGAI KARANG, KUANTAN, PAHANG DARUL MAKMUR

Phylum	Family	Species	ME1	ME2	ME3	ME4	ME5	ME6
		Rhizosolenia styliformis	0	7316	7879	0	0	0
		Rhizosolenia sp	0	7316	0	0	0	0
	Bacteriastraceae	Bacteriastrum delicatulum	0	0	35456	25326	0	0
		Bacteriastrum hyalinum	11256	25607	66972	37988	2533	0
		Bacteriastrum hyalinum var princeps	0	7316	0	0	0	0
		Bacteriastrum varians	0	7316	7879	80198	0	0
	Chaetoceraceae	Chaetoceros brevis	0	0	19698	16884	0	0
		Chaetoceros curvusetum	78791	18291	78791	84419	0	0
		Chaetoceros delicatulum	0	7316	0	8442	0	0
		Chaetoceros distants	0	0	7879	16884	0	0
		Chaetoceros diversum	0	0	3940	25326	0	0
		Chaetoceros messanense	0	10974	7879	71756	0	0
		Chaetoceros peruvianus	0	7316	43335	12663	2533	0
		Chaetoceros pendulum	0	0	0	0	2533	0
		Chaetoceros pseudocrinitum	0	0	15758	33767	0	0
		Chaetoceros sp.	11256	65847	106367	71756	10130	5740
	Biddulphiaceae	Biddulphia mobliensis	0	0	0	0	0	2870
		Biddulphia sinensis	33767	18291	39395	46430	20260	157863
		Hemialus indicus	0	7316	7879	0	0	0
		Cerataulina peligica	11256	7316	0	12663	0	0
	Eucampiaceae	Climacodium sp	0	7316	0	8442	0	0
		Eucampia sp	0	7316	0	0	0	0
		Ditylium sol	0	3658	11819	21105	0	0
		Streptotheca sp	22512	3658	7879	0	0	0
		Thalassiothrix Frauenfeldii	0	32923	23637	46430	0	0

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#### ENVIRONMENTAL IMPACT ASSESSMENT FOR PROPOSED DEVELOPMENT OF KUANTAN MARITIME HUB AT MUKIM SUNGAI KARANG, KUANTAN, PAHANG DARUL MAKMUR

Phylum	Family	Species	ME1	ME2	ME3	ME4	ME5	ME6
	Lithodesmiaceae	Triceratiumsp	0	0	0	4221	0	0
	Fragilariaceae	Fragilaria sp.	0	0	11819	0	0	0
		Trachyneissp	0	0	3940	4221	0	0
	Achnanthaceae	Cocconeissp	0	0	0	0	0	22962
	Naviculaceae	Amphora sp.	0	3658	3940	0	0	0
		Navicula lyra	0	0	3940	0	0	0
		Navicula sp (a)	0	10974	0	0	0	0
		Navicula sp (b)	0	0	0	0	0	2870
	Pleurosigmataceae	Gyrosigma sp.	0	0	0	4221	0	2870
		Pleurosigma sp.	0	7316	3940	16884	0	2870
	Nitzschiaceae	Nitzschia pacifica	0	18291	0	4221	0	0
		Nitzschia hungarica	0	0	0	0	2533	0
		Nitzschia pungen	0	3658	0	0	0	0
		Nitzschia sp (a)	0	10974	0	0	0	0
		Nitzschia sp (b)	0	7316	0	0	0	2870
Cyanophyta	Oscillatoriaceae	Trichodesmium sp	0	80479	0	0	303907	0
		Filamentous algae	19698	175591	0	0	329233	401833
		Green algae	306721	182907	488502	261698	205137	126290
Dinophyta	Ceratiaceae	Ceratium breve	0	0	0	0	0	2870
		Ceratium fusus	0	0	0	4221	0	0
		Ceratium sp	0	0	0	0	5065	5740
	Peridiniidae	Peridinium sp	0	0	3940	0	0	0
		Triposolenia sp	0	3658	0	0	0	0

C6-53 Revision No.: 1 Revision Date: Nov 2017

#### ENVIRONMENTAL IMPACT ASSESSMENT FOR PROPOSED DEVELOPMENT OF KUANTAN MARITIME HUB AT MUKIM SUNGAI KARANG, KUANTAN, PAHANG DARUL MAKMUR

Phylum	Family	Species	ME1	ME2	ME3	ME4	ME5	ME6
	Dinophysiaceae	Dinophysis sp	0	7316	7879	16884	5065	0
		Dinoflagelate developing stage	0	3658	0	0	0	0
		Unidentified sp	64721	7316	0	8442	12663	60275
	Total Density	(cells/m <sup>3</sup> )	1170605	1733958	1611270	2182221	1225758	1053375
	Total No of	species	19	47	40	45	25	18
Diversity Index H'			2.158	2.653	2.569	2.751	2.002	1.923
Equitability J'			0.733	0.6891	0.6965	0.7228	0.622	0.6653

## Zooplankton

Microplankton in the area consisted of at least 7 zooplankton subgroups, with 4 to 7 taxa observed at each station and among the zooplankton taxa, copepod, Tintinida and Molussca are the dominant taxa. Some other zooplankton taxa observed from the study areas were shown in **Table 6.3.9**.

A total of 7 different phyla with 20 families of zooplankton were identified around the proposed Project area. The seven major phyla comprised of Arthropoda, Protozoa, Mollusca, Annelida, Chaetognatha, Bhachiopoda and Chordata. Arthropoda dominated the counts and contributed 34.5% of total zooplankton density ( $1.58\times10^4$  ind/m<sup>3</sup>). Second followed by phylum Protozoa with 2.71% ( $1.245\times10^4$  ind/m<sup>3</sup>). Zooplankton which their species cannot be identified or zooplankton in its larvae stage will be categorised as Others and this group contributed 57.5% of the total zooplankton around the Project area ( $2.63\times10^4$  ind/m<sup>3</sup>). The first larval stage of many crustaceans, having an un-segmented body and a single eye are called Nauplius. Nauplius contributed 87% of the total density under category Others and 50% of the overall zooplankton density at the Project site. The high density of Nauplius in the surrounding indicator the ecosystem is productive. In terms of stations, ME1 recorded the most abundant zooplankton amounting up to  $1.24\times10^4$  ind/m<sup>3</sup>. The Shannon Weiner diversity index (H') ranged from 1.610 to 1.952.

Several surveys on zooplankton community had been carried out along the coastal waters of east coast Peninsular. Zooplankton community was dominated by copepod in both the coastal water and estuaries (Lokman et al., 1997; Zaleha et al., 2003). As reported by Zaleha et al. (2008), the dominance of calanoids and cyclopoids were found in Pahang coast in the South China Sea.

In coastal waters, the composition of zooplankton was also affected by primary productivity or the phytoplankton community (Mauny & Dauvin, 2002). Zaleha et al. (2008) also reported that patchy distribution of copepod in Pahang coastal waters with 22 to 35 species. The number of taxa found in this study was lower than other reports in the South China Sea (74 species, Othman, 1988) and Malacca Straits (88-117 species; Johan et al., 2002), partly due to the fact that zooplankton were identified to species level in the later studies.

Phylum	Family	Species	ME1	ME2	ME3	ME4	ME5	ME6
Calanoid	Calanidae	Calanoid copepod	1333	206	459	348	265	392
		Acartia sp.	0	0	0	0	0	20
	Calanidae	Calanus sp.	0	0	0	43	35	20
	Calocanidae	Calocalanus sp.	833	206	443	1022	460	157
		Eucalanus sp.	0	0	0	0	18	0
	Pontellidae	Labidocera sp	0	21	16	0	0	0
	Temoridae	Temora sp.	33	0	33	22	0	0
Cyclopoida		Cylopoid copepod	67	0	0	0	0	0
	Corycaeidae	Corycaeus sp.	183	329	246	109	124	0
		Oithona rigida	17	21	49	87	71	98

 Table 6.3.9: Relative abundance of Zooplankton found at study areas in October 2016



Chapter 6
ENVIRONMENTAL IMPACT ASSESSMENT FOR PROPOSED DEVELOPMENT OF KUANTAN MARITIME HUB AT MUKIM SUNGAI KARANG, KUANTAN, PAHANG DARUL MAKMUR

Phylum	Family	Species	ME1	ME2	ME3	ME4	ME5	ME6
	Oithonidae	Oithona sp	767	720	820	674	106	1902
	Oncaeidae	Lubbockia sp	33	0	16	87	0	0
		Oncaea sp.	433	82	16	65	18	78
		Zaussp	33	0	0	0	18	39
	Harpacticidae	Harpaticoid copepod	100	0	16	0	0	0
	Tachidiidae	Microstella sp.	100	123	197	65	53	39
		Euterpina sp.	850	41	33	109	53	275
		Tigriopus sp	17	0	33	0	0	20
		Evadne sp	0	0	0	22	0	0
Foraminifera	Discorbidae	Tretomphalussp	0	0	0	65	0	0
		Spirococulina sp	0	0	0	0	35	0
Tintinnida	Ptychocylididae	Favella sp.	0	0	16	0	0	0
	Tintinnidae	Tintinopsis aperta	0	0	0	0	0	20
		Tintinopsis beroidae	0	0	0	0	0	59
		Tintinopsis radix	0	103	33	435	0	39
		Tintinopsis norgu	0	0	0	174	18	0
		Tintinopsis radix	0	0	0	0	18	0
		Tintinopsis gracilis	100	0	0	130	0	0
Mollusca		Bivalve	0	21	0	0	53	0
		Gastropod	0	21	0	0	53	0
		Limacina sp	33	0	0	0	0	0
	Atlantidae	Atlanta sp	100	103	98	22	124	0
	Cavoliniidae	Cresis sp	0	41	213	109	0	0
	Polychaeta	Polychaete larvae	17	0	0	0	18	0
	Sagittidae	Sagitta sp	0	123	49	0	0	0
	Lingulidae	Lingula sp	67	103	197	239	18	98
	Oikopleuridae	Oikopleura sp.	17	103	115	239	0	0
	Ophiuroidea	Opiopleuteus larvae	0	0	0	22	0	0
		Copepodit	417	247	361	543	35	157
		Brachcanious larvae	17	0	0	0	0	0
		Metaneupleus	100	21	33	0	0	0
		Nauplii	6200	4362	4295	3370	2726	2039
		Shrimp larvae	167	0	0	0	0	0
		Sergestid larvae	367	0	0	22	0	0
		Cyprinid larvae	0	0	0	0	18	0
		Zoea larvae	33	21	0	0	0	0
		unidentified species	0	700	98	0	35	0
1	otal Density (indiv	riduals/m³)	12433	7716	7885	8022	4372	5451
	Total No of sp	ecies	27	22	24	24	23	17
Diversity Index H'				1.762	1.836	2.170	1.610	1.722

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ENVIRONMENTAL IMPACT ASSESSMENT FOR PROPOSED DEVELOPMENT OF KUANTAN MARITIME HUB AT MUKIM SUNGAI KARANG, KUANTAN, PAHANG DARUL MAKMUR

Phylum	Family	Species	ME1	ME2	ME3	ME4	ME5	ME6
Equitability J'		0.592	0.570	0.578	0.683	0.514	0.607	

# 6.3.2.3 Fish Fauna

# 6.3.2.3.1 Fishery Resources Study

Fishery resources study was conducted in October 2016 at 2 selected stations within the vicinity of the study area, namely F1 and F2. The locations and coordinates of both stations are shown in **Figure 6.2.9** and **Table 6.3.10**, respectively.

Sampling were carried out using four sets of three layered nets with a length of 500 m and a depth of 1.6 m which is the typical fishing methods employed by the local fishermen in the project area. The fishing gear was employed in a similar manner in all the stations. Nets were placed at each station for a period of 4 hours to include the period of low and high tides.

Fish species caught were mostly identified in-situ. Only specimens that could not be identified in the field were preserved in 10% formalin and later transferred to 70% ethanol for identification in the laboratory. Fish were identified following Matsunuma et al. (2011), Lim and Gambang (2009), Mansor et al. (1998) Matsuda et al. (1984) and Mohammed Shaari (1971). Data on fish species, number of individuals for each species, weight caught and catch per unit effort were tabulated.

## Table 6.3.10: Fishery Monitoring Stations

Station	Coordinates	Location
F1	3° 55' 56.46"N 103° 25' 13.46"E	Open sea about 3km south of the proposed project site, anticipated to be outside the zone of influence
F2	3° 57' 2.34"N 103° 23' 56.54"E	Open sea at 1 km distance from the Project Site

# Findings and discussions

A total of 234 samples of fish and crustacean were caught at the two stations during the field studies carried out in 17 to 18 October 2016. The list of fish and crustacean caught from each of the station is shown in **Table 6.3.11**.

At Station F1, 13 families represented by 14 species were caught. The two dominant families by the number of individual caught were Scombridae and Carangidae, each representing 47.3% and 9.9% of all the numbers of individual caught, respectively (**Table 6.3.12**).

13 families from 14 species were caught from Station F2 (**Table 6.3.11**). The three dominant families by the number of individual caught were Clupeidae and Carangidae/Leiognathidae representing 19.5% and 17.1% of all the numbers of individual caught respectively (**Table 6.3.12**).

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Station	Family	Species	English Name	Malay Name	N
F1	Scombridae	Rastrelliger Kanagurta	Indian Mackerel	Kembung	72
	Limulidae	Tachypleus gigas	Horseshoe crab	Belangkas	0
	Drepaneidae	Drepane punctata	Spotted sicklefish	Daun Baharu	1
	Portunidae	Portunus Pelagicus	Blue Swimming Crab,	Ketam Kaki Biru	2
	Dasyatidae	Dasyatis zugei	Pale-edged Stingray	Pari Ketuka	0
	Sciaenidae	Pennahia macrocephalus	Big-head Pennah Croaker	Gelama 1	4
	Sciaenidae	Otolithoides biauritus	Bronze Croaker	Gelama 2 (Selampai)	2
	Odontodactylidae	Hemisquilla ensigera	Mantis shrimp	Udang Mentadak	2
	Hemiscylliidae	Chiloscyllium plagiosum	Whitespotted bambooshark	Yu Bodoh	1
	Belonidae	Ablennes sp.	Needlefish	Todak	1
	Carangidae	Caranx sexfasciatus	Bigeye trevally	Cupak	15
	Soleidae	Synaptura commersonnii	Commerson's Sole	Lidah	9
	Haemulidae	Pornadasys maculatus	Saddle Grunter	Beliak Mata	9
	Leiognathidae	Leiognathus equulus	Common Ponyfish	Kekek	3
	Synodontidae	Saurida tumbil	Lizardfish	Mengkerong	1
	Ariidae	Plicofollis tenuispinis	Thinspine sea catfish	Duri	2
	Carangidae	Atule mate	Yellowtail Scad	Selar Kuning	14
	Clupeidae	Anodomtostoma Chacunda	Chacunda Gizard Shad	Selangat	14
F2	Scombridae	Rastrelliger Kanagurta	Indian Mackerel	Kembung	14
	Limulidae	Tachypleus gigas	Horseshoe crab	Belangkas	6
	Drepaneidae	Drepane punctata	Spotted sicklefish	Daun Baharu	0
	Portunidae	Portunus Pelagicus	Blue Swimming Crab,	Ketam Kaki Biru	1
	Dasyatidae	Dasyatis zugei	Pale-edged Stingray	Pari Ketuka	2
	Sciaenidae	Pennahia macrocephalus	Big-head Pennah Croaker	Gelama 1	4

Table 6.3.11: Family and Species of Fish and Crustacean Caught

#### ENVIRONMENTAL IMPACT ASSESSMENT FOR PROPOSED DEVELOPMENT OF KUANTAN MARITIME HUB AT MUKIM SUNGAI KARANG, KUANTAN, PAHANG DARUL MAKMUR

Station	Family	Species	English Name	Malay Name	N
	Sciaenidae	Otolithoides biauritus	Bronze Croaker	Gelama 2 (Selampai)	4
	Odontodactylidae	Hemisquilla ensigera	Mantis shrimp	Udang Mentadak	1
	Hemiscylliidae	Chiloscyllium plagiosum	Whitespotted bambooshark	Yu Bodoh	1
	Belonidae	Ablennes sp.	Needlefish	Todak	0
	Carangidae	Caranx sexfasciatus	Bigeye trevally	Cupak	14
	Soleidae	Synaptura commersonnii	Commerson's Sole	Lidah	4
	Haemulidae	Pornadasys maculatus	Saddle Grunter,	Beliak Mata	5
	Leiognathidae	Leiognathus equulus	Common Ponyfish	Kekek	1
	Synodontidae	Saurida tumbil	Lizardfish	Mengkerong	2
	Ariidae	Plicofollis tenuispinis	Thinspine sea catfish	Duri	0
	Carangidae	Atule mate	Yellowtail Scad	Selar Kuning	7
	Clupeidae	Anodomtostoma Chacunda	Chacunda Gizard Shad	Selangat	16

### Table 6.3.12: Dominant Families Caught From Each Station

Station	Family	Percentage
F1	Scombridae	47.3
	Carangidae	9.9
F2	Clupeidae	19.5
	Carangidae	17.1
	Scombridae	17.1

A total of 13 families comprising 14 species were caught from all the study stations. The 7 dominant families by the number of individual caught are Scombridae (36.8%), Clupeidae (12.8%), Carangidae (12.4%), Haemulidae (6%), Sciaenidae (6%), Soleidae (5.6%) and Limulidae (2.6%) (**Figure 6.3.2**).

The range in values of diversity, evenness and richness indices are 1.89 - 2.33, 0.67 - 0.87 and 3.18 - 3.19, respectively (**Table 6.3.13**). Diversity and evenness indices are highest at Station F2 and lowest at Station F1 except richness is the same.



Figure 6.3.2: Percentage composition of the dominant families based on the number of individual caught.

Table 6.3.13: Values of	Diversity (H <sup>r</sup> ), Evenness	(D') and Richness (J') in	dices for Each Station
Station	H'	D'	J'

.....

Station	H'	D'	J'
F1	1.89	3.18	0.67
F2	2.33	3.18	0.87



# 6.3.2.3.2 Published Fisheries

Fisheries data were obtained from the Department of Fisheries (MOF) Malaysia. Additional data were also obtained from the local Fishermen Associations and through interviews carried out with some full time fishermen in the study area. Report on the annual fisheries statistics of the Department of Fisheries were obtained to cover the period before the implementation of the proposed KMH project and the latest available data was for Year 2015.

In October 2016, there were 215 fishermen registered with PENERPA in Sg Balok and this make-up to about 2.6% of the registered fishermen in the whole of Pahang. There were 87 licensed fishing vessels in Sg. Balok or 4.1% of the total number in Pahang (**Table 6.3.14**).

Table 6.3.14: Number of fishermen and licensed fishing vessel (percentage of the whole Pahang)

Fisheries District	No. of Fishermen*	Licensed Fishing Vessel**
Sg. Balok, Kuantan	215 (2.6%)	87 (4.1%)
District of Kuantan	3,832	842
Whole of Pahang	8,330	2,122

Sources:

\* Registered fisherman with PERNEPA, 2016

\*\* Registered fishing vessel with DOF, 2015

Most fishermen in Sg Balok used outboard-powered vessels and used gill/drift nets for fishing. This indicates that fishing activities near shore are important.

Four of the most common type of fishing gears employed by fishermen in Pahang are gill/drift nets, trawl nets, portable traps and hooks and lines. Gill/drift nets are the most popular fishing gear used, accounting for 62% of the fishing gear used in the state (**Table 6.3.15**).

Fishing Gear	Pahang	Peninsular Malaysia
Gill / Drift Nets	1,204	21,776
Trawl Nets	411	4,010
Hooks and Lines	228	2,916
Portable Traps	86	325
Total	1,929	29,027

Table 6.3.15: Types and number of fishing gear

Source: MOF Malaysia, 2015

In 2015, 111,537 tonnes of marine fish were landed in Pahang with a value of RM634.81million or 8.44% of the total value of marine fish landed in Peninsular Malaysia. The marine fish landing peaks in April, June, September and October where the four months landings amounted to 45,693 tonnes contributed to about 41% of the State annual landing. All the landings of marine fish were not processed but were disposed of fresh (DOFM, 2015).



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In terms of the quantity landed, trash fish contributed the most at 26,834 tonnes(24.05% of the total landings), followed by Scad fish (*Decapterus spp.*) at 9,697 tonnes and Sardinella (*Sardinella spp.*) at 6,049 tonnes (**Table 6.3.16**).

Malay Name	English Name	Scientific Name	Landings (Tonnes)
Aji-Aji	Blackbanded trevally/ Amberjack	Seriolina nigrofasciata/ Seriola dumerili	20
Alu-Alu/Kacang-Kacang	Pickhandle barracuda/Obtuse barracuda	Sphyraena jello/Sphyraena obtusata	1,151
Aruan Tasik	Cobia	Rachycentron canadum	162
Bayan	Parrotfish	<i>Scarus</i> sp. <i>/Hipposcarus</i> sp. <i>/Bolbometopom</i> sp.	18
Biji Nangka	Yellow Goatfish	Upeneus Sulphureus	2,034
Baji-baji	Bartail flathead	Platycephalus indicus	2
Beliak Mata	Llisha	<i>llisha</i> spp.	64
Bawal Hitam	Black pomfret	Parastromateus niger	179
Bawal Putih	Silver pomfret	Pampus argenteus	186
Cermin/Sagai/Cupak	Indian threadfin/Trevally	Alectis indicus/Carangoides spp.	88
Cincaru	Hardtail scad	Megalaspis cordyla	1,567
Daun Baharu	Spotted sicklefish	Drepane punctata	9
Delah	Redbelly Yellowtail Fusilier	Caesio Cuning	27
Dengkis /Debam	Spinefoot / Surgeonfish	<i>Siganus</i> spp / <i>Acanthurus</i> spp.	52
Duri/Pulutan/Utik	Marine catfish	Tachysurus spp./Arius spp.	149
Demuduk/Rambai	Imposter trevally	Carangoides talamparoides	5
Gelama/Tengkerong	Jewfish/Carut Croaker/Tiger- tooth Croaker/Bronze Croaker	Decapterus spp./Sciaena spp./Johnius spp./ Otolithus spp. /Otolithoides spp.	495
Gerut-Gerut	Grunt	Pomadasys spp.	7
Gerong-Gerong	Golden trevally	Gnathanodon speciosus	1
Ikan Tiram	Kelee shad	Hilsa kelee	14
Ikan Barat-Barat	Unicorn Leatherjacket	Alutera Monoceros	1,386
Ikan Baja	Trash fish/ Rough fish	N/A	26,834
Ikan Campur	Mixed fish	Mixed species	3,352
Jahan/Goh	Catfish	Netuma thalassina/ Arius maculatus / Nemapteryx macronotacantha	134
Jebong	Triggerfish	Abalistes spp. /Baslistapus spp. / Balistoides spp.	20
Jenahak	John's snapper	Lutjanus fulviflamma	35
Kaci	Painted Sweetip	Plectorhinchus pictum	306
Kapas Laut	Longfin silverbiddy	Pentaprion longimanus	16



Chapter 6 ENVIRONMENTAL IMPACT ASSESSMENT FOR PROPOSED DEVELOPMENT OF KUANTAN MARITIME HUB AT MUKIM SUNGAI KARANG, KUANTAN, PAHANG DARUL MAKMUR

Malay Name	English Name	Scientific Name	Landings (Tonnes)
Kerapu	Grouper/Coral Trout	<i>Epinephelus</i> spp./ <i>Plectropomus</i> spp.	387
Kerisi	Japanese Threadfin Bream	Nemipterus Japonicus	4,755
Kerisi Bali	Goldbanded jobfish	Pristipomoides multidens	657
Kikek	Ponyfish(slipmouth)	Lelognathus spp/Gazz spp./Seculor spp.	23
Ketang	Giant grouper	Epinephelus lanceolatus	1
Kembong	Indian Mackerel	Rastrelliger Kanagurta	3,816
Kayu/Tongkol/Aya Hitam	Bigeye tuna	Thunnus obesus	4,925
Kayu/Tongkol/Aya Kurik	Mackarel tuna	Euthynnus affinis	788
Kayu/Tongkol/Aya Selasih	Frigate Tuna	Auxis thazard thazard	187
Ketam Laut	Sea crabs	Charybdis Cruciata	158
Ketam Rejong	Flower crab	Portunus pelagicus	344
Ketam Batu/Nipah	Mub crab	Syclla serrata	20
Layaran	Marlin	Istiophorus oriantalis	7
Lidah	Long Tonguesole	Cnyoglossus Lingua	18
Lolong	Oxeye scad	Selar boojos	5,403
Landok	Emperor fish	Lethrinus spp	26
Malong	Comger eel/Moray eel	<i>Muraenesox</i> spp./ <i>Gymnothorax</i> sp.	6
Merah	Red snapper	Lutjanus argentimaculatus / L. malabaricus	91
Mengkerong/Conor/Ubi-Ubi	Lizardfish/ Snakefish	Saurida spp/ Synodus spp	5,573
Pedukang/Belukang	Catfish	Arius spp/ Batrachocephalus mino	10
Puntong Damar/Bulus-Bulus	Silver Sillago	Sillago Sihama	195
Pasir-Pasir/ Timun-Timun	Monocle Bream	Scolopsis spp.	219
Pelaling/ Temenong	Indian mackerel	Rastrelliger Kanagurta	1,042
Pari	Ray	<i>Gymnura</i> spp./ <i>Dasyatis</i> spp./ <i>Himantura</i> spp.	1,212
Parang-Parang	Dorab wolf-herring	Chirocentrus dorab	409
Puyu laut	Gulf damselfish	Pristotis obtusirostris	12
Pelata	Yellowtail Scad	Ceranx (Alepes)	12
Pisang-Pisang	Rainbow Runner	Elagatis Bipinniatus	19
Pinang-Pinang	Fusilier	Caesio spp/ Dipterygonotus spp / Pterocaesio spp	68
Remong/ Kunyit-Kunyit	Snapper	Lutjanus spp/ Symphorichthys spp	1,194
Semilang	Eel catfish	Plotosus canius	44
Senolong/Kapas	King Threadfin	Polydactylus macrochir	14
Sebelah	Flatfish	Pseudorhombus spp.	39
Senangin	Threadfin	Eleutheronema tetradactylum	133



Chapter 6 ENVIRONMENTAL IMPACT ASSESSMENT FOR PROPOSED DEVELOPMENT OF KUANTAN MARITIME HUB AT MUKIM SUNGAI KARANG, KUANTAN, PAHANG DARUL MAKMUR

Malay Name	English Name	Scientific Name	Landings (Tonnes)
Senangin Buis	Blackspot threadfin	Polydactylus sextarius	11
Selar Kuning	Scad	Selar boops/ Alepes spp/ Atule spp	5,143
Selar	Scad	Selar spp./Alepes spp./Selaroides spp.	2,788
Selayang/Curut	Scad	Decapterus	9,697
Sotong Biasa/Cumit	Squid	Teuthida	7,727
Sotong Katak	Cuttlefish	Sepiida	2,167
Sotong Kereta	Octopus	Enteroctopus dofleini	4
Tanda	Russel's snapper	Lutjanus russelli	39
Temenggong/Lara Bara	Glasseye/ Red Bigeye/	Priacanthus spp/ Heteropriacanthus cruentatus	1,471
Talang	Queenfish	Scomberoides commersonianus	7
Todak/Banang	Needlefish	Ablennes sp. / Tylosurus sp.	4
Tamban Sisek	Sardinella	Amblygaster sirm/ Sardinella fimbriata/ Sardinella melanura	6,049
Tamban Buluh Bulat	Rainbow sardines	Dussumieria spp	486
Tamban/Cincang Rebong	White sardine	Escualosa thoracata	935
Trepang	Sea Cucumber	Holothuroidea spp	356
Tamban Beluru	Spotted sardinella/ Smoothbelly sardinella	Amblygaster sirm/ Amblygaster leiogaster	1,649
Tenggiri	Spanish mackerel	Scomberomorus spp.	506
Timah/Layor/Selayor	Large-head hairtail (Ribbon fish)	Trichiurus lepturus	382
Udang Karang	Lobster	Panulirus polyphagus	11
Udang Lobok	Slipper lobster	Thennus orientalis	52
Udang Harimau	Gaint tiger prawn	Penaeus japonicas/ P. monodon	6
Udang Putih Besar/Kertas	Whiteleg shrimp	Litopenaeus vannamei	54
Udang Putih Sedang	Whiteleg shrimp	Litopenaeus vannamei	367
Udang Putih Kecil/Kertas	Whiteleg shrimp	Litopenaeus vannamei	67
Udang Kaki Merah/Sua Lor (K)	Banana prawn	Fenneropenaeus merguiensis	135
Udang Kaki Merah/Sua Lor (S)	Banana prawn	Fenneropenaeus merguiensis	27
Udang Kaki Merah/Sua Lor (B)	Banana prawn	Fenneropenaeus merguiensis	39
Udang Pasir Besar	Banana prawn	Fenneropenaeus merguiensis	7
Udang Pasir Sedang	Banana prawn	Fenneropenaeus merguiensis	105
Udang Pasir Kecil	Banana prawn	Fenneropenaeus merguiensis	237
Udang Minyak	Sharp-rostrum Prawn	Parapenaeopsis hardwickii, P. coromandelica , P. hunger fordi, P. gracilima	31



ENVIRONMENTAL IMPACT ASSESSMENT FOR PROPOSED DEVELOPMENT OF KUANTAN MARITIME HUB AT MUKIM SUNGAI KARANG, KUANTAN, PAHANG DARUL MAKMUR

Malay Name	English Name	Scientific Name	Landings (Tonnes)
Udang Ekor Biru	Greasyback Shrimp	Metapenaeus ensis	80
Udang Susu	King prawn	Penaeus Iatisulcatus Kishinouye	5
Udang Lipan	Mantis shrimp	Stomatopoda	1
Yu	Shark	Chiloscyllium plagiosum	690
		Total	111,537

Source: MOF Malaysia, 2015

# 6.3.2.3.3 Fisheries Near Proposed Project Area

The area near the proposed Project site is claimed as a fishing ground for the local fishermen. Fishing boats observed during the field visit were out-board powered and most of fiberglass boats powered by a 40 to 115 HP engines reportedly operating in the coastal waters up to 5 nautical miles (nm). Most of the fishermen boats are licensed, received fuel subsidy and monthly allowance from the government.

Three-layered and gill nets are the main method of fishing used by the fishermen at the area. For gill net, the mesh sized used depend on the targeted species. Coastal fisherman used 1 <sup>3</sup>/<sub>4</sub> inches mesh size to catch near shore fish and deep water fisherman used 2 <sup>1</sup>/<sub>2</sub> inches up to 10 inches mesh size net. A three-layered net is to target shrimp. Other common fishing methods used include hooks and lines and portable trap.

The peak fishing season is in April to September with the shrimp season in November to March. Crab season will take place between Septembers to January. During this season, each fisherman could catch about 40 kg of shrimp and 40 kg of crab of mixed species.

There are two fishing aggregates devices near to the proposed Project's navigation channel which was installed by LKIM and DOF to aggregate fish as presented on **Table 6.3.17**. *Tukun Darat* is about 3 km from the proposed area to be reclaimed and *Tukun Pisang* is about 7 km away.

According to DOF and the local fishermen, there are no aquaculture and molluscs fishery projects near the proposed Project area.

Table 6.3.17: Fishing aggregates	devices near pro	posed Project site
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Name of Fish Aggregates Devices	Location Coordinate
Tukun Darat	03° 54.847' N 103° 26.149' E
Tukun Pisang	03° 54.665' N 103° 28.406' E



# 6.3.2.4 Marine Mammals and Turtles

Limited records are available on the occurrence and distribution of marine mammals in the waters surrounding Malaysia. However, the marine mammals listed in **Table 6.3.18** have been reported offshore Peninsular Malaysia.

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Common Name	Scientific Name
Sei whale	Balaenoptera borealis
Bryde whale	Balaenoptera edeni
Fin whale	Balaenoptera physalus
Common dolphin	Delphinus delphis
Dugong	Dugong dugon
Short-finned pilot whales	Globicephala macrorhynchus
Pygmy sperm whale	Kogia breviceps
Fraser's dolphin	Lagenodelphis hosei
Finless porpoise	Neophocaena phocaenoides
Irrawaddy dolphin	Orcaella brevirostris
Indo-pacific humpbacked dolphin	Sousa chinensis

Source: EIA – Cendor Field Development, Block PM-304, Exclusive Economic Zone, Offshore Peninsular Malaysia, South China Sea.

The Fin whale, Sei whale, Bryde whale, Indo-pacific humpbacked dolphin, and Dugong are listed as protected under the Convention on the International Trade of Endangered Species (CITES) of which Malaysia is a signatory. Additionally, Dugongs are listed as Vulnerable in the IUCN Red List of Threatened Species 2016.3.

Meanwhile 4 species of turtles are commonly found in the east coast, namely Leatherback turtle (*Dermochelys coriacea*), Green turtle (*Chelonia mydas*), Hawksbill turtle (*Eretmochelys imbricata*) and the Olive Ridley sea turtle (*Lepidochelys olivacea*). The IUCN Red List of Threatened Species 2016.3 has categorised the Hawksbill turtles as critically endangered, the Green turtles as endangered, and the Leatherback and Olive Ridley turtles as vulnerable.

These turtles nest along the coast of Terengganu, Pahang, Johor and many nearby islands between March and October after which they migrate back to the vast open space of South China Sea to their feeding ground. **Figures 6.3.3** and **6.3.4** show Green and Hawksbill turtle's migration routes respectively. Based on the figures, it is noted that Green turtle movement routes include the South China Sea near coastal area of Peninsular Malaysia. A list of turtle nesting areas reported along the east coast of Peninsular Malaysia is shown in **Table 6.3.19**.



State	Location
Terengganu	Cakar hutan at Paka
	Kijal
	Kuala Setiu Baharu
	Pulau Kapas
	Pulau Perhentian (Pantai Tiga Ruang Besar, Pantai Tiga Ruang Tengah, Pantai Tiga Ruang Menangis, Telok Karma and Tanjung Tukoh)
	Pulau Redang (Pantai Mak Sempit, Pantai Mak Simpan and Pantai Cakar Hutan)
	Pulau Tenggol
	Rantau Abang
	South of Pantai Geliga, Kemaman
Pahang	Pantai Chendor, Cherating

Table 6.3.19: Reported Turtle Nesting Areas along the East Coast of Peninsular Malaysia

Source: EIA of Proposed Tembikai Oil Development, Offshore Terengganu, June 2014



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Figure 6.3.3: Green Turtles Movement Cross over the Coral Triangle Countries

Chapter 6

ENVIRONMENTAL IMPACT ASSESSMENT FOR PROPOSED DEVELOPMENT OF KUANTAN MARITIME HUB AT MUKIM SUNGAI KARANG, KUANTAN, PAHANG DARUL MAKMUR



Figure 6.3.4: Hawksbill Turtles Movement Cross over the Coral Triangle Countries

Chapter 6

# 6.4 Land Use

Description on land use component surrounding the proposed Project site shall involve collation, review and analyses of both primary and secondary data. An initial site visit was carried out to familiarize with the existing use of the land of the proposed Project site and its surrounding areas. The zone of study is proposed up to 5 km radius from the proposed Project boundaries.

# 6.4.1 Environmental Sensitive Area

Several environmental sensitive areas (ESA) adjacent to the Project site are identified as mangroves, fishing aggregates devices (*tukun*), existing discharge points (including river and culverts) and nearby facilities such as residential and Kuantan Port including its navigation channel and anchorage area. These ESAs are tabulated in **Table 6.4.1** and illustrated on **Figure 6.4.1**.

Table 6.4.1: List of Environmental Sensitive Areas (ESAs) adjacent to the Proposed Project Site

Type of ESA		Approximate Distance from Project Site (km)	Direction
Mangroves	At estuary of Sg Pengorak	Immediate	North
Existing Discharge Point	Sg Pengorak	Immediate	North
	2 discharge culverts	Immediate	Northeast
	Sg Balok	3.3	Southwest
Facilities	Kuantan Port	0.2	Northeast
	LPK Apartment	0.1	North
	Kg. Selamat	0.1	North
Fish Aggregates Devices	Tukun Darat	3	Southeast
	Tukun Pisang	7	Southeast

In addition, an underground hydrogen pipeline owned by Air Product was reported to be running along the Jalan Tanjung Gelang as illustrated on **Figure 6.4.2**.

# 6.4.2 Existing Land Use within the Proposed Project Site

The proposed KMH is to be located fronting the South China Sea and in proximity to Kuantan Port (**Figure 1.4.1**). The proposed Project site is situated immediately south of Kuantan Port, approximately 0.9km from Gebeng Industrial Estate and 100m southeast of Kampung Selamat. The proposed Project boundaries cover the Tanjung Gelang coastal area which is located south of Kuantan Port and along Pantai Pengorak. The immediate surroundings of the proposed Project site are as shown in **Plates 6.4.1** to **6.4.3**.



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FIGURE: 6.4.2

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ENVIRONMENTAL IMPACT ASSESSMENT FOR PROPOSED DEVELOPMENT OF KUANTAN MARITIME HUB AT MUKIM SUNGAI KARANG, KUANTAN, PAHANG DARUL MAKMUR



Plate 6.4.1: View of north-border of the proposed Project site



Plate 6.4.2: View of the north-western side of the proposed Project site



Plate 6.4.3: View of proposed Project site.

# 6.4.3 Existing Land Use within 5 km from the Proposed Project Site

Existing land uses within 5km from the proposed Project boundaries mainly consists of industries, residentials, commercial areas, and schools. The existing land uses within 5km from the proposed Project boundaries based on initial site survey and desktop search is as shown in **Figure 6.4.3**, **Figure 6.4.4** and **Figure 6.4.5**. Some of the prominent land uses are tabulated in **Table 6.4.2**. Photos of key immediate land uses near the proposed Project Boundaries (within 1km) are as shown as **Plates 6.4.4 to 6.4.9**.





Source: Google Earth 2016

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### ENVIRONMENTAL IMPACT ASSESSMENT PROPOSED DEVELOPMENT OF KUANTAN MARITIME HUB AT MUKIM SUNGAI KARANG, KUANTAN, PAHANG DARUL MAKMUR

# LEGEND:

PROJECT SITE

PHASE 1

PHASE 2 (FUTURE DEVELOPMENT)

PHASE 3 (FUTURE DEVELOPMENT)

- 6) Masjid Balok Makmur
- 7) Sek Keb Balok Baru
- 22) Borsig
- 23) MIECO Chipboard Bhd
- 81) Quarry
- 105) Kg Selamat
- 106) Seberang Balok
- 123) Taman Balok Makmur
- 124) Taman Emerald Lnt Balok
- 144) KP Depot
- 145) Small Petronas Petrol Station
  146) Wisma Kuantan Port Consortium
  147) Evergreen Marine Corp and etc

- 148) Lembaga 149) Worker Quaters
- 150) SAYZ, railway station
- 156) TSS Transport Sdn Bhd
- 157) Aras Kuasa Sdn Bhd
- 158) Storm Water Culvert
- 159) PTFA 1

- 160) Logoplaste Malaysia 161) Air Product 162) FPG Oleo Chemicals
- 163) Kuantan Flour Mill
- 164) Felda Vege Oil
- 165) Felda Bulkers Sdn Bhd
- 166) Pangkalan TLDM 167) Bukit Tanjung Gelang

# LANDUSE WITHIN 500M - 1KM RADIUS

#### FIGURE: 6.4.3

#### Source: Google Earth 2016



2) Samsuria Resort Apartment 6) Masjid Balok Makmur 7) Sek Keb Balok Baru 8) SMK Pelabuhan & SK Pelabuhan 9) Grace 10) Sealed Air 11) Petronas Chemical MTBE 12) RP Chemicals 13) Polypropylene 14) South Pacific Chemical 15) TNB Gebeng 16) Cargill 17) PTS Goldkist Industry Sdn Bhd 18) Yonming 19) Gas Malaysia Berhad

20) KNM Process System 21) Asturi 22) Borsig 23) MIECO Chipboard Bhd 24) Petikemas Engineering 25) Lestari Bersatu Warehouse Sdn Bhd 26) Syarikat Logistik Petikemas (D'Lobster) 27) East Coast Multi-Service Sdn Bhd 28) Southern Steel 29) Yanox 30) ECMS & Padiberas Nasional 31) Ji Kang Dimensi Sdn. Bhd 32) Engtex 33) Vibrant Waves

34) Lee Thong Hung Logistics 35) Amalgamate Metal Corporation (M) Sdn Bhd 36) Kejora Teguh 37) JLM Engineering Sdn Bhd Warehouse 38) Aquasis 39) Boccard 40) Mestika Rimba 41) Pritam Singh Agency 42) Linde 43) Linsun Engineering 44) AMS Engineering Sdn. Bhd 54) Kanon Loading & Siong Heng Engineering 55) Paras Saksama Sdn. Bhd 58) Grandee Biotech 59) Vega Precision

69) Southern Industrial Gas Sdn Bhd 70) Multicipta Engineering 71) RWNA Engineering 75) Lafarge 76) Gapura Rizq 77) Silverstone, Petikemas 78) Fin Tubes 79) East Cost Multi-Service Technology Park 80) Felda Courier Service Express Delivery 81) Quarry 82) Shop Lots 83) Amalgamate Metal Corporation (M) Sdn Bhd 84) Amalgamate Metal Corporation (M) Sdn Bhd 85) Felda Transport 86) Felda Trading

87) Felda Transport Parking 88) Institusi Latihan Perindustrian 89) Dialog 90) Kinsteel 91) Urban 92) TM 93) Srijanis 94) MACES Sdn Bhd 95) East Cost Multi-Services 96) SME Bank Kompleks Usahawan 97) Brigestone 98) Shops Lots 99) Kinsteel 100) Micro Matrix 101) Malaysia Coal

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#### ENVIRONMENTAL IMPACT ASSESSMENT PROPOSED DEVELOPMENT OF KUANTAN MARITIME HUB AT MUKIM SUNGAI KARANG, KUANTAN, PAHANG DARUL MAKMUR

# LEGEND:

PROJECT SITE

PHASE 1

PHASE 2 (FUTURE DEVELOPMENT)

#### PHASE 3 (FUTURE DEVELOPMENT)

102) Taman Sg. Ular Jaya 103) Taman Sg. Ular Damai 104) Kg Gebeng 105) Kg Selamat 106) Seberang Balok 107) Taman Kasha Villa 108) Taman Aisha 109) Ko Seberano Balok 110) Taman MH Seberang Balok 111) Perkampungan Seberang Balok 1 112) Taman Balok Faiar 113) Taman Wira Jaya 114) Seberang Balok Aman 119) Taman Balok Putra 120) Kompleks Perumahan TLDM Balok Ria 121) Taman Cahaya 122) Kompleks Perumahan TLDM Seberang Balok 123) Taman Balok Makmur 124) Taman Emerald Lnt Balok 125) Taman Armani Balok Makmur 126) Balok Perdana 127) Kompleks Perumahan TLDM Taman Samudra 129) Institusi Latihan Perindustrian 131) Petronas Storage Room 132) Petronas Oil Terminal 133) AstaChem 134) Shell Malaysia Trading Sdn. Bhd 135) Petron 136) Union Harvest 137) BASF Port Tank Farm 138) Chemstation Asia 139) Decommissioned storage 140) UPC Tank Farm 141) Opposite UPC Tank Farm 142) East Coast Multi-Service Sdn. Bhd 143) Iron dust stockpile entrance 144) KP Depot 145) Small Petronas Petrol Station 146) Wisma Kuantan Port Consortium 147) Evergreen Marine Corp and etc 148) Lembaga 149) Worker Quaters 150) SAYZ, railway station 151) FGV 152) Cargill 153) Bredero Shaw 154) YAL Resources Holding and Kraypton Corporation 155) Felcra Niaga Sdn Bhd 156) TSS Transport Sdn Bhd 157) Aras Kuasa Sdn Bhd 158) Storm Water Culvert 159) PTFA 1 160) Logoplaste Malaysia 161) Air Product 162) FPG Oleo Chemicals 163) Kuantan Flour Mill 164) Felda Vege Oil 165) Felda Bulkers Sdn Bhd 166) Pangkalan TLDM 167) Bukit Tanjung Gelang

### LANDUSE WITHIN 500M - 3KM RADIUS

#### FIGURE: 6.4.4



	100	
1) Mermaid Inn	17) PTS Goldkist Industry Sdn Bhd	33) Vibrant Waves
2) Samsuria Resort Apartment	18) Yonming	34) Lee Thong Hung Logistic
3) Pacific Selatan Agency Sdn. Bhd (D'Rabbit)	19) Gas Malaysia Berhad	35) Amalgamate Metal Corpo
<ol><li>Tenaga Nasional Switch Station</li></ol>	20) KNM Process System	36) Kejora Teguh
5) Surau Kg Gebeng	21) Asturi	37) JLM Engineering Sdn Bh
6) Masjid Balok Makmur	22) Borsig	38) Aquasis
7) Sek Keb Balok Baru	23) MIECO Chipboard Bhd	39) Boccard
8) SMK Pelabuhan & SK Pelabuhan	24) Petikemas Engineering	40) Mestika Rimba
9) Grace	25) Lestari Bersatu Warehouse Sdn Bhd	41) Pritam Singh Agency
10) Sealed Air	26) Syarikat Logistik Petikemas (D'Lobster)	42) Linde
11) Petronas Chemical MTBE	27) East Coast Multi-Service Sdn Bhd	43) Linsun Engineering
12) RP Chemicals	28) Southern Steel	44) AMS Engineering Sdn. E
13) Polypropylene	29) Yanox	45) Kontena Nasional
14) South Pacific Chemical	30) ECMS & Padiberas Nasional	46) Kaneka
15) TNB Gebeng	31) Ji Kang Dimensi Sdn. Bhd	47) Eastman
16) Cargill	32) Engtex	48) Jacobs Engineering Sdn

- oration (M) Sdn Bhd
- hd Warehouse
- Bhd
- Bhd

49) New Construction, ERF Diesel (M) Sdn Bhd

- 50) Ecotower 51) Mechema
- 52) Waris Nove
- 53) Eng Parts Supply (M) Sdn Bhd
- 54) Kanon Loading & Siong Heng Engineering
- 55) Paras Saksama Sdn. Bhd
- 56) Mediland
- 57) Flowserve 58) Grandee Biotech
- 59) Vega Precision
- 60) Emergency Response Centre
- 61) Polyplastik tank
- 62) Dynaciate (Kuantan) 63) South Pacific Chemical
- 64) Voltage Solar Plant

- 65) Tangki Simpanan Menara Air (under construction)
- 66) Lynas
- 67) Misi Setia
- 68) KNM Process System
- 69) Southern Industrial Gas Sdn Bhd
- 70) Multicipta Engineering
- 71) RWNA Engineering
- 72) Ideal Metal Allov
- 73) TEV
- 74) Volvo
- 75) Lafarge 76) Gapura Rizq
- 77) Silverstone, Petikemas
- 78) Fin Tubes
- 79) East Cost Multi-Service Technology Park
- 80) Felda Courier Service Express Delivery
- 81) Quarry

82) Shop Lots 83) Amalgamate Metal Corporation (M) Sdn Bhd 84) Amalgamate Metal Corporation (M) Sdn Bhd 85) Felda Transport 86) Felda Trading 87) Felda Transport Parking 88) Institusi Latihan Perindustrian 89) Dialog 90) Kinsteel 91) Urban 92) TM 93) Srijanis 94) MACES Sdn Bhd 95) East Cost Multi-Services 96) SME Bank Kompleks Usahawan 97) Brigestone 98) Shops Lots 99) Kinsteel 100) Micro Matrix 101) Malaysia Coal 102) Taman Sg. Ular Jaya 103) Taman Sg. Ular Damai 104) Kg Gebeng 105) Kg Selamat 106) Seberang Balok 107) Taman Kasha Villa 108) Taman Aisha 109) Kg Seberang Balok 110) Taman MH Seberang Balok 111) Perkampungan Seberang Balok 1 112) Taman Balok Fajar 113) Taman Wira Jaya 114) Seberang Balok Aman 115) Perkampungan Balok Baru 116) Balok Pine 117) Perkampungan LKAP Balok Baru 118) Taman Balok Pelangi 119) Taman Balok Putra 120) Kompleks Perumahan TLDM Balok Ria 121) Taman Cahaya 122) Kompleks Perumahan TLDM Seberang Balok 123) Taman Balok Makmur 124) Taman Emerald Lnt Balok 125) Taman Armani Balok Makmur 126) Balok Perdana 127) Kompleks Perumahan TLDM Taman Samudra 128) Taman Putra Perdana 129) Institusi Latihan Perindustrian 130) MCKIP 131) Petronas Storage Room 132) Petronas Oil Terminal 133) AstaChem 134) Shell Malaysia Trading Sdn. Bhd 135) Petron 136) Union Harvest 137) BASE Port Tank Farm 138) Chemstation Asia 139) Decommissioned storage 140) UPC Tank Farm 141) Opposite UPC Tank Farm 142) East Coast Multi-Service Sdn. Bhd 143) Iron dust stockpile entrance 144) KP Depot 145) Small Petronas Petrol Station 146) Wisma Kuantan Port Consortium 147) Evergreen Marine Corp and etc 148) Lembaga 149) Worker Quaters 150) SAYZ, railway station 151) FGV 152) Cargill 153) Bredero Shaw 154) YAL Resources Holding and Kraypton Corporation 155) Felcra Niaga Sdn Bhd 156) TSS Transport Sdn Bhd 157) Aras Kuasa Sdn Bhd 158) Storm Water Culvert 159) PTFA 1 160) Logoplaste Malaysia 161) Air Product 162) FPG Oleo Chemicals 163) Kuantan Flour Mill 164) Felda Vege Oil 165) Felda Bulkers Sdn Bhd 166) Pangkalan TLDM FIGURE: 6.4.5 167) Bukit Tanjung Gelang