001190

JABATAN PERANCANGAN BANDAR DAN DESA
NEGERI TERENGGANU
Tingkat 3 dan 4, Wisma Negeri
20646 Kuala Terengganu
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MALAYSIA.

PLANMalaysia
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Perancangan Melangkaui Kelaziman
Planning: Beyond Conventional

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No.Faks : *09-624 4117*

Ruj.Kami : JPBD.Tr. 02/4740 (12)
Bertarikh : 14 Disember 2017
Bersamaan : 25 Rabiul Awal 1439

DHI (Malaysia)
Incoming/Outgoing
Date: 20-12-17
File no: Master

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Ketua Pasukan Kajian EIA
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3A01 & 02, Block G
Pusat Dagangan Phileo Damansara 1
No. 9, Jalan 16/11, Off Jalan Damansara
46350 Petaling Jaya
SELANGOR DARUL EHSAN.

Tuan,

PROPOSED RECLAIMATION AND DEVELOPMENT OF THE SUNRISE CITY MIXED DEVELOPMENT AT MUKIM SEBERANG TAKIR, DISTRICT OF KUALA NERUS, KUALA TERENGGANU - KEPERLUAN PENILAIAN IMPAK SOSIAL (SIA)

Dengan segala hormatnya saya merujuk perkara tersebut di atas dan surat tuan melalui rujukan 62801461-LET-hay-009 bertarikh 5 Disember 2017 adalah berkaitan.

2. Hasil dari semakan dan perbincangan yang dibuat, pihak jabatan bersetuju untuk memberi kelonggaran bagi pengecualian laporan Penilaian Impak Sosial (SIA) di dalam laporan EIA berdasarkan justifikasi yang diberikan oleh pihak perunding.

3. Walaubagaimanapun, laporan Penilaian Impak Sosial (SIA) bagi projek ini **perlu disediakan secara berasingan** selaras dengan keperluan Akta Perancangan Bandar dan Desa (Pindaan) 2017 (Akta A1522) di bawah Seksyen 20(B) yang diwartakan pada 16 Januari 2017 iaitu bagi projek-projek yang diangkat untuk mendapat nasihat dari Majlis Perancang Fizikal Negara.

4. Keperluan Penilaian Impak Sosial (Social Impact Assessment (SIA)) di dalam perancangan projek merupakan pendekatan penilaian impak pemajuan yang berteraskan sosial bagi memberi penekanan kepada kesejahteraan rakyat. Ia berperanan menilai isu-isu dari sesuatu cadangan pemajuan dengan mencadangkan alternatif pembangunan dan membuat pilihan terbaik bagi mengelakkan impak serta meminimumkan kesan negatif kepada komuniti.

Sekian, terima kasih.

...2/-

PROPOSED RECLAIMATION AND DEVELOPMENT OF THE SUNRISE CITY MIXED DEVELOPMENT AT MUKIM SEBERANG TAKIR, DISTRICT OF KUALA NERUS, KUALA TERENGGANU - KEPERLUAN PENILAIAN IMPAK SOSIAL (SIA)

"TRANSFORMASI TERENGGANU BAHARU"
"BERKHIDMAT UNTUK NEGARA"

Saya yang menurut perintah,

(TPr. HAJAH ROHAYA BINTI ABD. KADIR)
Pengarah
PLANMalaysia@Terengganu
(Jabatan Perancangan Bandar dan Desa
Negeri Terengganu Darul Iman)

NMN/smr...131217

Annex B

TOR Approval Conditions

Appendix C

TOR Extension Letter

Jabatan Alam Sekitar
Department of Environment
Kementerian Tenaga, Sains, Teknologi,
Alam Sekitar & Perubahan Iklim *(MESTECC)*
Aras 1 - 4, Podium 2 & 3, Wisma Sumber Asli
No. 25, Persiaran Perdana Presint 4
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Faks 03-8889 1040 / 8888 9987 (Pentadbiran)
03-8888 2693 (Integriti)
03-8888 4151 (Udara)
03-8889 1042 (Komunikasi Strategik)
03-8889 1045 (Penilaian)
03-8888 4070 (Air & Marin)
03-8888 0067 (Penguatkuasaan)
03-8888 9964 (Teknologi Maklumat)
03-8888 6120 (Bahan Berbahaya)
03-8889 1973/1975 (Bilik Operasi)
Laman Web : www.doe.gov.my

Ruj.Kami: JAS. 50/013/100/082 (26)

Tarikh: 03 September 2018

Pengarah Urusan
ELCCA Properties Sdn. Bhd.
M602, Blok Mawar
Pangsapuri Permint Harmoni
Jalan Batas Baru
20300 KUALA TERENGGANU, TERENGGANU

Tel. : 09-666 6431
Faks : 09-662 2430

Tuan,

BIDANG RUJUKAN (*TERMS OF REFERENCE,* TOR) BAGI LAPORAN KAJIAN PENILAIAN KESAN KEPADA ALAM SEKELILING (EIA) BAGI PROPOSED RECLAMATION AND DEVELOPMENT OF THE SUNRISE CITY MIXED DEVELOPMENT AT MUKIM SEBERANG TAKIR, DISTRICT OF KUALA NERUS, KUALA TERENGGANU, TERENGGANU OLEH ELCCA PROPERTIES SDN. BHD.

- **Permohonan Perlanjutan Tempoh Sah Bidang Rujukan (TOR)**

Saya dengan hormatnya diarah merujuk kepada perkara di atas dan surat tuan (Rujukan: EPSB/JAS/2018-(001)) yang bertarikh 14 Ogos 2018 adalah berkaitan.

2. Setelah menyemak permohonan tuan untuk melanjutkan tempoh pengesahan Bidang Rujukan (TOR) bagi cadangan projek di atas, Jabatan ini mengambil maklum mengenai urusan mendapatkan sokongan pihak Kerajaan Negeri Terengganu untuk mengangkat projek ini ke peringkat Majlis Perancangan Fizikal Negara (MPFN) dan tiada sebarang perubahan pada pembangunan bagi projek ini sepertimana yang telah dinyatakan di dalam TOR khususnya dari segi status guna tanah terkini, komponen dan lokasi projek.

RECEIVED
24 SEP 2018

Extra time for TOR

3. Sehubungan dengan itu, sukacita dimaklumkan bahawa tempoh pengesahan Bidang Rujukan (TOR) bagi cadangan projek tersebut di atas akan dilanjutkan selama **satu (1) tahun** bermula dari tarikh surat ini dikeluarkan.

4. Dalam hal ini semua perkara dalam TOR yang dikemukakan melalui **surat rujukan 62801461-RPT-101 bertarikh 20 Julai 2017**, dan perkara-perkara yang telah dikemukakan dalam **surat pengesahan TOR rujukan JAS.50/013/100/082 (14) bertarikh 24 Ogos 2017** hendaklah diambilkira di peringkat kajian EIA cadangan projek tersebut. Pihak tuan boleh meneruskan kajian dan penyediaan Laporan EIA mengikut garispanduan *Environmental Impact Assessment Guidelines in Malaysia 2016* yang diterbitkan oleh Jabatan ini.

5. Jabatan ini juga ingin menarik perhatian pihak tuan bahawa pengesahan ke atas Bidang Rujukan ini hanya sah diterima pakai dalam tempoh **satu (1) tahun** dari tarikh surat ini dikeluarkan dan akan terbatal sekiranya kajian EIA tidak dilaksanakan dalam tempoh tersebut.

Sekian, dimaklumkan.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menurut perintah,

(ROHIMAH BINTI AYUB)
b.p. Ketua Pengarah Alam Sekitar Malaysia

s.k

1. Pengarah
   Jabatan Alam Sekitar Negeri Terengganu
   Wisma Alam Sekitar
   Off Jalan Sultan Omar
   20300 KUALA TERENGGANU,TERENGGANU

Appendix D

Hydraulic Approval Letter

Appendix E

Baseline Report

Proposed Reclamation and Capital Dredging for the Sunrise City Mixed Development at Mukim Kuala Nerus, District of Kuala Nerus, Terengganu, Malaysia

Environmental Impact Assessment

Baseline Report

Elcca Properties Sdn. Bhd.

62801461-RPT-103 Rev. 03

August 2019

This report has been prepared under the DHI Business Management System certified by Bureau Veritas to comply with ISO 9001 (Quality Management)

Proposed Reclamation and Capital Dredging for the Sunrise City Mixed Development at Mukim Kuala Nerus, District of Kuala Nerus, Terengganu, Malaysia

Environmental Impact Assessment

Baseline Report

Prepared for Elcca Properties Sdn. Bhd.

Represented by Mr. Liew Ah Yong

Sunrise City

Current Revision Approvals

	Name / Title	Signature	Date
Prepared by	Noor Atika Abdullah, Malinda Auluck, Mohamad Hafiz Yahya	NAA, MAU, HAY	Aug 05, 2019
Reviewed by	Syed Mohazri Syed Hazari	SMH	Aug 27, 2019
Approved by	Tania Golingi	TAG	Aug 28, 2019

Classification

☐ Open	☒ Restricted	☐ Confidential

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Document Information

Project No.	62801461		
Project Title	Proposed Reclamation and Capital Dredging for the Sunrise City Mixed Development at Mukim Kuala Nerus, District of Kuala Nerus, Terengganu, Malaysia		
Subject	Baseline Survey Report		
Client	Elcca Properties Sdn. Bhd.		
Project Director	Mark Oliver		
Project Manager	Syed Mohazri Syed Hazari		
Document No.	62801461-RPT-103	**Rev**	03

Distribution	**Type of Data**	**No of copies**
Elcca Properties Sdn. Bhd.	Digital	1
DHI Water & Environment (M) Sdn. Bhd.	Digital	1

Document Revision History

Rev	**Rev Date**	**Description of Change/ Reason for Issue**	**Prepared by**	**Checked by**	**Approved by**
01	Nov 01, 2017	Survey Report submission to Client	RAPM, NAA, MAU, HAY	SMH	TAG
02	Dec 20, 2017	Baseline Assessment submission to Client	RAPM, NAA, MAU, HAY	SMH	TAG
03	Aug 28, 2019	Final Baseline Report	NAA, MAU, HAY	SMH	TAG

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CONTENTS

FIGURES

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ATTACHMENTS

1 Introduction

This report details the baseline assessment carried out for the Second Schedule Environmental Impact Assessment (EIA) study for the proposed Sunrise City development. The assessment is based on field surveys, secondary data collection and review, and consultations with government agencies as outlined in the following subsection.

1.1 Data Basis

1.1.1 Surveys

The scope of the surveys is based on the endorsed Revised Terms of Reference (TOR) as summarised in Table 1.1.

Table 1.1 Summary of baseline surveys

Environment	Component
Physico – chemical	• Marine Water Quality • Marine Sediment
Biological	• Benthic habitat mapping • Plankton • Macrobenthos • Mangrove • Fish Fauna • Terrestrial Vegetation
Human Environment	• Land Use

Survey activities were carried out in the period between September 2017 to October 2017 as detailed in Table 1.2.

Table 1.2 Duration and timing of survey components and reference to section in this report.

Survey Component	Date of Survey	Section in this Report
Marine Water Quality	• Neap: 29 Sept 2017 • Spring: 4 Oct 2017	2.1
Marine Sediment	3 Oct 2017	2.2
Habitat Mapping	29 Sept 2017- 1 Oct 2017	3.1
Plankton	29 Sept 2017	3.2
Macrobenthos	3 Oct 2017	3.3
Mangrove	30 Sept 2017	3.4
Fish Fauna	• Neap: 2 Oct 2017 • Spring: 4 Oct 2017	3.5
Terrestrial Vegetation	1 Oct 2017	3.6

Survey Component	Date of Survey	Section in this Report
Land Use	2, 3 & 5 Oct 2017	4.1

1.1.2 Secondary Data and Consultations

Apart from primary data, secondary data was also used, mostly to carry out a comparative assessment between the baseline data with other areas as published data for the Project site itself was scarce.

Table 1.3 List of agencies approached for secondary data.

Component	Agency	Data
Fisheries	Department of Fisheries Terengganu	• No. of vessel and fishermen for each zone • Fish landing (2013-2017) • Landing by gear type • Fishing vessels by gear type • Landing by species • Landing jetty
	Fisheries Development Authority of Malaysia (LKIM)	• FADs • Landing jetty
	Fishermen	• Location of FADs
Land use	Jabatan Warisan Negara	• Cultural heritage and archaeology
	Lembaga Muzium Negeri Terengganu	• Cultural heritage and archaeology
Marine Megafauna	UMT SEATRU	• Turtle nesting data • Nesting hotspot

2 Physical-Chemical Environment

2.1 Water Quality

Water quality surveys were carried out to determine the existing water quality around the Project site. The surveys in late September/ early October coincided with the intermonsoon period, with relatively calm waters and little rainfall. Water quality in Sg. Terengganu was generally good, falling within the DOE standards for estuarine waters with low suspended solids, but elevated ammonia levels were detected for spring tide samples at the river mouth.

Elevated faecal coliform counts were recorded inside the river and the areas around the river mouth. Bacterial pollution in other areas was however low, indicating rapid die-off and / or flushing of the riverine discharges, and also the absence of other sources along the coastline apart from Sg. Terengganu.

No visible plumes were observed discharging from the river, although the nearshore areas around the river mouth and within the Project site were observed to be more turbid than offshore. In-situ measurements of turbidity indicated slightly higher turbidity just off the river mouth, however this was not reflected in the results of the suspended sediments analysis.

In general, the water quality was good except for high ammoniacal nitrogen (NH_3-N) concentrations with four stations exceeding the MMWQS Class 3 limits and three stations exceeding the Class 2 limits. Nutrient concentrations were also generally higher during spring tide compared to the neap tide.

Further details of the water quality survey and its findings are given in this section. The certified laboratory results are available in Attachment A of this report.

2.1.1 Survey Methodology

2.1.1.1 Survey Period

The survey was carried out on two separate dates in September and October 2017 covering two tidal conditions as described in Table 2.1.

Table 2.1 Summary of water quality survey campaign.

Date	Tidal Condition	Water Level	Time (hours)
29 September 2017	Neap	Ebb	1140 to 1830
4 October 2017	Spring	Ebb	0900 to 1350

2.1.1.2 Survey Location

Water samples were collected at 10 stations as shown in Figure 2.1. The coordinates of the sampling stations and description of their locations are given in Table 2.2. At each station, water samples / measurements were collected / recorded at three depths, defined as follows:

- Surface - 0.5 m below water surface;
- Mid-depth - midpoint of the total depth of water column at the particular station; and
- Bottom - 0.5 m above seabed.

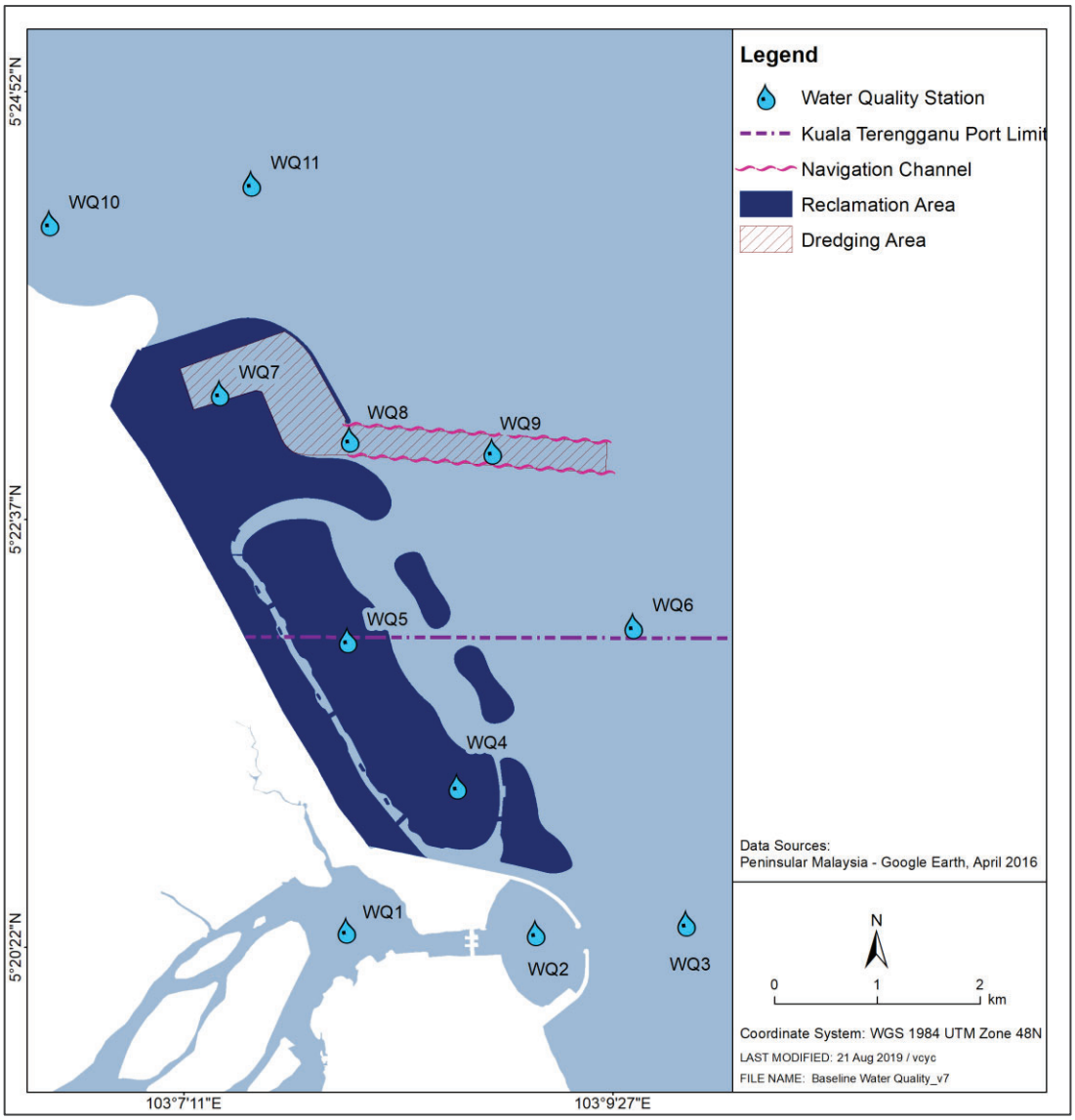

Figure 2.1 Location of water quality sampling stations.

Table 2.2 Coordinates of the water quality stations (decimal degrees; WGS1984) and description of the location.

Sampling Stations	Longitude (°E)	Latitude (°N)	Description
Estuarine			
WQ1	103.13374	5.34097	Terengganu River, approximately 2 km upstream of breakwater entrance; downstream of possible pollution sources.
WQ2	103.15015	5.33994	Terengganu river mouth (within breakwater basin).
Marine			
WQ3	103.16351	5.34165	Approximately 1 km offshore from Sg. Terengganu river mouth
WQ4	103.14366	5.35356	Within Project area, south; possible pollution sources from nearby residential area
WQ5	103.13384	5.36621	Within Project area, central.

Sampling Stations	Longitude (°E)	Latitude (°N)	Description
WQ6	103.15875	5.36782	Reference station approximately 1.4 km offshore of the Project area
WQ7	103.12291	5.38818	Within Project area, north, inside proposed basin (dredging area)
WQ8	103.13417	5.38397	Within Project navigation channel (capital dredging area)
WQ9	103.14670	5.38322	Within Project navigation channel (capital dredging area)
WQ10	103.10796	5.40312	Tok Jembal recreational beach
WQ11	103.12536	5.40613	Reference station approximately 1.0 km north of the Project area, and over 2 km offshore of Tok Jembal breakwaters.

2.1.1.3 Equipment and Water Quality Variables

Water samples for subsequent laboratory analysis were collected using a horizontal discrete water sampler. The analytes, the methodology and level of reporting are listed in Table 2.3 The analysis was undertaken by Alchemy Laboratory Services Sdn. Bhd., a SAMM accredited laboratory.

In-situ measurements of physical parameters were taken with a YSI 6600 V2 Multi-parameter Sonde. The measurement variables and accuracy are listed in Table 2.4.

Table 2.3 Water quality variables analysed in the laboratory, the test method and detection limits.

Parameter	Test Method	Laboratory detection limit	Estuarine stations	Marine stations
Temperature	*In-situ*	N.A.	√	√
Dissolved Oxygen	*In-situ*	N.A.	√	√
Salinity	*In-situ*	N.A.	√	√
Turbidity	*In-situ*	N.A.	√	√
Total Suspended Solids	APHA 2540 D	1 mg/L	√	√
Ammoniacal Nitrogen (NH_3-N)	APHA 4500-NH3 F	0.01 mg/L	√	√
Nitrate (NO_3-N)	APHA 4500-NO3- E	0.01 mg/L	√	√
Biological Oxygen Demand (BOD)	APHA 5210 B	1 mg/L	√	√
Oil and Grease	APHA 5520 B	1 mg/L	√	√
Faecal Coliform	APHA 9221 E	1.8 MPN/ 100 mL	√	√
Chromium Hexavalent	APHA 3500 Cr B	2 µg/L		√
Cadmium	APHA 3120 B	1 µg/L		√
Copper	APHA 3120 B	1 µg/L		√

Parameter	Test Method	Laboratory detection limit	Estuarine stations	Marine stations
Nickel	APHA 3120 B	1 µg/L		√
Iron	APHA 3120 B	1 µg/L		√
Lead	APHA 3120 B	2 µg/L		√
Manganese	APHA 3120 B	1 µg/L		√
Arsenic	APHA 3114 C	1 µg/L		√
Mercury	APHA 3112 B	0.001 µg/L		√

Table 2.4 In-situ water quality variables measured with the YSI Sonde.

Parameter	Unit	Accuracy
Temperature	° C	± 0.15 °C
Salinity	ppt	± 1% of reading or 0.1 ppt, whichever is greater
Dissolved Oxygen	mg/L	0 to 20 mg/L: ± 0.1 mg/L or 1% or whichever is greater
Turbidity	NTU	± 2% of reading or 0.3 NTU, whichever is greater
Depth	M	± 0.12 m

2.1.1.4 Water Sampling Procedures and Parameters

The sonde was allowed to warm up by switching it on for 10 minutes prior to sampling. Upon reaching each predetermined station, the location (GPS waypoint) was recorded. Observations on types of landuse or activities around the sampling station were recorded in a pro-forma datasheet while some photos were taken for record.

Date and time of sampling were noted in the datasheet. The water sampler / sonde was then lowered slowly through the water column to the desired depth. Upon reaching the desired depth, the sonde was held for a few minutes to achieve stable data recording, while the messenger on the water sampler was deployed to obtain a water sample. Note that the measurement procedures were repeated if the water sampler / sonde hit the seabed.

The collected water sample was transferred into labelled bottles provided by the laboratory and stored at temperature <4°C. Upon completion of sampling, the samples were collected by a representative of Alchemy Laboratory Services Sdn Bhd laboratory on the same day.

2.1.2 Guidelines and Standards

The water quality results were compared against Malaysian Marine Water Quality Criteria and Standard (MMWQS) adopted by the Department of Environment (DOE) Malaysia, Class 2, 3 and E1 (see Table 2.5), depending on the water sampling station location as shown in Table 2.6. However, Class E1 refers to characteristics of estuarine waters deemed to represent relatively undisturbed environment whereas jetties and marinas, and land-reclamation activities are present near the Sg. Terengganu river mouth. The city of Kuala Terengganu is also developed up to the Sg. Terengganu south riverbank while settlements are present on the north riverbank. It is therefore more appropriate to refer to Class 3 standards for the water quality in the Terengganu rivermouth.

Table 2.5 Malaysia Marine Water Quality Criteria and Standard (MMWQS).

Parameter / Unit		CLASS 2: Fisheries (including mariculture)	CLASS 3: Industry, Commercial Activities & Coastal Settlements
Temperature	°C	≤ 2°C increase over maximum ambient	
Dissolved oxygen	mg/L	>5	>3
Total suspended solids	mg/L	50 mg/L	100 mg/L
Oil and grease	mg/L	0.14	5
Mercury	µg/L	0.04	0.04
Cadmium	µg/L	2.00	3.00
Chromium (VI)	µg/L	10	20
Copper	µg/L	2.9	8
Arsenic (III)	µg/L	3	3
Lead	µg/L	8.5	12
Zinc	µg/L	50	100
Ammonia (NH_3-N)*	µg/L	60	320
Nitrate (NO_3-N)*	µg/L	60	700
Faecal coliform (Human health protection for seafood consumption)	CFU/100mL	70	70

** As the MMWQS follows the Asean Marine Water Quality Criteria (AMWQC), it is assumed that ammonia refers to NH_3-N while nitrate refers to NO_3-N as in the AMWQC /1/.*

Table 2.6 Classification of water quality stations based on MMWQS Classes.

Station	MMWQS Class	Justification
WQ1	Class 3	Sg. Terengganu Estuary
WQ2	Class 3	Sg. Terengganu Estuary
WQ3	Class 3	Coastal Settlement
WQ4	Class 3	Coastal Settlement
WQ5	Class 3	Coastal Settlement
WQ6	Class 3	Coastal Settlement
WQ7	Class 2	Coastal water
WQ8	Class 2	Coastal water
WQ9	Class 2	Coastal water
WQ10	Class 2	Coastal water
WQ11	Class 2	Coastal water

2.1.3 Results and Discussion

2.1.3.1 Onsite Observations

A summary of depth and weather condition at each station during each sampling campaign is given in Table 2.7, while observations during sampling are given in Table 2.8. Refer to Appendix A for Certificates of Analysis (COA)

Table 2.7 Summary of depth and weather condition at each station recorded during sampling.

Station	Water depth (m)		Weather condition	
	Neap (Ebb)	Spring (Ebb)	Neap (Ebb)	Spring (Ebb)
WQ1	5.0	4.8	Partly sunny	Sunny
WQ2	8.0	8.5	Partly sunny	Sunny
WQ3	9.5	10.0	Partly sunny	Sunny
WQ4	6.5	7.2	Sunny	Sunny
WQ5	6.6	6.9	Cloudy	Sunny
WQ6	11.5	13.0	Cloudy	Sunny
WQ7	5.0	6.0	Sunny	Sunny
WQ8	7.0	8.6	Sunny	Sunny
WQ9	11.0	13.0	Cloudy	Sunny
WQ10	4.0	5.3	Sunny	Sunny
WQ11	10.0	10.9	Sunny	Sunny

Table 2.8 Description of the water quality stations based on onsite observation.

Station	Observation
WQ1	• Turbid water. • Oil sheen was observed during spring ebb tide sampling (Photo 2.1). • Ship repair facility and earthworks were observed at the shoreline approximately 200 m from this station (Photo 2.2). • Vessels were anchored around this station during neap ebb tide sampling (Photo 2.3).
WQ2	• Turbid water. • Rock revetment was observed along the shoreline near to this station (Photo 2.5). • Approximately 100 m from the river mouth (Photo 2.4). • Oil sheen was observed during spring ebb tide sampling
WQ3	• Turbid water (Photo 2.6). • Rough sea condition. • Located approximately 1 km from the Sg. Terengganu river mouth (Photo 2.7).
WQ4	• Clear water. • Located approximately 500 m from the breakwater at Seberang Takir side (Photo 2.8).
WQ5	• Clear water (Photo 2.9).

Station	Observation
	• Located approximately 1 km from the sandy shoreline of Teluk Ketapang beach (Photo 2.10).
WQ6	• Clear water • Small jellyfish were observed at the sea surface during spring ebb sampling.
WQ7	• Clear water. • Discharge outlet was observed at the shoreline which is protected by rock revetment (Photo 2.11). • Located approximately 1 km from the shoreline of Teluk Ketapang beach.
WQ8	• Clear water with some sea foam (Photo 2.12). • Small jellyfish were observed at the sea surface during spring ebb sampling.
WQ9	• Clear water. • Small jellyfish were observed at the sea surface during spring ebb sampling.
WQ10	• Clear water. • Approximately 800 m away from the breakwater at Tok Jembal beach.
WQ11	• Clear water. • Small jellyfish were observed at the sea surface during spring ebb sampling.

Photo 2.1 Turbid water at station WQ1. Oil sheen was observed at water surface.

Photo 2.2 Ship repair facilities (yellow box) and earthwork activities (blue box) were observed along the shoreline

Photo 2.3 Vessels were anchored around station WQ1.

Photo 2.4 Sg. Terengganu river mouth

Photo 2.5 Rock revetment along shoreline

Photo 2.6 Turbid water at Station WQ3

Photo 2.7 Location of Station WQ3 near Sg. Terengganu river mouth entrance (yellow box)

Photo 2.8 Breakwater along the shoreline at Seberang Takir (500 m from Station WQ4)

Photo 2.9 Condition of water at Station WQ5

Photo 2.10 Teluk Ketapang beach, located 1 km from Station WQ5

Photo 2.11 Discharge outlet approximately 1 km from Station WQ7 (yellow box)

Photo 2.12 Condition of water at Station WQ8

2.1.3.2 Marine Water Quality

Physical Parameters

Temperature
The water temperature was consistent over the surveys ranging between 28.5°C and 30.2°C as shown in Figure 2.2. No stratification within the water column was observed, nor were there significant differences between the neap and spring tide sampling campaigns. These temperatures are within the typical sea surface temperature range of >28°C in tropical countries /2/.

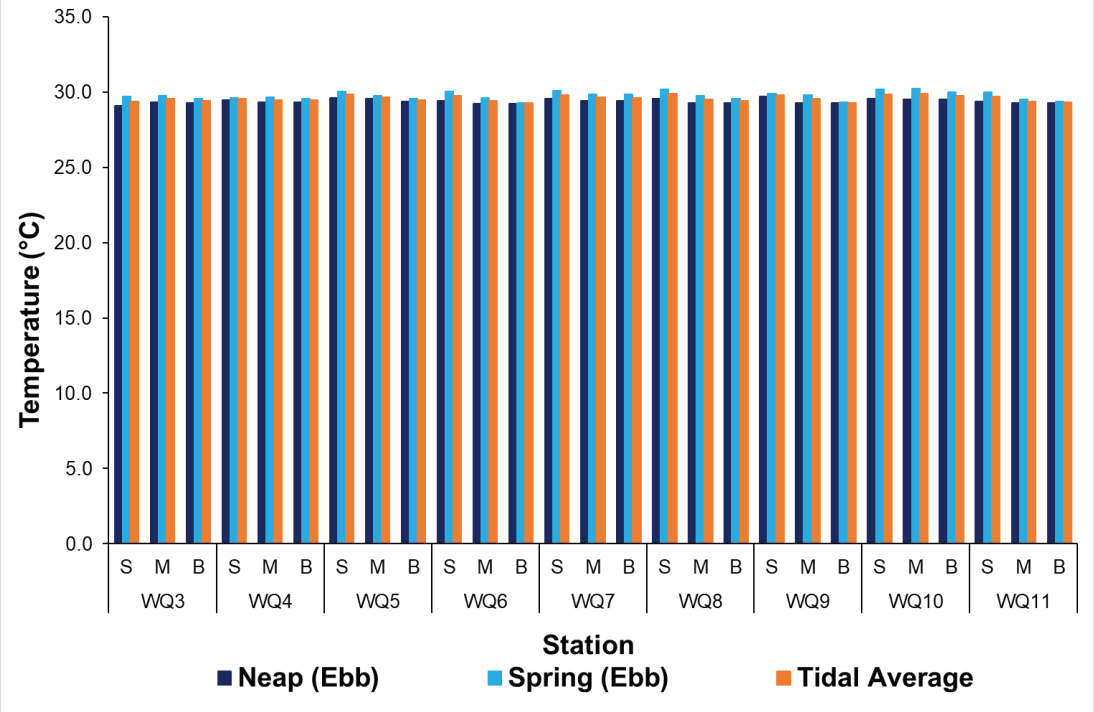

Figure 2.2 Temperature at marine water quality stations, where S= surface; M = mid depth and B = Bottom.

Dissolved Oxygen (DO)

Dissolved oxygen (DO) concentrations were consistent over the survey campaigns, ranging between 5.4 mg/L and 6.3 mg/L (Figure 2.3), which is above the minimum of 5 mg/L under MMWQS Class 2. Again, there does not appear to be any significant differences in DO concentrations between the neap and spring tide sampling campaigns, or within the water column.

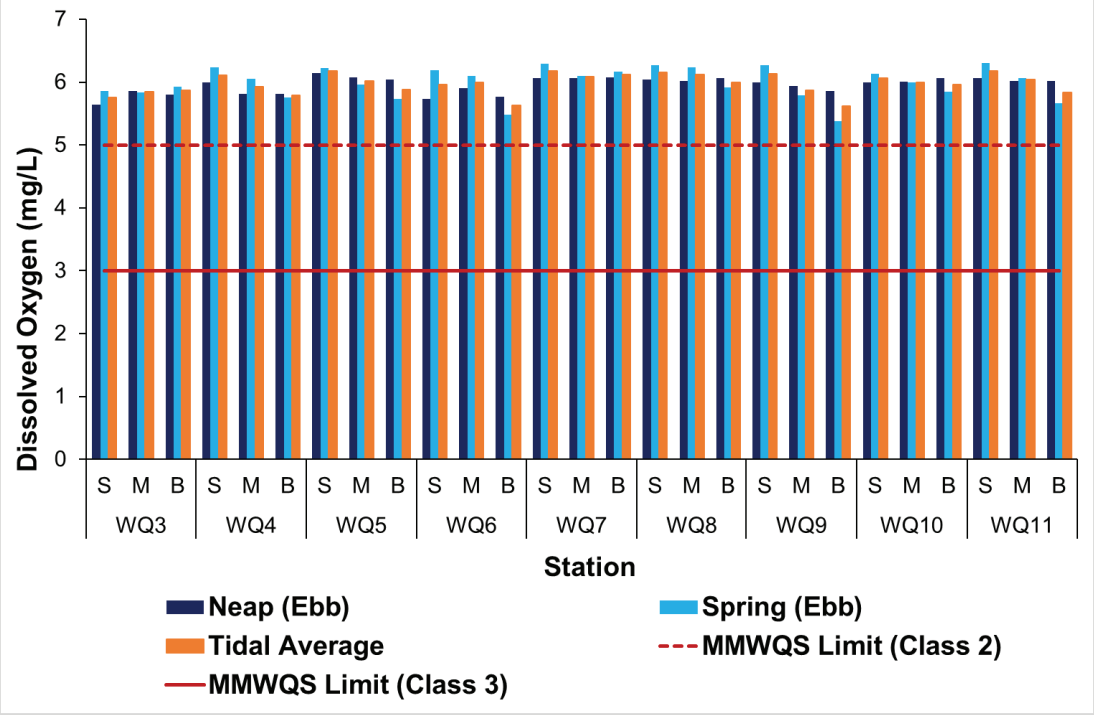

Figure 2.3 Dissolved oxygen (DO) concentration recorded at all the marine water quality stations.

Salinity

As shown in Figure 2.4, salinity was generally between 31 to 33 ppt with the exception of the surface sample of WQ3, which was an average of 18 ppt. The lower salinity at surface of WQ3 is likely to be due to freshwater discharge from Sg. Terengganu. Slightly lower surface water salinity was also observed at Stations WQ6 and WQ9 offshore of the project site at depths of around –10 m CD. In general, the salinity level at all the marine stations is within the typical seawater salinity (<34 ppt) in tropical waters /2/.

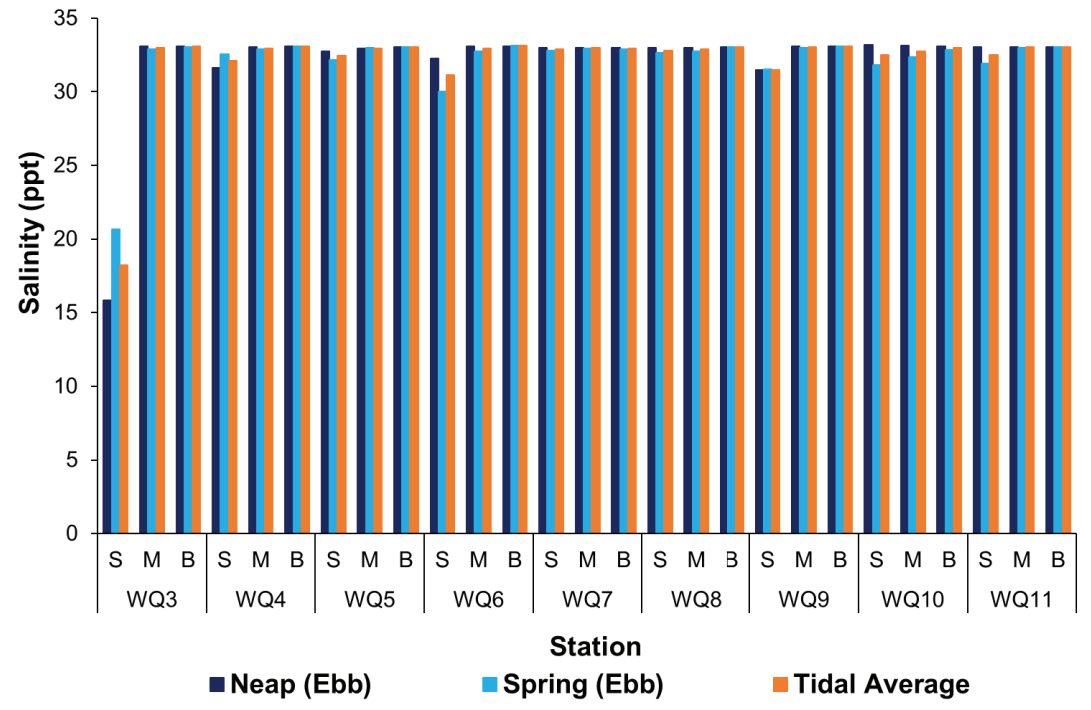

Figure 2.4 Salinity recorded at all the marine water quality stations.

Total Suspended Solid (TSS)

TSS concentration at all the marine water quality stations is shown in Figure 2.5. TSS concentration recorded during both neap and spring ebb tide was similar except at station WQ6 and WQ7 where it was higher during neap ebb tide, whereas at some other stations, higher concentrations were recorded for spring ebb tide samples. The average TSS concentration (average of neap and spring measurements) ranged between 11 mg/L and 29 mg/L which is below the MMWQS Class 2 and 3 limits of 50 and 100 mg/L respectively.

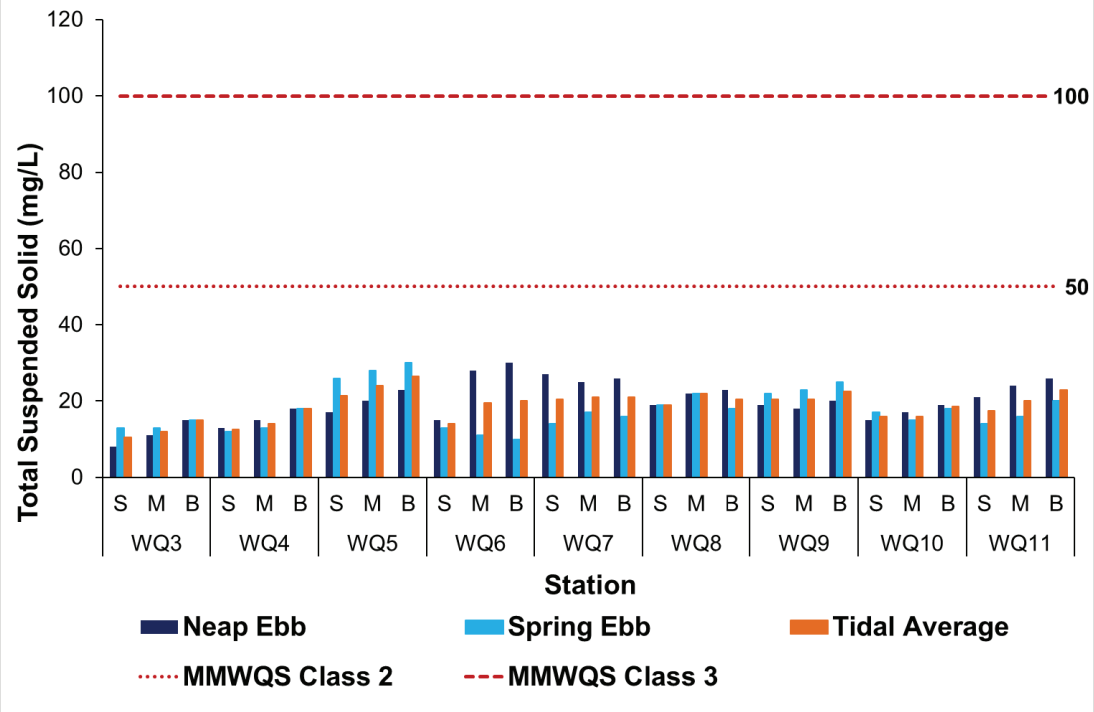

Figure 2.5 TSS concentration at all the marine water quality stations.

Turbidity

The average turbidity over spring and neap tide sampling campaigns ranged between 1.6 and 7.1 NTU as shown in Figure 2.6. Noticeably high turbidity was recorded at surface of station WQ3 on both sampling occasions, corresponding with the high turbidity observed in the field (refer Table 2.8). This is likely due to turbid water being discharged from Sg. Terengganu, given that lower salinity indicating freshwater inputs was also recorded in the surface water at Station WQ3.

In general, turbidity was higher during spring ebb tide compared to neap ebb tide. This may be due to natural variation as levels can vary considerably due to the spring-neap cycle of high and low tidal ranges with current flow generally being stronger during spring tide. It is also noted that the pattern of higher turbidity during spring tide sampling is not reflected in the TSS results (as described in the previous section). There is no specific standard for turbidity under MMWQS.

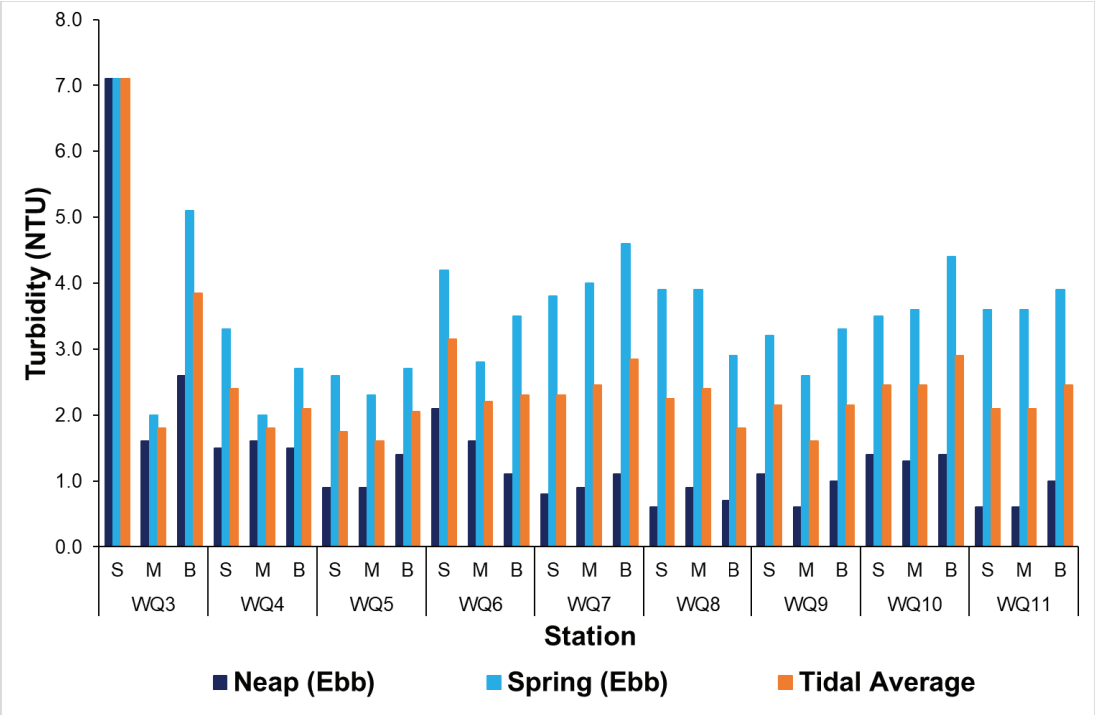

Figure 2.6 Turbidity (NTU) at the marine water quality stations during neap and spring tide sampling. The average of both sampling periods is also shown ("tidal average").

Organics

Oil and Grease

Concentration of oil and grease was below the laboratory detection limit of 1 mg/L at all the stations throughout the survey campaigns. This indicates low oil and grease pollution occurred within the coastal waters despite certain stations being located within areas of high navigation activities.

Biochemical Oxygen Demand (BOD)

BOD concentration recorded at all the marine water quality stations is shown in Figure 2.7. BOD concentrations over the spring and neap tide sampling campaigns ranged between 1.0 mg/L and 1.5 mg/L. BOD recorded during neap ebb tide was higher than during spring ebb tide. There is no limit for BOD under MMWQS.

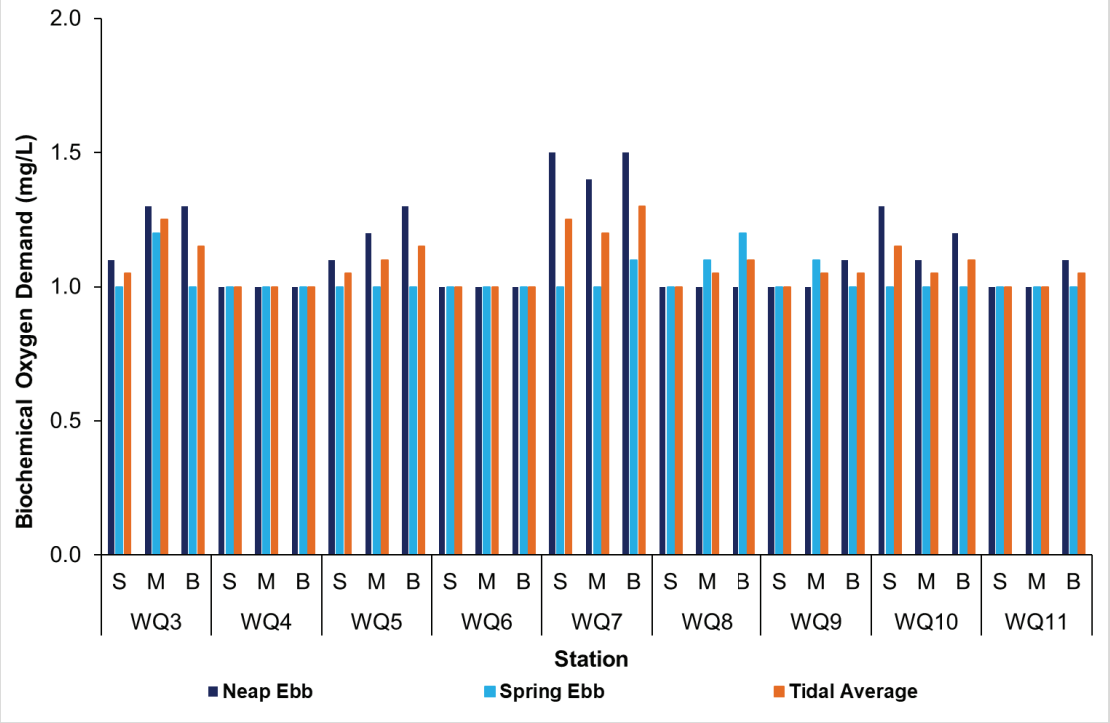

Figure 2.7 BOD concentration at all the marine water quality stations. Readings below the detection limit are shown as 1.0 mg/L in graph and tidal average calculation.

Nutrients

Ammoniacal Nitrogen

The average ammoniacal nitrogen (NH_3-N) concentration over spring and neap tide campaigns ranged between 0.01 mg/L and 0.60 mg/L as shown in Figure 2.8. Slightly more than half of the samples showed higher concentrations during spring tide with the average spring concentration at 0.20 mg/L compared to 0.08 mg/L during neap tide.

As stated in Section 2.1.2, it is assumed that the standard for ammonia in the MMWQS is referring to ammoniacal nitrogen with the limit for Class 2 and Class 3 waters being 0.05 mg/L and 0.32 mg/L respectively. For the neap tide samples, 42.4 % of the samples exceeded the Class 2 limit with only two samples (6.1 %) exceeding the Class 3 limit. However, 27.3 % of the spring tide samples exceeded the Class 2 limit and 30.3 % of the samples exceeded the Class 3 limit.

In general, ammoniacal nitrogen at stations WQ3, WQ4, WQ5, and WQ6 were within the Class 3 limit with only two points at station WQ6 during neap tide and two points at station WQ5 during spring tide exceeding the Class 3 limit. Ammoniacal nitrogen concentrations for stations WQ7 to WQ11 during neap tide were generally below the Class 2 limit except for bottom sample of station WQ7 and all depths at station WQ10. Exceedances were more common during spring tide with five points exceeding the Class 2 limit and five points exceeding the Class 3 limit.

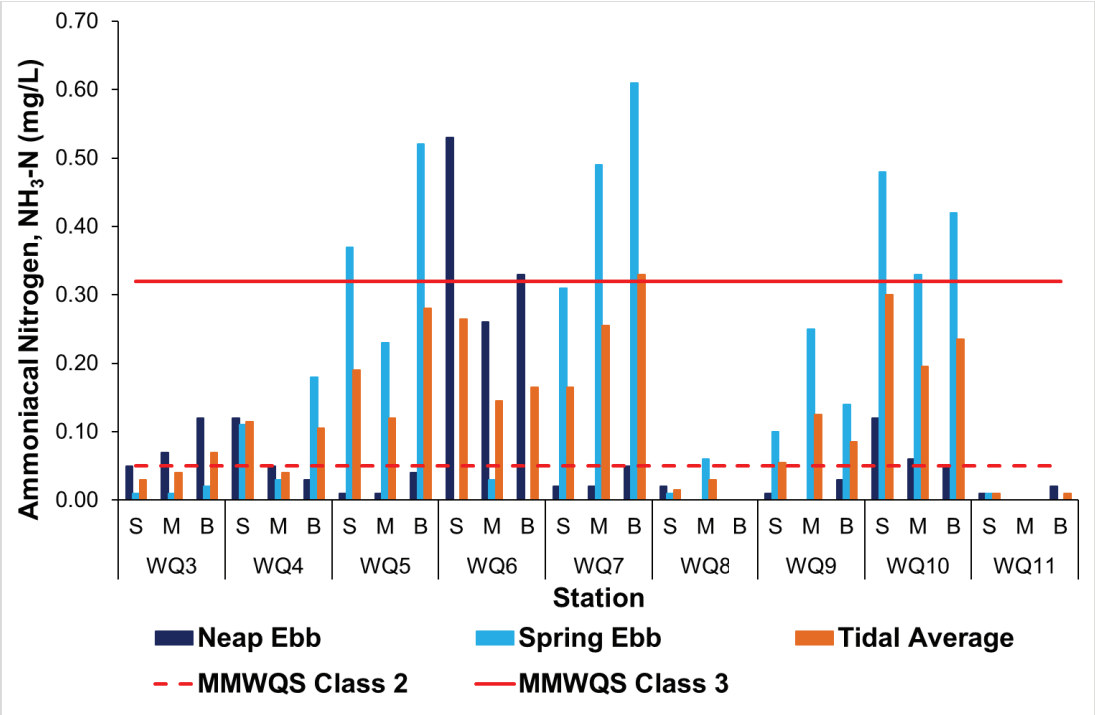

Figure 2.8 Ammoniacal nitrogen concentration at all the marine water quality stations. Concentrations below the detection limit are not shown in the figure.

Nitrate nitrogen

Nitrate (NO_3^-) nitrate-N) concentration at all the marine water quality stations is shown in Figure 2.9. Nitrate was mostly detected during spring tide ranging between 0.01 mg/L (laboratory detection limit) and 0.03 mg/L while concentrations during neap tide ranged between 0.01 mg/L and 0.05 mg/L. As stated in Section 2.1.2, it is assumed that the nitrate limit in the MMWQS refers to nitrate nitrogen with the limits for Class 2 and Class 3 being 0.06 mg/L and 0.7 mg/L respectively. Nitrate concentrations at all stations and sampling occasions were all below the Class 2 limit.

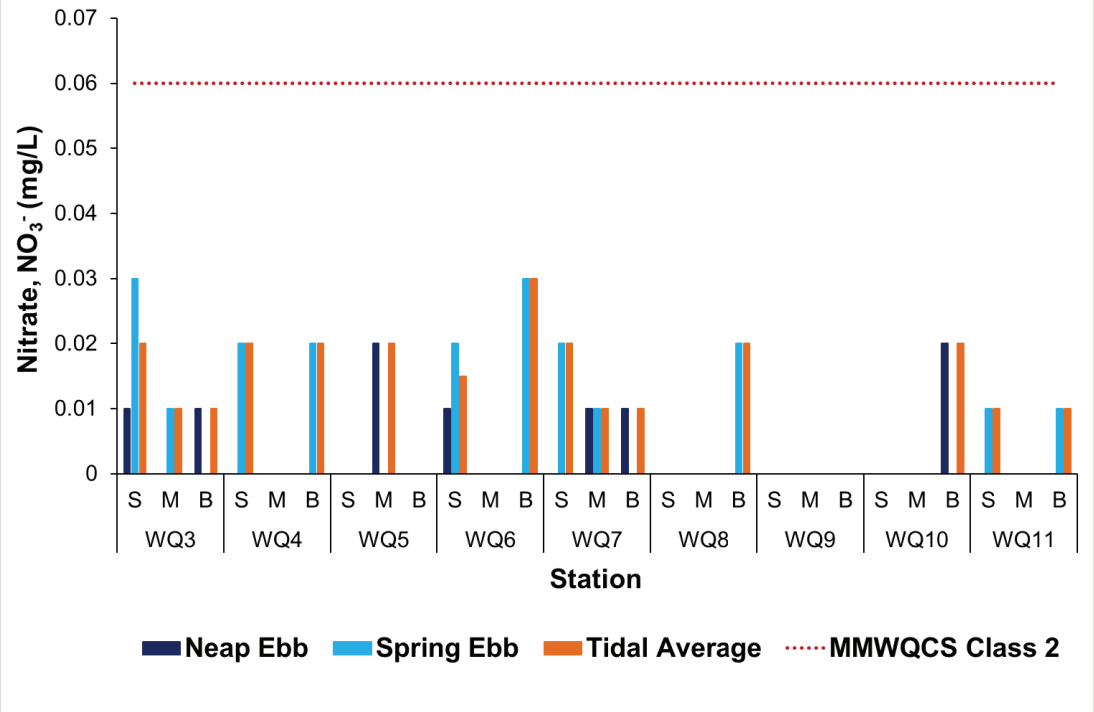

Figure 2.9 Nitrate concentration at all the marine water quality stations. Readings below the detection limit are not shown in the graph.

Faecal Coliform

Faecal coliform counts were low overall – in general less than 25 MPN/100 mL and were below the laboratory detection limit of 1.8 MPN/100 mL at stations WQ7 and WQ8 at all depths as shown in Figure 2.10. High faecal coliform counts were recorded only at station WQ3 (approximately 1 km from the Sg. Terengganu river mouth), with 240 MPN/100 mL at the neap sampling and 79 MPN/100mL during the spring tide sampling. High faecal coliform concentrations detected at stations WQ1 and WQ2 (Section 2.1.3.3) may be the source for the elevated readings at station WQ3. Lower surface salinity at station WQ3 also shows that the water at the station is influenced by the river discharge. The average over both campaigns of 8 MPN/100mL is within the old 200 MPN/ 100 mL limit of MMWQS Class 3. To note, current MMWQS limit for faecal coliform is given in CFU/100 mL and is at 70 CFU/100 mL.

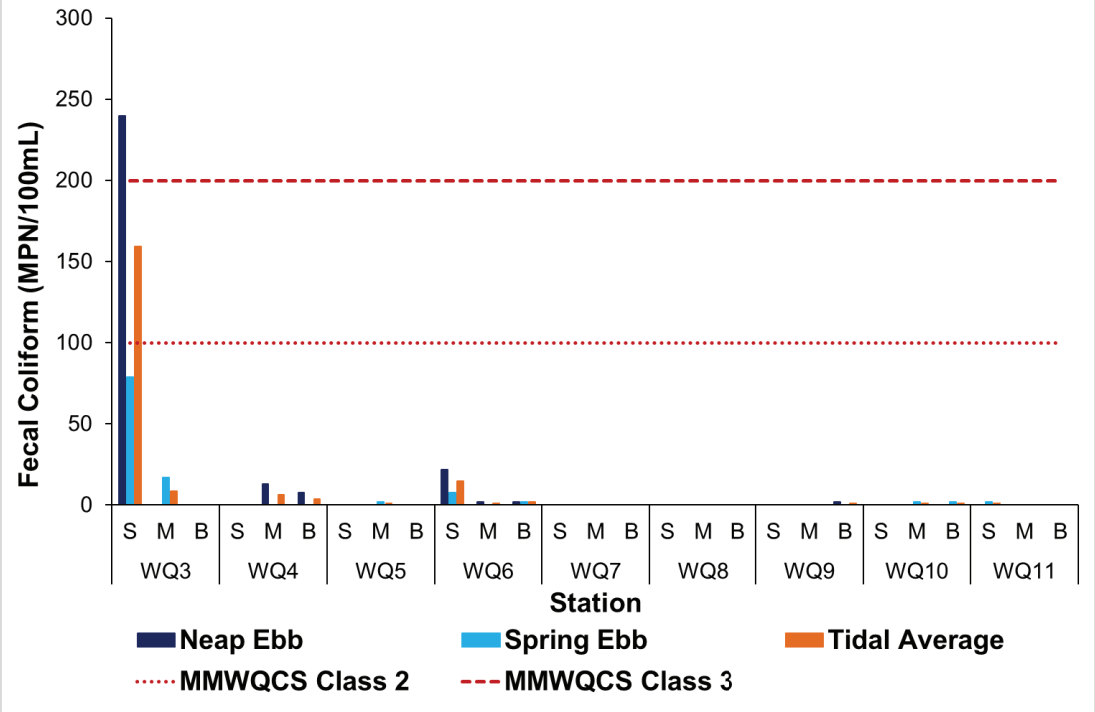

Figure 2.10 Faecal coliform count at marine water quality stations.

Heavy Metals

Nine heavy metals were analysed in marine water samples collected around the Project area. Concentrations of all the heavy metals were below their respective laboratory detection limits (refer to Table 2.3).

2.1.3.3 Estuarine Water Quality

Physical Parameters

Temperature

Temperature at stations WQ1 and WQ2 were consistent throughout the survey campaigns, ranging between 28.5 and 29.4°C with the tidal average between 28.6 °C and 29.8 °C as shown in Figure 2.11. This is similar to the temperatures recorded at the marine stations.

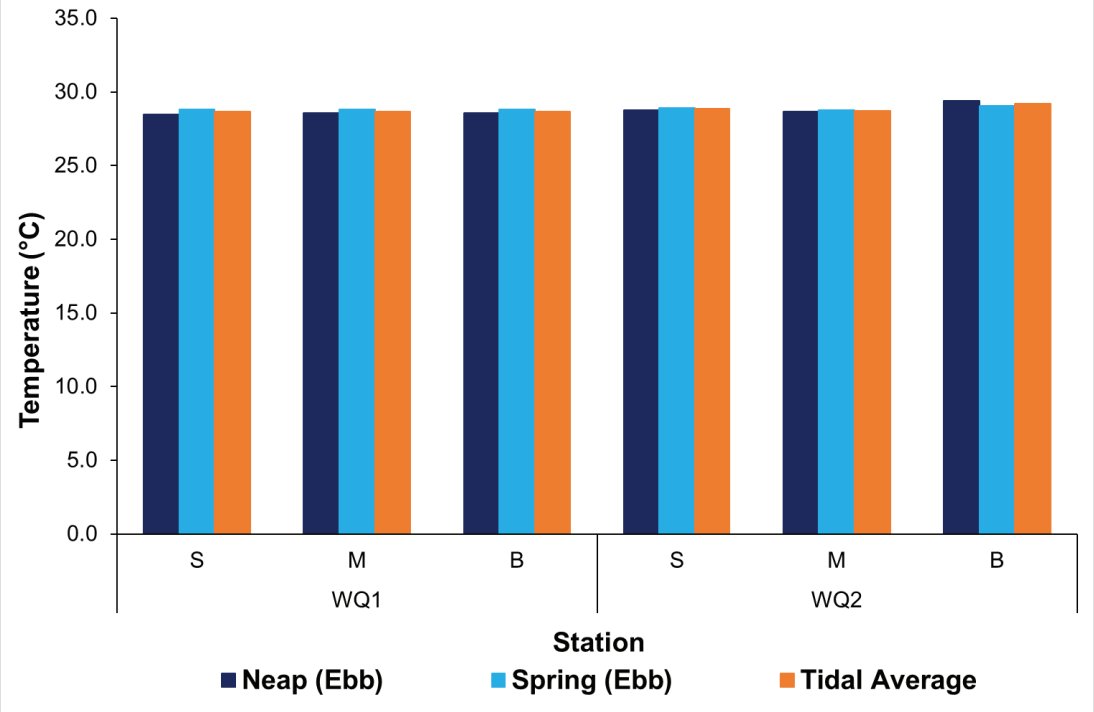

Figure 2.11 Temperature at all the estuarine water quality stations.

Dissolved Oxygen

As shown in Figure 2.12, average DO concentrations (over spring and neap tide sampling campaigns) ranged between 4.7 mg/L and 5.2 mg/L with most of the points being above the Class 3 MMWQS minimum of 3 mg/L. DO concentrations were slightly higher by less than one mg/L during the neap tide sampling campaign compared to spring tide at all stations.

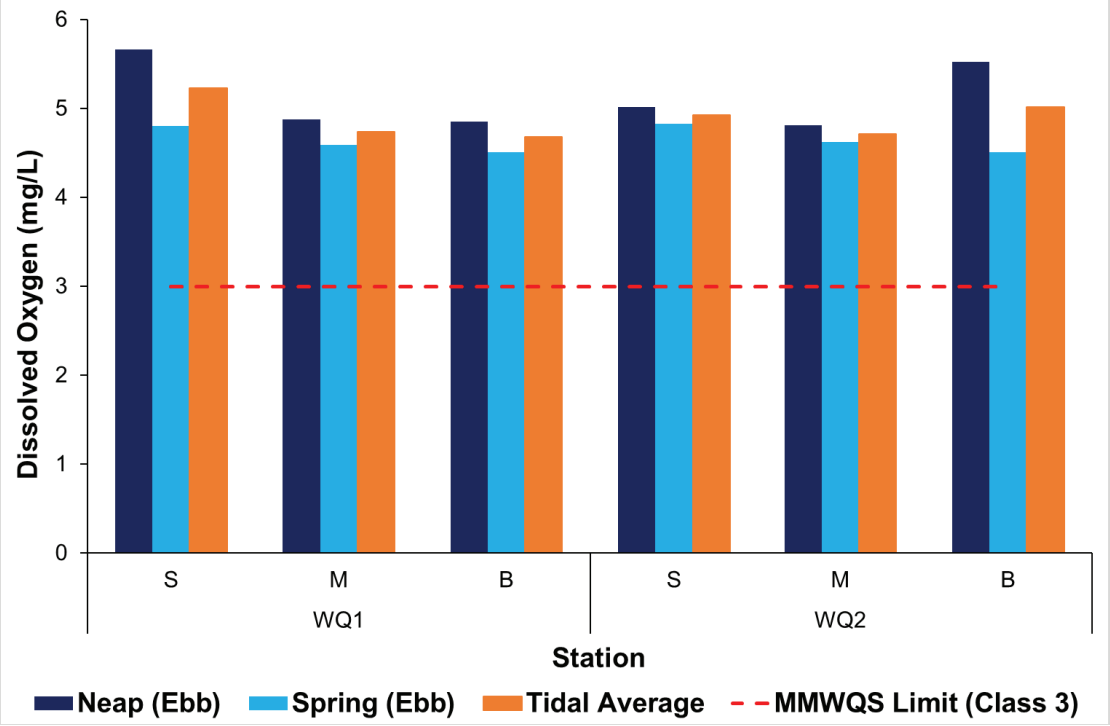

Figure 2.12 Dissolved oxygen (DO) concentration at all the estuarine water quality stations.

Salinity
Salinity was very low at the surface and mid-depths of station WQ1 (average 0.3 ppt), and slightly higher at the bottom depth, with an average of 1.1 ppt), see Figure 2.13.

The salinity at station WQ2, within the breakwater basin, was higher than at station WQ1 and the stratification (higher salinity at the bottom depths) was more pronounced, with the surface and mid-depth average tidal salinities between 0.1 ppt and 5.3 ppt, compared to the bottom depth average tidal salinity of 28.1 ppt.

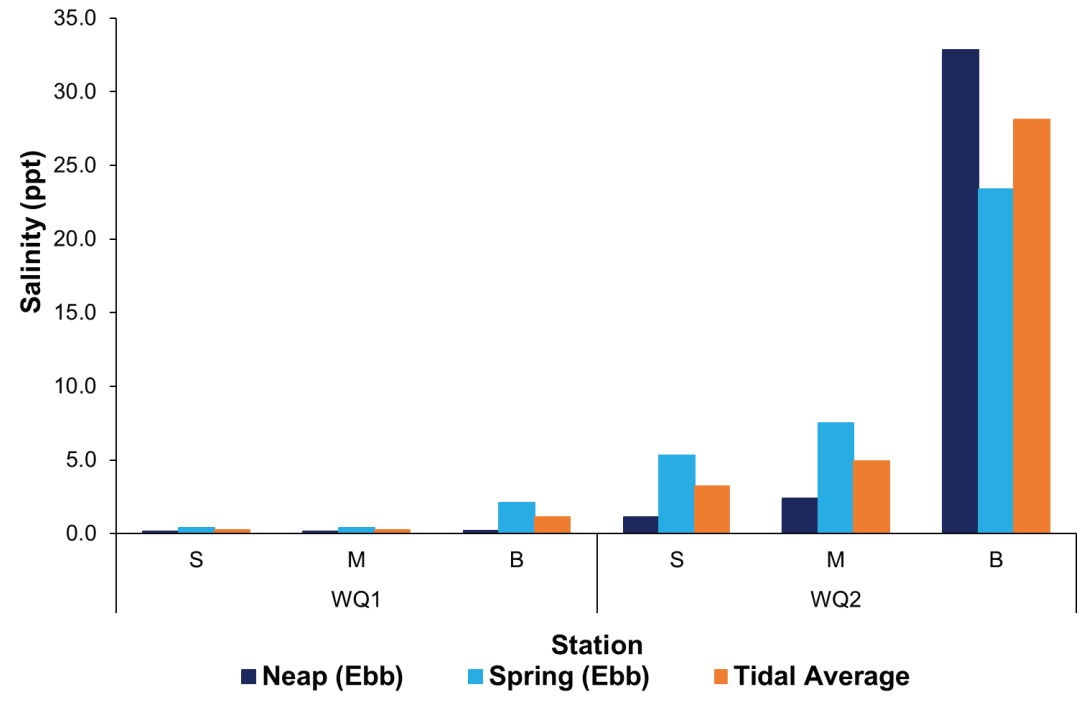

Figure 2.13 Salinity at all the estuarine water quality stations.

Total Suspended Solids (TSS)
The TSS concentrations at stations WQ1 and WQ2 is shown in Figure 2.14. For station WQ1, TSS was generally higher during neap tide whereas it was higher during spring tide for station WQ2. TSS was also highest for the bottom depth with lowest TSS concentrations at the surface except for station WQ2 where the mid depth spring sample was lower than the surface. Higher TSS near the bottom are expected as current movement disturbs the sediment and carries it into the water column. Overall average TSS was higher at WQ1 at 22 mg/L compared to 18 mg/L for station WQ2. Average TSS concentrations ranged between 14 mg/L and 29 mg/L, which are well within the Class 3 MMWQS limit of 100 mg/L.

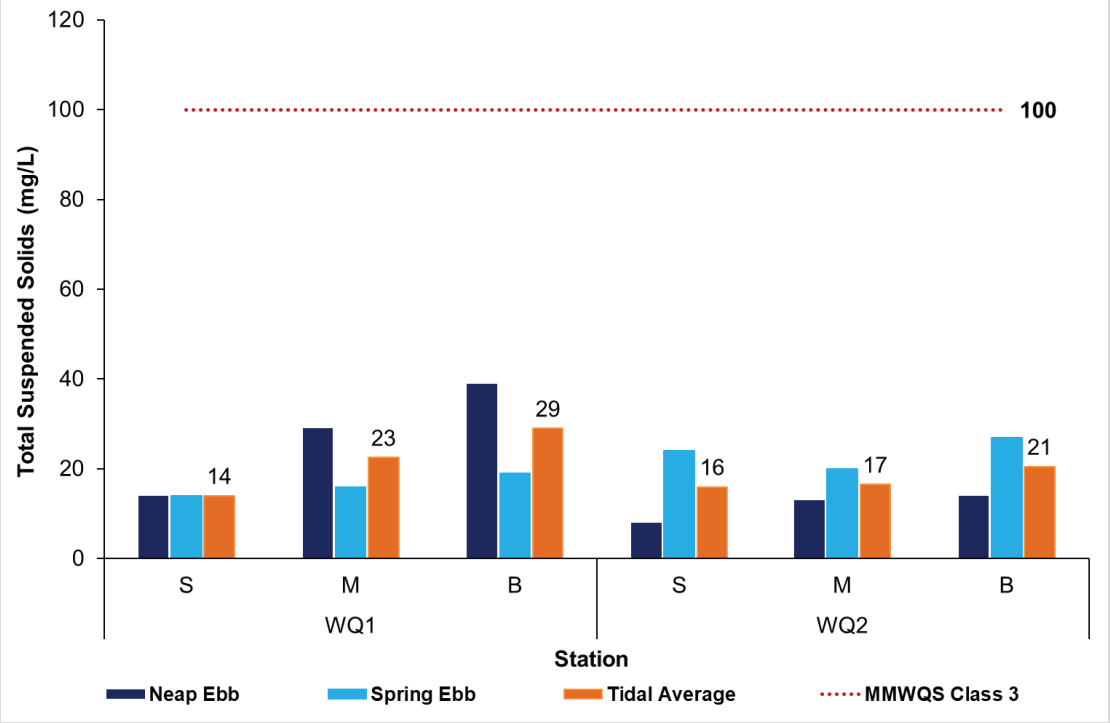

Figure 2.14 TSS concentrations at the estuarine water quality stations.

Turbidity

Turbidity at station WQ1 was higher than WQ2, as shown in Figure 2.15 which corresponds to the TSS findings. Turbidity distribution for station WQ1 also matches the TSS results where the highest readings were at the bottom. However, turbidity at station WQ2 was lowest at the bottom and highest at the surface. The average turbidity ranged between 6.5 NTU and 19.6 NTU, which is generally higher than the turbidity recorded at the marine areas.

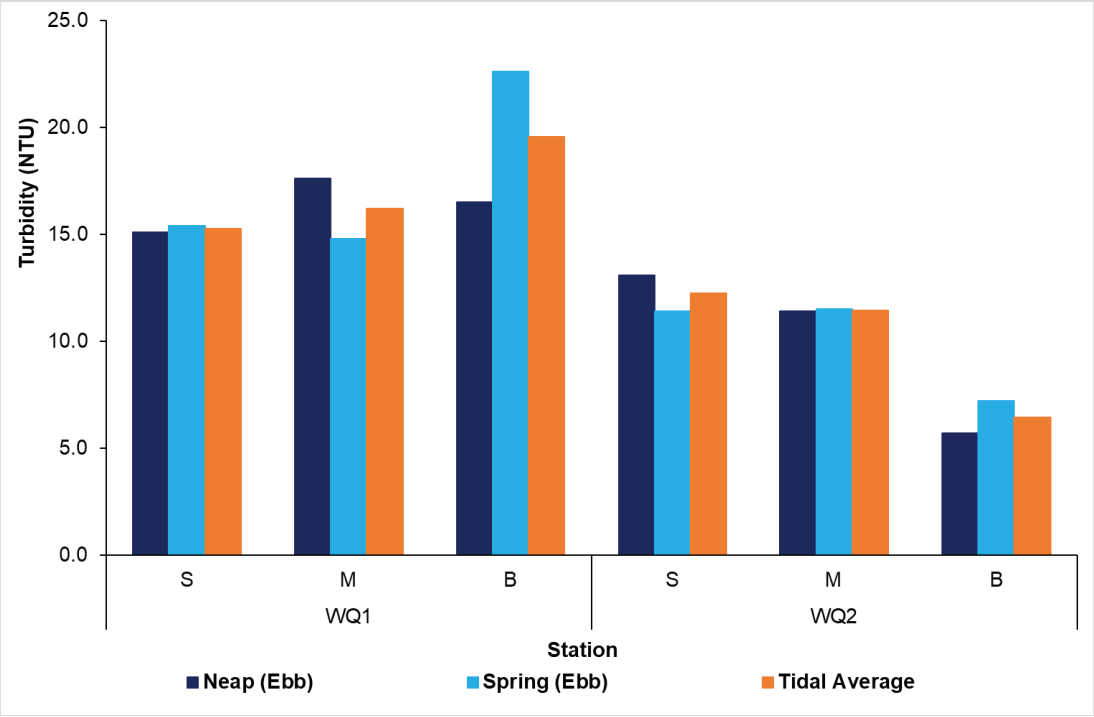

Figure 2.15 Turbidity at all the estuarine water quality stations.

Organics

Oil and Grease
Concentrations of oil and grease in water samples taken from stations WQ1 and WQ2 were all below the laboratory detection limit of 1 mg/L at throughout the survey campaigns. This is an indication that no oil and grease pollution occurs at the rivermouth area.

Biochemical Oxygen Demand (BOD)
BOD at estuarine water quality stations was detected at mid-depth of WQ1 and bottom of WQ2 only at a concentration of 1.1 mg/L and 1.2 mg/L respectively, while other samples were below the laboratory detection limit of 1.0 mg/L indicating very little organic matter in the water.

No limit for BOD is provided under the MMWQS but these concentrations can be considered as low as the National Water Quality Standards for Malaysia (NWQS) lists a limit of 3 mg/L for Class II waters (Fishery – Sensitive aquatic species).

Nutrients

Ammoniacal Nitrogen
Concentration of ammoniacal nitrogen at estuarine stations is shown in Figure 2.16. Average ammoniacal nitrogen concentration ranged between 0.06 mg/L and 0.35 mg/L. In general, ammoniacal nitrogen concentration was higher during neap ebb tide at station WQ1 while it was higher during spring ebb tide at station WQ2. As stated in Section 2.1.2, it is assumed that the standard for ammonia in the MMWQS is referring to ammoniacal nitrogen with the limit for Class 3 at 0.32 mg/L. Exceedance of the MMWQS Class 3 limit only occurred for WQ2 during spring tide. Urban development on both sides of Sg. Terengganu are possible sources of nutrient input.

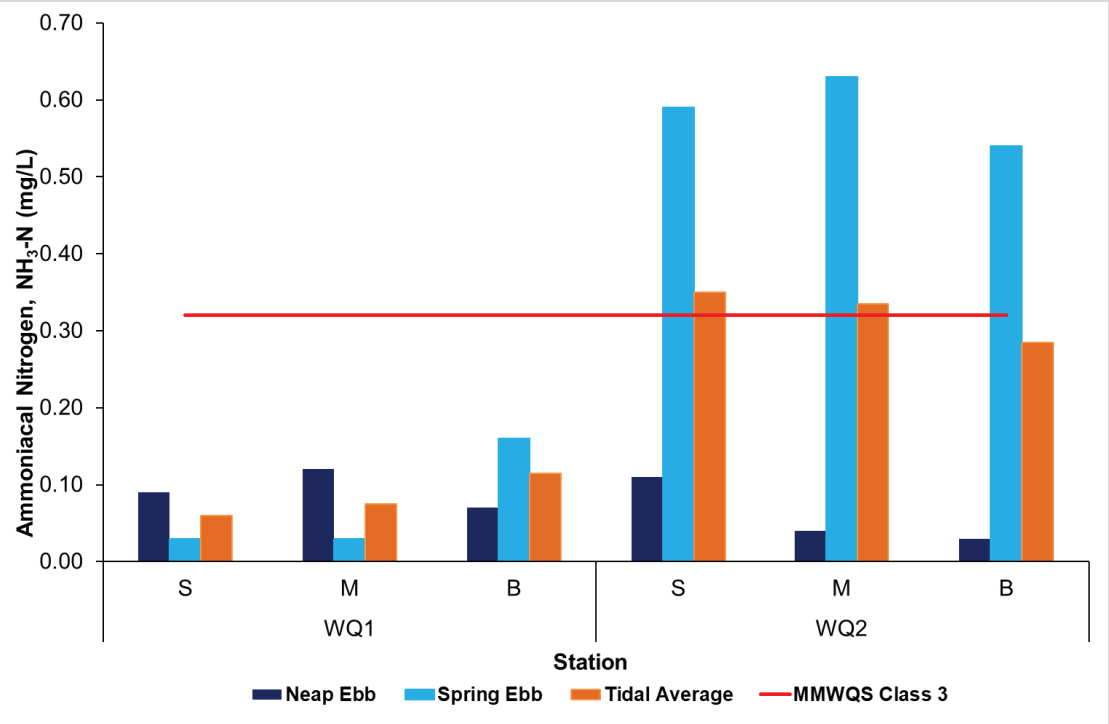

Figure 2.16 Ammoniacal nitrogen concentration at estuarine water quality stations.

Nitrate nitrogen
Nitrate nitrogen (NO_3^--N) concentrations at stations WQ1 and WQ2 are shown in Figure 2.17. Average nitrate concentration ranged between 0.01 mg/L and 0.04 mg/L which are below the 0.7 mg/L limit stipulated for MWQS Class 3. This is even lower than what was found in the

marine samples which indicate that nitrate in the marine samples may not have originated from Sg. Terengganu.

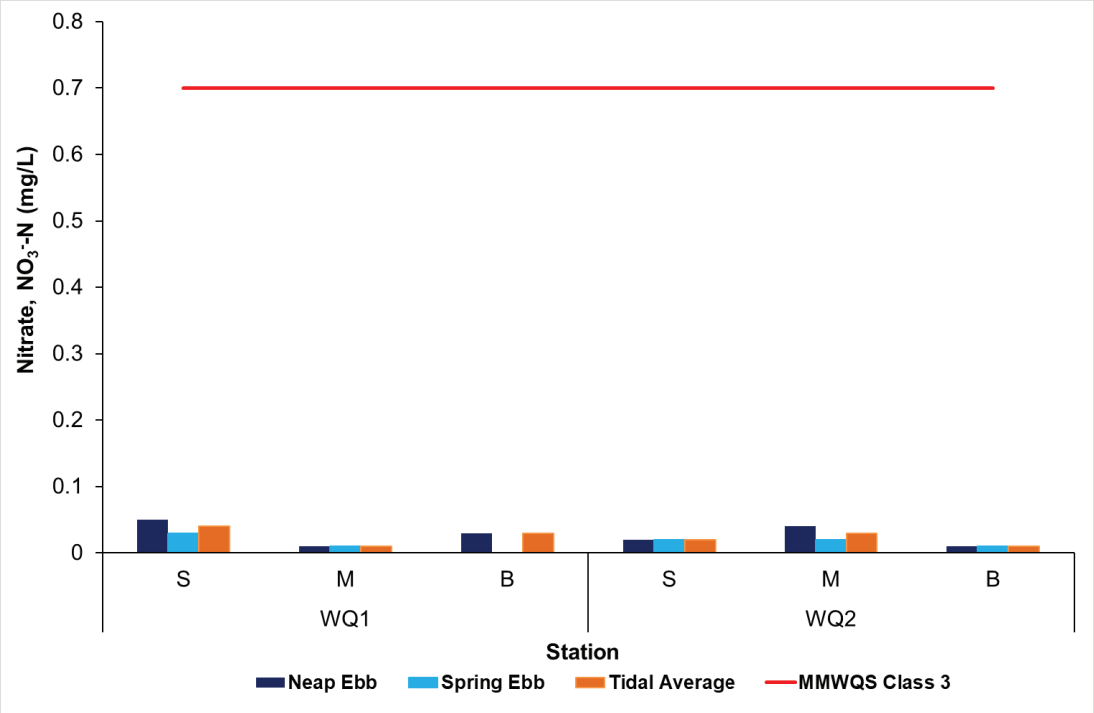

Figure 2.17 Nitrate concentration at estuarine stations.

Faecal Coliform

Faecal coliform counts at the estuarine stations are shown in Figure 2.18 and Figure 2.19. Average faecal coliform count was higher at these stations, ranging between 320 CFU/100 mL and 580 CFU/100mL for station WQ1 and between 130 MPN/100 mL and 920 MPN/100 mL at station WQ2. This is higher than at the marine water quality stations (maximum 22 MPN/100 mL) except for station WQ3 where faecal coliform was higher (between 17 MPN/100 mL and 240 MPN/100 mL).

Faecal coliform count at station WQ1 exceeded the NWQS Class IIA limit of 100 CFU/100mL with only two points not exceeding the Class IIB limit of 400 CFU/100mL. It is noted that the current MMWQS limit for faecal coliform for all water classes is 70 CFU/100mL. Possible sources of faecal coliform are sewage and agricultural runoff from the catchment area. The high concentrations indicate Sg. Terengganu as the probable cause for the high concentrations detected at station WQ3.

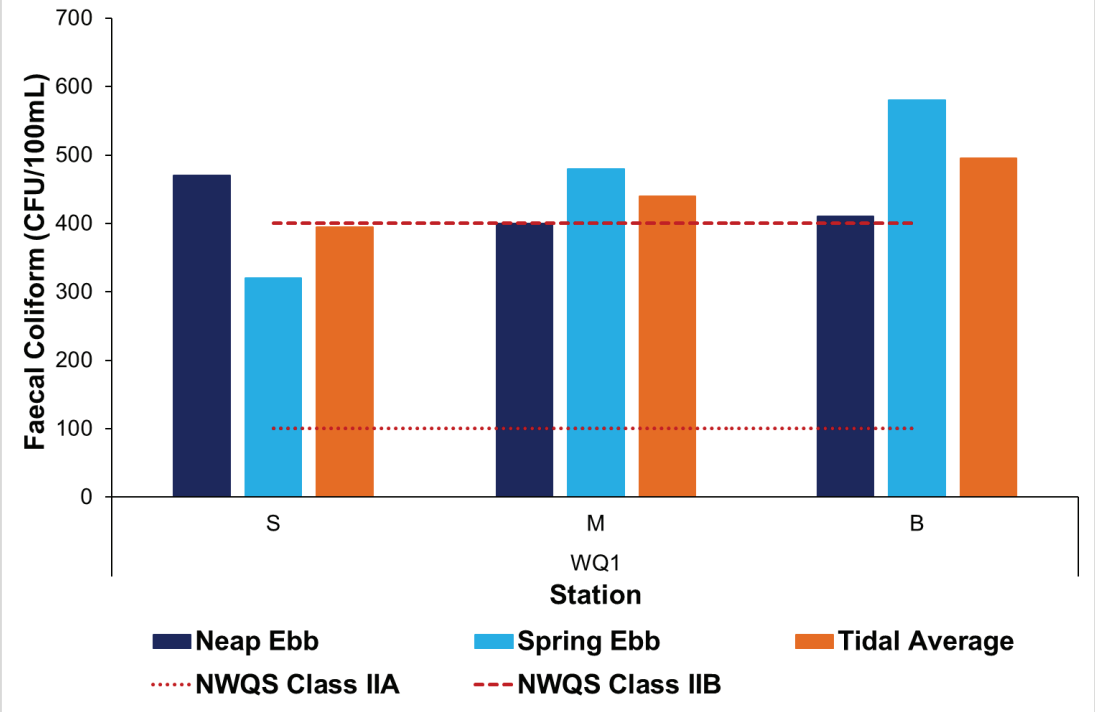

Figure 2.18 Faecal coliform count (CFU/100mL) at station WQ1.

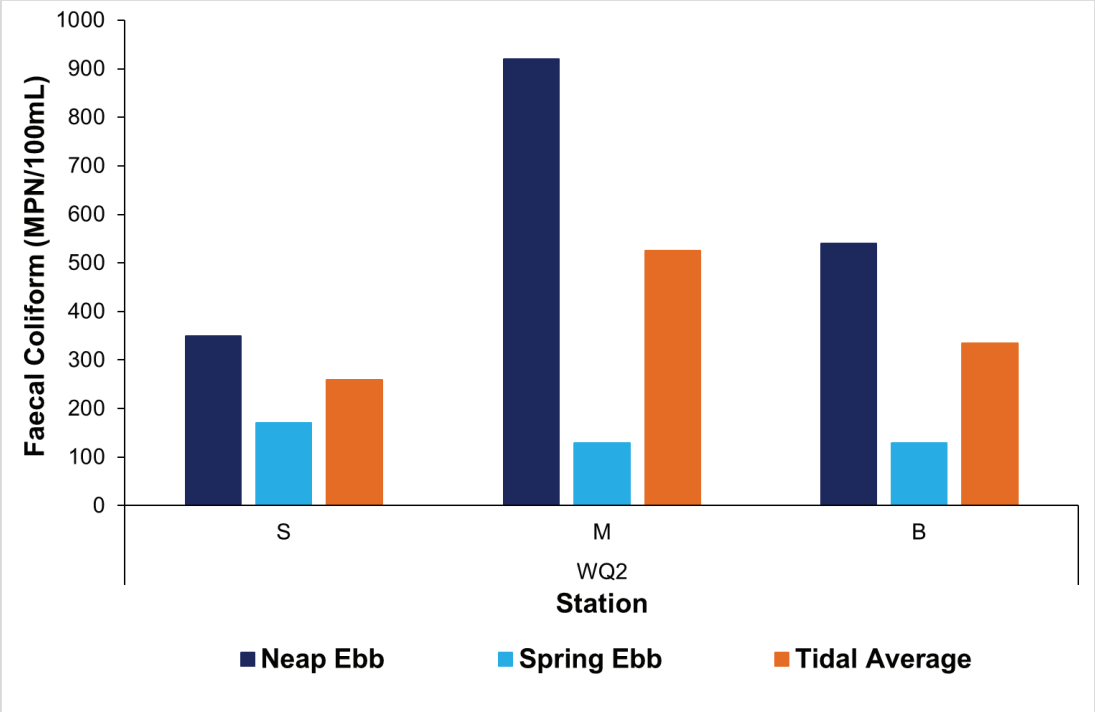

Figure 2.19 Faecal coliform count (MPN/100mL) at station WQ2.

2.2 Marine Surface Sediments

Marine sediment surveys were carried out to determine the physical and chemical properties of the sediment within and around project site. The Certificates of Analysis (COA) are attached in Attachment B.

2.2.1 Survey Methodology

2.2.1.1 Survey Period

The survey was carried out on October 3, 2017 between 1252 and 1415 hours.

2.2.1.2 Survey Location

Surface sediment samples were collected at selected locations as shown in Figure 2.20. The coordinates of the sampling stations for its location are given in Table 2.9.

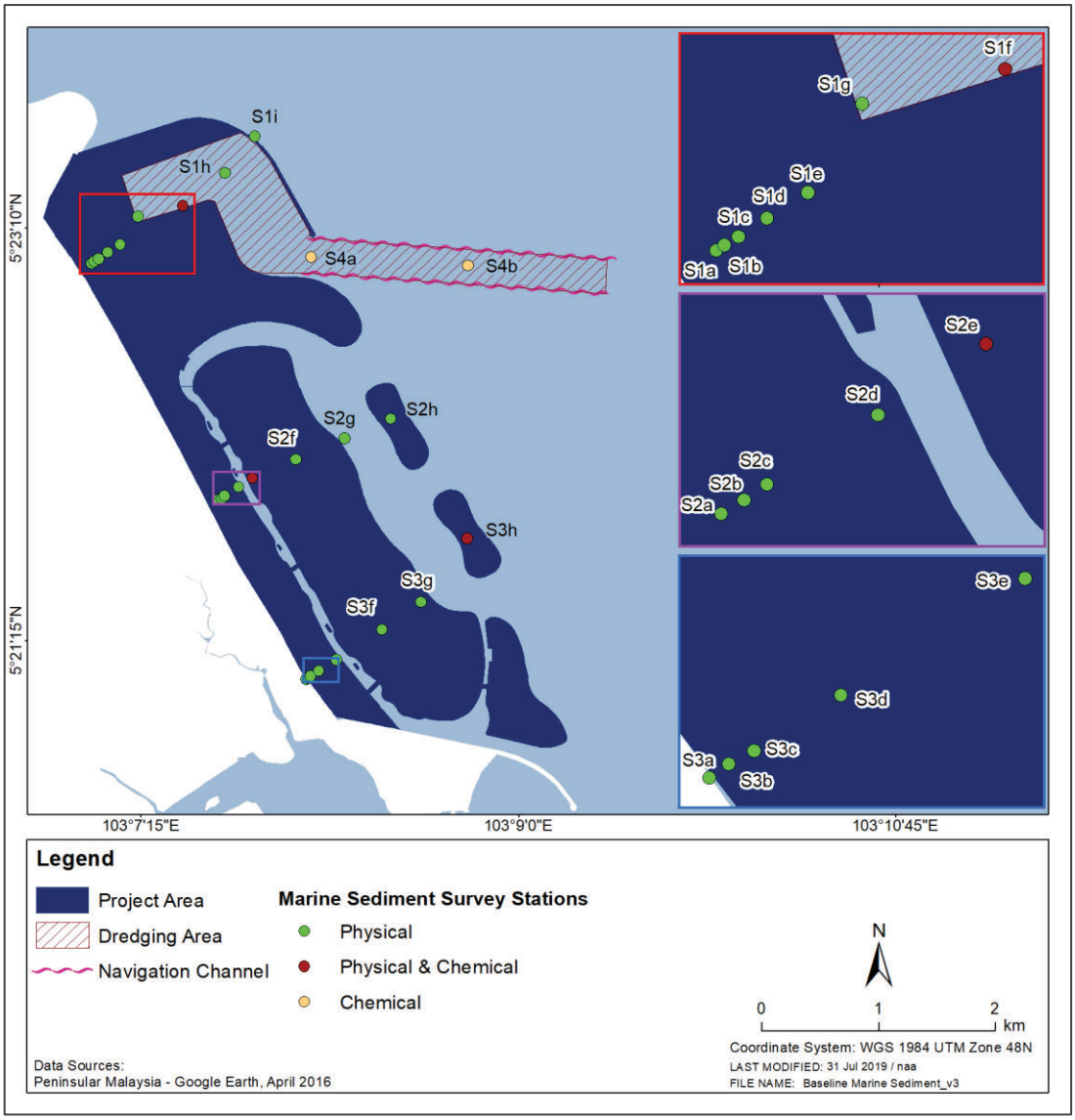

Figure 2.20 Sediment sampling stations.

Table 2.9 Coordinates of the sediment sampling stations (decimal degrees; WGS1984) and type of analysis.

Station	Longitude (°E)	Latitude (°N)	Type of Analysis		Justification
			Physical	Chemical Content	
S1a	103.11690	5.38344	√		Project area
S1b	103.11711	5.38357	√		Project area
S1c	103.11743	5.38378	√		Project area
S1d	103.11813	5.38424	√		Project area
S1e	103.11913	5.38487	√		Project area
S1f	103.12393	5.38790	√	√	Dredging footprint
S1g	103.12045	5.38705	√		Dredging footprint
S1h	103.12717	5.39045	√		Dredging footprint
S1i	103.12952	5.39329	√		Project area
S2a	103.12679	5.36510	√		Project area
S2b	103.12701	5.36523	√		Project area
S2c	103.12723	5.36539	√		Project area
S2d	103.12831	5.36607	√		Project area
S2e	103.12936	5.36677	√	√	Project area
S2f	103.13272	5.36825	√		Project area
S2g	103.13648	5.36991	√		Within Project area boundary
S2h	103.14008	5.37141	√		Project area
S3a	103.13360	5.35123	√		Project area
S3b	103.13374	5.35133	√		Project area
S3c	103.13392	5.35143	√		Project area
S3d	103.13456	5.35184	√		Project area
S3e	103.13590	5.35270	√		Project area
S3f	103.13946	5.35504	√		Project area
S3g	103.14244	5.35723	√		Project area
S3h	103.14600	5.36214	√	√	Project area
S4a	103.13391	5.38396		√	Dredging footprint
S4b	103.14600	5.38331		√	Dredging footprint

2.2.1.3 Sediment Sampling Procedures

At each sampling station, the GPS waypoint and water depth were first recorded before deploying a Van Veen grab (16.5 cm x 18.0 cm) to obtain the surface sediment sample. Observations of the bottom sediments were recorded (e.g. visual classification of sand or silt,

presence of organic matter and odour). Samples were retrieved from the grab sampler according to the following protocol:

- Grain size analysis – sediment samples placed in a labelled plastic zip lock bag using a plastic spatula and sent to SoilPro Technical (M) Sdn. Bhd. for particle size analysis.
- Chemical analysis – samples were retrieved from the centre of the grab, taking care to avoid any sediments in contact with the Van Veen grab, and placed in labelled plastic containers. The surveyors wore surgical gloves and used plastic spatulas to handle the samples to avoid contamination. The lid of the containers was sealed and stored on ice for shipment to Alchemy Laboratory Services Sdn Bhd laboratory.

Particle size analysis was carried out using the sieve method and/or hydrometer method where necessary. Both dry and wet sieving was carried out, depending on the characteristics of the sediment, whereby dry sieving was applied on coarse-grained cohesion-less sediment samples with insignificant silt and clay, while wet sieving was applied on composite coarse grained (gravel-sand) and fine grained (silt-clay) sediments.

The hydrometer method was applied for sediment samples which were dominated by fine-grained (silt-clay) particles. This method was also applied on samples (>20%) which passed through 63 µm in the dry sieve method.

Sediment particle size was classified into basic sediment size classes as summarised in Table 2.10.

Table 2.10 Sediment Particle Size Classification.

Particle size (mm)	Sediment Size Classes
>200	Boulders
60-200	Cobbles
20-60	Gravel
6-20	
2-6	
0.6-2.0	Sand
0.2-0.6	
0.006-0.2	
0.02-0.06	Silt
0.006-0.02	
0.002-0.006	
<0.002	Clay

Source: British Soil Classification System.

The chemical parameters analysed, along with the reference method and laboratory detection limit, are summarised in Table 2.11.

Table 2.11 Summary of the parameters analysed for marine sediment.

Parameter	Unit	Reference Method	Detection Limit
Total Organic Carbon (TOC)	%	APHA 5310 B (Modified)	>0.10
Total Petroleum Hydrocarbons (TPH)	mg/kg	USEPA 5030	>1
TPH Fractions (C6- C9)	mg/kg	USEPA 3550	>0.05

Parameter	Unit	Reference Method	Detection Limit
TPH Fractions (C10- C14)	mg/kg	USEPA 3550	>0.05
TPH Fractions (C15- C26)	mg/kg	USEPA 3550	>0.05
TPH Fractions (C27- C36)	mg/kg	USEPA 3550	>0.05
Cyanide	mg/kg	OSRMA P.456	>0.1
Heavy metals			
Cadmium	mg/kg	USEPA 3050 B	>0.01
Mercury	mg/kg	USEPA 3052	>0.02
Arsenic	mg/kg	USEPA 3050 B	>0.01
Lead	mg/kg	USEPA 3050 B	>0.01
Copper	mg/kg	USEPA 3050 B	>0.01
Nickel	mg/kg	USEPA 3050 B	>0.01
Chromium	mg/kg	USEPA 3050 B	>0.01
Iron	mg/kg	USEPA 3050 B	1
Manganese	mg/kg	USEPA 3050 B	1

Note
APHA means American Public Health Association
USEPA means United States Environmental Protection Agency
OSRMA means Official, Standardized and Recommended Methods of Analysis

2.2.1.4 Guidelines

The Dutch Standards are referred to evaluate the concentrations of heavy metals in the marine sediment /3/. The “target values” indicate the level below which risks to the environment are considered to be negligible, while the “intervention value” is an indicative value where remediation may be urgent, owing to increased risks to public health and the environment. (Table 2.12).

Table 2.12 The Dutch Standard limits for selected heavy metals in water sediments.

Parameter	Target Value (mg/kg)	Intervention
Cadmium (Cd)	0.8	12
Mercury (Hg)	0.3	10
Arsenic (As)	0.9	55
Lead (Pb)	55	530
Copper (Cu)	3.4	96
Nickel (Ni)	0.26	100
Chromium (Cr)	<0.38	220

2.2.2 Results and Discussion

2.2.2.1 Onsite Observation

Summary of the observations are given in Table 2.13 while the sediment sample images are shown in Photo 2.13. Refer to Appendix B for COA

Table 2.13 Details of sampled sediment.

Station	Depth (m)	Time of Sampling (Hours)	Visual Classification of Sediment Type	Odour (Yes / No)	Organic Matter
S1a	Beach	12:52	Sand	No	No
S1b	1.6	12:55	Sand	No	No
S1c	2.9	12:57	Mixed sand	No	No
S1d	3.1	12:59	Mixed sand	No	No
S1e	4.5	13:01	Coarse Sand	No	No
S1f	5.2	13:28	Coarse Sand	No	No
S1g	4.2	13:19	Coarse Sand	No	Yes
S1h	7.5	13:34	Mixed sand	No	No
S1i	9.2	13:38	Coarse Sand	No	Yes
S2a	Beach	15:03	Sand	No	Yes
S2b	1.4	15:00	Sand	No	Yes
S2c	2.2	14:56	Mixed sand	No	Yes
S2d	3	14:53	Mixed sand	No	Yes
S2e	4.3	14:42	Sand	No	Yes
S2f	8.2	14:37	Mixed sand	No	Yes
S2g	7.2	14:34	Coarse Sand	No	Yes
S2h	8.1	14:27	Mixed sand	No	Yes
S3a	Beach	15:52	Sand	No	Yes
S3b	0.6	15:51	Sand	No	Yes
S3c	1.3	15:49	Sand	No	No
S3d	3.4	15:48	Sand	No	No
S3e	4.2	15:46	Mixed sand	No	No
S3f	6	15:34	Mixed sand	No	Yes
S3g	7.3	15:30	Mixed sand	No	Yes
S3h	8.8	15:26	Sand	No	Yes
S4a	7.1	13:44	Mixed sand	No	No
S4b	11.3	14:15	Mixed sand	Yes	Yes