8 Environmental Management Plan

8.1 Scope

The Environmental Management Plan (EMP) described in this chapter is an integral part of this DEIA study. It establishes a strategy to manage environmental issues throughout the developmental stages. It also provides a framework specification upon which the project proponent will set the environmental control requirements for the proposed project through its tender contract documentation.

This EMP is prepared as a preliminary EMP specification where a Final EMP will be prepared after DEIA approval and before the commencement of any construction works. This allows comments during the DOE review stage to be taken into consideration in the final EMP together with the details of the appointed contractor and final construction methodology.

8.2 Objectives

This EMP is a tool designed to assist the Project Proponent in meeting the requirements of applicable environmental legislation and regulations in order to achieve best practice environmental management. It contains a written description of the proposed measures to be implemented in order to achieve and maintain acceptable levels of environmental impact. In summary, the objectives of this EMP are:

- To provide practical and achievable plans for the management of the proposed project, such that environmental requirements are complied with through monitoring and control of the predicted impacts;
- To provide the Project Proponent and the regulatory authorities with a framework in order to conform and comply with environmental policies and requirements; and
- To establish an environmental monitoring and audit programme to track environmental performance, and as an early trigger to remediate environmental non-conformance, if any.

8.3 Responsibilities

At the present stage, the EMP implementation is anticipated to involve the following key personnel/parties:

- Project Manager (Proponent)
- Contractor
- Environmental Officer (EO)
- Safety, Health and Environment Officer
- Field Supervisors
- Environmental Monitoring (EMP) Consultant
- Environmental Auditor
- Accredited Laboratory

The roles and responsibilities of the above are described in the following subsections, while the work flow is indicated in Figure 8.1.

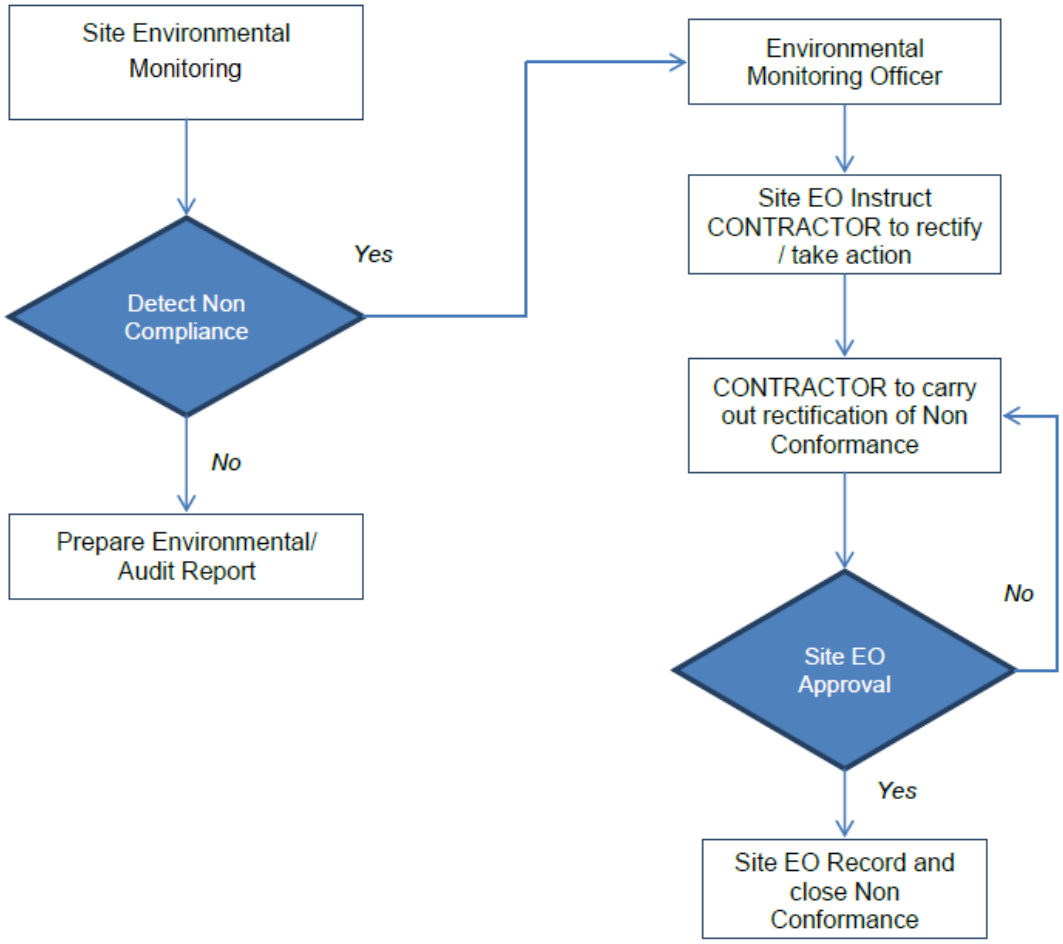

Figure 8.1 EMP Workflow

8.3.1 Proponent

The Project Proponent will generally be responsible for:

- Ensuring required environmental protection works are included in the tender documents
- Ensuring proper and timely submission of relevant environmental reports to the EMP Consultant for subsequent submission to DOE
- Ensuring Contractor(s) fulfil contractual obligations with respect to environmental protection

8.3.2 Contractor

The Contractor will generally be responsible for:

- Implementing the approved environmental control and mitigation measures
- Compliance with all environmental planning and construction requirements
- Complying with all requirements of relevant agencies and their legislation

There will be a number of key project activities involved in the construction (i.e. reclamation, dredging and piling), and since the Construction Contractor is carrying out all activities, these activities are considered as one for the purpose of this section.

8.3.2.1 Pre-construction

It is the responsibility of the Construction Contractor to prepare a detailed methods statement that complies with the conditions of the present EMP; and to provide input to the preparation of the Final EMP. During the construction phase, the Construction Contractor is also responsible for reporting detailed work plans for each construction phase to the Environmental Officer.

In addition to the environmental considerations, the Construction Contractor is also to consider the following before commencing work:

- Any best practice measures as prescribed by authorities such as the Department of Irrigation and Drainage and the Department of Environment;
- Marine Department requirements in terms of vessel movement and maritime safety; and
- Complying with any and all licences and approvals under relevant legislations.

8.3.2.2 During Construction

During construction, the Construction Contractor will be responsible for:

- Compliance with all the provisions of the EMP as applicable; and
- Regularly inspection and monitoring of all activities for adherence to proper environmental safeguards.

This will include routine inspections of the works, reports and/or correspondence relating to site environmental management issues.

8.3.2.3 Reporting

The Contractor will be responsible for establishing an Environmental Management File and associated database for the construction activities that would contain all documentation pertaining to environmental management of the works. This will be submitted to the Project Proponent and made available to the Environmental Monitoring Consultant in digital form for incorporation into the regular Environmental Monitoring Reports to be submitted to the DOE.

All environmental incidents and near misses occurring at work places during Project implementation period shall be reported immediately to the Project Proponent's Project Manager on site. All these incidents / occurrences shall be documented and dealt with in accordance with the Incident Reporting and Investigation procedures and legislative requirements.

Onsite, the Contractor's representative shall carry out the initial investigation of any incident in conjunction with the Contractor's HSE Officer(s). The Contractor's Site Manager is responsible for ensuring that appropriate investigation is conducted and close out actions implemented as necessary. Onsite and all personnel shall be made aware of the incidents and actions to prevent re-occurrence. Any resulting Environmental / HSE Alerts, produced by Contractor & their Subcontractors, shall be shared with all parties onsite to prevent re-occurrence of similar events.

8.3.3 Project Manager

The Project Manager will generally be responsible for the following environmental management aspects:

- Implementing and enforcing appropriate environmental, safety and health practices at the Project work area
- Ensuring that all planning on-site considers the safety of personnel and the protection of the environment
- To ensure compliance with applicable regulations, as outlined in this EMP

- Coordinating and implementing the environmental control measures as detailed in this EMP report
- Assigning on-site environmental personnel to oversee implementation of the mitigation measures, described in this EMP, and ensure compliance with environmental requirements
- Overseeing the Environmental Monitoring Programme;
- Liaising with the relevant government departments, as required
- Seeking the advice of the EMP Consultant regarding any environmental issues of concern

8.3.4 Environmental Officer

The Environmental Officer (EO) works closely with the appointed contractors (and the EMP Consultant) to formulate the Final EMP prior to start of construction, and continues during the construction phase through feedback monitoring or adaptive management principles to continuously revise and refine work methods and procedures to ensure environmental quality objectives are met while at the same time optimising work schedules and production. DOE require the EO to be full time on site. The expected responsibilities of the EO include the following:

- Coordinate implementation of the environmental management programme
- Direct environmental awareness inductions and material distribution.
- Perform regular internal audits of sub-Contractor's implementation on the environmental protection activities including waste management, housekeeping and erosion and sediment control measures.
- Maintain an independent Environmental Management File and associated database for all activities pertaining to environmental management of the works, and in particular audit schedules and outcomes.
- Coordinate environmental incident investigations and report findings to Project Manager.

8.3.5 Safety, Health and Environment Officer

The duties of the Safety, Health and Environment Officer are as such:

- To advise and coordinate all matters pertaining to safety, health and environmental management associated with the construction activity on site
- To ensure compliance with applicable legislation and guidelines
- To ensure all emergency control equipment, safety equipment and environmental protection measures on-site are properly implemented
- To investigate and report environmental incidents and non-conformances to the Project Manager
- To ensure an appropriate level of environmental awareness amongst all site personnel by organising induction and ongoing training, and awareness campaigns
- To ensure good communication between the Project team and government agencies with respect to the environment matters
- To collect, update and maintain proper records on safety, health and environmental incidences

8.3.6 Field Supervisors

The general responsibilities of the Field Supervisors are as such:

- Conduct pre-task evaluations of work scope and the area
- Obtain daily-required permits and ensure compliance to permit conditions
- Ensure employees are trained for their duties as per the project safety program
- Conduct pre job safety briefings prior to starting work and ensure employee's understanding

- Conduct specific equipment and PPE inspection
- Actively involve employees in the project safety program
- Enforce project policies and procedures
- Assist in incident investigations

8.3.7 Environmental Monitoring / EMP Consultant

The general responsibilities of the Environmental Monitoring Consultant are as such:

- Oversee the conduct of periodic environmental monitoring to check the effectiveness of the mitigation measures and as per EIA approval conditions
- To provide advice to the Project Manager on related issues arising from the EMP implementation
- Advise the project proponent on the adequate mitigation measures needed to minimise or prevent the occurrence of adverse environmental impacts

8.3.8 Accredited Laboratory

All analyses and reports concerning environmental monitoring/samples will be carried out by laboratories accredited under Skim Akreditasi Makmal Malaysia (SAMM).

8.3.9 Training and Awareness

In order for the measures outlined in the EMP to be implemented effectively, staff, contractors and subcontractors will be made aware of the existence of the EMP and its requirements. Awareness activities are to include induction training for all staff outlining all aspects of:

- Safety and security;
- Responsibilities and reporting procedures on-site;
- Equipment operation;
- First aid;
- Work procedures;
- Scheduled waste handling;
- Spill response training; and
- Awareness of the EMP.

8.4 Review and Update of EMP

A copy of the Final EMP will be required to be kept on-site and be easily obtainable by the public at all times. During the construction works, the Project Proponent's Project Manager will hold an additional copy. The EMP should be regularly reviewed in relation to conditions encountered and updated as appropriate.

8.5 Compliance with Environmental Requirements

In regards to the study area, applicable legislation and regulations are listed in Table 8.1. It is noted that the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987 it listed as a key legislation applicable for the ongoing environmental management of the project, as the individual developments within the various sellable lots within the Industrial Park will need to carry out EIAs as required under this Order prior to construction and operations.

Table 8.1 Legislation applicable in the management of the study area

Sector	Federal Legislation
Water	• Environmental Quality Act 1974 (Act 127) • Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987 • Environmental Quality (Industrial Effluent) Regulations 2009 • Environmental Quality (Sewage) Regulations 2009 • Merchant Shipping (Oil Pollution) Act 1994 (Act 515) • Malaysian Maritime Enforcement Agency Act 2004 (Act 633)
Air	• Environmental Quality Act 1974 (Act 127) • Environmental Quality (Clean Air) Regulations 2014
Noise	• Environmental Quality Act 1974 (Act 127) • The Planning Guidelines for Environmental Noise Limits and Control 2004 • The Planning Guidelines for Vibration Limits and Control 2004.
Erosion control	Land Conservation Act 1960 (Revised 1989) (Act 385)
Drainage	• Environmental Quality Act 1974 (Act 127) • Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987 • Land Conservation Act 1960 (Revised 1989) (Act 385) • Land Development Act 1956 (Revised 1991) (Act 474)
Coral	Fisheries Act 1985 (Act 317)
Fisheries	• Continental Shelf Act 1966 (Act 83) • Fisheries Act 1985 (Act 317) • Exclusive Economic Zone Act 1984 (Act 311)
Avifauna	Wildlife Conservation Act 2010 (Act 716)
Marine megafauna	• Fisheries Act 1985 (Act 317) • Wildlife Conservation Act 2010 (Act 716)
Navigation	• Port Authorities Act 1963 (Revised 1992) • Merchant Shipping (Oil Pollution) Act 1994 (Act 515) • Malaysian Maritime Enforcement Agency Act 2004 (Act 633)
Fisheries activities	• Fishermen's Association Act 1971 (Act 44) • Lembaga Kemajuan Ikan Malaysia Act 1971 (Act 49) • Continental Shelf Act 1966 (Act 83) • Fisheries Act 1985 (Act 317)
Tourism	Tourism Industry Act 1992 (Act 482)
Physical development	• Environmental Quality Act 1974 (Act 127) • Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987 • Land Conservation Act 1960 (Revised 1989) (Act 385) • Land Development Act 1956 (Revised 1991) (Act 474)
Land use	• Environmental Quality Act 1974 (Act 127) • Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 1987 • Land Conservation Act 1960 (Revised 1989) (Act 385) • Land Development Act 1956 (Revised 1991) (Act 474)

8.6 Monitoring Programme

The environmental monitoring programme comprises the following components as described further in the following subsections:

- Sediment plume monitoring during dredging.
- Water quality monitoring
- Coastal profile monitoring
- Ecological monitoring
- Air quality monitoring
- Noise monitoring
- Social impact monitoring
- Fisheries and Aquaculture

8.6.1 Management of Suspended Sediments during Reclamation and Dredging

Mitigation of suspended sediment plumes during dredging and reclamation focuses on the control of the spill at source (i.e. the spill from the dredger/ barges), which is a key concern in particular during the dredging activity which will occur in Phase 2 of construction. The monitoring programme differentiates between the reclamation and dredging stage as outlined in the following subsections.

8.6.1.1 Reclamation Works

Compliance monitoring activities for the control of suspended sediments during reclamation works (Phases 1 and 3) are outlined Table 8.2.

Table 8.2 Compliance monitoring activities for suspended sediment control

Required activity	Auditing and Reporting	Frequency
Construction of bund	Layout plan and photographs of the bund and temporary protection.	At construction start and as required
Inspection and maintenance of bund to be carried out monthly / after storm events.	Contractor to keep a log of regular inspection and any maintenance events, including photographs with a date stamp.	Monthly and after major storm events
Installation of silt curtain on western face of reclamation	Layout plan and photographs of the silt curtains	At construction start

Monitoring of suspended sediment concentrations (water sampling and analysis) shall be carried out as follows:

- Daily water sampling at fixed locations shown in Figure 8.2
- Daily monitoring of TSS at two stations at each reclamation outlet location (release location from bunded area): (1) at overflow outlet; and (2) within 200 m of outlet.
- Surface mapping of initial plume dispersion using line transects of in-situ measured turbidity under a range of tidal conditions to establish the extent of sediment movement and thereafter weekly surveys.

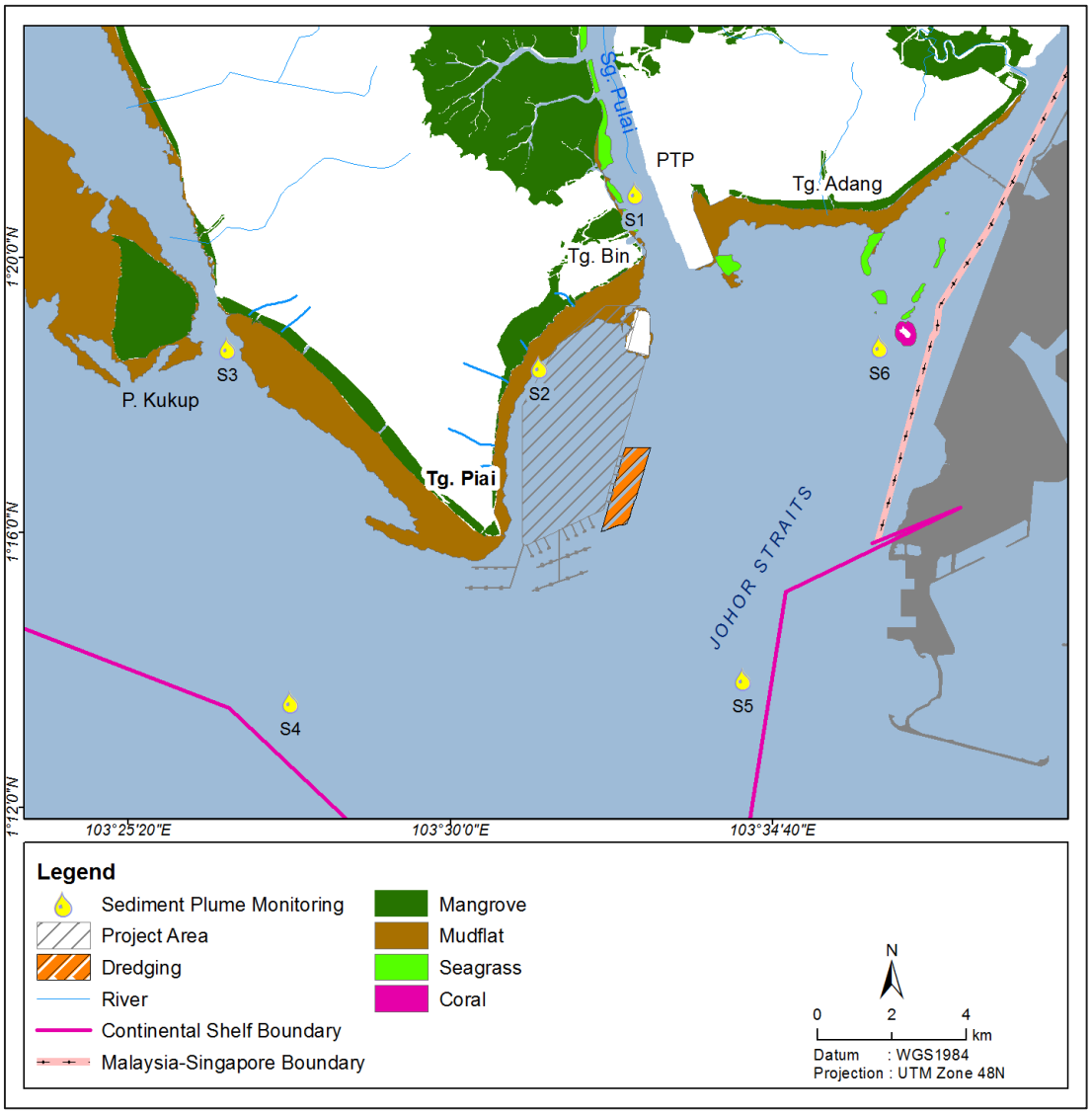

Figure 8.2 Location of the fixed sediment plume monitoring stations during reclamation.

Table 8.3 Coordinates of the fixed sediment plume monitoring stations shown in Figure 8.2 above in WGS 1984 (decimal degrees).

Station	Longitude (E°)	Latitude (N°)	Description
S1	103.545	1.34909	Upstream control station for Sg. Pulai
S2	103.521	1.30689	Within reclamation area
S3	103.446	1.31139	Sensitive receptor – P. Kukup Ramsar area
S4	103.462	1.22568	Sensitive receptor – continental shelf border ~ 5 km from project.
S5	103.571	1.2312	Sensitive receptor – Malaysia-Singapore border.
S6	103.603	1.31192	Sensitive receptor – coral and seagrass near P. Merambong

8.6.1.2 Dredging and Reclamation Works (Phase 2)

As set out in Section 6 above the key environmental impacts during the construction phase is the sediment plume that is generated when capital dredging and reclamation works are carried out simultaneously. To manage these impacts it is proposed to use sediment spill control and monitoring (referred to hereafter as feedback monitoring).

Feedback monitoring has been effectively utilised at several sites in Southeast Asia and is now considered international best practice for the environmental control of dredging and reclamation operations. This method of managing the sediment spill is accepted international best practice (it is a recommended mitigation measure in the PIANC report on Dredging and Port Construction around Coral Reefs /1/) and has been used successfully to manage the sediment plume during the capital dredging works for the Phase 1 dredging for the Pengerang IDPT in southwest Johor.

Feedback Monitoring

The intention of this monitoring and management plan is to ensure that the suspended sediment limits at the sensitive receptors are met whilst at the same time allowing the maximum possible dredging rates. This monitoring and management plan includes the following key elements:

1. Monitor the dredger location and reclamation activities and measure suspended sediment concentrations in the overflow water and flow rate to calculate spill volumes from each dredging cycle that are applied to estimate daily spill volumes. This is carried out daily and will involve sampling overflow water from each hopper barge that leaves the site.

2. Monitor suspended sediment concentrations in the vicinity of the Tg. Piai area on a daily basis during periods when dredging or reclamation is being carried out and online measurement of suspended concentrations at high frequency (5 to 15 minutes) to ensure that TSS thresholds are met. If the suspended sediments concentrations are shown to be exceeding the allowable limits the allowable sediment spill is modified to prevent this based on additional modelling as set out in (1) above.

3. Carry out predictive modelling of the sediment spill occurring from the dredging and reclamation activities on a regular basis based on the current dredging works and proposed activities. This modelling includes hindcast (past events) to quantify the spatial and temporal evolution of the sediment plume and take action if any measures are required in case pre-specified threshold values (defined based on the existing sensitive receptors). The numerical model is also constantly compared to measured data to confirm the predictions are accurate and provide a good description of the sediment spill occurring during the dredging and reclamation activities that have taken place. The modelling also allows the forecast of the sediment plume such that the allowable spill budget can be modified to maximise reclamation and dredging production while at the same time meeting environmental quality objectives.

The main advantages of Feedback Monitoring are:

- Control measurements are targeted at the spill from the dredger which is the source of the spill and pollutant itself, which can be undertaken with a high degree of accuracy, without uncertainties normally encountered with fixed turbidity sensors at the receptor areas that cannot differentiate between loading produced from the dredging and natural variability in the background conditions;

- Sediment plume models (numerical models) are used to keep a running balance of cumulative impact levels based on actual production and measured spill against the pre-determined threshold limits. Action can then be taken in advance of any negative impacts occurring in the field;

- The use of a sediment plume hindcast model allows complex reclamation and dredging schedules to be addressed resulting in accurate assessment of cumulative impacts and the definitions of spill budgets that are adaptive to changes in area usage, equipment numbers and equipment size;

- The models give a spatial picture at all receptor sites not just the locations where instrumentation is deployed, as is the case for traditional monitoring methods. Coverage is thus more rigorous; and

- The use of spill measurements and modelling allows the monitoring and management system to be responsive to changes in conditions (e.g. seasonal effects) and work schedules, which is not possible utilising traditional impact assessment and monitoring methods.

These basic processes of feedback monitoring are illustrated in Figure 8.3.

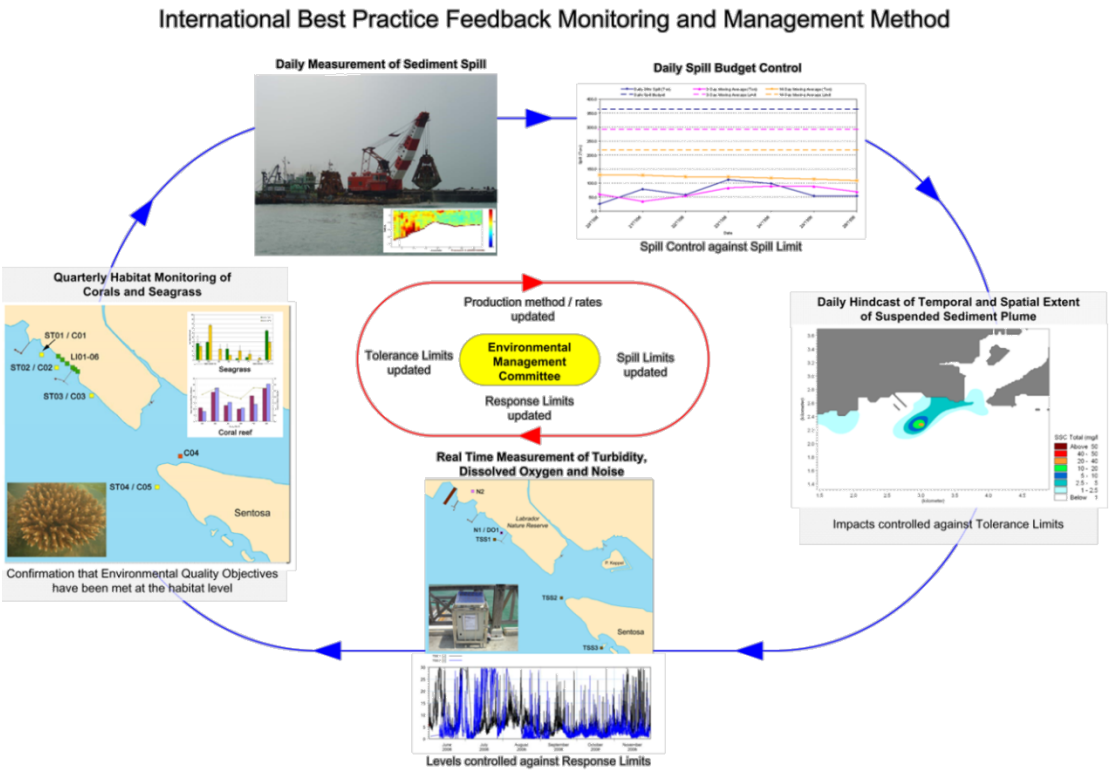

Figure 8.3 Flow diagram illustrating the feedback monitoring process.

Monitoring Schedule

Monitoring shall be carried out during the reclamation and capital dredging works. The monitoring programme is shown Table 8.4.

Table 8.4 Suspended sediment monitoring programme for Phase 2 Dredging and Reclamation Works.

Phase	Frequency
Pre-construction, Phase 2	Monitoring shall be carried out daily for 2 weeks immediately before reclamation/dredging works commence to provide a baseline on background suspended sediment concentrations. In addition, one online turbidity monitoring station will be set up and operated for a minimum of 2 weeks before the start of reclamation/dredging works. During this period suspended sediment samples will be taken at these locations to allow the relationship between Turbidity and Total Suspended Sediment Concentrations to be established. The feedback numerical modelling shall be run during this period based on the Contractor's proposed initial reclamation/dredging rates to set initial sediment load limits.
Construction – during reclamation and capital dredging	Monitoring shall be carried out daily during reclamation/dredging works. Initial results of the measured suspended sediment concentrations shall be available to the Contractor within 48 hours of the sample being taken. Continuous measurements of suspended sediment concentrations will be made at one location. The forecast / hindcast model shall be run 3 times a week during the reclamation/dredging works.

Suspended Sediment Plume Monitoring Stations

Suspended sediment concentrations will be monitored during the reclamation/dredging works by means of on line instrumentation (one monitoring point) and daily measurements of the suspended sediment concentrations. A total of six (6) fixed monitoring stations are required, with samples be taken at 3 depths in each station. The locations of the on line instrument and the fixed sampling stations are shown in Figure 8.4.

In addition to the fixed stations, at least four mobile monitoring stations are recommended, which are established based on the location of the visible plume:

- Dredge plume monitoring at two locations within the plume (within 100 m and 400 m of dredger) once per day for turbidity and total suspended solids for a period for 1 month at the dredging site.
- Two stations at each reclamation outflow: (1) at overflow outlet; and (2) within 200m of outfall.

Parameters

Parameters to be measured include:

- Turbidity (NTU) – daily through the water column
- Total Suspended Solids (TSS) - weekly
- On Line Monitoring of Turbidity
  - An online instrument will be used to measure turbidity and suspended sediment concentrations at a point between the reclamation area and the Tg. Piai Ramsar Site.
  - Measurements shall be taken continuously and made available on line real time

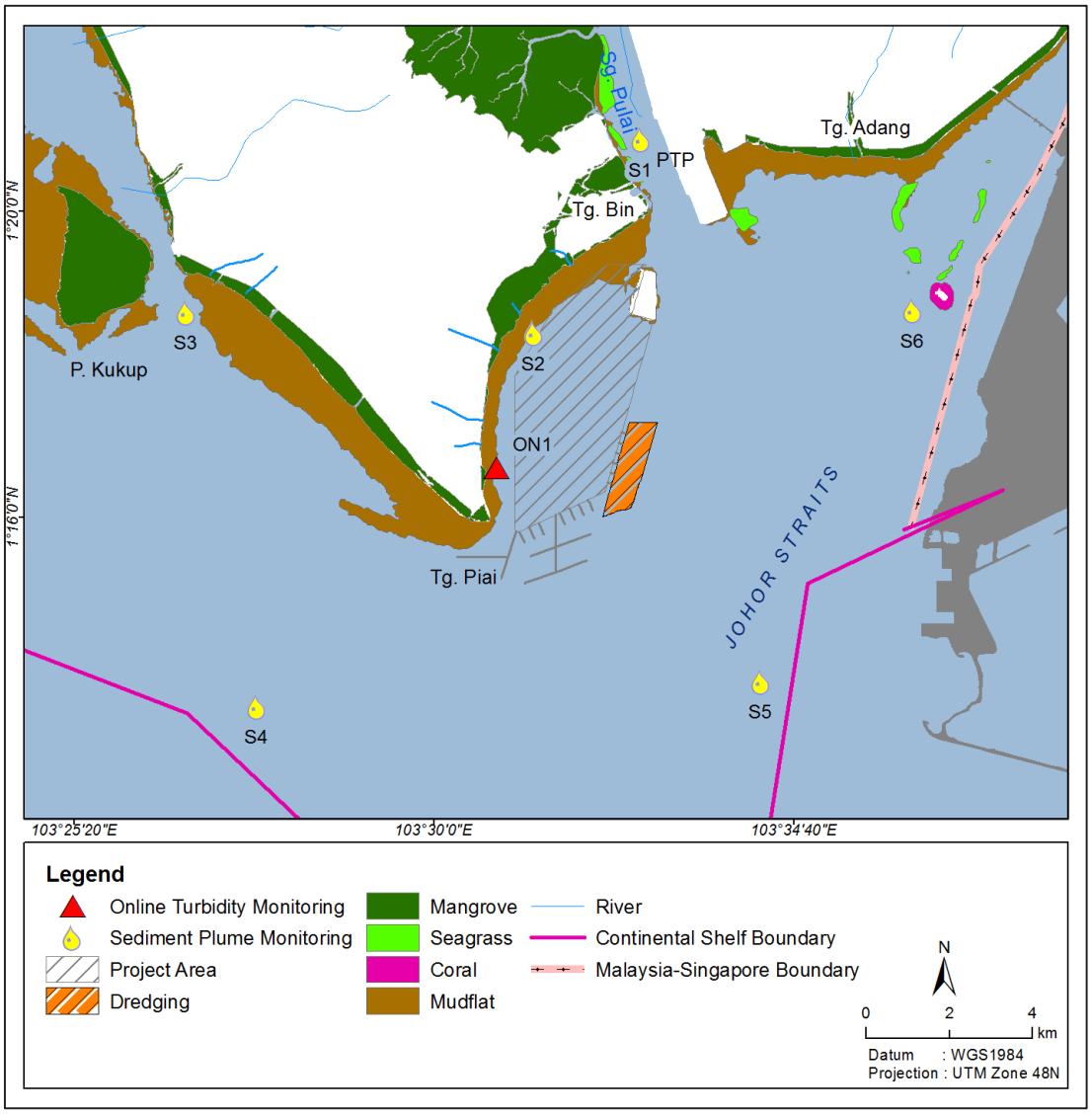

Figure 8.4 Locations of the fixed sediment plume monitoring stations during dredging and reclamation.

Table 8.5 Geographic coordinate for online turbidity monitoring station in WGS 1984 (decimal degrees).

Station	Longitude (E°)	Latitude (N°)	Description
ON1	103.513	1.27754	Online turbidity monitoring station near reclamation area

Monitoring of Overflow and Discharge Water Suspended Sediment Concentrations

A key component of feedback monitoring is to measure suspended sediment concentrations in the overflow or discharge water from the split hopper barges and flow rate to calculate the sediment spill.

Four samples shall be taken from each hopper load; these shall be equally spaced through the discharge period. The suspended sediment concentration will be analysed in these samples.

8.6.2 Ambient Water Quality

An ambient water quality programme will also be carried out throughout the construction and operational stages. This programme will monitor other parameters of concern such as oil and grease, BOD, etc. and complements the Suspended Sediment monitoring programme outlined above.

8.6.2.1 Construction Stage Monitoring

Compliance Monitoring

Compliance measures relating to mitigating the water pollution are outlined in Table 8.6 with the relevant monitoring requirements.

Table 8.6 Water pollution control measures and methods for monitoring compliance

Required activity	Compliance monitoring	Frequency
Discharge of floatables, chemicals, or other polluting substances from dredge and other construction vessels, the reclamation site offices and workers' quarters are not allowed; collection of such wastes shall be made on a regular basis and disposal of any prescribed substances shall follow existing State/Federal regulations	Layout plan and photographs of the oily waste temporary storage area(s), garbage disposal site and sewage facility at reclamation site	At construction start and as required
	Site inspection by contractor	Weekly
	Log of scheduled waste disposal	As required
Adequate and well-maintained sanitary provisions for on-site workers quarters and offices.	Site inspection by Environmental Manager	Monthly
Adequate containers/bins shall be provided for solid wastes	Site inspection by Environmental Manager	Monthly
Discharge of oily wastewater from sea vehicles' engine rooms should be channelled into an oil separator. The waste oil should then be stored in slop tanks and managed as schedule waste.	Requirement to be included in tender documents. Contractors to keep a log of scheduled waste disposal	Pre-construction. As required.
Any temporary onsite diesel storage areas should be located at least 30m away from the waterfront to prevent accidental spillage into the marine environment.	Layout plan and photographs of storage areas.	At construction start and as required
	Site inspection by contractor	Weekly

Impact Monitoring

Monitoring Schedule

The water quality monitoring shall be carried out **monthly during the construction phase**, however, the analysis of heavy metals may be restricted to the first six months of monitoring if there is no indication of elevated levels during this monitoring period.

Monitoring Stations

Water quality samples shall be obtained at 10 marine stations and two river mouth stations (at the two larger rivers of Sg. Chokoh Besar and Sg. Perpat Punggor) at mid depth. The

station locations are shown in Figure 8.5 and the corresponding coordinates are given in Table 8.7.

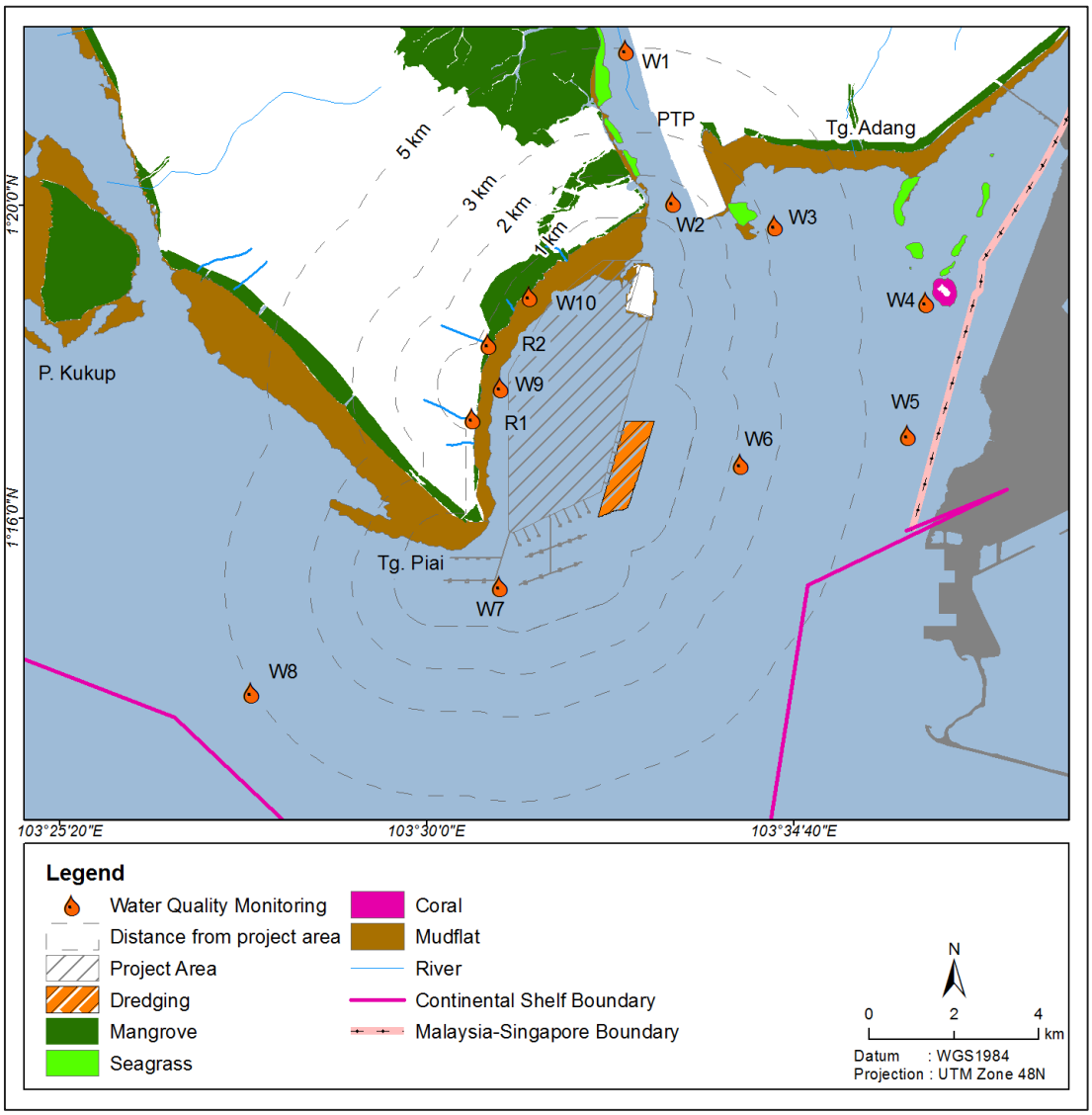

Figure 8.5 Water quality monitoring stations – construction stage.

Table 8.7 Geographic coordinates and description of the water quality stations in WGS84 (decimal degrees).

Station	Longitude (E°)	Latitude (N°)	Description
W1	103.542253	1.366652	Upstream control station for Sg. Pulai
W2	103.552205	1.334356	Sg. Pulai river mouth / near Tg. Bin outfall.
W3	103.573795	1.329222	Sensitive receptor – seagrass at PTP/ Tg. Adang.
W4	103.605924	1.312996	Sensitive receptor – coral reef around P. Merambong
W5	103.601948	1.284539	Sensitive receptor – Malaysia-Singapore border.
W6	103.566579	1.278310	Monitoring station – ~ 1 km east of project
W7	103.515541	1.252245	Monitoring station – immediately south of project off Tg. Piai
W8	103.462847	1.229463	Sensitive receptor – continental shelf border ~ 5 km from project.
W9	103.51563	1.294721	Sensitive receptor – channel fronting Tg. Piai Ramsar area
W10	103.521823	1.314233	Channel monitoring & sensitive receptor near Tg. Piai forest reserve mangroves.
R1	103.509771	1.288041	Sg. Perpat Punggor
R2	103.513107	1.303897	Sg. Chokoh Besar

Parameters
The parameters to be analysed for samples collected from the water quality monitoring programme are listed in Table 8.8.

Table 8.8 Water quality parameters to be analysed – construction stage

Parameters	Method Reference
Physical	
Temperature	In-situ profiles
pH Value	In-situ profiles
Dissolved Oxygen	In-situ profiles
Salinity	In-situ profiles
Conductivity	In-situ profiles
Turbidity	In-situ profiles
Total Suspended Solids	APHA 2540D
Heavy metals	
Chromium	APHA 3125B
Cadmium	APHA 3125B
Copper	APHA 3125B
Nickel	APHA 3125B
Iron	APHA 3125B
Lead	APHA 3125B
Manganese	APHA 3125B
Arsenic	APHA 3125B
Mercury	APHA 3125B
Organic	
Biological Oxygen Demand	APHA 5210B
Oil and Grease	APHA 5520B
Microbial	
Faecal Coliform	APHA 9222D

8.6.2.2 Operations Stage Monitoring

Monitoring Schedule
The water quality monitoring shall be carried out **quarterly from the completion of the reclamation up to one year after the commissioning of Phase 1, and annually thereafter**.

Monitoring Stations

During the operations stage the key parameters of concern are the changes to the thermal plume pattern around the Tg. Bin Power Plant cooling water outfall, potential water quality impacts in the channel between the project and the mainland, and pollution from general runoff or accidental spills and leaks from the terminal site and shipping vessels at berth. The zone of potential impact is expected to be primarily around the project site and the monitoring stations have been located accordingly.

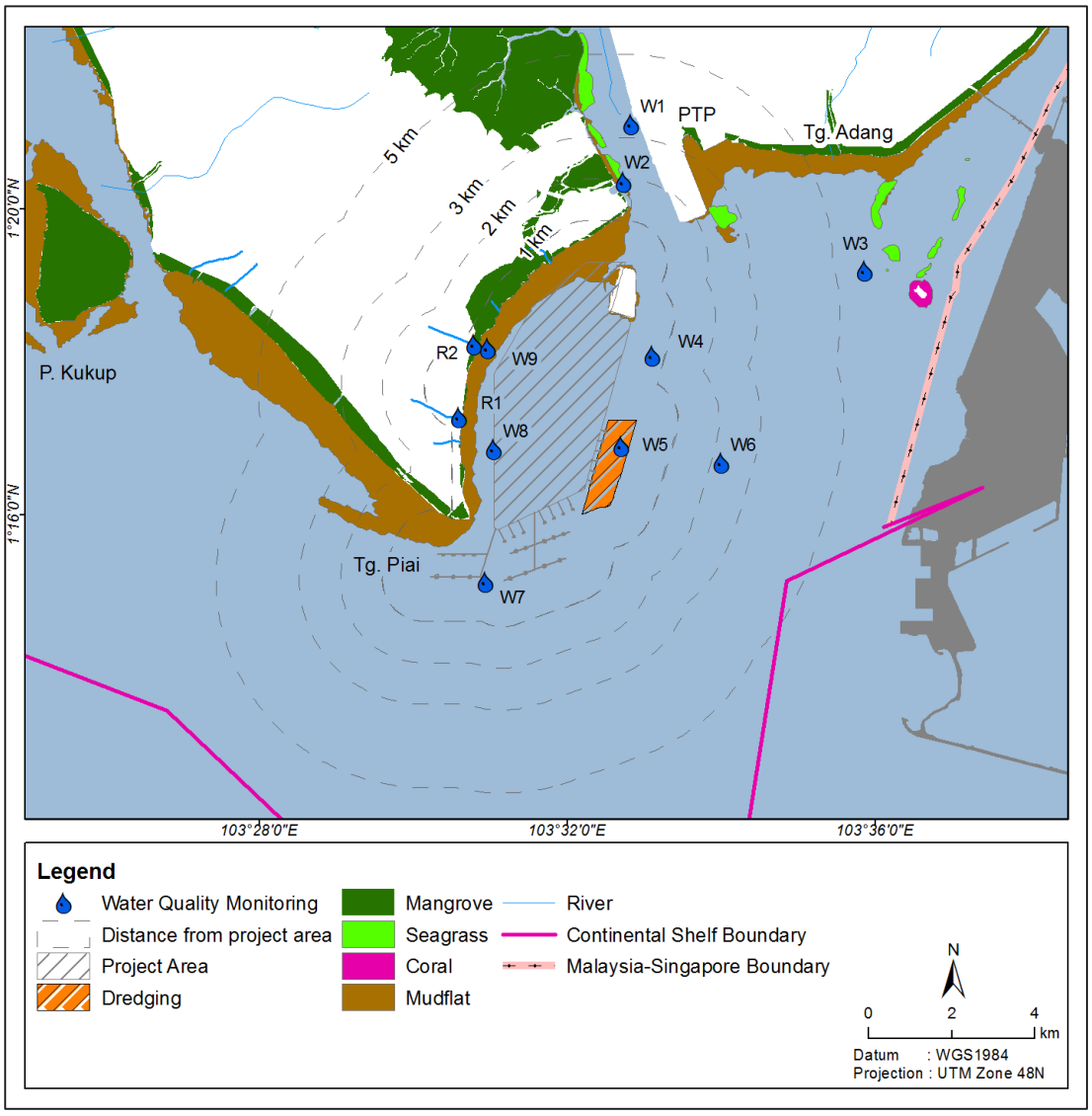

Figure 8.6 Water quality monitoring stations – operations stage.

Table 8.9 Geographic coordinates and description of the water quality stations during operation stage in WGS84 (decimal degrees).

Station	Longitude (E°)	Latitude (N°)	Description
W1	103.547	1.351923	Upstream control station for Sg. Pulai
W2	103.5454	1.339322	Sg. Pulai river mouth / near Tg. Bin cooling water intake.
W3	103.5975	1.319975	Sensitive receptor – off seagrass and corals at Tg. Adang/ P. Merambong
W4	103.5516	1.301482	Monitoring station – east of project.
W5	103.545	1.281911	Monitoring station – east of project
W6	103.5666	1.27831	Monitoring station - ~ 2 km east of project
W7	103.5155	1.252245	Monitoring station – immediately south of project off Tg. Piai
W8	103.5173	1.281168	Sensitive receptor – channel fronting Tg. Piai Ramsar area
W9	103.516	1.303065	Channel monitoring & sensitive receptor near Tg. Piai forest reserve mangroves.
R1	103.509771	1.288041	Sg. Perpat Punggor
R2	103.513107	1.303897	Sg. Chokoh Besar

Parameters

Channel Water Quality
Water quality monitoring is advised to determine possible eutrophication trends due to increase in human activities and potentially reduced flushing within the newly-created channel between the existing shoreline and the reclamation area. Water quality analysis for sampling from the two river stations and three channel stations shall include:

- Temperature – in-situ profiles
- Salinity- in-situ profiles
- DO - in-situ profiles
- BOD
- Oil & grease
- Nitrate nitrogen (NO_3N)
- Ammonium nitrogen (NH_4N)
- Orthophosphate phosphorus (PO_4P)
- Chlorophyll-a
- Faecal coliform

Water quality samples should be obtained at mid water depth, with at least two replicate samples per station.

Marine Water Quality
Water quality parameters to be monitored during the operations stage focus on hydrocarbons as the main potential pollutant, however other parameters are also included as listed in Table 8.10.

Table 8.10 Water quality monitoring parameters – operations stage.

Parameters	Method Reference
Temperature	*In-situ profile*
pH Value	*In-situ profile*
Dissolved Oxygen	*In-situ profile*
Salinity	*In-situ profile*
Turbidity	*In-situ profile*
Total Suspended Solids	APHA 2540D
Chemical Oxygen Demand	APHA 5210B
Oil and Grease	APHA 5520B
Total Petroleum Hydrocarbons	USEPA 8260 / 8015B
Benzene, Toluene, Ethylbenzene, Xylene	USEPA 8260
Total Volatile Organic Compounds	USEPA 8270

8.6.3 Coastal Bathymetric Profile Monitoring

In order to monitor the potential impacts of the project on the nearby coastline, bathymetric profile monitoring is recommended. These profile transects have been selected to cover the areas where there is potential for erosion/sedimentation and extend from the shore to the -5 m CD contour to fully cover the active sediment transport area. Given the benign wave conditions behind the proposed reclamation area it is proposed to monitor the shore with fifteen coastal profiles as shown in Figure 8.7. It should be noted that three profiles are proposed along the Tg. Piai National Park coastline where significant erosion has been identified. The profiles need to be undertaken using a multi-beam sounder to identify sediment layers and the data post processed to Chart Datum.

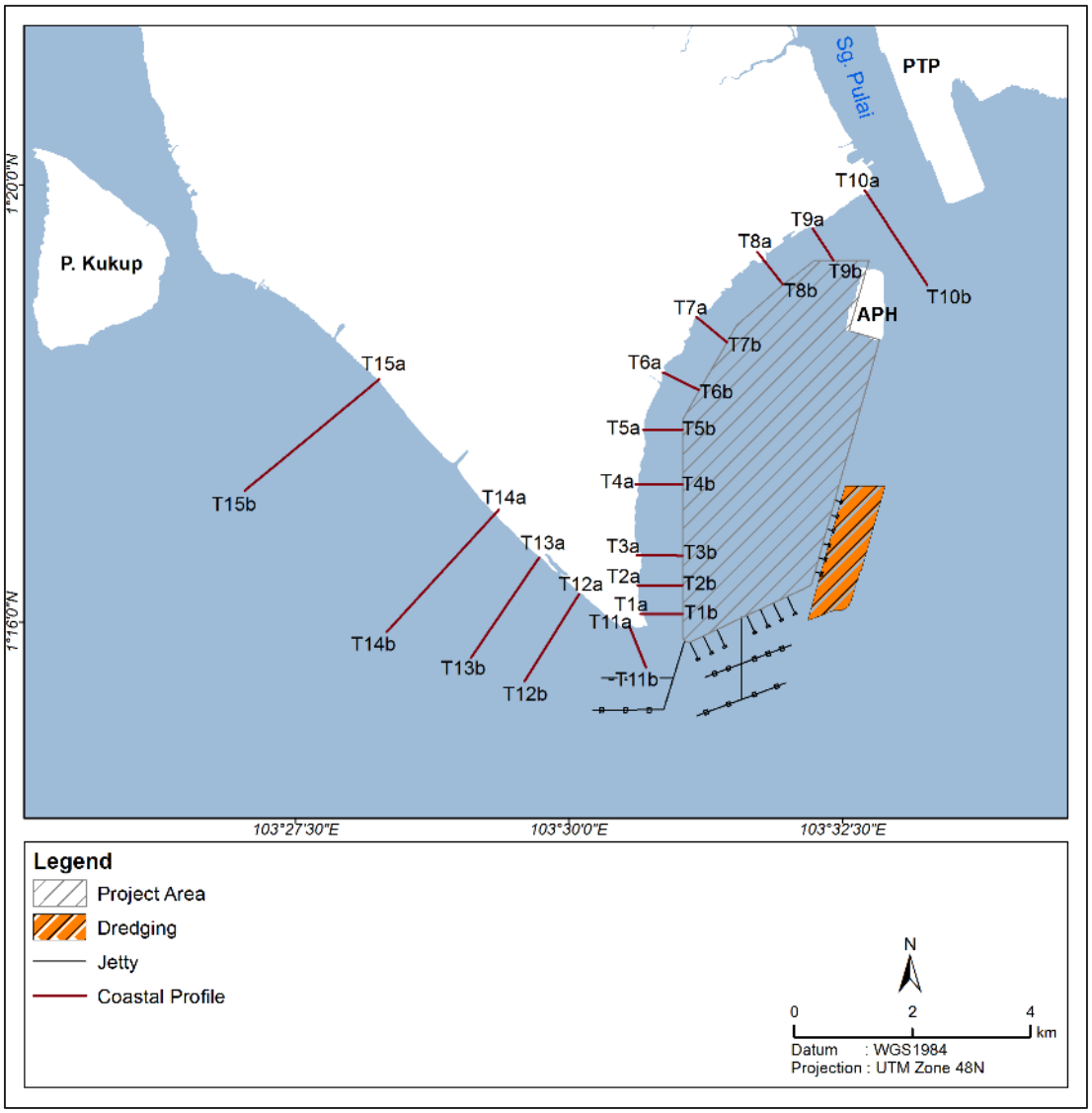

Figure 8.7 Proposed location of the coastal profile monitoring

The frequency of the coastal profile monitoring is:

- Once before construction starts
- Quarterly during construction stage
- Biannually upon completion of Phase 1 construction

8.6.4 Ecological Impacts

8.6.4.1 Biological Monitoring

The biological monitoring would enable primary and secondary productivity of the area to be measured as well as provide additional insight into the interpretation of the water quality data. It is recommended that the biological parameters be monitored as follows:

- Quarterly during the reclamation phase. Upon completion, the biological monitoring shall be continuously monitored for at least another two quarters.
- Half yearly during the operation of the marine facilities.

The parameters investigated would be the density and diversity of:

- Phytoplankton
- Zooplankton
- Macrobenthos
- Fish Fauna

The sampling stations for the above components are outlined below. Methods will follow that of the baseline studies except where otherwise specified, the objectives being no significant decrease in primary, secondary and benthic productivity as well as fish fauna in the areas immediately outside the project site.

The description of the sampling stations for the biological monitoring is provided in Table 8.11 to Table 8.16 and shown graphically in Figure 8.8 to Figure 8.10. The primary benchmarks would be no significant decrease in primary, secondary and benthic productivity as well as fish fauna at the study area.

Phytoplankton and Zooplankton

The plankton monitoring (phytoplankton and zooplankton) is proposed as shown below (Figure 8.8 and Table 8.11).

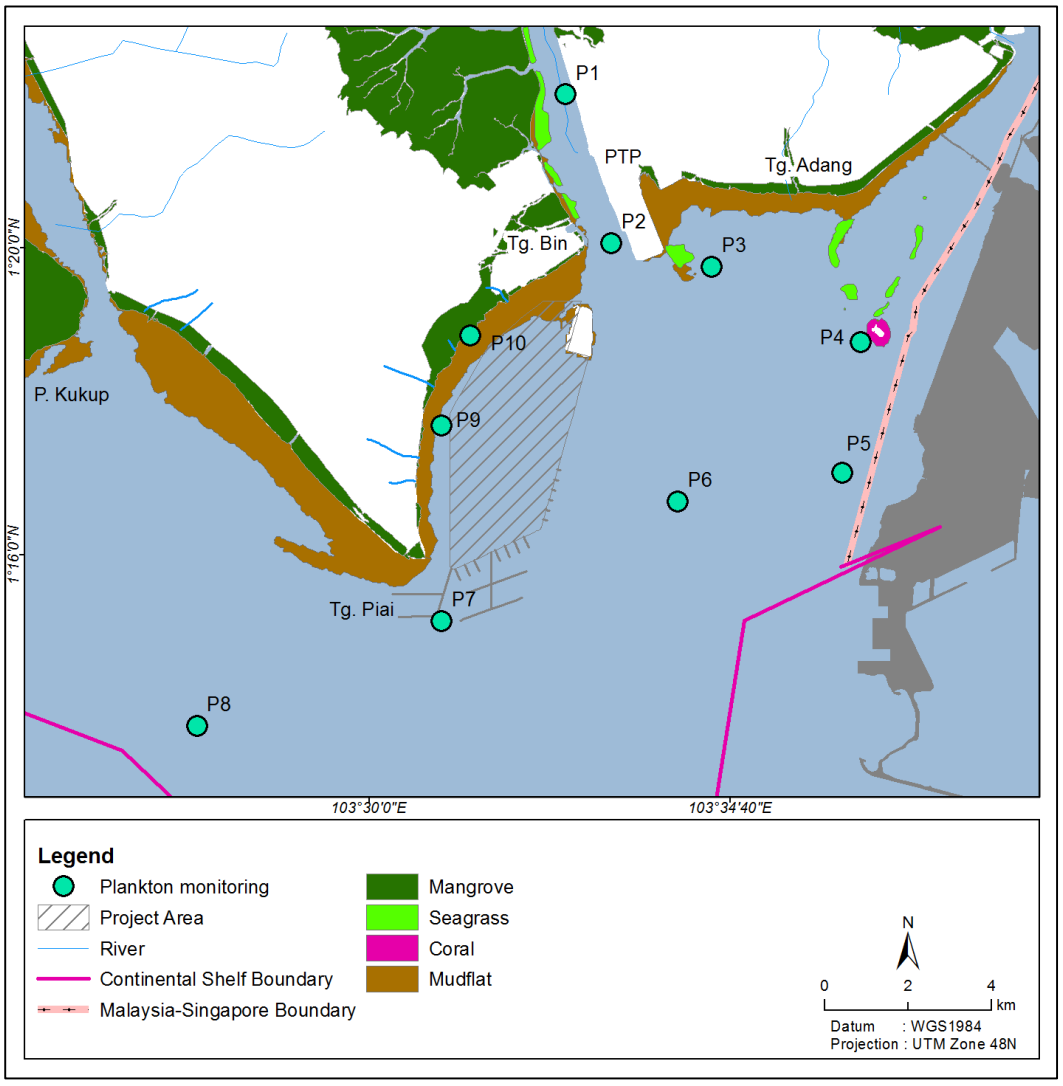

Figure 8.8 Locations of the plankton sampling stations.

Table 8.11 Geographic coordinate and description of the sampling stations for plankton (phytoplankton and zooplankton) monitoring in WGS 1984 (decimal degrees).

Station	Coordinate		Description
	Longitude (E°)	Latitude (N°)	
P1	103.542253	1.366652	Upstream control station for Sg. Pulai
P2	103.552205	1.334356	Sg. Pulai river mouth / near Tg. Bin outfall.
P3	103.573795	1.329222	Sensitive receptor – seagrass at PTP/ Tg. Adang.
P4	103.605924	1.312996	Sensitive receptor – coral reef around P. Merambong
P5	103.601948	1.284539	Sensitive receptor – Malaysia-Singapore border.
P6	103.566579	1.278310	Monitoring station – ~ 1 km east of project
P7	103.515541	1.252245	Monitoring station – immediately south of project off Tg. Piai
P8	103.462847	1.229463	Sensitive receptor – continental shelf border ~ 5 km from project.
P9	103.51563	1.294721	Sensitive receptor – channel fronting Tg. Piai Ramsar area
P10	103.521823	1.314233	Channel monitoring & sensitive receptor near Tg. Piai forest reserve mangroves.

Macrobenthos

Macrobenthos are an important component of the ecosystem in this area, providing a food source to both fish fauna and shorebird communities. Hence the impacts and recovery of this important resource will be monitored throughout the construction stage and during operations.

Macrobenthos monitoring during construction stage will be carried out quarterly at all the monitoring stations shown in Figure 8.9 with coordinates listed in Table 8.12.

During operations, monitoring will focus on the channel between the project and the Tg. Piai coastline, and in the area immediately surrounding the project as described in Table 8.12. Monitoring frequency can be reduced to biannually after one year following completion of construction of Phase 1.

At each sampling site at least three replicate samples per station will be collected and the samples processed as per the methods used in the DEIA. Sediments will also be analysed for grain size analysis and TOC.

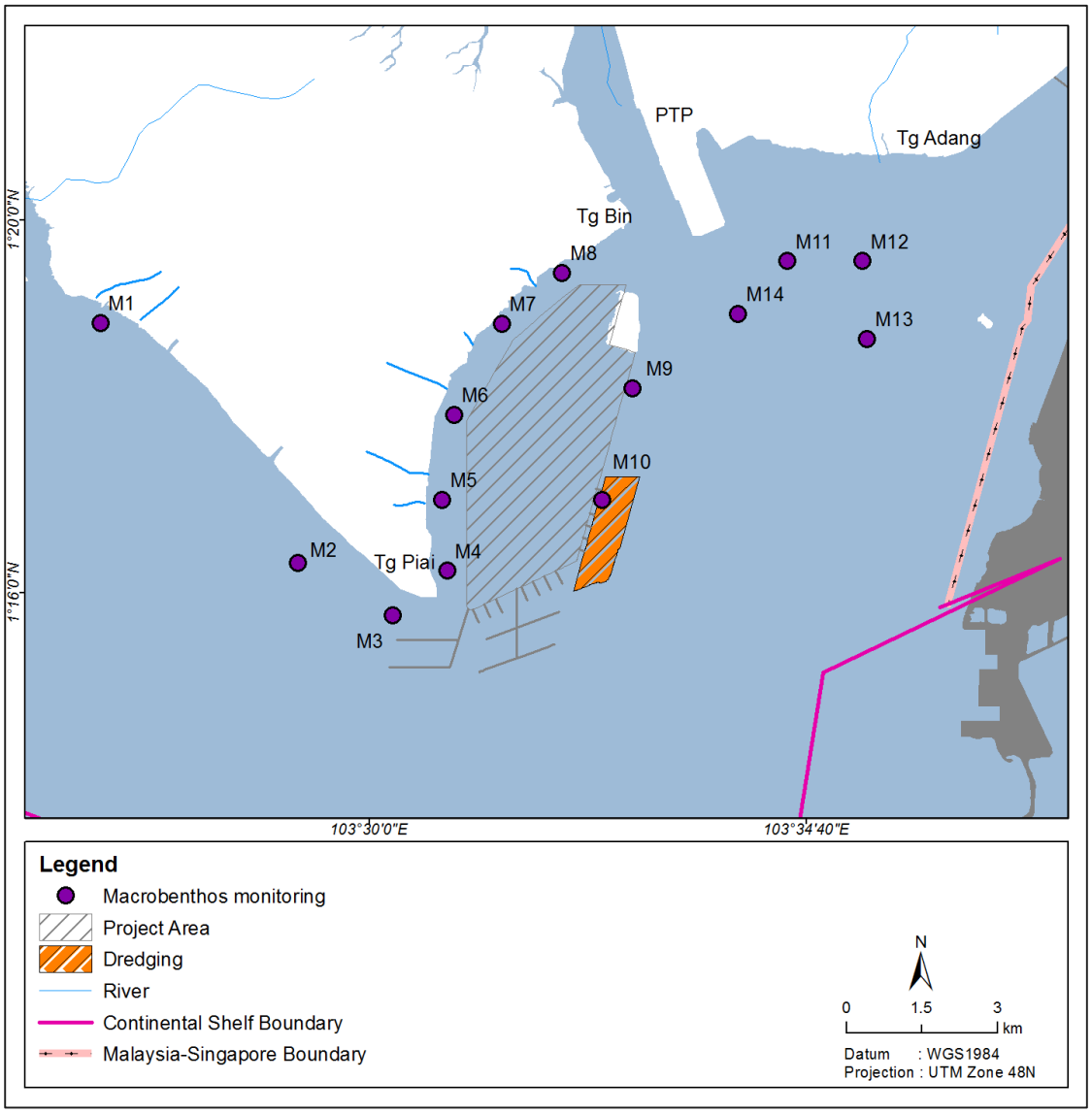

Figure 8.9 Location of the sampling stations for macrobenthos monitoring

Table 8.12 Description of the sampling stations for macrobenthos monitoring

Station	Coordinate		Project Stage	
	Latitude (N)	Longitude (E)	Construction	Operations
M1	01° 19.228’	103° 26.542’	✓	
M2	01° 16.323’	103° 29.248’	✓	
M3	01° 15.747’	103° 30.271’	✓	✓
M4	01° 16.230’	103° 30.834’	✓	✓
M5	01° 17.002’	103° 30.789’	✓	✓
M6	01° 17.910’	103° 30.908’	✓	✓
M7	01° 18.884’	103° 31.432’	✓	✓
M8	01° 19.429’	103° 32.057’	✓	✓

Station	Coordinate		Project Stage	
	Latitude (N)	Longitude (E)	Construction	Operations
M9	01° 18.198’	103° 32.820’	✓	✓
M10	01° 17.012’	103° 32.490	✓	✓
M11	01° 19.565’	103° 34.463’	✓	
M12	01° 19.558’	103° 35.274’	✓	
M13	01° 18.719’	103° 35.318’	✓	
M14	01° 19.810’	103° 33.825’	✓	

Fish Fauna

Monitoring of fish fauna will be carried out at six stations as shown in Figure 8.10 and listed in Table 8.13.

Table 8.13 Geographic coordinates (degrees, minutes) of the fish fauna monitoring stations.

Station	Coordinate	
	Latitude	Longitude
F1	1° 20.484'	103° 32.620'
F2	1° 19.848'	103° 34.023'
F3	1° 19.194'	103° 35.518'
F4	01° 17.894'	103° 34.509'
F5	01° 16.854’	103° 30.807'
F6	1° 17.976'	103° 27.176'

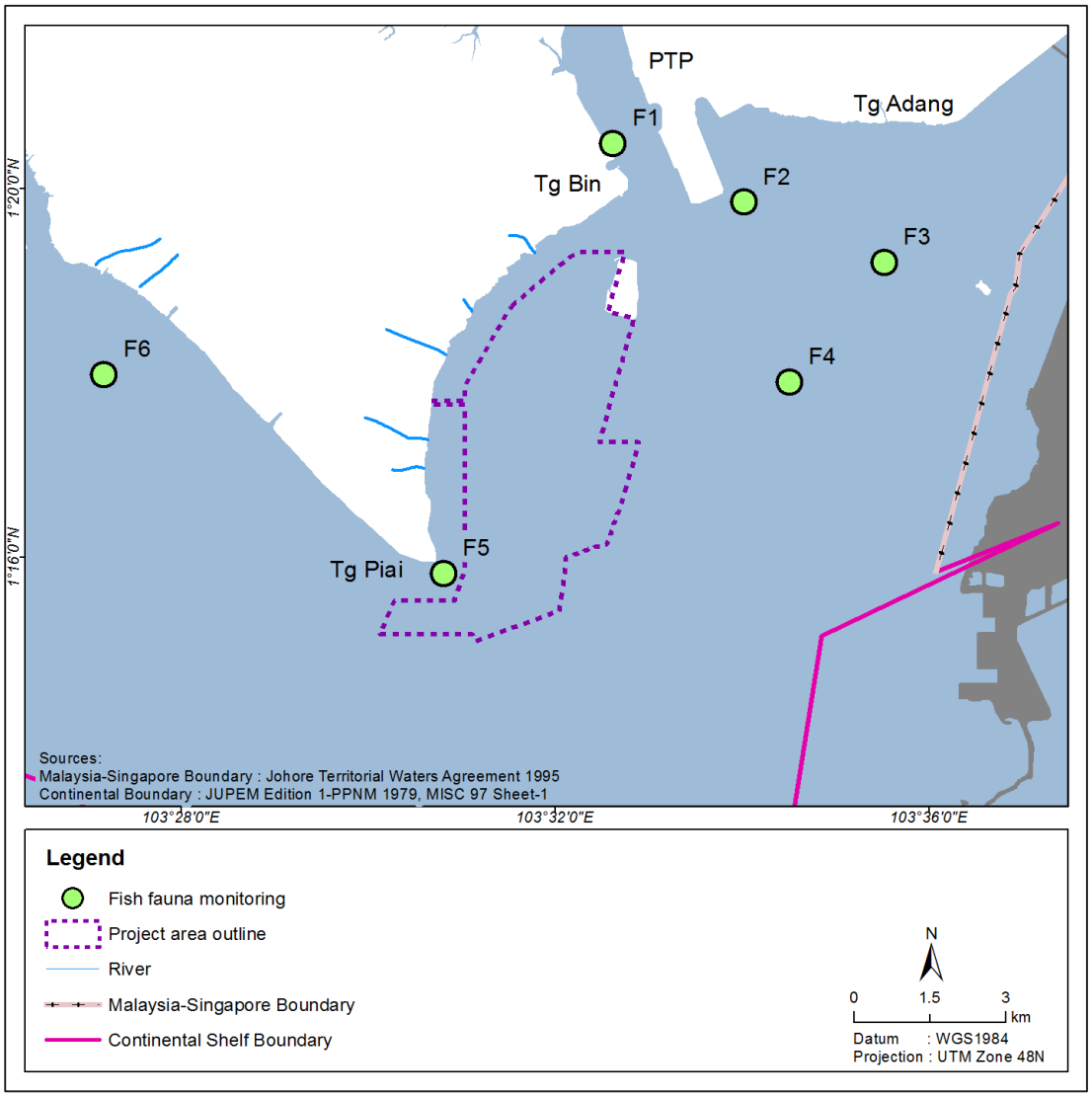

Figure 8.10 Location of fish fauna monitoring stations.

8.6.4.2 Habitat Monitoring

Mangroves, seagrass beds and coral reefs are among the most important ecosystems that support a wide variety of biodiversity at the study area. The monitoring of these sensitive habitats would enable the health and status of these areas to be measured and any adverse impacts on the habitats due to the reclamation and operation of the proposed project can be closely monitored. To ensure the proposed project would not affect these sensitive habitats, the following monitoring regime is recommended:

- Quarterly during the reclamation phase. Upon completion of each phase, habitats monitoring shall be continuously monitored for at least another two quarters.
- Half yearly during the operation of the marine facilities.

The habitats investigated would be the status and health of:

- Mangroves
- Seagrass beds
- Coral reefs

The monitoring should be on transect based, with quantitative outputs to enable clear comparison of habitat health. The primary benchmarks would be no significant deterioration of habitat health and status at the study area.

Mangrove

A total of 11 stations along the Tg. Piai shoreline adjacent to the project are recommended (Figure 8.11 and Table 8.14). In addition to the methodology as per the baseline for this DEIA (Appendix G), the following observations should also be documented:

- Monitoring the growth rate / survival of 100 young trees at each station (by tagging individuals saplings and tracking them throughout construction). This is because the mature *Rhizophora* trees are unlikely to show any measurable early response to stress – the younger trees will respond quicker.
- Sedimentation level monitoring – 3 permanent poles to monitoring the sediment level to be established at each station
- Grain size analysis – 3 samples per station

Table 8.14 Coordinates (decimal degrees) of transect start points for mangrove monitoring

Station	Latitude (N)	Longitude (E)
T1	1.2660	103.5103
T2	1.2666	103.5110
T3	1.2670	103.5114
T4	1.2673	103.5113
T5	1.2771	103.5109
T6	1.2862	103.5108
T7	1.2923	103.5111
T8	1.3128	103.5190
T9	1.3189	103.5244
T10	1.3217	103.5264
T11	1.2920	103.4849

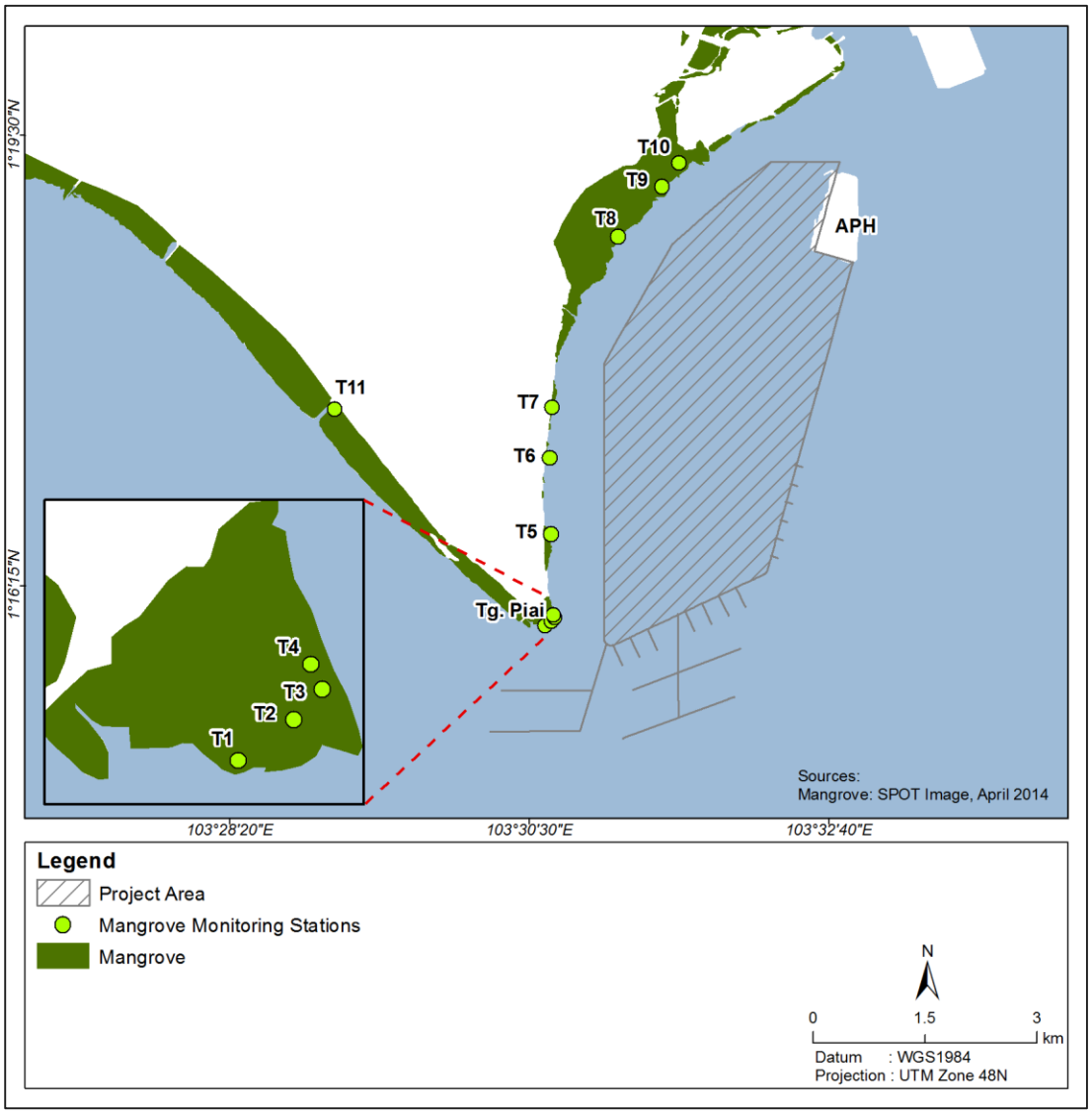

Figure 8.11 Location of mangrove monitoring stations.

Seagrass

Fifteen monitoring stations will be established for seagrass monitoring covering the areas off Tg. Pelepas Port, Tg. Kupang/Merambong Shoal and within Sg. Pulai (Figure 8.12 and Table 8.15).

Parameters to be measured:

- Seagrass area mapping (to determine whether distribution patterns are changing)
- Shoot density
- Species diversity
- % cover of substrate

The seagrass monitoring should be carried out monthly for the duration of the dredging and reclamation phase, although the repeat schedule will be optimised through feedback system as the project progresses.

After the completion of dredging and reclamation, monitoring shall be carried out quarterly during the remaining construction stage.

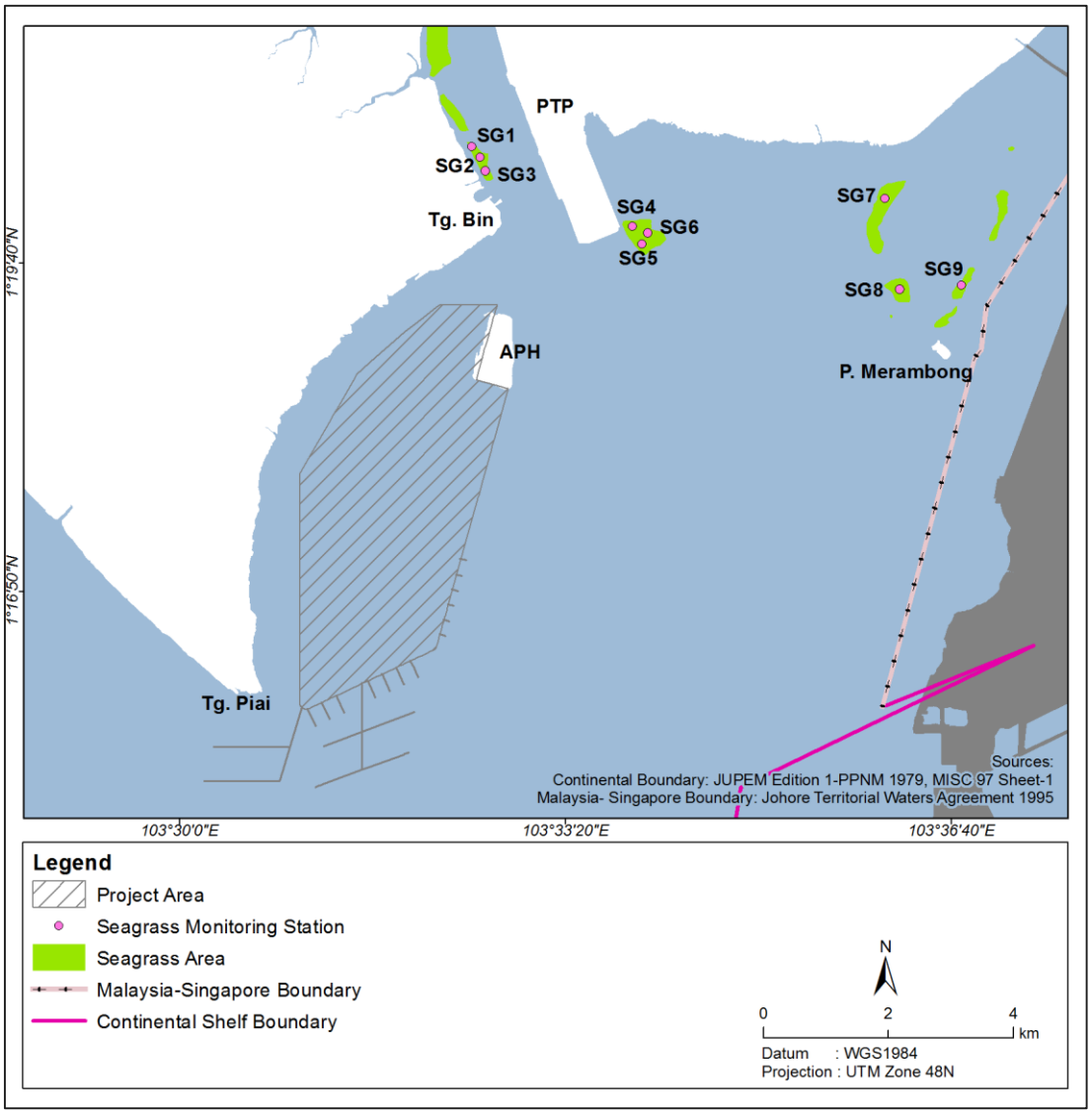

Figure 8.12 Seagrass monitoring stations.

Table 8.15 Location of the seagrass monitoring stations in decimal degrees.

Station	Coordinate	
	Latitude (N°)	Longitude (E°)
Between Sg. Tembusu and Sg. Dinar		
SG1	1.344542	103.542
SG2	1.343032	103.543
SG3	1.341123	103.544
Off Tg. Pelepas Port		
SG4	1.333126	103.565
SG5	1.330584	103.567
SG6	1.33217	103.567

Station	Coordinate	
	Latitude (N°)	Longitude (E°)
Tg. Adang Shoal / Merambong Shoal		
SG7	1.337137	103.602
SG8	1.32413	103.604
SG9	1.324613	103.613

Coral Reef

For coral reef monitoring, four (4) stations are proposed. The description of the stations and location of the diving sites for coral reef monitoring are provided in Figure 8.13 and Table 8.16 respectively. Methods will follow those used in the DEIA.

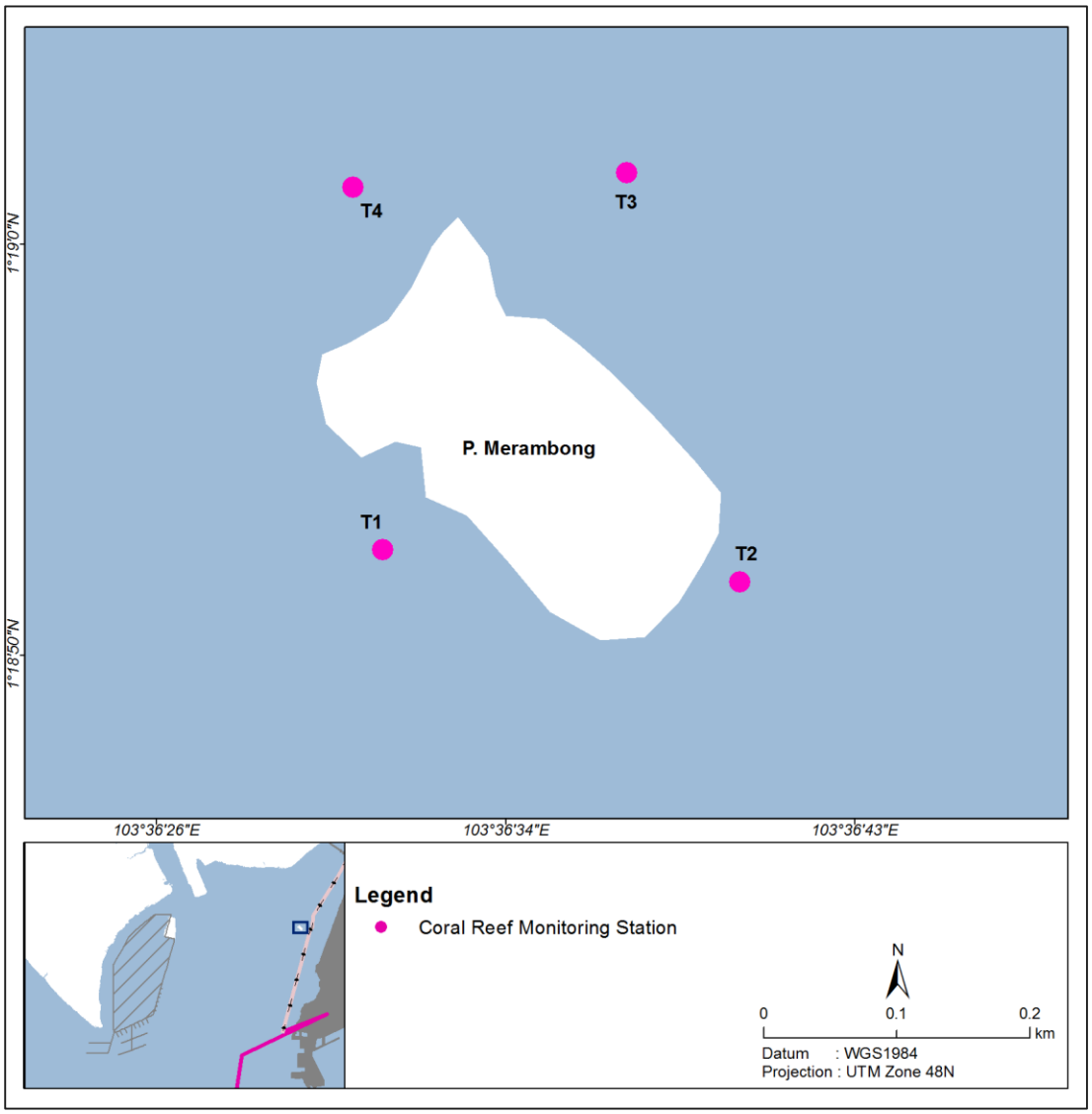

Figure 8.13 Location of coral reef monitoring stations.

Table 8.16 Coordinates of coral reef monitoring stations (starting points).

Station	Latitude	Longitude
T1	1°18.876’	103°36.525’
T2	1°18.863’	103°36.670’
T3	1°19.029’	103°36.624’
T4	1°19.023’	103°36.513’

8.6.5 Air Quality

8.6.5.1 Compliance Monitoring

The compliance monitoring for the recommended air emissions abatement measures are detailed Table 8.17.

Table 8.17 Air emissions abatement measures and related compliance monitoring during the construction phase

Required activity	Compliance monitoring	Frequency
Construction machinery shall be maintained according to national standards for emissions.	Equipment/ vehicle maintenance log to be kept by contractors	As required
Spraying of bare surfaces	Layout plan and photographs of wet dust suppression system	At construction start
Stabilisation of access point and main haul roads within site	Layout plan and description of stabilisation works	Monthly
Access point and main haul roads within site to be inspected monthly and maintained as necessary.	Photographic record.	Monthly
Lorries transporting the earth fill shall cover the loads with tarpaulin	Site inspection	Monthly
Wheels of construction vehicles leaving the site shall be clean	Layout plan and photographs of washing bay system	At construction start
	Site inspection	Monthly
	Public complaints	As required
No open burning on site	Site inspection	Daily
	Public complaints	As required

Table 8.18 Compliance monitoring for air quality during operational phase

Required Activity	Compliance monitoring	Frequency
To conduct air emission monitoring and ambient air monitoring throughout the terminal operations as per the DEIA	To be included into the annual audit report	Annual

8.6.5.2 Impact Monitoring

The stations for the monitoring of air emission is proposed at the boiler stack, while the monitoring of ambient air quality during both construction and operations is proposed as shown in Figure 8.14.

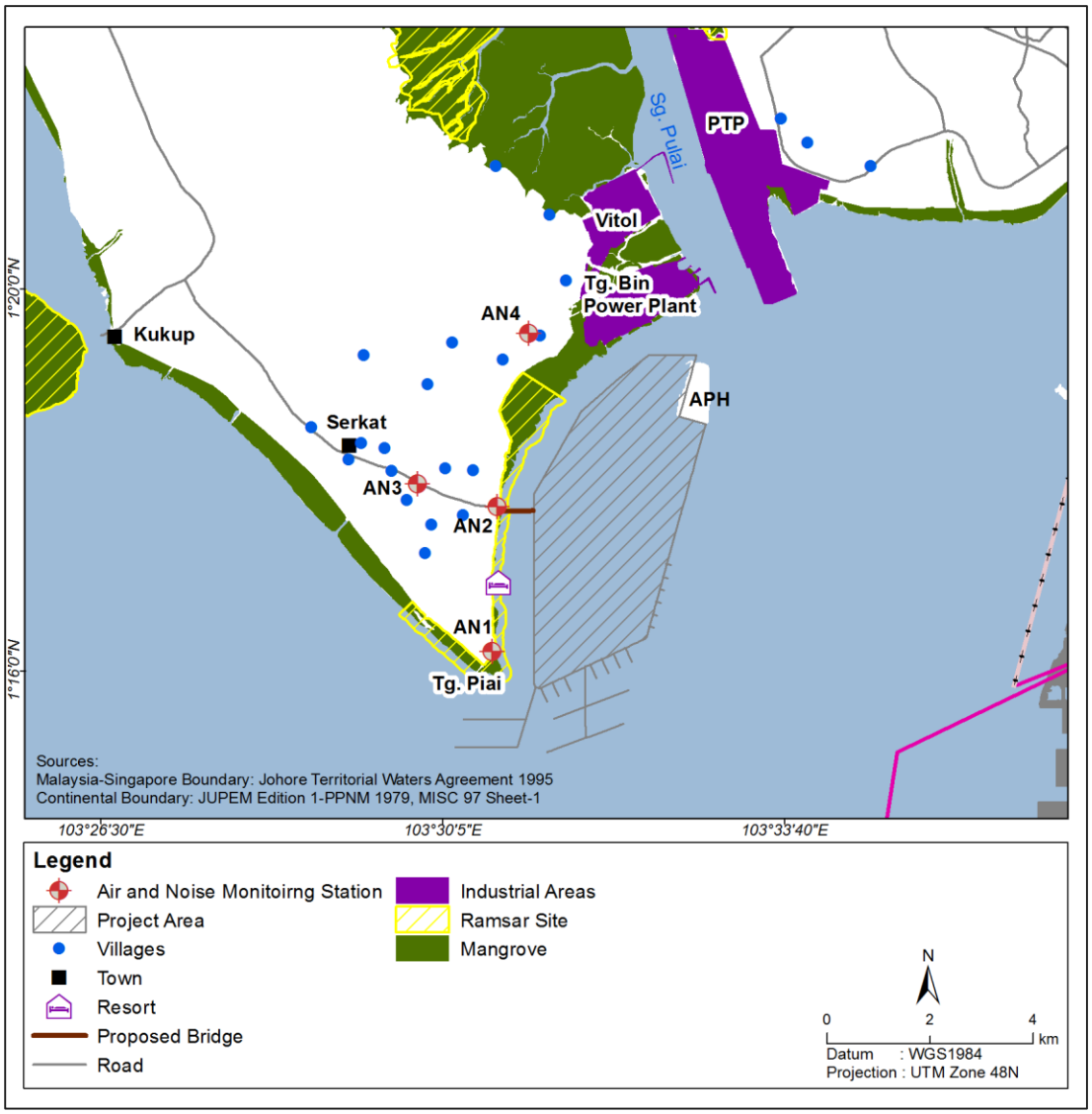

Figure 8.14 Air quality and noise monitoring stations

The monitoring and parameters to be analysed during construction and operation phase are listed Table 8.19.

Table 8.19 Parameters to be measured in the air quality monitoring

Phase	Monitoring Schedule	Parameters to be measured
Construction	Quarterly	• Total suspended particulates (TSP) • Particulate matter (PM_{10}) • Sulphur Oxides (SOx) • Nitrogen oxides (NOx) • Carbon Monoxide (CO)
Operations – emissions monitoring (boiler stack emissions)	Quarterly	
Operations – ambient air quality monitoring	Biannually	

8.6.6 Ambient Noise Level

8.6.6.1 Compliance Monitoring

Noise abatement measures and the proposed monitoring of compliance with these measures are outlined Table 8.20.

Table 8.20 Noise management measures and compliance monitoring

Required activity	Compliance monitoring	Frequency
Construction machinery shall be fitted with noise suppressors recommended by the manufacturer	Machinery/equipment specifications list	To be included in contract
Installation of enclosures around power generators and other noisy machinery.	Layout plan and photographs of physical noise barriers and equipment enclosures	At construction start and when necessary
Noise Complaint Register	• Set up and create public awareness of noise complaint register (local telephone number) • Noise complaints to be recorded in log book • Complaints to be investigated within 24 hrs following lodgement. • Log book to be included in monitoring report • Additional mitigation measures to be implemented where frequent or repeating noise complaints are received.	Per occurrence

8.6.6.2 Impact Monitoring

Monitoring Schedule

The noise monitoring shall be conducted before the start of construction and quarterly throughout the construction and operation phases.

Monitoring Stations

Noise monitoring during the construction and operation phases will be carried out at the same locations as the air quality stations shown in Figure 8.14 above.

Parameters

Parameters to be recorded for ambient noise level monitoring during construction and operation are:

- Equivalent Continuous Sound (L_{eq})
- Maximum sound pressure level over monitoring period (L_{max})
- Statistical indices (L_{90}, L_{10})

"A" weighted noise levels should be monitored at each station over at least 24 hours continuously (12-hours day and 12-hours night) using a pre-calibrated precision integrating noise meter.

8.6.7 Social Impact

8.6.7.1 Compliance Monitoring

Compliance monitoring for the proposed mitigation measures are set out in Table 8.21 below.

Table 8.21 Socio economic compliance monitoring programme

	Required Activity	Compliance monitoring	Frequency
1	Preferential employment of locals, patronisation of local businesses and suppliers.		
	(i) Set up of Employment and local business register. Registration exercise to be carried out for individuals and local businesses/ suppliers.	Submit documentation of employment registration exercise.	At construction start, then annually
	(ii) Monitoring of local employment by project proponent and all contractors and subcontractors.	Provide statistical data of % local employment. This should include breakdown of job category (e.g. unskilled, skilled labour, management, etc.)	Annual report
	(iii) Provision of training/ education to locals to increase employability and/or entrepreneurial ability. Project proponent needs to liaise with relevant government agencies to develop such programmes.	Number of Training / education programmes for local community members	Annual report
2	Siting of workers' quarters to consider sensitivity of neighbouring villages/ residential areas.	Proposed location of workers' quarters, expected worker population to be submitted to local authority and discussed with local community leaders. Submit documentation of consultations.	At construction start/ as required
3	Community awareness programmes and dialogue	Regular consultations through establishment of Community Working Group involving village heads.	At construction start/ then quarterly
4	In-migration status	Monitoring of in-migration – e.g. at kampung level (assisted by Ketua Kampungs and JKKK)	Annually

8.6.7.2 Impact Monitoring

Impact monitoring in the socioeconomic sense refers to ongoing community consultation with respect to issues identified as potentially significant during the DEIA study, and also to determine whether any other unforeseen problems emerge following construction start.

The monitoring survey shall be carried out using questionnaires which target existing and impending issues as well as getting the respondents' opinions on how to tackle related problems. Key villages to be selected for the socio-economic monitoring campaign will be based on locality of these villages within the direct and primary impact area.

Directly affected villages are those identified villages that will experience direct and indirect (e.g. economic) impacts from the project development. The term "directly affected" will also include any people, households, firms, or private institutions who, on account of changes that result from the project will have their (i) standard of living adversely affected; and/or (ii) business, occupation, place of work or residence, or habitat adversely affected. Villages that may be affected by the project will be those along the Tg. Piai shoreline (air, noise and traffic nuisance during construction), villages with fishing community, villages that experience disruption to access of facilities or everyday activity, e.g. those along the access roads to the construction site. However, these need to be finalised and re-confirmed during the preparation of the Final EMP prior to construction start.

Methodology

Suggestion/ complaint centres

It is proposed that a suggestion / complaint centre will be set up at three areas where the local community can give their opinions and suggestions on the construction activities. These will be located at the site office, the Fisheries Association office at Kukup and the Pontian District Office. Any complaints should be responded to within one working day (at the least notification that the complaint has been registered and is being investigated). The complaints register will need to record the date of the complaint, nature of complaint, date and nature of response, follow up action and resolution date. All entries into this complaints register will be summarised in the Environmental Monitoring reports.

Interview/ Questionnaires

The approach of getting feedback from the public will be in the form of:

- Interviews – a series of structured open-ended interviews with selected community representatives to obtain information/concerns/views.
- Questionnaires – a written, structured series of questions issued to a sample of local people to identify concerns and perceived impacts.

Monitoring will be carried out in three periods of time: before, during (quarterly) and after the construction is completed for each phase. The social feedback survey will be conducted to gain feedback and concerns from the affected population on the project as well as to inform them on the project status and remind them on the safety requirements.

Details of the proposed monitoring elements are given in Table 8.22. All monitoring is the responsibility of the project proponent, who may also assign the tasks to its contractors and subcontractors (but remains the responsibility of the project proponent), unless otherwise specified.

Table 8.22 Socio economic feedback monitoring programme (interviews, stakeholder groups)

Parameter	Indicator
Employment opportunities	Number of local residents employed by the Contractor
Loss of livelihoods, reduced access to resources.	Change in income from fishing catch; Public complaints

Parameter	Indicator
Restricted access to the beaches by the fishermen when going to sea will affect their fishing activity.	Public complaints
Overwhelming of local communities due to influx of people seeking jobs	Public complaints
Pressure on existing infrastructure and amenities of the study area	Public complaints; dialogue with local authorities.
Increase in crime and violence in the area.	Public complaints; dialogue with local authorities
Disruption to existing recreational & tourism activity	Public complaints
Potential dissatisfaction or conflicts among local residents as a result of unrealized employment expectations	Public complaints
Social or cultural problems due to interaction of traditional villagers with construction workforce	Public complaints
Income from businesses	Change in income

8.6.8 Fisheries and Aquaculture

8.6.8.1 Compliance Monitoring

Continuous consultation with the local fishermen and aquaculture operators on any deleterious effect or losses is recommended. Specific activities and compliance monitoring are listed in Table 8.23

Table 8.23 Compliance monitoring programme for mitigation of impacts to fisheries.

Required Activity	Compliance monitoring	Frequency
Establishment of Fishermen's Working Group prior to construction start.	To submit committee members names and minutes of meetings	Prior to construction start/ then quarterly.
Undertake regular visits to fish landing sites to obtain Fishermen's catch species numbers and metrics	To submit sampling schedule and data to Marine Department and data analysis and schedule to be included in the EMP report	Three sample sets prior to construction start/ then monthly for first 12 months, thereafter quarterly
Inform fishermen of work schedules, safety buffer zones and restricted areas before each construction phase and when required (e.g. any change in schedules, activities, etc.)	To submit schedule to Marine Department and schedule to be included in the EMP report	At construction start/ then quarterly

8.6.8.2 Impact Monitoring

Monitoring of fisheries activities in the project area and fish cage culture farming operations at Pulau Kukup shall be carried out on the following basis:

- Three sample sets prior to construction start/ then monthly for first 12 months, thereafter quarterly during the reclamation / dredging and reclamation phase and up to 6 months upon completion of construction.
- Half yearly during the operation of the marine facilities.

Fisheries and aquaculture monitoring shall examine landings in terms of volume and species diversity. This shall be undertaken through interviews with selected fishermen and cage culture operators buttressed by data from the Department of Fisheries. This is to establish causes and enable remedial action to be taken at the earliest possible.

8.7 Reporting Requirements

During construction works it is proposed that quarterly Environmental Monitoring Reports documenting the monitoring activities and findings as outlined in the previous sections are submitted to DOE. However, during dredging and reclamation this should be increased to monthly to report the findings of the more frequent monitoring activities at this stage.

During operations, bi-annual reporting is required.

8.8 Emergency Response Plan (ERP)

An Emergency Response Plan (ERP) will be established for both construction and operational stages. The operational stage ERP shall cover both the Terminal and marine facilities. The ERP shall address at least the following:

- Marine collision in terminal
- Oil Pollution Emergency Plan
- Fire on the vessel(s) or on terminal.

Fire and chemical spill drills should be conducted regularly for all associated facilities' to ensure that all members of the Emergency Response Team are well prepared and understand their individual roles and accountability during a fire or chemical spill incident.

Terminal operations will be suspended or otherwise amended immediately if an environmental incident occurs that may be exacerbated by continued terminal operations.

8.8.1 Compliance Monitoring

- SOP/EOP to be submitted to Marine Department and other relevant authorities prior to commencement of construction and terminal operations.
- Monitor and record incidents, including "near hits" and incorporate into RRP review and update.
- All equipment required in the implementation of the emergency response plan must be on site and maintained on schedule in order to respond to any emergency such as oil spill effectively and efficiently.
- Inspection and verification of the emergency response equipment and gear (firefighting equipment, oil spill response equipment etc.) to be conducted bi-annually.

8.8.2 Oil Spill

In the event that oil products are spilled into the sea or an oil slick is observed the Captain/ Vessel Master and / or port operation manager shall be notified immediately by the person observing the oil spill, giving sufficient details so that the necessary steps can be taken.

The Captain/ Vessel Master and / or port operation manager is responsible for the compliance and execution of the Oil Pollution Emergency Plan (OPEP), where applicable.

Steps to be taken will include:

- Stop the spill source immediately

- Remove floating oil with absorbent or skimming
- Deploy containment booms to control flow dispersion of spillage
- If the spill is large, the Marine Department shall be informed immediately to activate the Contingency plan for Oil Spill and Toxic Chemical with the assistance of the Department of Environment.

8.8.3 Collision at Sea

In all cases, the Captain / Vessel Master from colliding vessel have the final responsibility for the safety of the vessel and people on board.

Immediately after the collision or as soon as a real danger of collision is known to exist, the Captain/Vessel Master has the prevailing authority to order the termination of all operations and to choose all necessary means with regard to the security of the vessel.

In the case of a collision being imminent, the actions to be carried out by the crew should be as follows:

- Inform Vessel Master and engine room.
- Sound the general emergency alarm.
- Manoeuvre the vessel so as to minimise effects of collision.
- Close watertight doors and automatic fire doors.
- Switch on deck lighting at night.
- Make the vessel's position available at the radio.
- Sound bilges and tanks after collision.
- Check for fire/damage:
  - Access and survey the damage
  - Determine immediate, medium and long term consequences
  - Decide if ongoing activities must be suspended
  - Decide if evacuation is in order
- Offer assistance to other vessel.
- Notify appropriate authorities and vessels in the vicinity

8.9 Project Closure

8.9.1 Design for Decommissioning

It is important to anticipate the decommissioning activities and incorporate them in the design phase. "Design for decommissioning" principles are recommended.

The "design for decommissioning" is a proactive approach and includes the following considerations during the planning stage:

- Using materials that are easy to recycle or reuse.
- Using modular designs to make it easier to assemble, disassemble and transport parts of the facilities
- Minimising the use of hazardous materials.
- Minimising the amount of contaminated material or hazardous waste that will be generated upon decommissioning.
- Make arrangements for ongoing servicing of site specific navigations markers

Establishing the contractual liabilities of the Operators (i.e. purchaser/ developer of lots); i.e. the company should be responsible for pollution caused by their own operations, such that the Operator should:

- Consider any insurance requirements

- Make provisions for future costs

8.9.2 Compliance Monitoring

In the event of project closure or abandonment, the compliance monitoring to be implemented varies depending on the stages the project is in and may include the activities outlined in Table 8.24. The required decommissioning plan following any period of operations is described further in Section 8.9.3.

Table 8.24 Compliance audit for project closure or abandonment (monthly during decommissioning).

Required activity	**Compliance monitoring**
Abandonment during Construction	
Removal of construction machinery	List of machineries and site inspection with photographic evidence
Removal of construction waste	Site inspection and photographic evidence
Appropriate management and disposal of scheduled wastes	Site inspection and photographic evidence of collection area; log of disposal / chain of custody
Construction of revetment/bundwall to stabilise reclaimed area.	Layout plan and photographic evidence
Landscaping of exposed areas	Site inspection and photographic record.
Decommissioning following Operations	
Preparation of Decommissioning Plan	Submission / notification to relevant authorities
Dismantling and removal of tanks, pipes and other equipment or structures	Site inspection and photographic record.
Disposal or decontamination of equipment, structures and soils	
Removal of all hazardous wastes	Site inspection and photographic evidence of collection area; log of disposal / chain of custody
Soil contamination survey and remediation plan	Contamination surveys to be carried out and remediation plan developed as required
Rehabilitating the facility	Rehabilitation plan; progress reports
Maintenance of park such as housekeeping and landscaping, site specific navigation and other hazard warnings	Site inspection and photographic record

8.9.3 Decommissioning Plan

A Decommissioning Plan will be established by each Operator within the Park. Decommissioning includes dismantling, demolition and disposal of terminal buildings and infrastructure. The Decommissioning Plan shall take due consideration of the regulatory framework with respect to the specific activity including:

- Identification of all legal requirements and consultations with the appropriate authorities at an early stage in the decommissioning planning phase.
- Notifications: appropriate notifications need to be made to DOE when decommissioning activities are planned. Additional pollution prevention measures or remediation may be required depending on the planned future uses of the land.

The Decommissioning Plan shall include a contamination assessment requirement whereby the Operator shall assess the state of soil contamination by the relevant hazardous substances used, produced or released as a result of the terminal operations and compare with the baseline conditions. In the event of significant environmental damage, the Operator shall adopt measures and develop practices for remediation of land damage aiming at reaching the baseline condition. Depending on the outcome of the environmental risk assessment and degree of environmental damage cause, the Operator shall take the necessary actions aimed at the removal, control, containment or reduction of relevant hazardous substances,

The Operator shall adopt general HSE guidelines for prevention and control of health and safety impacts.

The key topics to address in the Decommissioning Plan include:

- Noise and vibration (e.g. during use of cranes, transportation of materials and people
- Soil erosion and sedimentation control in the event of excavation activities
- Air quality (decommissioning activities may generate emissions of fugitive dust, uncontrolled release of hazardous materials or gases);
- Hazardous materials (release of petroleum based products such as lubricants, hydraulic fluids, PCBs, oil etc. during storage, transport or use in equipment, spill clean-up material, etc.).
- Solid waste (release of non-hazardous materials such as scrap and cement building materials).
- Environmental monitoring and reporting to be undertaken (e.g. storage tank emissions to air and water, effluent discharges, and waste disposal).

After the site is closed the Operator remains responsible for monitoring, reporting and corrective measures until the site is returned to the satisfactory state.

This requirement shall be included in all sales agreements for individual developments.

8.10 Final EMP Requirements

Prior to start of works, an EMP document is to be submitted and approved by DOE including:

- Contractual responsibilities and liabilities.
- Details of dredging plan.
- Emergency Response Plan (specific to the Contractor's equipment and methodologies). This should cover emergency preparedness to manage any of the following:
  - Marine works
  - Marine collision at dredging area
  - Fire on vessel
  - Wildlife incident (marine megafauna strikes or entrainment).

In addition, given its intended purpose as a stand-alone document, the Final EMP should also contain:

- A brief description of the proposed dredging, construction and operational activities and associated development;
- A summary of the potential environmental impacts from the project;

- Environmental management (mitigation) measures which will be addressed during the proposed works; and
- Roles and responsibilities for implementation of the EMP and reporting requirements.