



CHAPTER 8

MITIGATION MEASURES

8.1 Adherence To Requirement

This Chapter provides the mitigation measures that is recommended for the Proposed Project based on the impacts outlined in earlier **Chapter 7**.

Besides the legal requirements, the technical requirements used by the DOE are to be adhered and complied with as listed in the following guidelines:-

- Guidance Document for the preparation of LD-P2M2 (Land Disturbing Pollution Prevention and Mitigation Measures) for the topside development;
- Guidance Document for addressing soil erosion and sediment control for the topside development; and
- Other relevant guidelines and guidance documents issued by DOE pertaining to environmental management.

8.2 Proposed Mitigation Measures

A. Mitigation Measures During Pre Construction Stage

The activities during the pre construction stage as discussed in **Chapter 7** involved the various studies and do not involve large scale physical works. The impacts as discussed in **Chapter 7** are minimal. However, the findings from the various studies will be used to design the Proposed Project.

The mitigation measures to be undertaken during the pre-construction stage include the following:-

- Use standard codes of practices and procedures during surveys and investigations;
- Ensure strict adherence to guidelines and standards in analyzing data obtained from surveys and studies as these are used for design and planning purposes; and
- All consultants appointed for the various jobs are to provide best engineering methods and control without entailing excessive costs in developing the site.

An important element for the reclamation area is the geotechnical design considerations that has to be integrated in the Proposed Project. The geotechnical design considerations are discussed below:-

(i) Geotechnical Design Consideration

(a) General

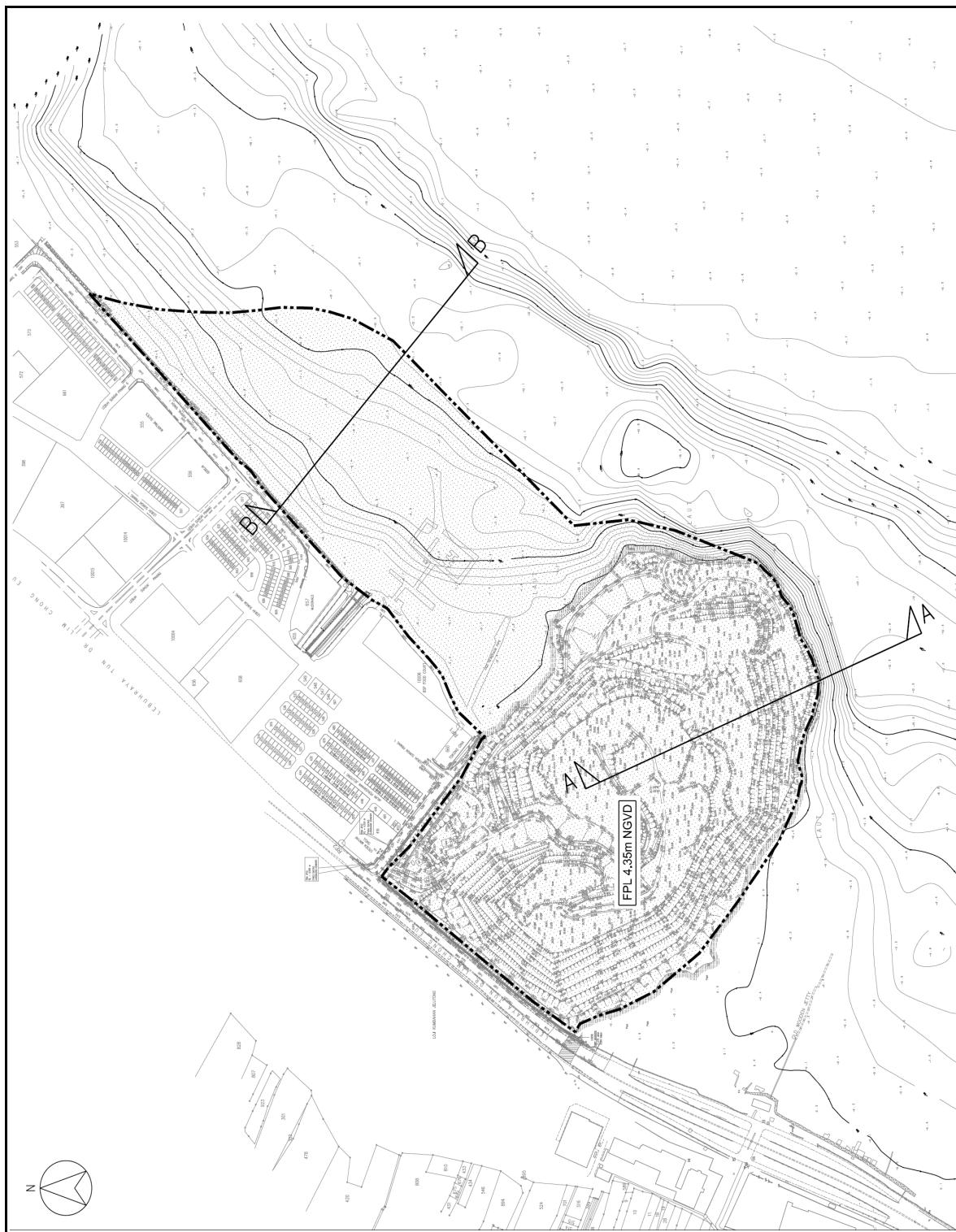
The existing Jelutong Landfill of approximately 36.42 hectares (90 acres) will be rehabilitated for future development use therefore, the stability of the post-rehabilitated landfill needs to be properly assessed. It should be noted that as rehabilitation of the landfill involves removal of dump materials follow by a layer of fill, hence consolidation settlement will be significant. In addition, an area of approximately 28.33 hectares (70 acres) is proposed for reclamation area. Due to the nature of the subsoil condition (soft clay) at the proposed site, settlement and embankment stability are the two main issues that need to be addressed during and after reclamation works. Therefore, it is imperative that the design of the reclamation works satisfies both settlement and stability criteria. Critical sections are selected for stability analyses as shown in **Figure 8.1 to Figure 8.3**.

Excessive differential settlement occurring at the building platform and surrounding infrastructure could cause serviceability problems, distress and damages to future structures. If the subsoil is excessively stressed, it may lead to instability of the embankment fill. In addition, uncontrolled and rapid filling during reclamation works over soft ground conditions could result in deep seated slip failure. Therefore, it is evidenced that settlement (both total and differential), filling rate and embankment stability issues need to be addressed and considered.

(b) Settlement Analysis

It is necessary to estimate the magnitude of settlement that occurs during construction and waiting period so that the total actual thickness of the fill at site can be designed to ensure stability. An iterative process is required in the estimation of settlement to ensure that the post construction settlement is less than the allowable settlement. The iteration captures the extra fill (more load) required to compensate for settlement which in turn, leads to further settlement of the subsoil. If PVD (Prefabricated Vertical Drain) is adopted as ground treatment method, it shall be designed to achieve 100% degree of primary consolidation.

Design calculation on consolidation settlement for the highest fill area is attached in **Appendix B-007** which considered 100% of primary consolidation. The settlement analyses are carried out by using Terzaghi's 1-D consolidation and the estimated settlement for clay thickness of 12m and maximum fill height of approximately 16.35m is presented in **Table 8.1**.



Not To Scale

Figure 8.1 Cross Section Layout

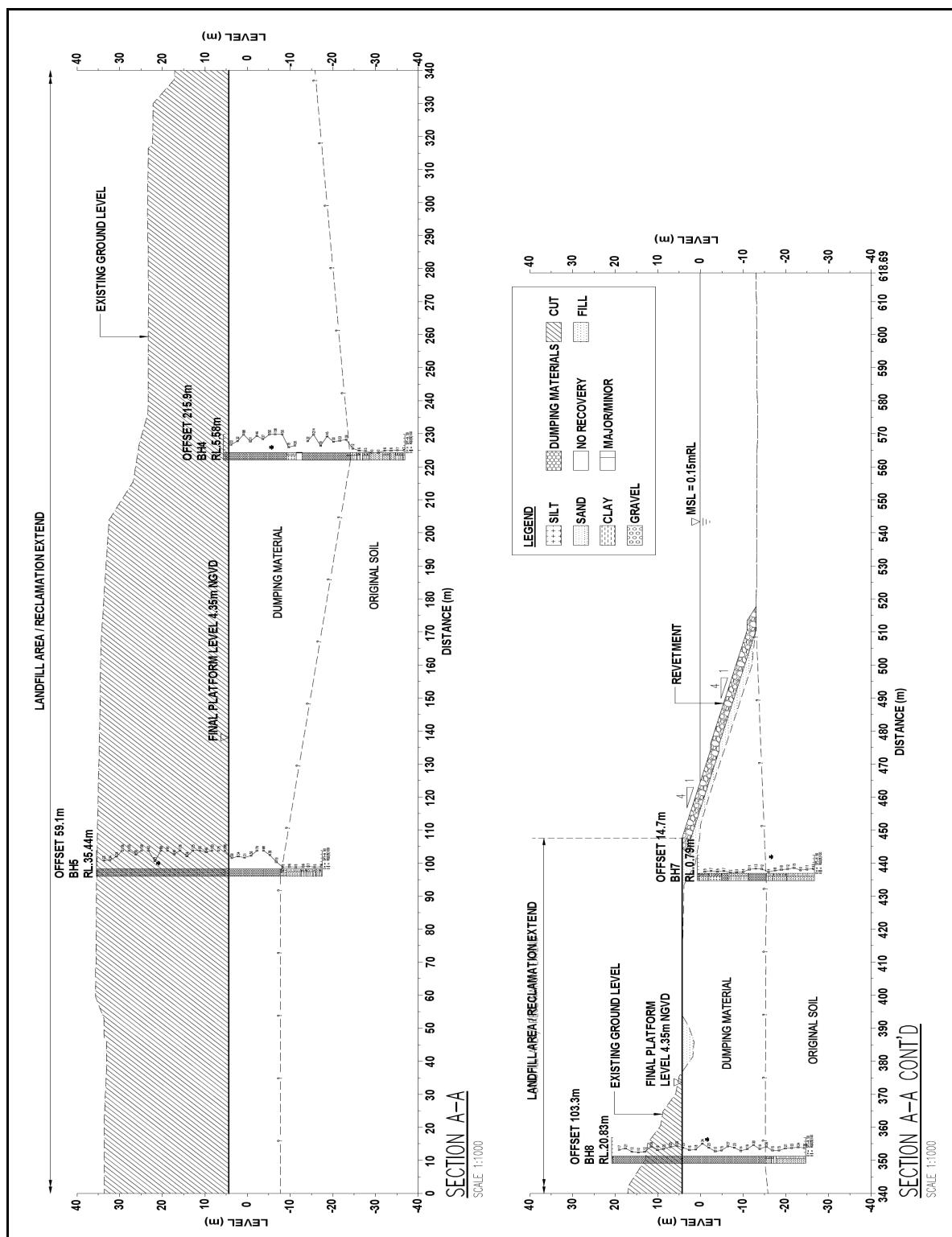


Figure 8.2 Cross Section A-A

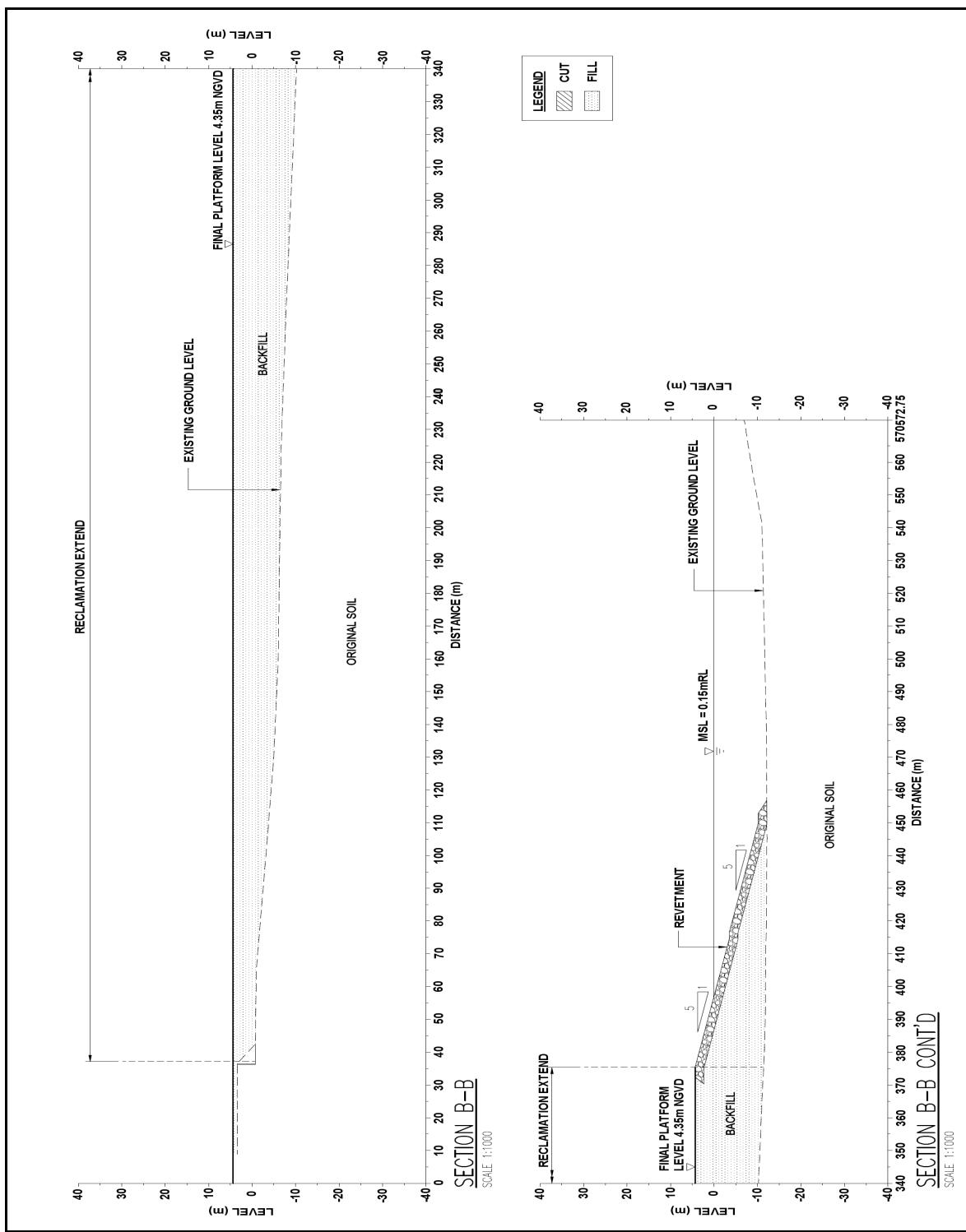


Figure 8.3 Cross Section B-B



Table 8.1
Settlement Analysis Summary (Reclamation)

Soft Clay Thickness (m)	Net Fill Height (m)	Estimated Settlement (m)	Actual Fill height (m)
12.0	16.35	2.95	19.30

(c) Reclamation Embankment Stability Analysis

Generally, the stability of the reclaimed platform is analysed to determine the safe fill slopes and the required ground treatment during construction. The stability of the reclaimed platform is commonly assessed using a limit equilibrium analysis. It is very important to check for the stability of the reclaimed platform with consideration for different potential failure surfaces.

Static Condition

The following stages are taken into consideration in the stability analyses:-

- Construction stage – Short term stability of the reclaimed platform over soft ground, which is generally the most critical, is analysed based on the undrained shear strength (s_u) of the subsoil prior to the commencement of construction works (Total Stress Parameters); and
- Serviceability stage – Long term stability of the reclaimed platform was assessed using drained condition with effective stress parameters to simulate the long-term stability of the reclaimed platform under constant permanent loading during serviceability stage.

The required FOS (Factors Of Safety) for each stage are shown in **Table 8.2**.

Table 8.2
Factors Of safety

Stage	Condition	Sea Water Condition	FOS
Construction	Undrained (Total Stress Parameters)	Normal – MLWS	1.2
Construction	Undrained (Total Stress Parameters)	Rapid Drawdown → MHWS ^a to MSL ^b	1.1
Serviceability	Drained (Effective Stress Parameters)	Normal – MLWS	1.4
Serviceability	Drained (Effective Stress Parameters)	Rapid Drawdown → MHWS ^a to MSL ^b	1.2

Notes:

i) Normal – Groundwater level and sea level are at the same level at Mean Low Water Spring (MLWS)

ii) Rapid Drawdown – Groundwater level and sea level are not at the same level; Mean High Water Spring (MHWS_a) to Mean Sea Level to (MSL_b)

iii) a – Groundwater level

iv) b – Seawater level

Due to the soft clay, the reclamation fill is proposed to be carried out in stages to allow for sufficient gain in strength of the subsoil. Surcharge load of 10kPa is modelled to simulate the machineries load in stability analyses. The construction sequence is further described in subsequent section. The stability analyses for the critical section for reclamation are carried out for the following sequences:-

- Construct sand containment bund by filling 0.5 m above MSL (Mean Sea Level) (construction stage);
- Fill 0.5m above MHWS (Mean High Water Spring) then install PVD (Prefabricated Vertical Drain) and additional surcharge thickness of 1.0m. Lay 80m length basal reinforcement and top up additional 0.5m and rest for 4 months (construction stage);
- Fill up to the designed surcharge level and rest for 3 months (construction stage); and
- Remove temporary surcharge to the designed final platform level (serviceability stage).

Seismic Condition

The history of earthquake event in Malaysia is not well documented due to lack of recorded data, clear guidelines on adopted PGA (Peak Ground Acceleration) is not officially available. However, based on seismic hazard map produced by USGS in April 2008 as shown in **Figure 8.4** (based on the far field seismic impact), the anticipated PGA for project site shall be in the order of 4% to 5% of gravitational acceleration. In addition, the design of Penang 2nd Bridge (Sultan Abdul Halim Muadzam Shah Bridge) has considered PGA of 5.55%. Thus, a PGA value of 5.55% has been adopted in the seismic sensitivity assessment of reclaimed platform stability.

With seismic load considered, the reclaimed platform shall achieve a minimum FOS of 1.2 as suggested by NAVFAC (Naval Facilities Engineering Command) SM 7.01, 1986 for embankment subjected to transient loads, such as earthquake.

The stability analyses for static and seismic conditions of the reclamation fill are shown in **Appendix B-007** and a summary of the results are shown in **Table 8.3**. Results from the stability analyses show that the minimum FOS is achieved for each Construction Stage and Serviceability Stage.

Table 8.3
Stability Analysis Summary (Reclamation)

Filling Stage	Sea Water Condition	Factor of Safety	Remarks
Sand Containment Bund (Undrained)	MLWS	1.573	FOS≥1.2, achieved minimum safety factor
	MHWS to MSL	1.593	FOS≥1.1, achieved minimum safety factor
1st Fill (1.5m fill above PVD Platform Level, Undrained)	MLWS	1.417	FOS≥1.2, achieved minimum safety factor
	MHWS to MSL	1.461	FOS≥1.1, achieved minimum safety factor
2nd Fill (6.2m fill above 1st Fill Level, Undrained)	MLWS	1.330	FOS≥1.2, achieved minimum safety factor
	MHWS to MSL	1.355	FOS≥1.1, achieved minimum safety factor
Final Platform Level (Undrained)	MLWS	1.317	FOS≥1.2, achieved minimum safety factor
	MHWS to MSL	1.280	FOS≥1.1, achieved minimum safety factor
Final Platform Level (Drained)	MLWS	1.703	FOS≥1.4, achieved minimum safety factor
	MHWS to MSL	1.712	FOS≥1.2, achieved minimum safety factor
Final Platform Level (Drained, Seismic: 5.55%g)	MLWS	1.232	FOS≥1.2, achieved minimum safety factor

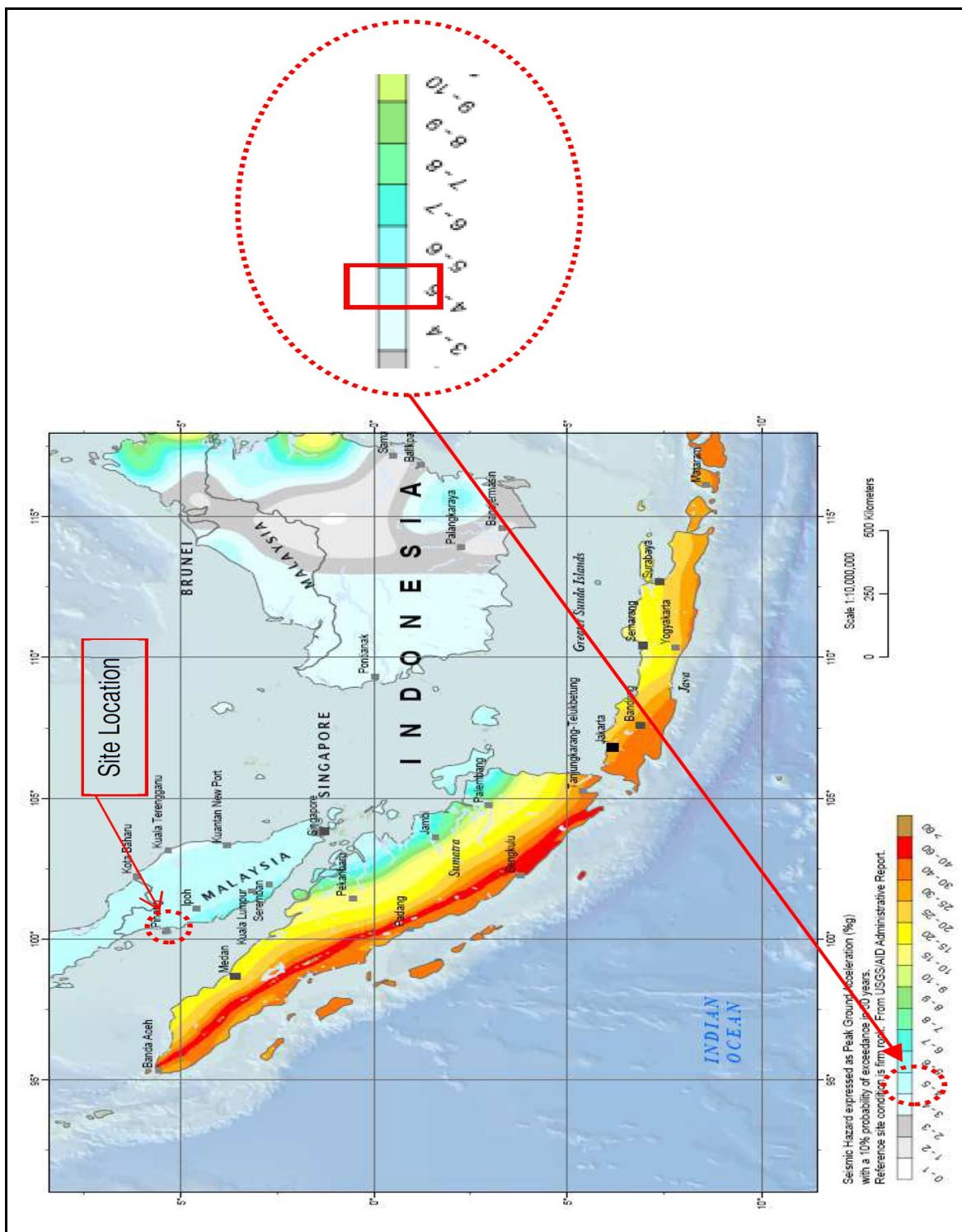


Figure 8.4 Seismic Hazard Map By US Geological Survey (USGS)

(d) Existing Landfill Post Rehabilitation Stability Analysis

Based on the latest survey topography plan, the levels of existing landfill currently range between +4m NGVD at its lowest point seaward and +37m NGVD at its highest point closer towards Tun Dr. Lim Chong Eu Highway. The landfill has been in operation since 1992 and has an area of approximately 90 acres. The dump materials have occupied the landfill for approximately 30 years and the rehabilitation includes removing dump materials to form a final platform level of +4.35m NGVD.

Removal of dump materials of around 32m thick effectively reduces the overburden stresses and leads to an increase in stabilising effects of the existing site. Moreover, the existing shoreline will be protected with rip-rap revetment to further enhance the stability. A critical section of the existing landfill is selected for the stability analyses of the landfill after removal of the dump materials to final platform level and construction of the revetment (post rehabilitation). The critical section is analysed using limit equilibrium method for serviceability stage under drained condition using normal seawater condition, rapid drawdown condition as well as seismic condition. The design rip-rap revetment surrounding the shoreline of the rehabilitated dump site shall be no steeper than 1V:4H.

Results from the analyses shows that the minimum factor of safety is achieved and **Appendix B-007** shows the stability analyses whereas **Table 8.4** shows the summary of the results.

Table 8.4
Stability Analysis Summary For Landfill Site

Filling Stage	Sea Water Condition	Factor of Safety	Remarks
Final Platform Level (Drained)	MLWS	1.751	FOS≥1.4, achieved minimum safety factor
	MHWS to MSL	1.685	FOS≥1.2, achieved minimum safety factor
Final Platform Level (Drained, Seismic: 5.55%g)	MLWS	1.220	FOS≥1.2, achieved minimum safety factor

(e) Ground Treatment Design

Ground treatment is required when the stability of the reclaimed platform is unable to achieve the required factor of safety in the most critical condition during construction stage. In addition, ground treatment also is required to shorten the construction period, especially to expedite the dissipation of excess pore water pressure during construction stage. Basically, the application of ground treatment is to improve the soil strength and reduce the long-term settlement of the soft founding soils. This will allow the subsoil to support the reclaimed platform with the required factor of safety within the serviceability limit stage.

B. Mitigation Measures During Construction Stage

The impacts due to the rehabilitation and reclamation activities and construction on the existing and new landmass are outlined in **Chapter 7.3.2** of the EIA report. The following provides the mitigation measures required during the construction activities.

(i) Rehabilitation Works On Existing Landfill

The following are the mitigation measures to manage and control the issues during the rehabilitation of the existing landfill.

(a) Gaseous Emissions Control Measures

The following method shall be in place to control the landfill gas emissions especially methane:-

- Capture residual gas includes methane which rehabilitation work is in progress by drilling perforated tubes down into the excavation layer depth and extended for continuation of monitoring at final platform level to collect residual gas which is piped to where gas flow is flared and is thus to be sampled regularly to determine concentration to ensure no harmful content;
- Open flaring consist of a pipe through which the gas is released as a means to regulate the gas flow;
- Each 2m layer of excavation during rehabilitation is thus to be installed with 150mm diameter perforated steel pipe for this purpose as shown in **Figure 8.5**. The typical excavation and passive gas collection system installation sequence is shown in **Figure 8.6**;

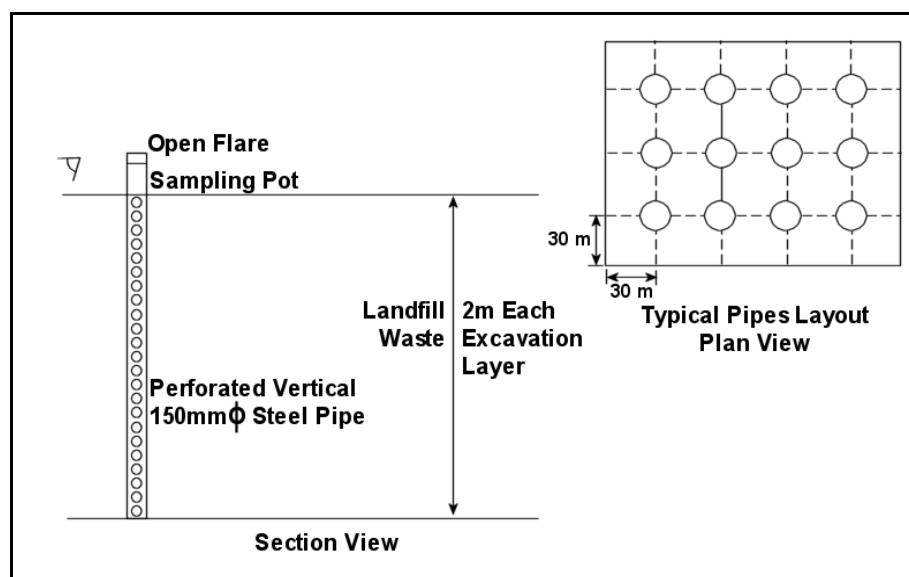


Figure 8.5 Passive Gas Collection System

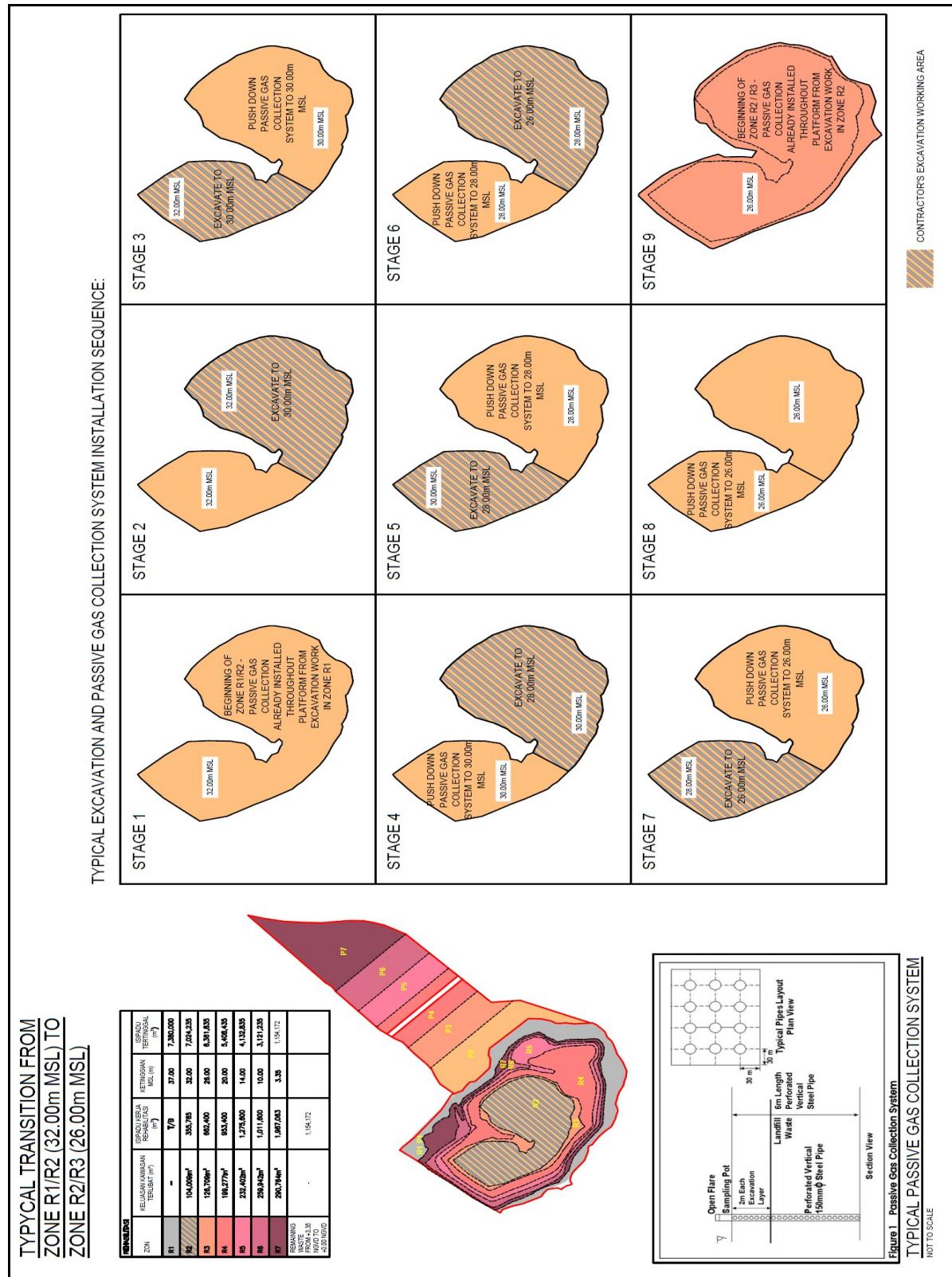


Figure 8.6 Typical Excavation And Passive Gas Collection System And Installation Sequence

- After completion of landfill rehabilitation works and prior to any future top side development, there shall be no methane gas release; and
- Nonetheless, where there is still release of methane gas, additional pipes are to be installed and no future top site development shall commence until there is no further release of methane gas observed at site.

It should be noted that some public concerns may be raised about whether the venting of landfill gas may create toxic chemicals and regular air sampling must be conducted to gauge content accordingly.

However according to USEPA, issue of dioxin formation from existing data from several landfills did not provide evidence showing significant dioxin formation during landfill gas combustion. Because of the potential imminent health threat from other components of landfill gas, landfill gas destruction in a properly designed and operated control device such as flaring (or energy recovery) is preferable to uncontrolled release of landfill gas.

Landfill gas collection and treatment according to USA RCRA (Resources Conservation and Recovery Act) for landfill gas mitigation control is to be adopted for use in the Proposed Project during rehabilitation stage.

With information about landfill gas, an operator can assess gas production and distribution changes and modify the venting perforated piping to most efficiently run an active gas collection system.

Flaring is a more reliable technique that can eliminate landfill gas odors by releasing the odor-causing gases. Thus, if sampling content found odor content, landfill gas collected and vented is to pass through a filter of bacterial slime. As long as oxygen is present, bacteria will decompose landfill gas under aerobic conditions, producing carbon dioxide and water.

(b) Groundwater Contamination Control Measures

Due to the high levels of pollutants in the groundwater such as BOD, COD and Ammonia Nitrogen, leachate treatment during rehabilitation work include as described below:-

- Collection of leachate via pumping to collection sump encounter during the rehabilitation work to send for offsite treatment via tanker as the leachate contains high amount of organic compounds and heavy metals that exerts services threat to public health;
- Offsite treatment require efficient method before release into receiving water include physiochemical treatment such as coagulation, flocculation and membrane filtration follow by biological treatment include activated sludge or membrane bio oxidation; and

- Various leachate treatment options are outlined as shown in **Table 8.5** and **Table 8.6** which can be used to select option for leachate treatment to minimize impact of leachate generation.

Table 8.5
Removal Efficiency Of Physicochemical Treatment Methods

Method	Country	Efficiency		Remarks	Reference
		COD Removal	NH4-N Removal		
Coagulation Flocculation.	Greece	56% (Fe), 39% (Al)	-	Fe salts are efficient than Al salts	(Diamadopoulos 1994)
	France	55% (Fe), 42% (Al)	-	Good pre-treatment for RO systems	(Amokrane, Comel and Veron 1997)
	Greece	80% (Fe)	-	FeCl3 concentration – 2 g/L at pH 10	(Tatsi, et al. 2003)
Air stripping	Finland	4%-20%	89% (20°C), 64% (6°C)	24 h aeration, pH 11	(Marttinen, et al. 2002)
	Turkey	-	72%(pH12), 20%(pH10)	2 h aeration	(Ozturk, et al. 2003)
	Hong Kong	-	90% (20°C)	24 h aeration, Air flow rate- 5 L/min	(Cheung, et al 1997)
	Greece	-	95% (pH 11.5)	24 h aeration, Air flow rate- 3.5 L/min	(Diamadopoulos 1994)
	Turkey	-	94% (pH 11, 20°C)	12 h aeration, Anaerobically pre-treated	(Calli, Mertoglu and Inanc 2004)
	Turkey	-	85% (pH 9.2)	Anaerobically pre-treated	(Ozturk, et al. 2003)
RO	Italy	98%	-	Pressure applied -53 atm	(Chianese, Ranauro and Verdone 1999)
	Sweden	90%	82%	Pre-treated with storage tank and wetland	(Thörneby, et al. 2003)
	Sweden	98%	98%	Conventional LL and biodegradable waste leachate	(Linde, Jönsson and Wimmerstedt 1995)
Adsorption	Germany	91%	-	Granular Activated Carbon (GAC) column experiments	(Morawe, Ramteke and Vogelpohl 1995)
	Spain	>85%	-	GAC, Contact time 2 h, Non-biodegradable organic matter	(Rodriguez, et al. 2004)
	Turkey	87% (PAC), 77% (Zeolite)	30% (PAC), 40% (Zeolite)	Absorbent concentration 0-5 g/L, 30 h Fed-batch operation	(Kargi and Pamukoglu 2004)
	Malaysia	-	40%	Activated carbon + Limestone 5:35 mixture	(Aziz, et al. 2004)

Source: Supplementary Document, A Review of Leachate Treatment Techniques, W.A.P.P. Rathnayake¹, G.B.B. Herath^{2*}

The 9th International Conference on Sustainable Built Environment, Kandy, Sri Lanka, December 13th -15th, 2018

Table 8.6
Removal Efficiency Of Physicochemical Treatment Methods

Method	Country	Efficiency			Remarks	Reference
		COD Removal	BOD5 Removal	NH4-N Removal		
ASP	England	>92%	>98%	99%	At 10°C, SRT=10 d, increased sludge treatment involved	(Robinson and Maris 1983)
ASP+ Chemical ppt.	Hong Kong	97.7%	-	Ppt. as MgNH4PO4. 6H2O	Increasing [NH4-N] 53à800 mg/L, decreasing COD removal 97% à77%	(Li and Zhao 2001)
ASP+ beam radiation	Korea	70%	98%	-	72 h batch test	(Bae, et al. 1999)
ASP	Indonesia	52.5%	94.3%	75.5%	HRT 24 h, SRT 16-36 days	(Setiadi and Fairus 2003)
SBR	Poland	80-92%	-	67-75%	Ultra sound pre-treated, 24 h cycle, combined domestic and LL	(E. Neczaj, M. Kacprzak, et al. 2007)
	Poland	76.2%	-	83%	HRT 2 days	(Klimiuk and Kulikowska 2005)
	Greece	75%	95%	65%	With enzymatic treatment	(Zouboulis, Loukidou and Christoboulou)
SBR+ enFenton + Chemical ppt.	Taiwan	85%	-	81%	Optimum pH 5, Al based coagulant	(Lin and Chang 2000)
SBR+ Chemical ppt.+ Ammonia strip.	Turkey	75%	-	44%	21 h operation	(Uygur and Kargi 2004)
UASB+CSTR	Turkey	98%	-	99.6%	CH4 production 60% in UASB reactor	(Osman and Dalia 2005)
UASB+UF+ RO	Turkey	98-99%	-	85%	Best for young leachate treatment	(Ozturk, et al. 2003)
UASB	Spain	>82%	-	-	Max. OLR=15 kg COD/ m3/ d, HRT= 0.6 d	(Garcia, Jose and Pedro 1996)
UASB	Sweden	90%-	-	-	Potato processing leachate	(Parawira, et al. 2006)
MBR+RO	Korea	97%	97%	96%	Full scale, retrofitted existing LLTP	(Ahn, et al. 2002)

Source: Supplementary Document, A Review of Leachate Treatment Techniques, W.A.P.P. Rathnayake¹, G.B.B. Herath^{2*}

The 9th International Conference on Sustainable Built Environment, Kandy, Sri Lanka, December 13th -15th, 2018

The following are to be in place to address issues relating safety and health during the rehabilitation works:-

- Eliminate heat and ignition sources such as sparks, static discharges and hot surfaces;
- Post 'No Smoking' signs;
- Wear appropriate respirator if high landfill gas is detected especially at the areas near the vent pipes are in place to capture methane gas;
- Put on appropriate personal protective equipment to investigate for high landfill gas detected such as safety goggles and face shields;
- First aid measures are to be in place; and
- Emergency response plan is to be in place to cater for incidents and abnormal conditions at site.

(c) Waste Handling At Waste Recycling Site

The recycling process will generate fugitive dusts due to the open stockpile for the suitable products (earth/sand) while the recycling machines will generate dusts from the crushing process and thus the following controls shall be in place.

i. Air Pollution

The following measures are to be in place to mitigate impacts of the recycling process:-

- Submit the written notification under Regulation 5, Environmental Quality (Clean Air) Regulations 2014 prior to the installation any fuel burning equipment and any dust collector;
- Ensure all emissions from the crushing process are channeled to a dust collector example as shown in **Figure 8.7**;
- Recycling machine to be fully enclosed; and
- Screens are to be provided at the drying process.

ii. Water Pollution

No industrial effluent will be generated from the recycling process as the processes are dry processes.

iii. Unsuitable Wastes And Unsuitable Materials

The following measures are to be in place to control the unsuitable wastes generated at site:-

- Unsuitable waste and unsuitable materials generated during the recycling will be analyzed for subsequent disposal at sanitary landfill or secure landfill according to the waste and material characteristics;
- Although regulated wastes are not accepted at Jelutong Landfill, any abnormal wastes found during the sorting process such as empty paint cans, empty contaminated containers shall be inventoried, labeled and stored according to the Environmental Quality (Scheduled Wastes) Regulation 2005 and disposed at DOE licensed facility. The labels to be used for the scheduled wastes are shown in **Figure 8.8**;
- Notify DOE for the generation of any scheduled wastes within a month of generating the scheduled wastes vide the eSWIS; and
- Ensure the conveyors of the recycling machine are fully enclosed so that there are no fugitive emissions during material transfer.

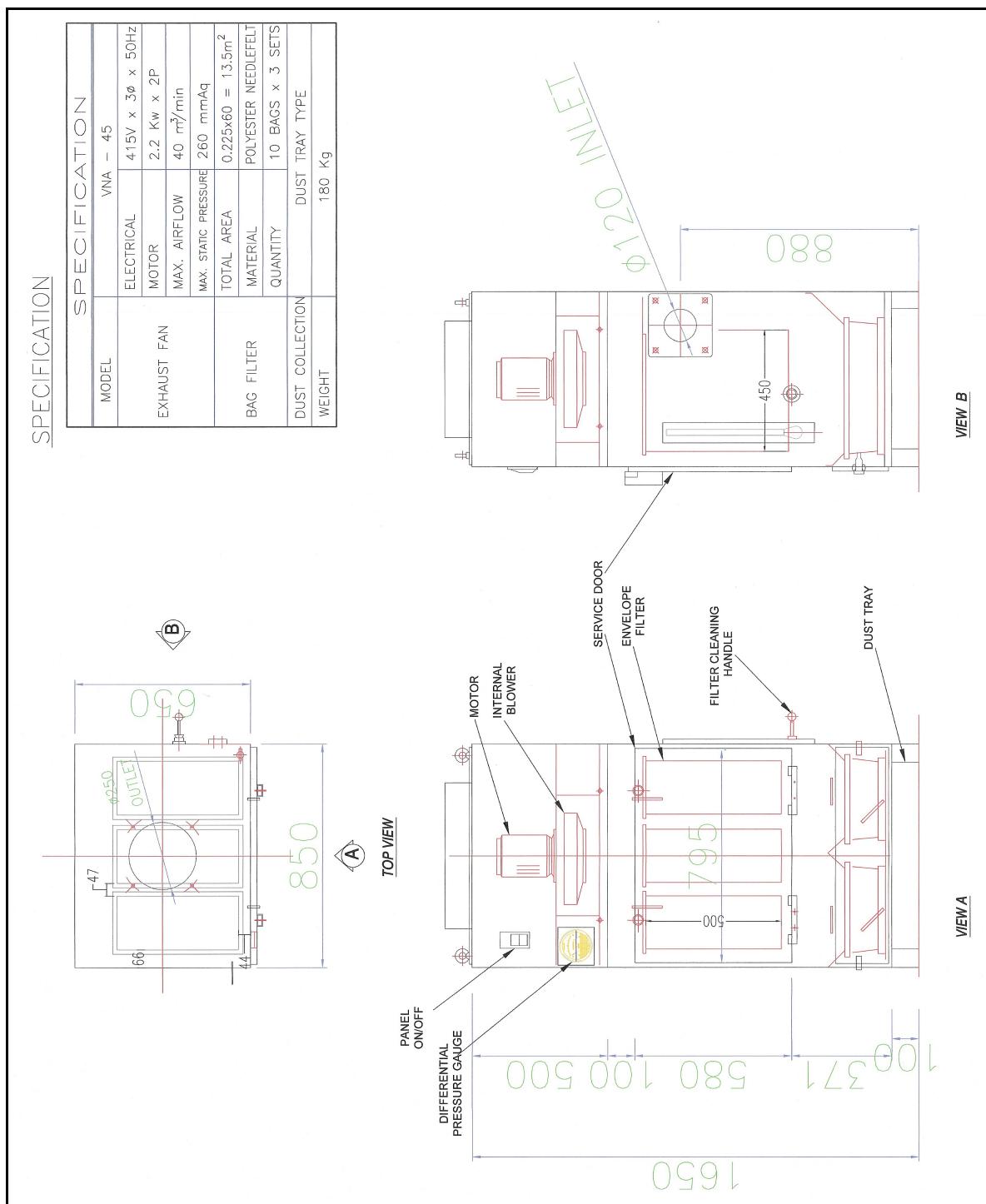


Figure 8.7 Example Of Dust Collector Diagram



Label Buangan	
BAHAN TOKSIK	
Kod Buangan	:
Nama Buangan	:
Tarikh Dihasilkan	:
Nama Pengeluar Buangan	:
Alamat Dan No. Telefon	:

Nota: Label diletakkan pada sudut 45 darjah. Saiz label tidak boleh kurang daripada 10 cm x 10 cm kecuali jika saiz bekas buangan memerlukan label yang saiznya lebih kecil.

Figure 8.8 Labels To Be used For Scheduled Wastes

iv. Hazards

The following measures are to be provided to ensure workers safety in the Proposed Project:-

- Implement a safety management system;
- Instill and nurture safety consciousness;
- Train and provide programs to cater for safety and risk management which shall include:-
 - A manual for fire prevention and control in which the responsibilities of each and every employee responsibilities as stated in the manual.
 - A directive that requires every employee responsibilities as stated in the manual.
 - Every employee is instructed to be familiar with potential sources of fires.
 - Every employee is to be trained to be familiar the operation of every piece of fire fighting equipment.
- Formulate ERP to cater for any abnormal conditions.

The following measures are to be provided to mitigate adverse impacts on health from the rehabilitation process:-

- Ensure a waste management system is in place;
- Ensure an incident/accident reporting system as shown in **Figure 8.9** is in placed; and
- Ensure routine checking and maintenance of all equipment at site is in place.

The following measures are recommended in the control and management of the unsuitable material generated from the material recycling process:-

- Provide separate stockpile areas for the unsuitable and suitable material to be reused at the reclamation site as shown in **Figure 8.10**;
- Inspect all the suitable material to be reused so as to ensure no cross contamination with the unsuitable material;
- Keep a log book on the quantity of suitable material and unsuitable material generated at site;
- For the unsuitable material, separate the wastes so that those can be recycled by downstream users can be collected for sales;
- Those unsuitable material that cannot be recycled are to be disposed at the Pulau Burong when the quantities are adequate with approval from the related authorities; and
- All personnel handling the materials are to be equipped with PPE (Personnel Protective Equipment).

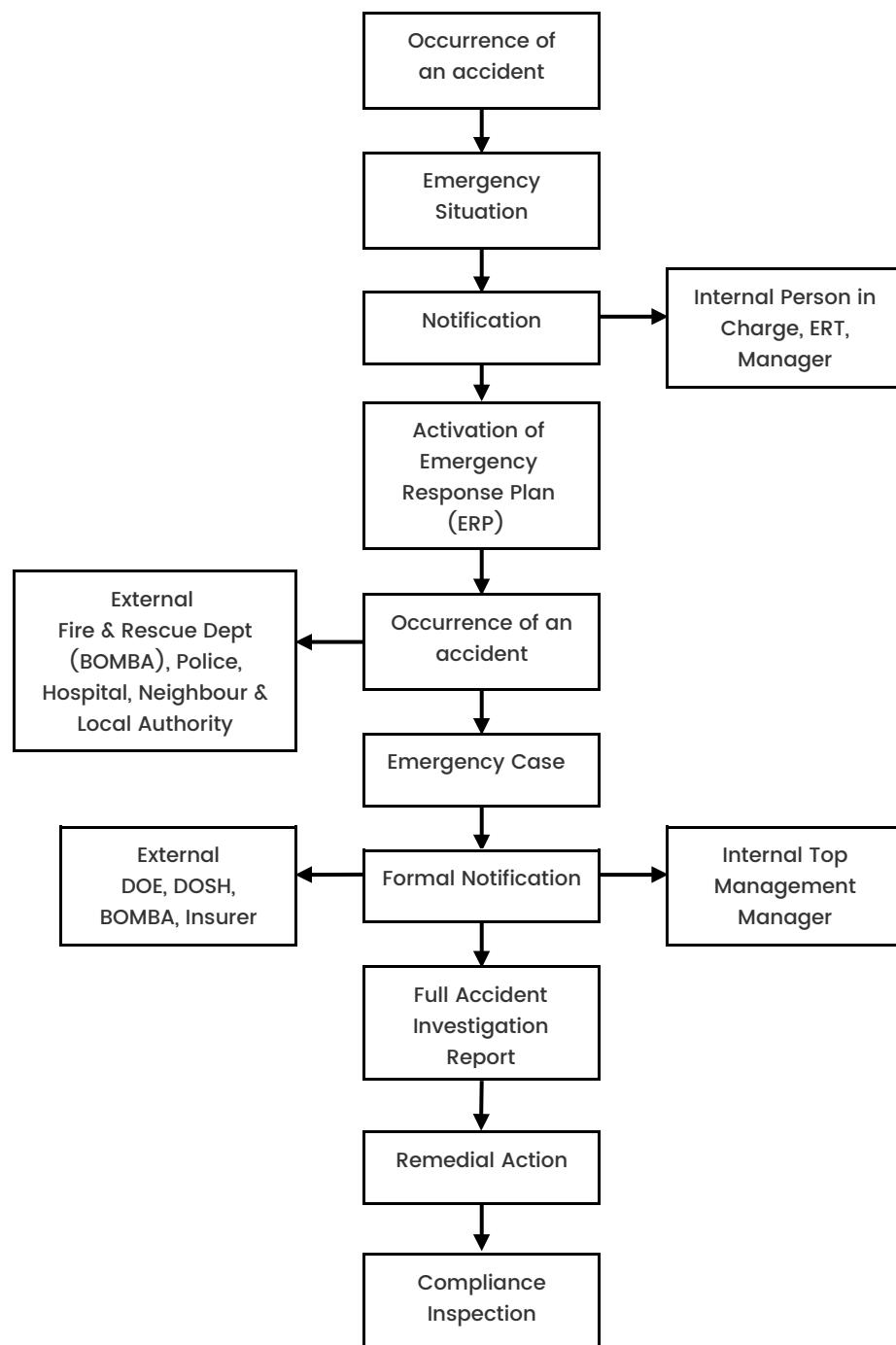


Figure 8.9
Accident Notification and Reporting Flowchart

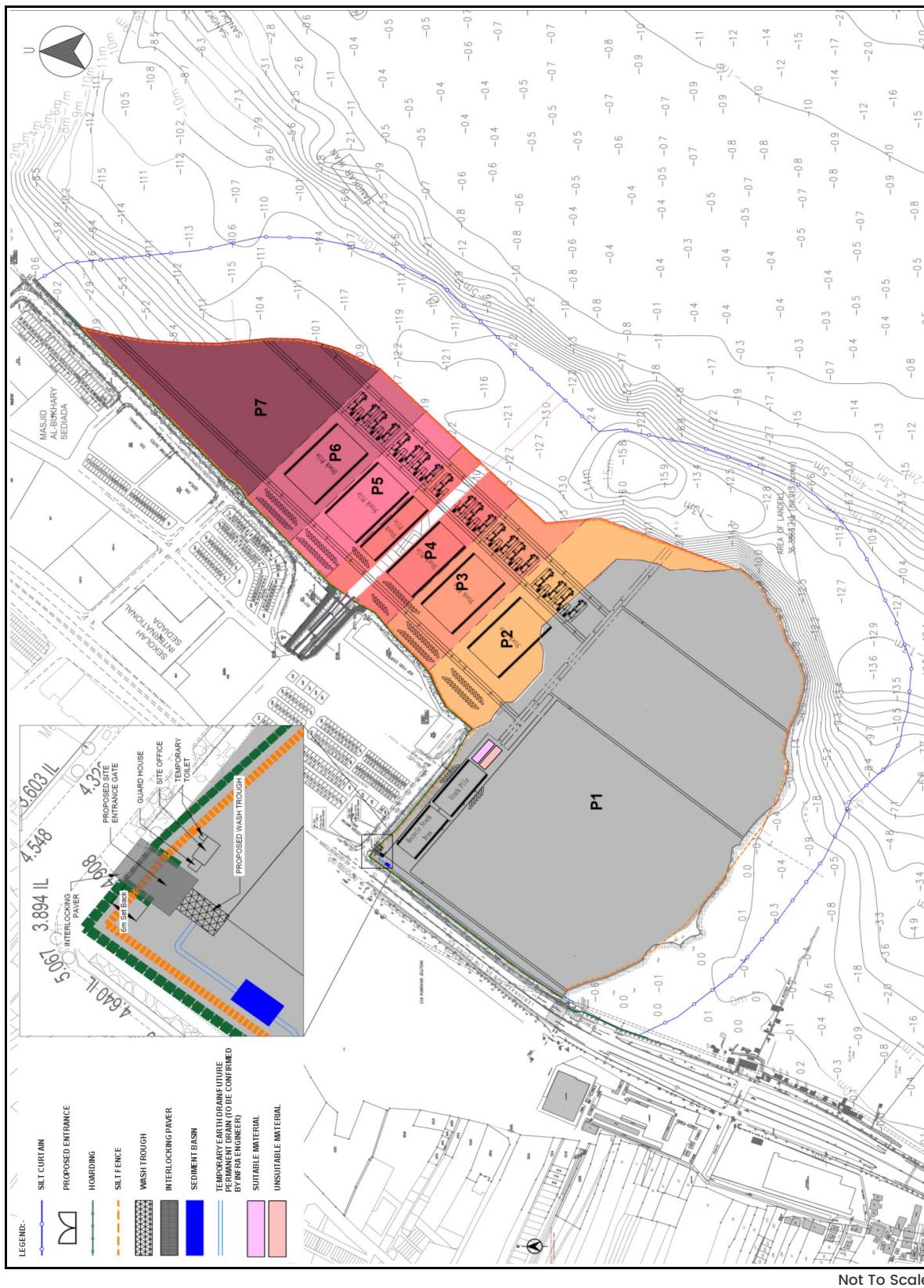


Figure 8.10 Erosion And Sediment Control Plan

(ii) Reclamation Works

The rehabilitation and reclamation activities may give rise to impacts both in the short term i.e. during and immediately after the reclamation process and in the longer term, chiefly as a result of changes on the hydraulic regime because of altered bathymetry. The consequence of these impacts on the local community on coastal processes, on water quality and on marine life is to be given due consideration. The mitigation measures to be implemented to address issues relating to the rehabilitation works are as follows:-

(a) Coastal Processes Control Measures

The following construction schedule is required throughout the reclamation works as shown in **Table 8.7**.

Table 8.7
Proposed Construction Sequence

Stage	Description
Stage 1	Sand containment bund to be filled 0.5m above MSL (Mean Sea Level) (+0.65m NGVD) and to form slope gradient of not steeper than 1V:7H on both sides. Temporary surface protection shall be provided where necessary.
Stage 2	To continue the reclamation filling works at inner area to 0.5m above MHWS (Mean High Water Spring) (+1.63m NGVD).
Stage 3	Install PVD (Prefabricated Vertical Drains) with 1.1m c/c spacing as soon as fill has reached 0.5m above MHWS.
Stage 4	Install settlement gauges and top up additional 1.0m thick sand blanket with slope gradient not steeper than 1V:4H.
Stage 5	Top up additional 1.0m thick surcharge with slope gradient not steeper than 1V:4H and rest for 3 months.
Stage 6	After 3 months rest period, carry out subsequent surcharge filling to reach final ground treatment level and install settlement markers. Rest another 5 months.
Stage 7	Temporary surcharge shall be removed after resting period or as per Engineer's instruction to the proposed platform level and settlement markers are to be repositioned to the final platform level.
Stage 8	Sand containment bund shall be trimmed to construct permanent rip-rap revetment with slope gradient not steeper than 1V:5H.

Source: Geotechnical Design Report

Long term effects on the existing shoreline from land reclamation activities outlined in **Chapter 7** is in relation to potential shoreline changes which may result from changes in the hydraulic regime and altered bathymetry. Thus the measures to be implemented are as follows:-

- The reclamation plan as shown in **Appendix B-001** shall be followed closely.
- All recommendations outlined in the coastal hydraulic report is to be followed stringently. This include the method statement for the reclamation activity as outlined of this EIA report; and

- Shoreline monitoring is to be conducted once before any reclamation, every 3 month during reclamation and every 6 months after reclamation up to 3 years of the reclamation works. Shoreline monitoring involves conducting the bathymetry survey of the area reclaimed as well as the areas to the north and south of the reclamation site to assess any changes to the shoreline.

Reclamation works will disturb the existing land surface and condition that may contribute to increase in surface run-off and high concentration of TSS (Total Suspended Solids) in the stormwater discharge especially during rain events. Therefore, the erosion and sediment control plan shall be provided prior to construction works.

The ESCP Plan is crucial to manage the surface runoff and stormwater discharge from the construction site. Suitable erosion and sediment control measures shall be provided during the construction stage to minimise the impact resulting from construction works to the neighbouring area. The proposed detailed ESCP cover the construction works of the reclamation works which only cater for sandfilling works up to design platform level and rock revetment works.

The general construction condition as follows:-

- The Erosion and sediment control Plan shall be read in conjunction with the engineering plans or written instructions that may be issued in relation with this project;
- Contractor shall ensure that erosion and sediment control works are undertaken in accordance with the Urban Stormwater Management Manual for Malaysia, 2012 (MSMA 2nd Edition);
- All contractors shall be informed of their responsibilities in minimizing the potential for soil erosion and pollution of down slope areas; and
- Contractor is required to carry out earthwork in accordance with recommendations contained in CP 2003 Code of Practice for Earthworks.

The erosion and sediment control measure proposed for this reclamation works is shown in earlier **Figure 8.10**. The detailed descriptions of proposed erosion and sediment control measures are as follows and not limited to:-

- Hoarding;
- Silt Curtains;
- Silt Fence;
- Site Access and Wash Trough; and
- Temporary Earth Drain.

The erosion and sediment control measure proposed for this reclamation works is shown in earlier **Figure 8.10**. The detailed descriptions of proposed erosion and sediment control measures are as follows and not limited to:-



i) Hoarding

Despite no construction works is being carried out from the landside, hoarding shall be used to barricade the construction area. The proposed hoarding location is along the land boundary of the Project Site as shown in **Figure 8.11**. The hoarding shall be erected prior to start of construction works to prevent any interference or entry from unauthorised personnel to the site. Hoarding is important to barricade the active construction area and control access to the site via one access point. It is also able to minimise noise from the project site.

ii) Silt Curtain For Filling Works

The construction method involves sand filling works from sea-going barges and no major land disturbance works will be carried out outside of the Project Boundary. Silt curtain is proposed to be installed along the Project Boundary with details as shown in **Figure 8.12** to minimise plume dispersion. However temporary slope protection in the form of reversion or geobags will be provided at the boundary of the landfill site facing the sea to protect the slopes in contact with water to minimize erosion. A permanent rip rap reversion of 1V:5H for reclamation area and 1V:4H for rehabilitation site shall be provided upon reaching the final platform level. Typical details of the temporary reversion is shown in **Figure 8.13**. The silt curtain shall be installed prior to commencement of filling works. The silt curtain will function as a barrier to control the sediment plume spreading towards the sensitive receptors adjacent to the Project Site. The silt curtain will minimise sediment pollutants flowing across the curtain while allowing water volume exchange through and under the curtains.

The recommended silt curtain specification is shown in **Table 8.8**.

Table 8.8
Specification Of Silt Curtain

Item	Details
Silt Curtain Type	III (Heavy Duty to be used at area with current speed up to 1.5 m/s with presence wind or wave with tidal action)
Curtain Depth	Up to 7.3 m allowing at least 0.5m clearance between skirt and seabed bottom during low tide
Fabric Strength	150 kN/m
Float Size	300 mm
Chain Weight	5 kg/m
Span Length	20 m



Template 1: Example Of Silt Curtain

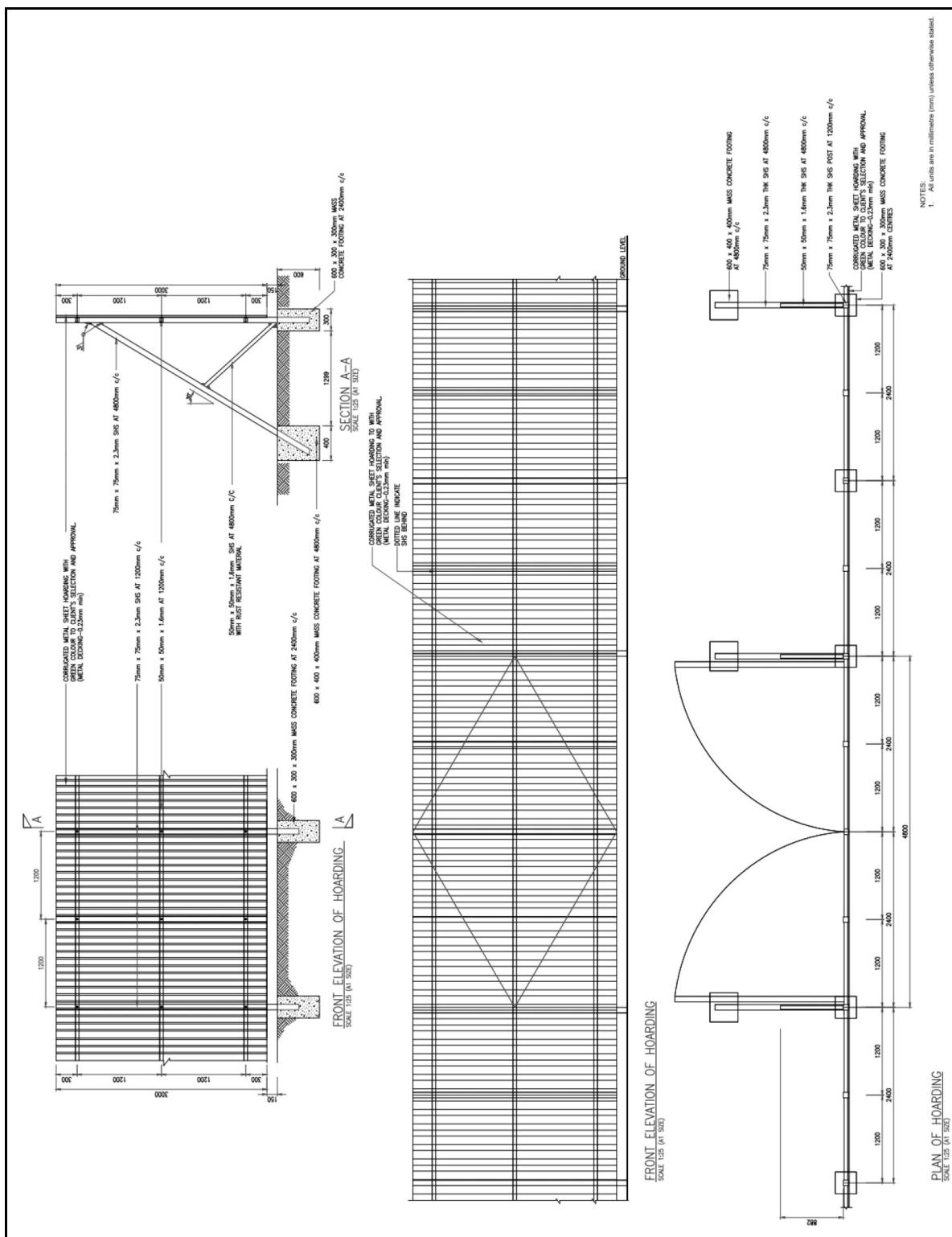


Figure 8.11 Proposed Hoarding Details



Yes

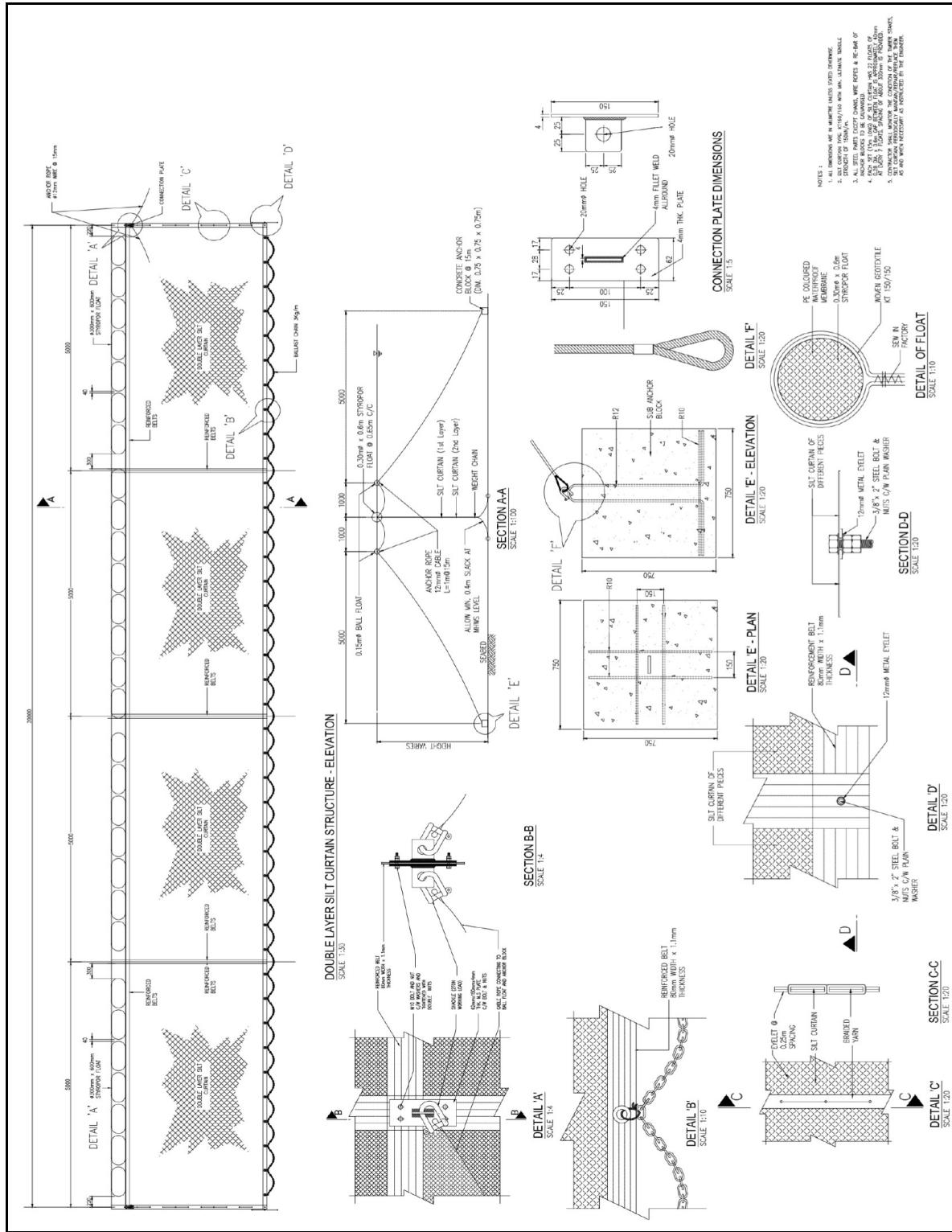


Figure 8.12 Proposed Silt Curtain Details

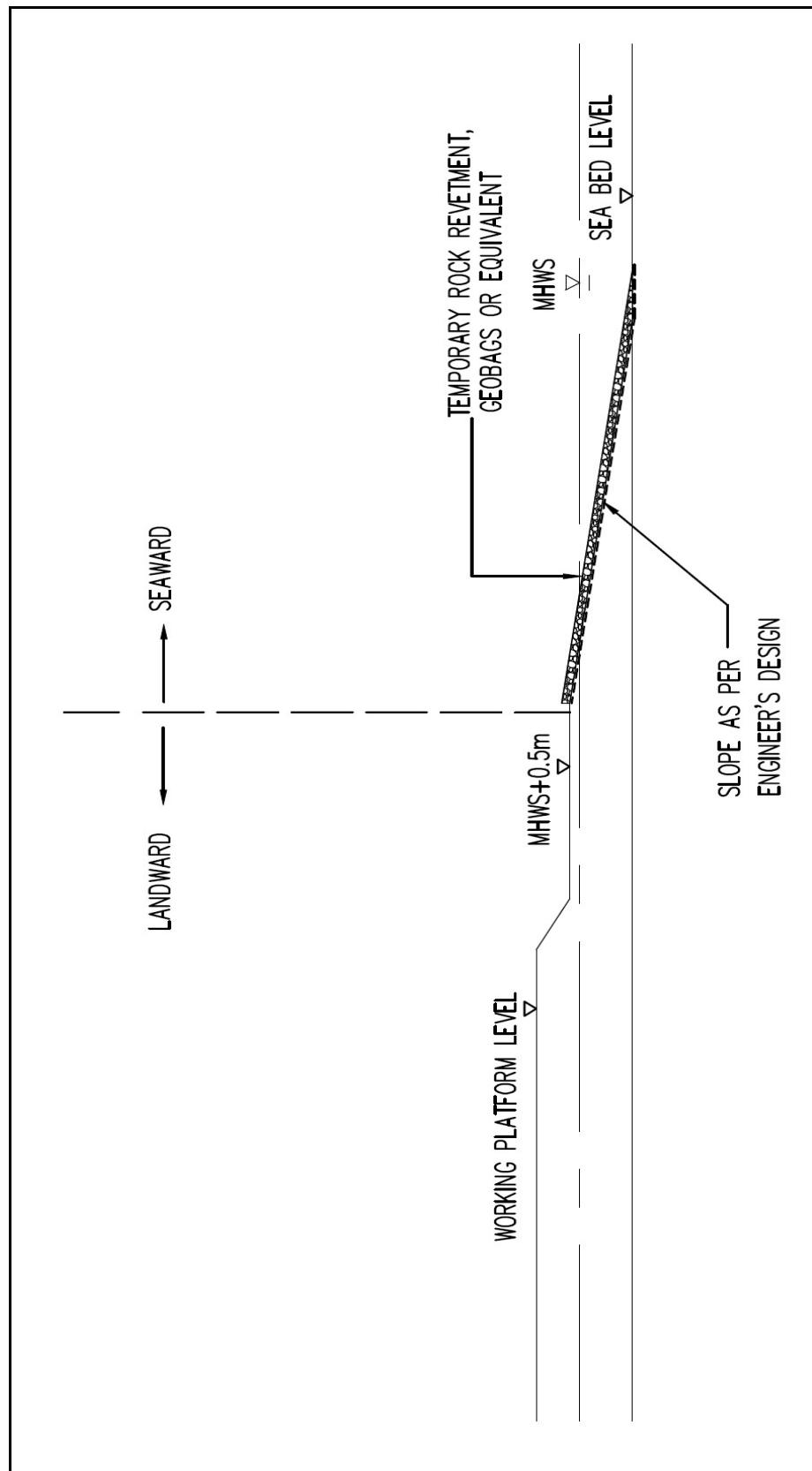


Figure 8.13 Typical Details Of Temporary Revertment



iii) Silt Fence

The silt fence consists of filter fabric stretched across and attached to series of supporting posts. The silt fence shall be installed around the reclaimed area as shown in **Figure 8.14** to ensure that the silt from the surface run-off from the dumpsite area does not silt up inside any drain or directly flow to the sea.



Template 2: Example Of Silt Fence

iv) Site Access And Wash Trough

The site access should be constructed with heavy duty interlocking paver block. Vehicle access to site shall be limited to only essential vehicles for construction work and all vehicles shall enter and exit the site through the established site access point. Wash trough as shown in earlier **Figure 8.14** shall be provided at the site access to remove excessive sediment from out bound vehicles prior to leaving the site. The discharge from wash trough shall be diverted to the temporary earth drain and no direct discharge to existing drain is allowed.



Template 3: Example Of Proposed Wash Trough At Site Entrance

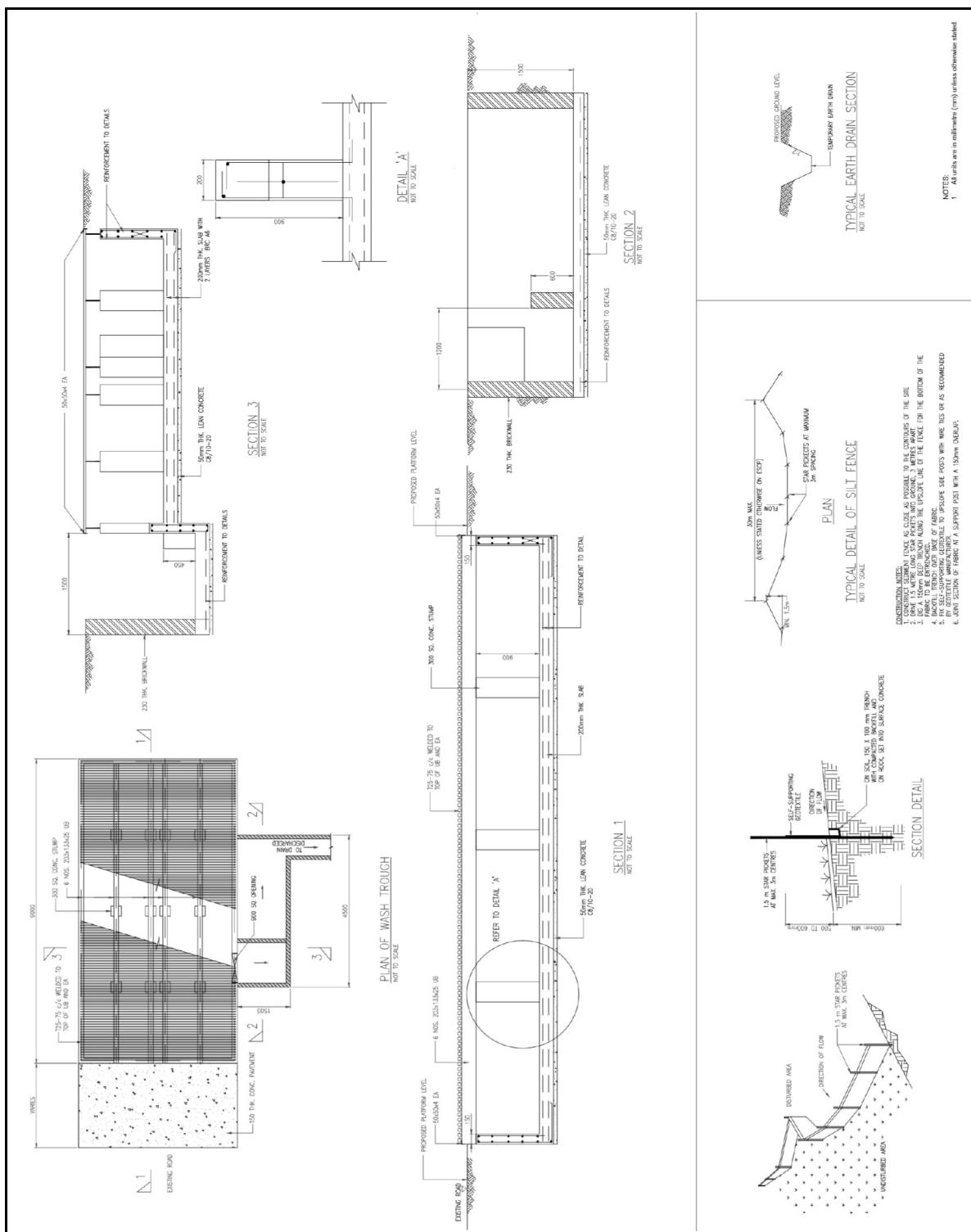


Figure 8.14 Proposed Silt Fence, Wash Trough And Temporary Earth Drain Details



v) Temporary Earth Drain

The purpose of the temporary earth drain is to divert discharges from the wash trough and along the perimeter of rehabilitation area. The details of the proposed temporary earth drain is enclosed in earlier **Figure 8.13**. The drain is proposed to have a longitudinal slope of V:H 1:1000 with a minimum bottom width of 1.5 and side slope of V:H 1:2. The overall length of the temporary drain at its longest is approximately 720 m.



Template 4: Example Of Temporary Earth Drain

The following best management practices shall also be carried out by the Contractor during the construction phase to ensure the effectiveness of the proposed control measures:-

i) Silt Curtains And Filling Works

- Filling works from the barges shall not be carried out outside of the silt curtain area;
- Excavators or bulldozers shall only be used once the filling works have reached above water level;
- Any material which is deposited outside the boundary of the works or any debris which falls or is deposited into tidal waters during the filling works shall be removed by the Contractor at its cost and expenses prior to the practical completion of the works;
- If at any time during the course of filling works, an environmental incident occurs or an environmental risk is identified, all measures must be taken immediately and informed to the relevant authority;
- All floating plant and associated moorings will be kept clear of navigational channels when working or moored;
- Navigational lights, buoys, marks or any warning signs shall be supplied, installed and maintained;
- All filling works or any associated works shall stop during storm or dangerous weather conditions;

- Discharge of ballast water (including bilge water) to the sea/lagoon shall not be allowed. Temporary storage facilities shall be provided inside the vessel;
 - Proper drainage of the site shall be maintained. Drains shall be checked that they are in good operational condition;
 - Recently stabilised lands shall be checked to ensure that erosion hazards have been effectively reduced and any repair works conducted properly;
 - All erosion and sediment control measures shall be kept in good conditions until all earthworks activities are completed and the site has stabilised; and
 - Additional erosion and sediment control works shall be constructed as necessary to ensure the desired protection is given to the site and areas downstream.
- ii) Silt Fence
- Settled soil or sediment built-up behind the silt fence shall be removed periodically;
 - Damaged or torn silt fence shall be replaced immediately to ensure effectiveness of the system; and
 - Damaged fence post shall be placed and secured immediately.
- iii) Wash Trough
- Accumulated sediment and dirt inside washing area shall be removed periodically to prevent blockage or overspill;
 - The outflow from wash trough outlet must be drained to nearest temporary drain; and
 - Site supervisor or environmental officer shall ensure that there is no overflow of discharged water into existing drain
- iv) Temporary Earth Drain
- The temporary earth drain shall be stabilised and compacted properly if there is any sign of slope failure or bed erosion; and
 - Earth drain shall be free from any rubbish or excessive sedimentation built-up in the drain.
- v) Laydown Area
- All waste shall be stored at designated area before disposing to authority's approved disposal area;
 - If skid tank is provided inside the laydown area to store diesel or fuel, the tank shall be placed in a containment tray to prevent and minimise possibility of direct spillage at the project site. The tank shall be

checked periodically to ensure no leakage at the containment tray; and

- All construction materials shall be stored properly within the laydown area. Any materials that are highly erosive or dissolve when in contact with water shall be stored in closed container.

The following site inspection and maintenance shall be carried out on a regular basis to ensure the proposed control measures are in good conditions:-

- On-board supervisors will be assigned to check the condition of the silt curtain before commencement of works on a regular basis;
- Water quality monitoring and regular inspection need to be carried out to ensure no suspended solids are passing through the silt curtain system and maintain proper functioning of the silt curtain during the entire filling works period;
- Filling works will stop immediately if silt curtain is found damaged. Lift up the silt curtain from the water and sew (double-line sew) a new piece of screen to the existing screen to cover the damaged area. A sufficient overlapping length is needed (at least 1 m);
- Rubbish around the silt curtains will be collected at regular intervals on a daily basis to ensure water behind the silt curtain will be kept free from floating debris;
- Sufficient spare screens will be kept on site for replacing damaged curtains. The screens need to be stored properly to avoid direct contact with water and sunlight;
- All blinkers or reflective strips need to be inspected regularly to ensure they are in good working condition;
- Sediment build up behind silt fence shall be removed regularly;
- Condition of fence fabric, fence post and joints shall be inspected monthly or within 24 hours after a rain event that exceeds 12.5 mm; and
- Wash trough shall be inspected monthly or within 24 hours after a rain event that exceeds 12.5 mm to ensure no debris or minimal sediment is accumulated inside the wash trough.
- TSS Monitoring
 - TSS monitoring stations are JPS requirements proposed to be carried out to ensure compliance and the need for supplementary mitigation measures. The locations and frequency of sampling is further discussed in **Chapter 9** of this report;
 - The value of SS (Suspended Solids) shall be determined at each designated monitoring stations on monthly basis according to the approved EMP.

- The water quality monitoring shall be conducted on a monthly basis and the reports to be submitted to DOE, DOF and JPS on a monthly basis.
- Shoreline Monitoring
 - Shoreline monitoring is recommended during the project implementation stage and post project to assess the impact of the proposed reclamation works on the adjacent coastline as per JPS requirement.
 - The survey of the shore profiles. The survey shall be carried out by licensed surveyor. The cross-shore profiles shall be measured with spot levels along the profile taken at 50 m spacing.
 - The landward limit of the shore profile should be set at 10 m beyond the existing coastline whereas the seaward limit at approximately 400 m to 800 m from the coastline, depending on the site condition. Reference Bench Mark must be set up for every cross-section as reference for later surveys. The shoreline monitoring shall be carried out every three (3) month during reclamation period and every six (6) month after project completed. The monitoring can be discontinued if the shoreline is found to be stable (3) years after completion of the project.
- Maintenance Dredging
 - According to the coastal hydraulic report, siltation is observed around the reclamation boundary due to blockage effect and the siltation rate is less than 0.01 m/day and the extend is 500m as shown in **Figure 8.15**;
 - If the coastal hydraulic engineer or environmental consultant on reviewing the monitoring results shows that the reclamation have significant impacts to the adjacent marine environment especially to the adjacent jetty and Sungai Pinang, maintenance dredging shall be carried out. For this purpose, the appointed Coastal Hydraulic Engineer shall made a formal request to the Project Proponent to engage a competent contractor to conduct the maintenance dredging. A method statement for the maintenance dredging including the time taken and schedule of works shall be submitted to the DOE for approval prior to the conduct of the maintenance dredging. The periodic removal of sediments from existing river mouth and jetty shall be carried out to maintain an appropriate safe depth of water for navigation at the jetty area.

(b) Sea Traffic And Risk Control Measures

The potential sources of the fill material identified earlier in **Chapter 7** are located in Malaysia waters (Off Perak Costline) as shown in **Figure 8.16**. To cater for sea traffic safety during transport of the fill material, the mitigation measures to be in place are as follows:-

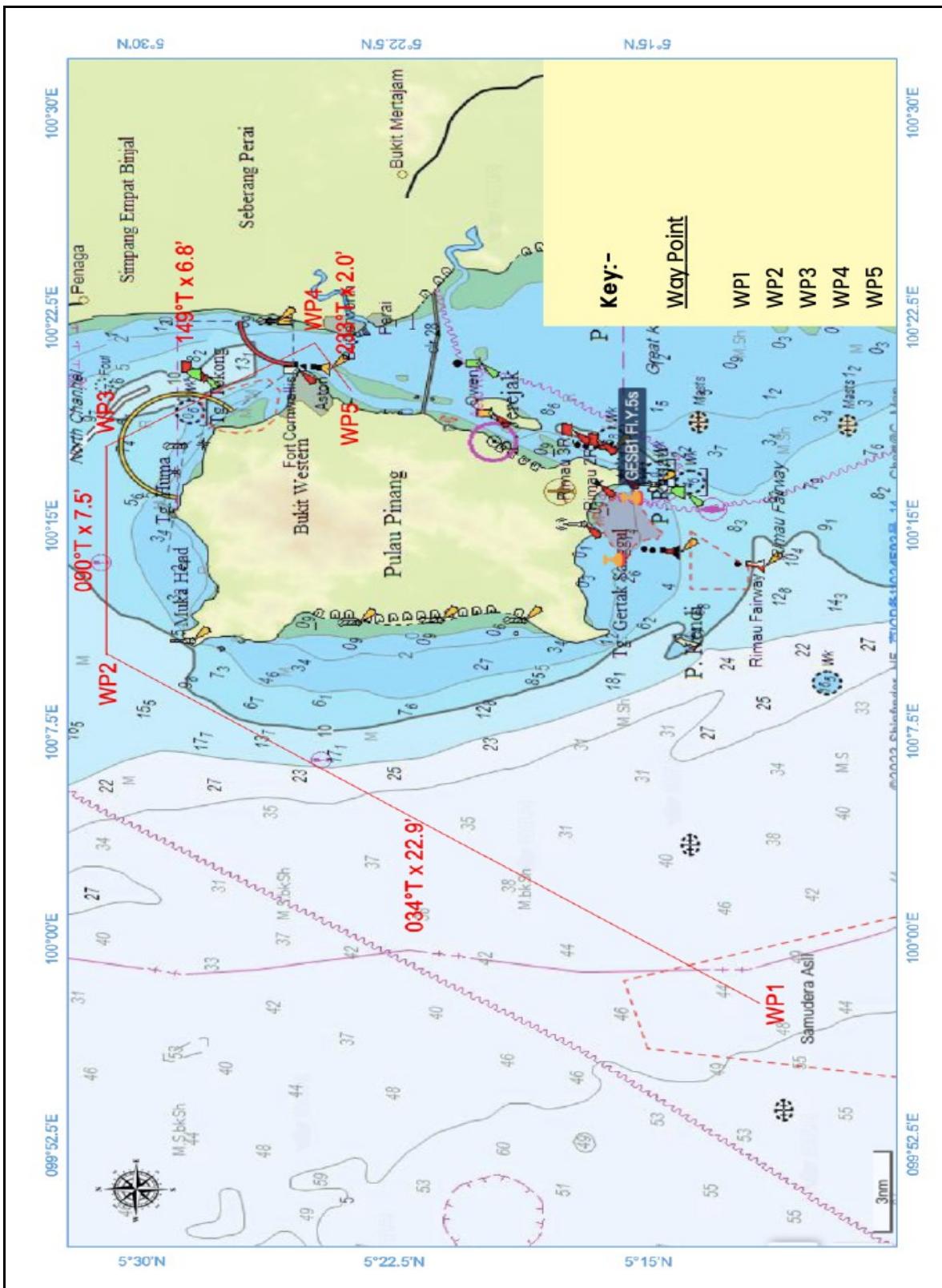


Source: Coastal Hydraulic Study, September 2022

Figure 8.15 Extend Of Siltation with 500m of Proposed Project Site



The logo consists of a red checkmark symbol above the word "Yes" in a purple sans-serif font.



Source: TOR For Marine Risk Assessment, December 2023.

Figure 8.16 Passage Plan From Sand Source Area To Reclamation Site

- Identify the routes to be used in transporting the fill material to the reclamation site. Mark these routes on the Admiralty Chart Datum and obtained the necessary approvals from the Harbor Master prior to notification in the Mariner's Notification or other notification channels;
- Close liaison will have to be maintained with the port authority in respect of drawing up the schedule of vessel movements to chart hydraulic fill to the reclaimed area;
- Provide adequate signs, safety lights and navigational markers at the dredging both and reclamation sites according to the Convention on the International Regulation for Prevention of Collision at Sea 1972 and the Merchant Shipping Ordinance 1952;
- Avoid the creation of material transfer basins as they can create navigation interferences with local fishing crafts;
- Reclamation works to be conducted from 8.00 am to 6.00 pm only;
- Install a global positioning system on the vessels and submit recordings of the vessels on a routine basis to the relevant authority;
- Surveillance monitoring of sea traffic plying the area shall also be conducted; and
- Identify the routes to be used in transporting the fill material in total enclosure to the reclamation site. Mark these routes on the Admiralty Chart Datum and obtain the necessary approvals from the Harbor Master prior to notification in the Mariner's Notification or other notification channels. Close liaison will have to be maintained with the port authority in respect of drawing up the schedule of vessel movements to chart hydraulic fill to the reclaimed area.

Following the completion of a risk assessment, the Consultant has put forth a series of recommendations for RCM (Risk Control Measures). These measures are aimed at enhancing safety and mitigating risks associated with maritime operations in the area. The recommendations are as follows:-

- Passage From Sand Source Area To Reclamation Site
 - Sand carriers en-route to the Jelutong Landfill reclamation site may access it via the northern channel of Penang Port. Licensed harbour pilots are required to guide these sand carriers when navigating within the mandatory pilotage area of Penang Port. Sand carriers with a draft of less than 7 meters should remain outside the dredged channel at all times.
- North Channel – In Bound
 - The North Channel is entered at Latitude 05°35'N and Longitude 100°13'E, about 1.5 nautical miles southeast of the Fairway Buoy.
 - It is marked by seven (7) pairs of IALA Region A lateral buoys. A maximum of 10% of draught as under keel clearance is needed at all times during the passage whilst transiting the channel. For deep draught vessels, due allowance for course alteration into

the channel at buoy no. 1 should be given so as not to arrive at too acute an angle.

- Between buoy no. 1 and buoy no. 2, vessel will experience a bodily drift to the north or south depending on the prevailing tidal condition. This drift is especially pronounced during periods of spring tides. Upon reaching buoy no. 1, the course is 127°T thence course is altered to 145°T at buoy no. 5 to pass between no. 6 pair of buoys. Vessel drawing more than 10m draught are advised to pass through buoy no. 7 before leaving the channel. Inbound vessels with a draught of less than 7m may proceed without using the channel by staying close to the buoys. An alternative route for shallow draught vessels, upon reaching buoy no. 5 is to alter course to 160°T, keeping buoy no. 6 and buoy no. 7 to port.
- North Channel – Out Bound
 - **Table 8.9** provides the passage plan for sand carriers to reclamation site. Russian Wreck Buoy should be kept to port and upon reaching it, course is altered to 340°T direct to buoy No. 5, keeping Tokong Buoy and buoy No. 6 to starboard. For deep draft vessels, it is advisable to do dog leg upon reaching Tokong Buoys and steer towards buoy No. 6 to enter the channel.

Table 8.9
Passage Plan For Sand Carriers To Reclamation Site

Waypoint	Latitude	Longitude	Course	Distance	Remark
WP1	05°11.7'N	099°57.7'E	034°T	22.9 nm	Samudra Asli
WP2	05°30.8'N	100°10.4'E	090°T	7.5 nm	Muka Head
WP3	05°30.8'N	100°17.9'E	149°T	6.8 nm	Buoy 7
WP4	05°24.9'N	100°21.5'E	233°T	2.0 nm	Aston
			Total	39.2 nm	

Source: TOR For Marine Risk Assessment, December 2023.

- The Project Proponent should employ a competent Marine Traffic Supervisor responsible for day-to-day supervision of marine operations, including traffic control, liaising with maritime authorities, and responding to marine-related emergencies. The Marine Traffic Supervisor should, unless otherwise specified by the Marine Department, hold a minimum qualification of Watchkeeping Officer <3000 GT Near Coastal;
- Prior to mobilization to the project site, sand carriers or barges should undergo inspection by the Marine Traffic Supervisor;
- It is preferable for barges to be registered under the Malaysian Flag and classed by members of the IACS (International Association of Classification Societies);

- Crew members must possess appropriate certification and competence in accordance with STCW (Standard Training and Certification Watchkeeping) regulations;
- The Captain of the vessel should be proficient in English;
- Sand carriers or barges should be fully equipped with safety and pollution prevention equipment as specified in the SOLAS (Safety of Life at Sea) and the MARPOL (International Convention for the Prevention of Pollution from Ships) regulations, as applicable;
- Port State Control inspections are to be conducted upon arrival at the project site to ensure compliance with regulations and safety standards; and
- A manual containing the SOP (Standard Operating Procedures) for transporting the fill material by vessels from the proposed sand dredging site to the reclamation site including the actions required to cater for emergencies shall be in place and shall be submitted to Jabatan Laut and Suruhanjaya Pelabuhan Pulau Pinang and presented to these authorities prior to any works at site.

(c) Marine Resources And Productivity Control Measures

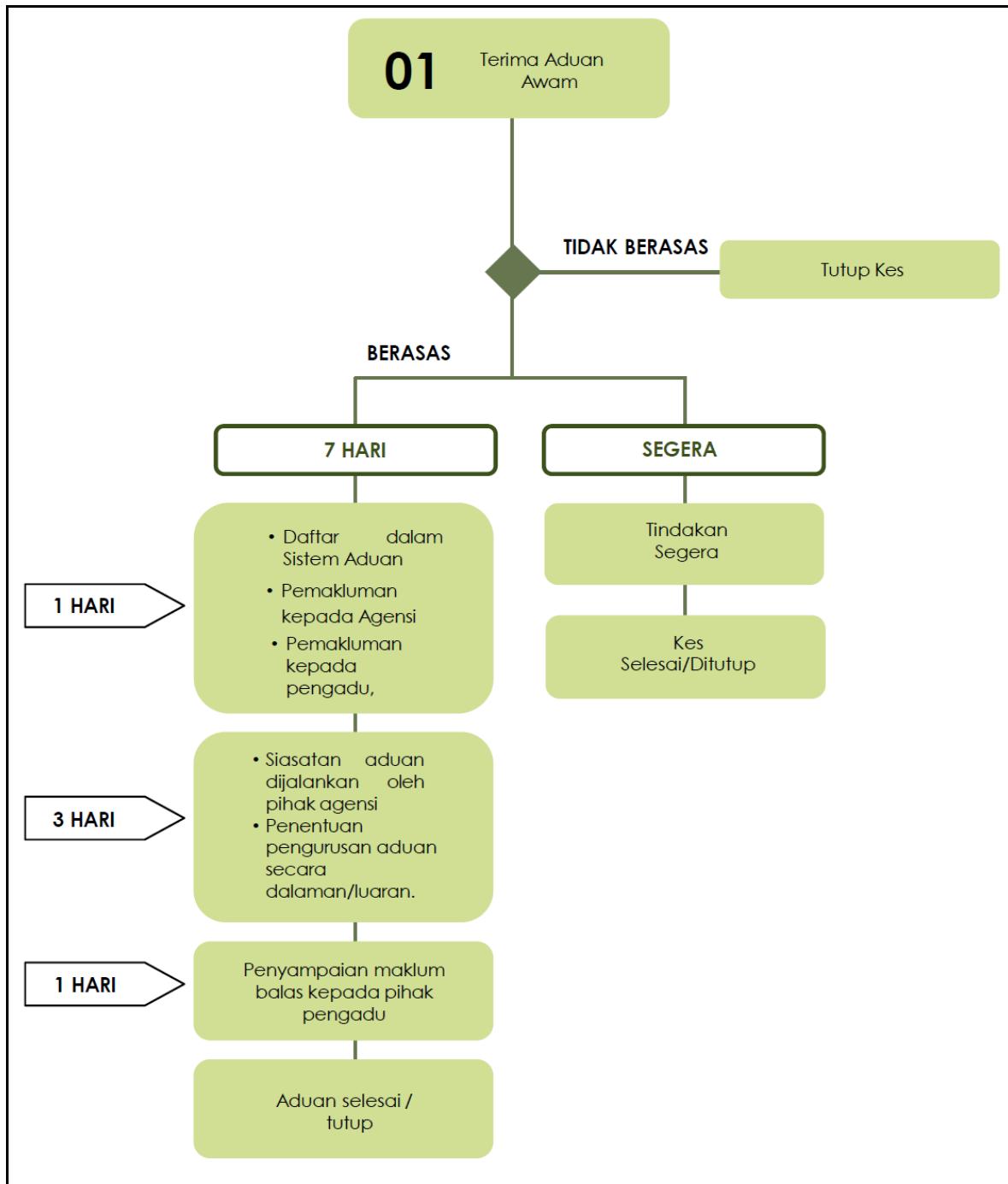
This section discusses the key mitigating measures recommended to minimize or alleviate the adverse impacts discussed previously. Best management practices will be carried out to minimize any potential impact to the fisheries and the coastal environment.

- Mitigating measures for the marine fish impact are directly dependent on the mitigating measures for the water quality impact. Water quality will be monitored frequently during reclamation activities to ensure the sediment level is below the acceptable limit for fisheries;
- Implementation of sand bund and double layered silt curtain with 70% effectiveness can significantly reduce the potential short-term impacts to the surrounding environment. Silt curtains are able to control the dispersion of turbid water by diverting the flow under the curtain, thereby minimizing turbidity in the upper layer of the water column outside the silt curtain;
- Sufficient site drainage will be installed to guarantee that wastewater and runoff from the construction site to ensure it is appropriately controlled and treated before being released into the surrounding water;
- Specific provisions for upgrading fishery infrastructure facilities such as maintenance and repair of the nearby fishing jetties should be conducted; and
- Awarding compensation directly to registered fishermen who are adversely affected by the reclamation area.



(d) Socio Economy Control Measures

The following social impact assessment plan as outlined in SIA report shall be in place as shown in **Table 8.10**. To cater for any complaints received from the public, the following flow in **Figure 8.17** shall be used.



Source: SIA Report, 2023

Figure 8.17 Flow Chart of Complaint Management by Project Operators

Table 8.10
Social Impact Management Plan

Code	Variables	Expected Impact	Score (Level of Significance)	Outcome	Mitigation Measures	Key Performance Indicators (KPI)	Executor	Monitoring Party	Monitoring Period
KP10	Quality Of Life Environment (Liveability)	Concerns about changes to the surrounding landscape as a result of construction works as well as reclamation activities that affect the recreation area at Persiaran Karpal Singh. (Survey, Workshop)	18 Significant (High Priority Height)	The environment of the Karpal Singh Promenade is in a controlled state and the visual quality/ sea view is in a good, comfortable and clean condition.	<ul style="list-style-type: none"> i. Ensuring that part of the Karpal Singh Park area can still be accessed by the public safely and cleanly. i. Using suitable fenced boards that do not block the view of the sea 100%. i. Provide an information board (infographic notice board) that is easy for the surrounding community to understand regarding development proposals. ii. Provide safety signs to prevent accidents to the public during the construction phase. 	<ul style="list-style-type: none"> i. Zero (0) regarding accidents among visitors who visit around Persiaran Karpal Singh. i. Fence board maintenance if there is any damage. i. Signboard maintenance should be done if the information written on the safety sign/information becomes unclear/invisible. 	<ul style="list-style-type: none"> i. Developer ii. Contractor appointed by the developer 	<ul style="list-style-type: none"> i. MBPP 	Throughout the construction period (twice a year until the construction phase is completed)
KP12	Quality Of Life Environment (Liveability)	Redemptive activities will disturb marine life. (Questionnaire, FGD)	18 Significant (High Priority Height)	Disruption to marine life is at a minimum and the quality of life of fishermen is preserved.	<ul style="list-style-type: none"> i. Ensuring that machinery during construction that is used for sea reclamation activities does not cause pollution, whether oil spills, construction materials and others. i. Ensuring that the development carried out does not cause permanent destruction to the mudflat and fishing ground ecosystems which are important ecosystems for fishing resources. i. All committed pollution control measures and control measures specified in the study, EIA and FIA are fully implemented to minimize the impact in the catchment area. i. Road waste management needs to be managed/discharged using the right method so that pollution problems do not occur. 	<ul style="list-style-type: none"> i. Maintenance and inspection of the machinery used to ensure that the machinery is in good condition i. 100% monitoring and assessment of marine ecosystem impacts. i. 100% compliance with Environmental Impact Assessment (EIA) approval requirements ii. 100% compliance with Fishery Impact Assessment (FIA) approval requirements i. Construction waste cannot be dumped directly into the sea, but must be managed through proper methods/processes 	<ul style="list-style-type: none"> i. Developer ii. Appointed Contractor 	<ul style="list-style-type: none"> i. Fisheries Department Pulau Pinang (Lead Agency) ii. DOE Pulau Pinang i. DOE Pulau Pinang i. MBPP 	<ul style="list-style-type: none"> Throughout the construction period (monthly) Throughout the construction period Throughout the construction period (on a monthly basis and encouraged to inspect - after the construction work time is over)

Table 8.10 (Continue)

Code	Variables	Expected Impact	Score (Level Of Significance)	Outcome	Mitigation Measures	Key Performance Indicators (KPI)	Executor	Monitoring Party	Monitoring Period
KP9	Quality Of Life Environment (Liveability)	Damaged and dirty roads due to heavy vehicles going in and out leading to the construction area will happen. (Survey, FGD, Workshop)	16 Significant (High Priority)	Impacts and negative effects on existing roads are minimized and the mobility of existing residents is managed and comfortable	i. Developers and contractors need to repair existing roads in the event of damage to the road surface as a result of heavy vehicles entering and exiting. ii. Apply the wash trough method so that the lorry exits / enters in a clean condition.	i. 100% compliance with TIA and RSA approval requirements and in accordance with the conditions set by the Public Works Department and MBPP Engineering Department.	ii. Developer iii. Contractor appointed by the developer	i. MBPP (Lead Agency) ii. JKR Daerah Timur Laut	Throughout the construction period (until the receipt/submission of the interim notification)
					i. Controlling and limiting the movement of heavy vehicles in/out with the permitted load volume per day to the construction area.	i. The load capacity of heavy vehicles leaving/entering is according to the permitted load			Throughout the construction period (until the end of the construction phase)
					i. Avoid using roads around the proposed site (Lebuh Sungai Pinang) except Lebuhraya Tun. Dr. Lim Chong Eu and Jalan Perusahaan Jelutong only. Note: •The construction phase will involve Tun Dr Lim Chong Eu Highway and only an estimated 30m of Jalan Perusahaan Jelutong will be used. •Heavy vehicles during construction will only be within the Jelutong landfill area.	i. Zero (0) complaints regarding road damage due to vehicles exiting/entering the construction site. ii. The time period for action to be taken after complaints from residents or nearby users about road damage (for routine maintenance) is no more than 7 days.			
KPII	Quality Of Life Environment (Liveability)	Coastal erosion will disturb the stability of the slope, damage to nature and the fishing ecosystem. (Survey, FGD, Workshop)	16 Significant (High Priority)	Impacts related to coastal erosion are minimal.	i. The developer and contractor need to create a protective layer for the beach/sea area to control soil movement/silt dispersion. ii. Construction of Rock Revetment at the boundary of proposed reclamation to prevent erosion from exposed slopes. ii. The construction of a Containment Sand Bund to trap the reclamation fill material from being washed away by the current during the reclamation process is recommended before the reclamation operation begins.	i. 100% compliance with the approval requirements of the Department of Irrigation and Drainage. i. Compliance with MSMA guidelines on the Erosion and Sediment Control Plan (ESCP).	i. Developer ii. Contractor appointed by the developer	i. JPS Daerah Timur Laut ii. DOE Pulau Pinang	Throughout the construction period (every 3 months until the end of the construction phase)

Table 8.10 (Continue)

Code	Variables	Expected Impact	Score (Level of Significance)	Outcome	Mitigation Measures	Key Performance Indicators (KPI)	Executor	Monitoring Party	Monitoring Period
KPI13	Quality Of Life Environment (Liveability)	Expropriation activities will threaten the safety of fishermen going in and out of the sea. (Questionnaire)	16 Significant (High Priority)	Ensuring that fishing activities in the sea do not experience any significant disruptions that affect survival.	i. Ensuring that construction machinery involved in sea reclamation activities does not harm fishing activities. ii. Ensure that fishermen's access to fishing activities will not be blocked/hindered/interrupted at any time during construction.	i. Zero (0) regarding the safety issue of fishermen who are in irrigation. ii. Ensure that there are zero (0) complaints from the fishermen if they experience any interference to carry out fishing activities in the sea.	i. Developer ii. Appointed Contractor	i. LKIM	Throughout the construction period (continuously until the end construction phase)
KPI14	Quality Of Life Environment (Liveability)	Leachate from the Jelutong landfill has the potential to increase seawater pollution. (Questionnaire, FGD)	16 Significant (High Priority)	Water Quality Controlled to minimize pollution	i. Turbidity and Total Suspended Solid (TSS) monitoring should be carried out during reclamation activities. ii. Water turbidity and TSS levels should be monitored once before construction (baseline) and every three (3) months during construction simultaneously with the Shoreline Monitoring Program (SMP) at six (6) monitoring stations:- <ul style="list-style-type: none">• 5°24'00.07"N 100°20'04.14"E• 5°24'04.89"N 100°20'19.65"E• 5°23'39.61"N 100°20'06.27"E• 5°23'28.99"N 100°19'48.43"E• 5°23'12.20"N 100°19'20.70"E• 5°22'50.58"N 100°19'27.88"E iii. Construction work must be stopped if daily compliance limits are breached. v. Ensure monitoring of Environmental Impact studies (EIA) is carried out.	i. Attainment of water quality standards based on Environmental Impact Assessment (EIA). ii. 100% of the Environment Department's requirements are complied with (Malaysian Marine Water Quality Index)	i. Developer	i. DOE Pulau Pinang (Lead Agency) i. JPS Daerah Timur Laut ii. MBPP	Throughout the construction period (Road and Drainage construction stage)
KPI15	Quality Of Life Environment (Liveability)	Increases air pollution leading to exposure to dust and dust. (Questionnaire, FGD)	16 Significant (High Priority)	Air pollution caused by proposed development in the surrounding area is reduced.	i. Cover building materials with canvas sheets to reduce the impact of dust spreading from construction transport activities. ii. Practice wetting the surface of open ground and roads used by construction vehicles.	i. 100% compliance with the approval conditions by the MBPP technical department.	i. Developer	i. DOE Pulau Pinang (Lead Agency)	Throughout the construction period (at the earthworks and construction stages)

Table 8.10 (Continue)

Code	Variables	Expected Impact	Score (Level Of Significance)	Outcome	Mitigation Measures	Key Performance Indicators (KPI)	Executor	Monitoring Party	Monitoring Period
					i. Ban on open burning. ii. Periodic servicing of all construction vehicles will be done to control the emission of black smoke.	i. Achieving 100% compliance does not contribute to pollution problems. ii. Built Vehicle in good condition and 100% no black smoke emission.			
KPI7	Quality Of Life Environment (Liveability)	The influx of many foreigners as construction workers. (Questionnaire)	16 Significant (High Priority)	Entry of foreign workers for construction work in accordance with the prescribed legislation.	i. Ensure that the recruitment of foreign workers is applied through a valid channel and approved by the Regulatory Agency, Department of Labor under the Ministry of Home Affairs (KDN). ii. The age limit for employment of foreign workers is from 18 to 45 years. iii. Prospective workers in the construction sector are not included in the list of foreign individuals who are prohibited from entering according to Section 8(3) of the Immigration Act 1959/1963 and foreign workers must be recruited from source countries authorized by the Malaysian Immigration Department. i. Provide an efficient and systematic management system to manage, control, control and ensure that each construction worker does not disturb the peace of the surrounding residents and in accordance with the set standards. i. Placement of Workers in Centralized LaborQuarters (CLQ) located within the ZOI radius. ii. Provider of at least 2 vans/vans for construction workers to go/return	i. 100% compliance the conditions of registering as a foreign worker and the conditions of a worker's license. ii. A record of the entry of foreign workers that is valid according to the legislation of the Department of Labor. iii. Zero entry (0) among Unauthorized Foreign Immigrants (PATI). i. Record movement in and out employee the construction of each day i. Zero (complaint /related cases by accident or disturbance against security citizen.	i. Developer ii. Contractor appointed by the developer i. PDRM ii. JTK Pulau Pinang iii. MBPP	i. JTK Pulau Pinang i. MBPP (Lead Agency) ii. JKR Daerah Timur Laut	Throughout the construction period until the end of the construction phase)
KPI8	Quality Of Life Environment (Liveability)	Road congestion and disruption to traffic flow especially during peak hours due to vehicles going in and out of the construction area. (Questions, Research, FGD, Workshop)	16 Significant (High Priority)	Traffic management and population mobility are always managed.	i. Ensure that all recommendations from traffic study consultants (TIA) and Road Safety Audit (RSA) are followed. ii. Providing a Traffic Controller along the movement of heavy vehicles out/in from/to the development site area.	i. 100% compliance with TIA and RSA approval requirements and in accordance with the conditions set by the Public Works Department and MBPP Engineering Department.	i. Developer	i. MBPP (Lead Agency) ii. JKR Daerah Timur Laut	Throughout the construction period

Table 8.10 (Continue)

Code	Variables	Expected Impact	Score (Level of Significance)	Outcome	Mitigation Measures	Key Performance Indicators (KPI)	Executor	Monitoring Party	Monitoring Period
					<p>i. Provision of road signs, traffic warning lights, traffic controllers and others to reduce traffic conflicts.</p> <p>i. Heavy vehicles in and out of the construction site are carried out during non-peak hours to avoid traffic congestion.</p> <p>i. Jalan Perusahaan Jelutong only used as main road for vehicle out/in</p> <p>Note:</p> <ul style="list-style-type: none"> • The construction phase will involve the Tun Highway, Dr. Lim Chong Eu and only an estimated 30m of Perusahaan Jelutong road will be used. • Heavy vehicles during construction are only within the Jelutong landfill area. 	<p>i. Place the board road signs, traffic lights traffic warning and traffic controller on the highway Lim Chong Eu.</p> <p>i. Heavy vehicles are prohibited from exiting/entering from/to the development site during peak hours (7:00am – 9:00am and 4:30pm – 7:30pm).</p> <p>i. Zero (0) complaints from residents regarding the issue of heavy construction vehicles using surrounding roads except Jalan Perusahaan Jelutong.</p> <p>ii. The time period for action to be taken after complaints from nearby residents against road damage or traffic disruption (for routine maintenance) should be less than 7 days.</p>		<p>i. JKR Daerah Timur Laut</p> <p>i. MBPP</p>	Throughout the construction period (until the end of the construction phase)
KPI19	Quality Of Life Environment (Liveability)	Concerns about delays in completing development projects at the same time disrupting social activities/shops and community facilities. (Questionnaire)	16 Significant (High Priority)	The project will be developed within the proposed period	<p>i. The developer must complete the Development project according to the time frame and comply with the approval given</p> <p>i. Comprehensive discussions with stakeholders for issues that arise during the construction period.</p> <p>i. Ensuring construction signage provides information on developers, consultants, plan approval numbers, construction project duration.</p>	<p>i. Compliance with the time period of the Joint Development Agreement (JDA).</p> <p>i. Compliance with the JDA period.</p> <p>i. Ensuring the provision of accurate and concise information about the progress of work that has been carried out</p>	<p>i. Developer</p> <p>ii. Contractor appointed by the developer</p>	<p>i. PDC</p>	<p>Throughout the construction period (until the end of the construction phase)</p> <p>Throughout the construction period (updating information must be done every 6 months)</p>

Table 8.10 (Continue)

Code	Variables	Expected Impact	Score (Level of Significance)	Outcome	Mitigation Measures	Key Performance Indicators (KPI)	Executor	Monitoring Party	Monitoring Period
					<p>i. Ensuring the appointment of contractors and subcontractors has been clearly defined and drawing up appropriate penalties for delays.</p> <p>i. Make new adjustments and schedules to reduce the impact of delays</p>	<p>i. Controlling and reducing the risk of delays related to subcontractors</p> <p>i. Ensuring the project timeline follows the JDA planning and timeframe</p>			Throughout the construction period (at the level of engineering work and construction work)
KP20	Quality Of Life Environment (Liveability)	Increased waste and solids resulting from construction activities will drift from the sea to the banks of the construction area. (Questionnaire, FGD)	16 Significant (High Priority)	Waste and solid waste due to construction activities are at a minimum level.	<p>i. Using sand bund containment to prevent reclamation fill materials from being swept away by water currents</p> <p>i. Construction waste must be disposed of at a site authorized by the council and disposed of according to the Environmental Quality Regulation (Schedule Waste 1989)</p> <p>i. Ensuring the cleanliness of construction areas and ensuring that construction materials/waste does not disturb the environment.</p> <p>ii. All construction materials/waste must be placed within the proposed site (Jelutong landfill site) only and prohibited from being placed outside the proposed site.</p> <p>iii. Encourage construction workers to be responsible in the management of construction waste.</p>	<p>i. Ensure that 100% of the reclamation fill material is controlled from being washed away by water currents</p> <p>i. Compliance 100% solid waste management plan at the construction site.</p> <p>i. Compliance 100% solid waste management plan at the construction site.</p> <p>ii. Ensure 100% of construction workers understand and carry out waste management properly</p>	<p>i. Developer</p> <p>ii. Jabatan Perkhidmatan Perbandaran MBPP (Lead Agency)</p> <p>ii. JPS Timur Laut</p>		Throughout the construction period (every 3 months)
KP21	Quality Of Life Environment (Liveability)	Construction activities will affecting existing drainage. (FGD)	16 Significant (High Priority)	Temporary drainage is built while construction works are carried out.	<p>i. Ensure open type temporary drainage to channel existing waste water into the sea.</p> <p>ii. Ensuring that a new permanent drain will be proposed to replace this temporary drain in the future.</p> <p>iii. Temporary drainage should be built by providing a small gap in the land reclamation area.</p> <p>iv. Ensure that the surface of the drain is sandy as from the material used for recycling activities.</p>	<p>i. 100% compliance with the Hydraulic Study approval requirements.</p>	<p>i. Developer</p> <p>ii. MBPP (Lead Agency)</p> <p>ii. JPS Timur Laut</p>		Throughout the construction period (periodically)

Table 8.10 (Continue)

Code	Variables	Expected Impact	Score (Level of Significance)	Outcome	Mitigation Measures	Key Performance Indicators (KPI)	Executor	Monitoring Party	Monitoring Period
					i. Provision of reserve canal/paritumain 6 meters wide (minimum) ii. Do not build any permanent/temporary structure within 50 feet of the bank of the main canal/ditch.	i. 100% compliance with the approval requirements set by the Penang State Irrigation and Drainage Department		i. JPS Timur Laut	Throughout the construction period (at the road and drainage level)
EK2	Economy And Material Welfare	Reclamation activities will interfere with fishing activities due to the reduction of fishing areas. (Questions, Research, FGD, Workshop)	16 Significant (High Priority)	Fishermen's income is not affected by the development of the project.	i. Ensuring that fishing boats for fishing activities can operate around the clock.	i. 100% access to fishermen for the sea	i. Developer	i. Jabatan Perikanan Pulau Pinang (Lead Agency) ii. LKIM	Throughout the construction period (continuously)
					i. All commitments and control measures stated in the study, EIA and FIA are fully implemented to minimize impact in the catchment area.	i. 100% compliance with Environmental Impact Assessment (EIA) approval requirements ii. 100% compliance with Fishery Impact Assessment (FIA) approval requirements		i. DOE Pulau Pinang (Lead Agency) ii. LKIM	
EK3	Economy And Material Welfare	Exploitation activities will reduce sea catches, sources of income and increase the cost of fishing activities because they have to catch in more distant areas. (Survey, FGD, Workshop)	16 Significant (High Priority)	Improvement of the standard and survival of fishermen in the long term.	i. Installing a Silt Curtain during construction to trap sediment release from the site to prevent the spread of suspended sediment that will affect marine life.	i. 100% compliance with Fishery Impact Assessment (FIA) approval requirements. ii. 100% compliance with Environmental Impact Assessment (EIA) approval requirements.	i. Developer	i. Jabatan Perikanan Pulau Pinang (Lead Agency) ii. LKIM	Throughout the construction period (every 3 months)
					i. Conduct skills training and programs, provide fishing and marketing facilities to the fishing community in and around Jelutong. ii. Forming and implementing a Fisherman Taskforce to ensure issues related to fishermen are resolved.	i. Ensuring zero (0) complaints related to fishermen.			
					i. Ensuring that fishing boats for fishing activities can be accessed at all times regardless of the tide.	i. 100% access to fishermen for the sea			
EK5	Economy And Material Welfare	Changes in access to sea areas will increase the cost of fishing activities. (Questionnaire)	16 Significant (High Priority)	A fish landing complex and a nearby jetty can be used by the fishing community.	i. Ensuring the access of fishermen to carry out fishing activities is not hindered. ii. The new fish landing complex and jetty are accessible and operating well.	i. One (1) landing complex and Jetibaru must be provided and equipped with basic fishing facilities	i. Developer ii. LKIM	i. Jabatan Perikanan Pulau Pinang (Lead Agency) ii. LKIM	Throughout the construction period (once a month)

Table 8.10 (Continue)

Code	Variables	Expected Impact	Score (Level of Significance)	Outcome	Mitigation Measures	Key Performance Indicators (KPI)	Executor	Monitoring Party	Monitoring Period
KKI	Health And Social Welfare	Risk transmission of dengue and infectious diseases among construction workers. (FGD)	16 Significant (High Priority)	i. There is no infectious disease problem caused by construction workers. ii. The well-being of life, a habitable and safe environment.	i. Ensure that the proposed development area is always clean by providing a centralized maintenance and cleaning system. ii. Monitoring the spread of infectious disease outbreaks among construction workers with strict SOPs and in accordance with the conditions set by the Malaysian Ministry of Health (KKM).	i. 100% compliance with the approval conditions by the Department of Municipal Services. ii. Comply with the conditions in accordance with Section 11 of the Disease-Carrying Insect Extermination Act (APSP) 1975 (Act 154) (Conditions/S11 /Act/54/00/201 6).	i. Developer ii. Contractor appointed	i. MBPP ii. Pejabat Kesihatan Daerah Timur Laut (PKD)	Throughout the construction period (on a weekly basis)
PGI	Geography Process	Construction work is likely to result in flooding. (FGD)	16 Significant (High Priority)	Infrastructure and drainage systems are safe from the risk of flood disasters.	i. The construction of a perimeter ditch around the development site and the main monsoon ditch before the construction works are carried out and ensure that the drainage system in the surrounding area is not affected. ii. Make a hydraulic calculation for the capacity of the ditch size and the size of the catchment pond according to the Environmentally Friendly Drainage Manual Design (MSMA) taking into account the capacity of runoff for the development area up to the final discharge.	i. 100% Compliance with the Drainage System Master Plan. ii. Ensure that the drainage system is made according to the established guidelines	i. Developer ii. Contractor appointed by the developer	i. JPS Daerah Timur Laut (Lead Agency) ii. MBPP	Throughout the construction period (monthly/once a month)

Table 8.10 (Continue)

Code	Variables	Expected Impact	Score (Level Of Significance)	Outcome	Mitigation Measures	Key Performance Indicators (KPI)	Executor	Monitoring Party	Monitoring Period
					i. Repairing and upgrading the ditch from the proposed site to the final discharge. ii. The preparation of flood reservoirs to help flood problems that are at risk of occurring behind the coastline	i. Compliance 100% condition and standards that determined by the Bahagian Pengurusan Banjir, Jabatan Perparitan dan Saliran Pulau Pinang			
KPI6	Quality Of Life Environment (Liveability)	The noise produced during the construction work will disturb the tranquility of the residents and cause complaints to be received from neighboring lots about the construction work until night. (Survey, FGD, Workshop)	16 Significant (Moderate Priority)	The impact of noise pollution caused by construction activities on the site is reduced.	i. Construction activities are controlled by limiting construction activities until 8pm only. ii. The use of noise barriers can be used to reduce the impact of noise on residential areas around the site. iii. The use of machines with silencers to overcome noise problems that can disturb the surrounding residents. iv. Regular vehicle and machine maintenance will be done to reduce the production of gas, dust and noise.	i. Ensure zero (0) complaints from surrounding residents related to construction activities. ii. Ensure that noise does not exceed the level and standards set by the Department of Environment.	i. Developer ii. Contractor appointed	i. JPS Pulau Pinang (Lead Agency) JPS Pulau Pinang	Throughout the construction period (every 3 months)

(iii) Construction On New Landmass

Construction on the new landmass will proceed after completion of both rehabilitation work and reclamation work according to the phasing plan outlined in **Chapter 5** which will be implemented by the individual land owners once the Planning Permission and individual EIA studies (if required) and the earthworks and building plans have been approved for the individual land parcel to be developed. Sampling of methane gases shall be conducted prior to any topsite development at the rehabilitated site and the development can only proceed when methane gases are not detected at site.

Thus the mitigation measures that has to be in place which ill be highlight in the individual EIA report and EMP for the related land parcel are as follows:-

(a) Land Disturbance Control Measures

- LD-P2M2 (land disturbance pollution prevention and mitigation measures) is to be in place;
- LD-P2M2 shall contain the following:-
 - Details of the phasing schedule, staging and sequencing;

- Site meetings shall be conducted prior to start of any activity or land disturbing activity to be attended by Project Proponent, Project EO (Environmental Officer), Project contractors and sub-contractors to discuss in details all the relevant scope of work that have relevance to pollution prevention and mitigating measures;
- Perimeter controls to be provided as per ESCP (Erosion and Sediment Control Plan);
- ESCP to be in place before land disturbing activities are executed; and
- Site inspection to be conducted on routine basis.
- ESCP shall be in place.

All recommendations made in the geotechnical report prepared by the geotechnical consultant shall be integrated in the design and implementation of the individual land parcels. The following method statements and construction sequence are proposed:-

- Erect site hoarding and sediment basin/siltraps and tyre washing bay prior to commencement of earthworks;
- Construct temporary drains/earth bunds along the boundaries prior to excavation;
- Construct temporary access to the intended land parcel. Clear the site along the access only;
- Do not excavate at random, designate the site into planned zones of cut and fill for construction control;
- Spot level checks frequently to avoid over excavation;
- Regularly check and maintain the sediment basin/silt-traps to ensure muddy water is not discharged to the existing stream; and
- Regularly clean and maintain the tyre wash basin and to ensure all earth moving vehicles go through the basin to have their tyres cleaned up before entering public road. To regularly clean the public road.

As outlined earlier in **Chapter 7**, the parcel and building to be developed may require earthworks for the foundation system and subsequently construction works. To minimize the land disturbing activity the following shall be in place:-

- To implement the ESCP before, during and after the execution of the earthwork to prevent contamination and disturbance to the surrounding area and the existing river;
- To ensure Soil Erosion is minimized through controlling site clearing and excavation schedule;
- To stockpile excavated topsoil for use in vegetation later on;
- To maintain road access and to provide stabilization measure as well as tyre wash basin at strategic locations;

- To provide temporary drainage system, including cut off drains to direct the run-off away from crossing the disturbed and unstable area;
- To direct run-off from disturbed area to sediment control BMPs for treatment before discharging out to natural waterway;
- To design site formations and slopes with proper stabilization measures and drainage system to channel surface run-off to sediment ponds for erosion control;
- To design sediment control BMPs and provide adequate sediment ponds and/silt-traps at the strategic location within the site;
- To provide adequate check dams along the steeper temporary drains to control flow velocity, hence sediment transportation;
- To prepare and provide site control, inspection and maintenance programme to be followed throughout the earthwork construction period and upon completion of earthwork for the protection of the site and public areas and interests;
- To ensure surface run-off shall be properly diverted by constructing adequate permanent concrete channels to be discharged to the final discharge point and to avoid draining away of fine material due to inherent underground water after filling up of the depressions ,it is recommended that underground curtain wall be constructed across the original depression area near the outlet to filter and prevent loss of fine material which may result in possible settlement of the fill ground;
- Soil eroded during land disturbance can wash away and contaminate stormwater if contaminated stormwater enters a drainage line or stormwater drainage system, it will eventually discharge into an adjacent waterway and pollute it;
- Type of sediment controls suitable for a particular situation depend on the nature of the site, in terms of such factors as rainfall patterns, soil type and topography. These factors need to be taken into account when selecting appropriate controls and ensuring that designs are adequate;
- Ways of minimising sediment run-off are to be take into consideration as follows:-
 - Reduce stormwater on the site
If uncontaminated water enters part of the site that has been cleared, it will quickly pick up sediment and need to be treated. Additional water way also add to the erosion potential, increasing the risk of pollution.
It is therefore desirable to divert clean stormwater away from those parts of the site where soil is to be exposed. This can be done by constructing diversion and intercept drains around the site while ensuring that the water discharging from such drain is disposed of without causing erosion.

Wherever possible, the new stormwater drainage system should be installed before any land disturbance activities commence. If possible on-site inlets should not be connected until the site has been stabilised. In this way, silt-laden stormwater cannot escape the site via this route and pollute surface waters. It will have to be treated onsite.

- There is a direct relationship between the velocity of water flowing over exposed soil and the rate of erosion. Installation of check dam on the site to retard water flows is an effective measure to reduce erosion in areas where high water flows are expected.
- To prevent scouring, drainage lines may need to be lined or velocity-reducing structures, such as crushed rock or geotextile placed in the drainage line.
- ESCP of LD-P2M2 as outlined in details in **Appendix D-001** of this EIA report proposed to served as working document for erosion and sediment controls in providing detailed design specifications for ESCP for implementation during engineering stage include:-
- Most damage is done in the initial part of a storm, between 30 minutes and two hours into a storm, and during prolonged storms.
- Designs of control structures, therefore, need to account for peak run-off flows.
- Where it is not possible to schedule works to avoid times of the year when high rainfall is expected, then additional controls may be required, such as installing extra sediment traps or enhancing the capacity of existing controls.
- Sediment ponds or basins hold sediment-contaminated run-off long enough for suspended sediment to settle out. Clarified water can then be discharged to river or shore;
- Permanent structures that will provide ongoing sediment control, after a site has been stabilized, should be designed using a 50- year-recurrence interval or deem required;
- Temporary sediment control structures should be designed to take predicted flows, based on a one-in-two-year storm (two-year ARI with intensity for six hours) and sub-catchment areas, while contingency plans should be in place to account for extreme storm events. Use the Universal Soil Loss Equation at all time during implementation to estimate long-term average annual yield of sediment from small uniform sections of catchments. Run-off and sediment control structures should be designed and constructed to accept the expected peak flows and sediment loads;



- Fine colloidal clays suspended in run-off require a long time to settle, often exceeding the economic or practical detention storage capacity especially in area where space is limited. Flocculants may need to be added to hasten settlement;
- Adequate controls should be placed on all drainage lines. Silt loads should be treated as close to their source as possible using effective sediment traps;
- Effectiveness of sediment control devices depends on an adequate inspection, maintenance and cleaning program. Inspections, particularly during storms, will show whether devices are operating effectively. Where a device proves inadequate, it should be quickly redesigned to make it effective; and
- Some of the proposed BMP's as discussed above to be used for the individual plots to be developed are outlined with illustration in **Table 8.11.**

Table 8.11
Proposed Site BMP (Topsite Development)

BMP	Purpose and Application	Illustration
Construction Entrance	To keep sediment from being tracked onto public roads. A rock surface driveway is constructed where traffic levels the site.	
Topsoil Stockpiling	Preserve topsoil for later use when seeding.	
Dust Control	Minimize dust on a construction site.	
Silt Fence	Provide a place for water to pond and silt to fall out.	



Table 8.11 (Continue)

BMP	Purpose and Application	Illustration
Sediment Trap	Trap sediment by collecting it in a small depression and slowly discharging it.	
Debris and Trash Management	Provide waste storage containers on-site to minimize the amount of debris that is blown or washed off the site.	
Scheduled Waste Management	Provide containers for storing scheduled wastes with secondary containment to prevent leaks and spillage.	
Sanitary Facilities	Provide permanent or portable sanitary facilities.	

It is anticipated that the sediment erosion can be mitigated with the BMP's in place.

The frequency of maintenance for the BMP's and related items are shown in **Table 8.12**.

Table 8.12
Frequency And Schedule Of Maintenance (Housekeeping)

No.	Sequence / Item	Maintenance Works	Maintenance Frequency
1	During earthwork Construction	(i) Desilt all the drain, sump pit, check dam and sediment basin and tyre wash basin.	Once a week and immediately after prolong rain
		(ii) Stabilize or cover up disturbed land.	Daily
		(iii) Remove and cart away loose earth on the ground.	Daily
		(iv) Maintain/repair damaged temporary and permanent drainage system.	Daily
2	Upon completion of earthworks	(i) Regularly desilt and clear all drain of shrubs and debris.	Once a month and immediately after rain
		(ii) Thoroughly check and repair any visible crack and damage of the drains	Once in 3 months
		(iii) Maintain detention pond and ensure outlets are clear of blockage.	Once a month and immediately after prolong rain
		(iv) Maintain workability of road surface condition.	Once a year
		(v) Carry out maintenance to other items which do not cause imminent danger/damage.	Once in 3 months

Besides soil erosion and sediment which can affect water quality, sewage from the construction workforce and base camps can also affect water quality. Thus the mitigation measures to be in place to address sewage from the construction workforce are as follows:-

- Provide a temporary sewage treatment facility in the form of septic tanks or mobile toilets with SPAN's approval for any construction camps provided at site;
- Routine desludging to be conducted for the septic tank or mobile toilet; and
- Any discharges from the septic tank is to comply with Standard B, Environmental Quality (Sewage Regulations) 2009.

(b) Air Pollution Control Measures

As discussed in **Chapter 7** various activities during the construction stage will result in fugitive emissions. Thus to control the issues the following shall be in place:-

- Carry out regular surface damping or wetting at affected public roads or access to construction site as shown in **Figure 8.18**;



Figure 8.18 Examples of Surface Damping and Wetting During Construction

- Ensure construction vehicles moving in and out of the site do not cause deposition of soil or dust on public roads by providing wheel-wash troughs and hose at the ingress and egress points wheel wash facilities shall be designed with the following features:-
 - Temporary concrete hard standing of sufficient size to accommodate a standard sized vehicle, laid to fall with drainage and sump;
 - High pressure water jets; and
- Practice strict compliance with speed restriction for all vehicles operating within the construction site or on access roads to the site. A limit of 30 Km/hr shall be imposed.

In order to control emissions from any generator set installed at site the following control measures are to be adopted:-

- Written notification is to be submitted to the DOE 30 days prior to the installation of the generator set at the construction site; and
- Best operating practices and routine maintenance of generator sets required to reduce emission at site.

(c) Noise Control Measures

Various sources have been identified in the impact assessment which may contribute towards higher noise from the construction activities. Amongst these sources include vehicular movements, piling work and general construction activities. One of the most effective means of reducing noise from road construction where there are residential activity nearby is to limit the time of operating of noise equipment, vehicles and operations. Even with restricted hours, every effort should be made to reduce the noise of all activities.

In order to control noise from transportation activities the following measures are to be provided:-

- Temporary signs to indicate speed for vehicle entering and exiting the project site to be placed at strategic locations along main access road; and
- All contractors involved in transporting material to the project site as well as those involved in transporting waste out of the project site shall be made aware of the requirements in relation to controlling the speed of vehicles.

In order to control noise from construction activities the following are to be implemented to reduce noise annoyance to an acceptable level to the community:-

- Provide hoarding along the boundary of the site;
- Use less noisy construction method;
- Maintain plants and equipment that are used on site regularly;
- Shut down plant and equipment used intermittently between work periods or throttled down to a minimum;
- Orientate plants and equipments known to emit noise strongly in one direction, so that the noise is directed away from the receivers;
- Use suitable noise suppression or abatement measures in proximity close to receptors such as provision of noise screen as shown in **Figure 8.19**;



Figure 8.19 Hoarding

- Use silencers or mufflers for all noisy plants and equipments used on site;
- Site mobile plants and equipments as far away as possible from sensitive receivers;
- Utilize material stockpiles and other structures effectively where practicable to screen receivers from noisy on site construction activities;
- Impose workers spending long hours on site operating machinery and equipment to wear protective ear mufflers to prevent hearing impairment;

- Limit construction activities to daytime hours only where ever possible;
- Monitor noise levels at the boundary of the construction site;
- Schedule deliveries to the site so that disruption to local amenity and traffic are minimized;
- Advice local residents when unavoidable out of work hours will occur; and
- Adhere to 60 dBA Leq noise pressure level during the daytime.

Some of the possible mitigation measures to control noise are also outlined in **Table 8.13**.

Table 8.13
Mitigation Measures To Control Noise From Machinery and Equipment

Machine	Source of noise	Possible remedies
Pile driver	Pneumatic or steam winch	Enclose hammer head and top of pile in acoustic screen: 'dampen' sheet steel piles to reduce vibration and resonance
	Impact on pile	Use resilient pad between pile and hammer head.
Excavator, scraper, shovel, loader and dumper	Engine	Fit more efficient silencer on engine exhaust
Generator or compressor	Generator or compressor	'Dampen' metal casing
Concrete breakers	Power unit	Fit more efficient silencer on engine exhaust. Dampen metal casing and line with sound absorbent material. Before modifying machine obtain advice from manufacturer
	Tool	Fit a muffler or silencer on pneumatic tools - this will reduce the noise without impairing efficiency
	Bit	Little noise once surface is broken, use sound damped or muffled steels
Riveter	Impact on rivet	Enclose working area in acoustic screen
Cartridge gun	Explosion of cartridge	Use a sound reduced gun
Pump	Engnie pulsing	Enclose in acoustic screen(allow for engine cooling and exhaust).
Concrete mixer	Engine	Fit more efficient silencer on diesel or petrol engine.
	Filling	Don't let aggregates fall from an excessive height .
	Cleaning	Don't hammer the drum

(d) Social Economy Control Measures

As described in **Chapter 7**, various activities during the construction stage can result in safety issues and hazards to the community in the area including construction nuisance and local traffic disruption which will cause discomfort to the local community. Thus to address these issues the mitigation measures that shall be in place are provided below:-

Safety issues relating to construction activities are to be mitigated include:-

- Safety Officers shall be appointed to ensure that operators adhere to safe operating practices at all times. Safety Officers shall:-
 - Review safety aspects of construction activities;
 - Ensure all works are carried out according to procedures approved by relevant authorities;
 - Ensure conducive working environment;
 - Ensure that all personnel conform to strict codes of personal protection include PPE, etc; and
 - Assist in the preparation, and upgrading of safe working procedures for all personnel.
- Hire workers, with preference to the local labor force shall be given;
- Hiring foreign workers that meet the requirements outlined by the relevant authorities;
- Provide strict instructions to the foreign workers to ensure the well being of both foreign workers and local community; and
- Monitor the movement of all foreign workers to ensure their safety as well as the safety of the local community.

The mitigation measures required during the construction stage to address potential traffic hazards are as follows:-

- Traffic to be controlled entering and exiting project site especially during earthworks by limiting 10 lorry trips per hour to minimize issues relating to traffic;
- Transport of heavy equipment to be conducted during off peak traffic hours. (i.e between 9.30 am to 4.30 pm);
- Transport heavy equipment during daytime only;
- Vehicles transporting machinery to be serviced on a routine basis;
- Employ experienced transport companies to transport heavy equipment to the site;
- Lead car to be used to direct vehicle transporting heavy equipment; and
- All equipment transported to the site to be secured safely during transport of equipment.

In order to reduce annoyance to the road users during the construction stage, the contractor has to carry out the traffic management study and propose an integrated and comprehensive Traffic Management Plan is to be in place. This is to be expedited during the construction period, which may include the followings, but not least:-

- (i) Traffic management plan at selected sectors of the alignment:
 - Manning and control of traffics at the main access roads to the roadside premises;
 - Providing alternative roads or service roads; and
 - Rerouting of local traffic movements if necessary.

- (ii) Accessibility to Respective Premises
 - Providing alternative lanes for vehicles to egress or ingress into business premises or kiosks or parking areas in front of shopping areas. The provision of alternative lane shall be carried out before any major construction works are carried out.
- (iii) Implement an emergency response plan and proved service to the road users in case of accidents or abnormal situations. The emergency response plan is to be submitted to the related agencies prior to any works at site.

Safety at the construction site is to be ensured as follows:-

- All provision of the Factories and Machinery (Building Operators and Works of Engineering Construction Safety) Regulations 1986 shall have to be followed accordingly in order to provide a safe working environment for he workers;
- Proper safety warning signs shall be erected;
- All passageway or scaffold platform or other elevated working surface shall be kept free of slippery items to provide slip-safe footing;
- Suitable eye protection equipment shall be provided for workers engaged in welding or cutting operations;
- All workers working within areas where there is a danger of being struck by falling objects or materials shall be provided with a safety helmet;
- Every worker required to work in water, wet concrete or other wet footing shall be provided with suitable waterproof boots;
- Safety officers shall be appointed to ensure operations adhere to safe operating practices at all times. Safety Officers shall:-
 - Review safety aspects of construction activities;
 - Ensure conducive working environment;
 - Ensure that all personnel conform to strict codes of personal protection such as PPE, etc; and
- Assist in the preparation, and upgrading of safe working procedures for all personnel.

(e) Wastes Control Measures

Biomass, domestic wastes from workers' camp and site office and construction wastes will be generated at site during the construction activities. Thus to manage the various types of wastes generated at site the following shall be in place :-

- Waste management plan is to be formulated to be used to manage the biomass and wastes at site;
- Site clearing to be conducted only at identified areas for the Proposed Project;

- All biomass cleared from site shall be disposed off site at approved landfill site with approval from MBPP;
- The location of the approved landfill site in Pulau Burung;
- Waste management plan is to be implemented as shown in **Table 8.14**; and
- Open burning is prohibited on site.

Table 8.14
Waste Management Plan

1.0	Purpose
	The purpose of waste management plan is to be used as a method statement for managing the wastes due to site clearing for construction activity.
2.0	Method Statement
2.1	<p>Identification of Wastes</p> <ul style="list-style-type: none"> • Wastes from site clearance is obtained from the site clearing activities consisting of potential undergrowth; and • Wastes from construction activities involves wooden form work, excess piping material, bricks, empty paint cans and others. <p>Prior to any clearing work at site ensure approval from the local authorities is obtained and the structures to be cleared marked at site.</p>
2.2	<p>Clearing Activity</p> <p>Stockpile areas for (a) and (b) are to be allocated and only areas identified at the project site be used for stockpiling.</p> <p>Important steps to be taken prior clearing the site consists of:-</p> <ul style="list-style-type: none"> • Walk the construction route to identify the limit of clearing, location of utility lines location for stockpiles and access roads; • Remove all tree trunks, chipped then for easier transport and stockpiled at dedicated areas; and • Remove construction wastes according to schedule.
3.0	<p>Environmental Consideration</p> <p>It is important that environmental consideration must be adhered at all times include:-</p>
3.1	<p>Before Working</p> <ul style="list-style-type: none"> • Walk the job prior to starting any clearing activity to ensure limits of clearance; • Ensure that vehicle and equipments to be used are right and adequate at site; and • Ensure that the entire site is hoarded and safety signs are in place.
3.2	<p>During Work</p> <ul style="list-style-type: none"> • Avoid the use of machinery or vehicles outside the construction zone and use designated parking areas; • Locate stockpiles and their access in cleared areas away from drainage lines; • Ensure all workers are equipped with PPE.
3.3	<p>After Work</p> <ul style="list-style-type: none"> • Biomass removal must be carried out before any construction work without posting residual impact; and • Disposal of wastes at approved sites by MBPP.

The control measures to be taken in the management and disposal of domestic wastes from the workers' camp and site office are as follows:-

- Provide adequate garbage bins for the site office and construction camps;
- Dispose solid wastes at least twice a week;
- Appoint a licensed vendor to dispose solid wastes; and
- Practice good housekeeping at site.

The following measures are recommended to control construction waste and scheduled wastes during construction activities:-

- Any excess material, PVC trimmings, pipes etc to be disposed off site at approved sites;
- Scheduled waste such as used oil to be collected and stored in containers. These containers shall be coded with labels such as Code SW 305 for spent lubricant oil, Code SW 306 for spent hydraulic oil, SW 409 for contaminated drums and SW 417 for spent paint according to the Environmental Quality (Scheduled Wastes) Regulation 2005. Samples of these labels are shown in **Figure 8.20**;

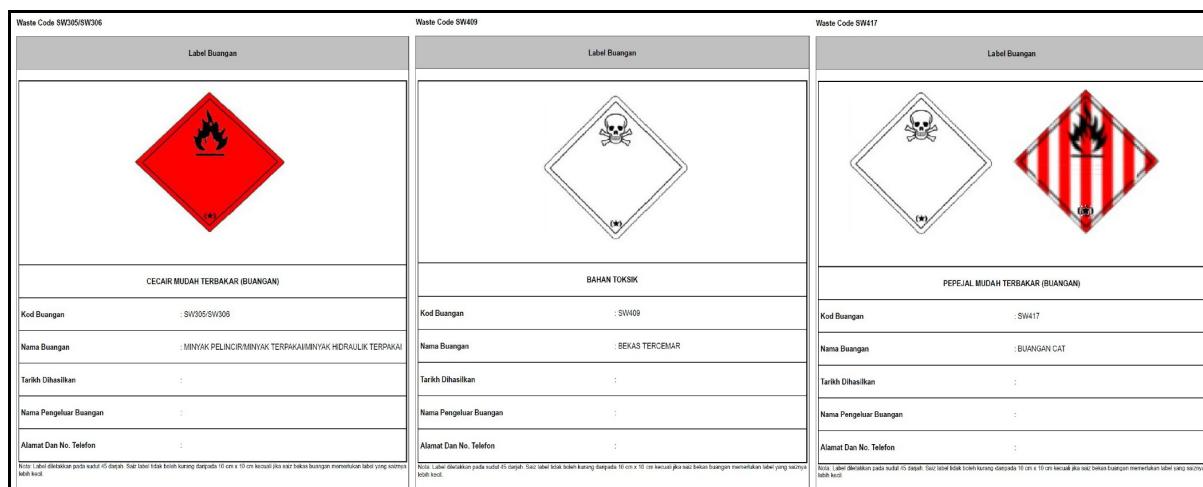


Figure 8.20 Labels for Scheduled Wastes

- An enclosed shed to be labelled as scheduled waste storage area shall be provided at site;
- Only compatible scheduled wastes can be place within the shed. The floor of the scheduled wastes storage area is to be impermeable and provided within secondary containment that can provide 110% percent containment of any liquid scheduled wastes;
- All scheduled wastes are to be disposed at DOE's licensed facilities and an inventory and notification via the DOE's electronic scheduled waste inform system (eSWIS) shall be in place;
- Good housekeeping practices are to be practiced at site;
- All bins, containments, holes etc that can contain stagnant water is to be checked on a daily basis so that they are kept dry and not be a mosquito breeding area;
- MBPP is to be informed and approval obtained during earthwork stage pertaining to the disposal site for any excess earth or rocks generated from the earthwork activities; and
- Waste minimization is to be introduced at site to minimise the waste load discharged to the environment;

- When choosing between waste minimisation options, the following hierarchy for waste management is preferred:
 - waste avoidance and/or reduction
 - reuse
 - recycling
- Diverting the waste stream in these ways means that waste treatment and waste disposal options can be reduced;
- Construction sites should pursue this hierarchy and seek out waste reduction opportunities;
- Identify opportunities it is necessary to consider all aspects of the project and the wastes it generates;
- Waste can be minimised by using improved technology, recycled or reused on-site, or by making purchasing decisions that favour recycled products;
- Wherever possible, include performance measures and targets for reduction, reuse and recycling options in the environmental management plan;
- Waste minimisation opportunities include:
 - obtaining construction materials, paints, lubricants and other liquids in reusable packaging or containers · using noise barriers made from recycled materials;
 - using overburden to construct temporary noise barriers;
 - using contaminated water out of sediment trap for dust suppression and irrigating adjacent vegetated land;
 - sending waste concrete to a concrete recycler instead of landfill; and
 - segregating and recycling solid wastes generated by construction activities, offices and mess-rooms · collecting lubricating oil from the construction vehicle fleet and sending it to a recycler.

C. Post Construction Stage

The post construction or operation stage of the Proposed Project will result in impacts to water quality due to stormwaters and urban runoffs, domestic wastes, traffic and air pollution from mobile sources and human impacts. Thus the mitigation measures to be in place are as follows:-

(i) Land Control Measures

Once the Proposed Project is completed, land form is to be maintained for the intended land use. However maintenance is often neglected or improperly performed resulting in rapid deterioration of the facilities provided at site. It follows that it is impossible to build and use a building and related road that requires no maintenance.

In order to plan for maintenance needs, it is important to keep a complete set of "as built" plans and records of all maintenance operations and observations. The as built plan should contain the following:

- Complete job index;
- Complete history of project from planning stage to construction;
- Photographic records;
- Exact location and observations of any unstable conditions in relation to the road location;
- Exact location of culverts and other drainage features;
- Wet areas that may have required additional excavation and replacement with more suitable ballast backfill materials; and
- All major changes made to the original plan

Drainage structures must be kept free of debris and obstructions. On newly constructed internal roads, or in where heavy traffic is taking place, cleaning may have to be more frequent.

Grass growing in ditches, unless it is dense enough to cause a major impediment to flow, should not be removed during clearing. Likewise, shoulder and cut banks must not be undercut.

Road surfaces should be reworked only as necessary to provide a smooth running surface and a good crown or slope for drainage. All-season roads will require continual monitoring for surface and subgrade wear or deterioration. Rutting and loss of road surface often occur during rainy season or heavy use. A plan should be in place to provide care when necessary to maintain continued use of the road.

(ii) Water Quality Control Measures

In to ensuring the stormwaters are catered for the drainage system for the Proposed Project are to be designed according to MASMA to cater for higher stormwater flow during intense storm will good engineering designs, potential issues relating to flash floods and floodings can be minimized. The measures to be provided are as follows:-

- Permanent drains and on site storage shall be provided at site to cater for the increase in stormwater pollution load. Gross pollution trap will be provided at the final discharge manhole to trap all leaves and rubbish from entering the drain;
- Engineering details of road and drainage shall be submitted to the JPS for approval; and
- Ensure maintenance of drains, oil and silt trap conducted on a routine basis to ensure the continuous performance of these structures and to detect any potential areas of concern.

Besides stormwaters, sewage will be generated from the Proposed Project. To address issues on sewage the following measures are to be undertaken:-

- In line with the need to control sewage, sewage from the Proposed Project will be collected and conveyed to the proposed manhole which will convey sewage to the pumping station which will be upgraded (NPS) according to IWK's requirement conveying sewage to the regional sewage treatment plant at Jelutong. The location of the pumping station to be upgraded and related manholes are shown in **Figure 8.21**;
- The sewage reticulation network shall be approved by SPAN or its agent, IWK;
- The reticulation network to be maintained accordingly by the service provider; and
- Discharges from the regional sewage treatment plant are to be monitored by service provider.

(iii) Domestic Wastes Control Measures

The following measures are to be incorporated in the Proposed Project:-

- To ease solid waste collection and disposal, a central refuse collection area will be provided meeting MBPP's standard requirements; and
- All solid wastes will be disposed by the service provider on a routine basis at MBPP's approved landfill site.

(iv) Traffic and Air Pollution from Mobile Sources Control Measures

The only sources of air pollution is from the gaseous emissions from mobile sources. The only way to reduce these emissions is to practice engineering controls such as switching off the motor engine whilst waiting for passengers and to landscape the area to act as a filter.

8.3 Summary of Mitigation Measures

Table 8.15 provides a summary of the potential impacts P2M2 (Pollution Prevention and Mitigation Measures) required for the Proposed Project to protect various aspects of the environment.

8.4 Abandonment And Rehabilitation Plan

It is not anticipated that the Proposed Project will be abandoned. Nonetheless, in the event that the Proposed Project is temporary or permanently abandoned due to various reasons, then an abandonment plan as shown in **Table 8.16** shall be in place.

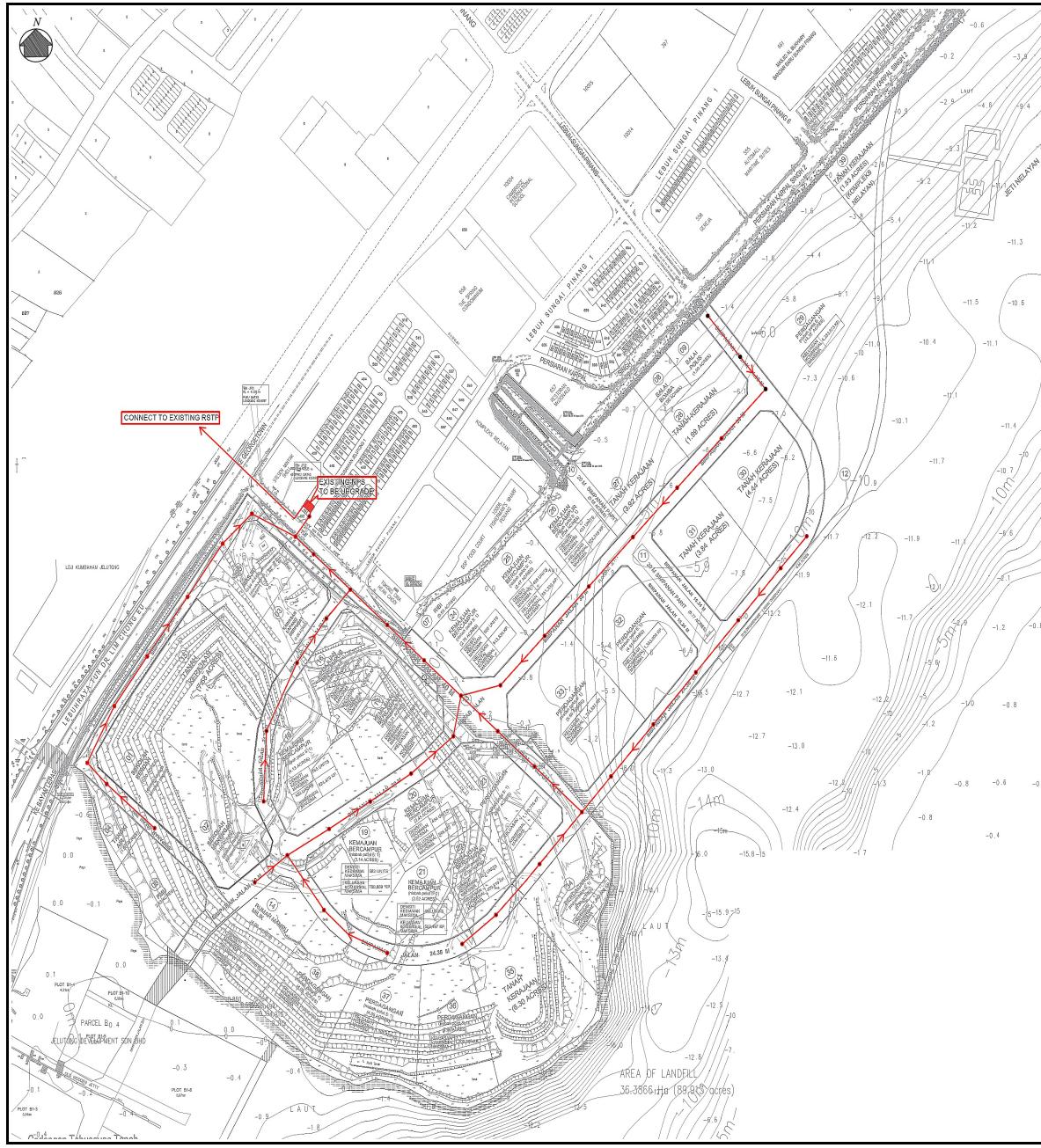


Figure 8.21 Sewerage Reticulation Plan

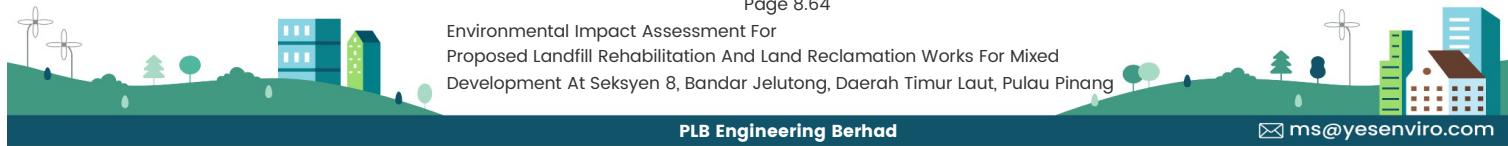


Table 8.15
Summary Of Potential Impacts And
Recommended Pollution Prevention And Mitigating Measures

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
Surface, River Water Quality And Marine Water Quality			
<u>Rehabilitation Works And Reclamation Works</u> • Rehabilitation activities • Recycling work	<ul style="list-style-type: none"> Rehabilitation activities may also cause landfill residual gas and leachate issues. Reclamation activities may result in sediment transport which will affect the marine water quality in the area. Reclamation activities may also effect the shoreline. 	<ul style="list-style-type: none"> BMP as outlined in LD-P2M2 to minimize sediment and runoff; Collection of leachate encounter during the construction work to send for offsite treatment due to leachate contains high amount of organic compounds and heavy metals that exerts services threat to public health; Offsite treatment require efficient method before release into receiving water include physiochemical treatment such as coagulation, flocculation and membrane filtration follow by biological treatment include activated sludge or membrane bio oxidation; Various leachate treatment options which can be used to select option for leachate treatment to minimize impact of leachate generation; and Landfill gas capturing during rehabilitation work is to be carried out using perforated pipes and flare with regular monitoring to ensure no harmful gas is release. <ul style="list-style-type: none"> All recommendations outlined in the hydraulic finding in the EIA report is to be followed stringently. This include the method statement for the reclamation activity as outlined of this EIA report; Shoreline monitoring is to be conducted on once in 3 months during the reclamation activities and every 6 months up to 3 years after the reclamation works complete; Before proceeding with reclamation works, sand containment bund shall be filled in layers to above mean sea level to serve as a retaining structure to retain reclaimed materials and at the same time, the bund serves to contain any sediment plumes arising from reclamation activities from being transported towards the adjacent marine environment; After the sand bund construction, sand will be discharged in the reclamation area via barges; The type of silt curtain to be used. According to the flow condition at the project site, Type II silt curtain can be chosen for this project as the current speed is generally less than 1 m/s. Good project management is required during construction stages to minimize the disturbance to the water body and sea bed by construction activities, and prevent leakage of sediment and other pollutions from the site and working vessels. Environmental monitoring during constructions shall be implemented to ensure the performance of prevention and mitigation measures. 	<ul style="list-style-type: none"> None None



Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
		<ul style="list-style-type: none"> • A long-term coastline monitoring is also recommended to assess the coastline stability post-project. For example, the coastline profiles adjacent to the project site can be measured and compared every year to identify the evolution trends of the coastline; • Because the major impact of the project on the water environment is the sediment plume during reclamation works, silt curtains shall be used to restrict the spread of sediment plume released during reclamation activities. Silt curtain provides a form of barrier from the water surface to a depth so that it can minimize sediment transport from a disturbed area adjacent to or within of water. • Silt curtain must be in placed prior to the commencement of the reclamation works; • Fill material is to give consideration of:- <ul style="list-style-type: none"> – The type of fill material may vary from the fine to coarse sands. This will depend of the source of borrow areas within the economic haulage distance; and – Detailed investigations are required to establish its quality, quantity, physical properties, etc. Acceptability of the fill materials will be considered in terms of quantity and quality. • Method of filling involves:- <ul style="list-style-type: none"> – It is anticipated barges transferring material from approved sand source to fill the proposed reclamation area from the sea. The sand material will be extracted from the source using suction dredger and loaded onto the barges which will transport the material to site; and – Avoid the creation of material transfer basins as they can create navigation interferences with local fishing crafts. • Filling works. Based on the hydraulic study conducted for the reclamation area the following is recommended:- <ul style="list-style-type: none"> – Sand bund to be constructed before any dumping activities take place to prevent excessive dispersion of sediments during the dumping process. The perimeter bund recommended shall be in the form of rock revetments; – Perimeter bund to be provided to create the shape of the proposed land mass; 	

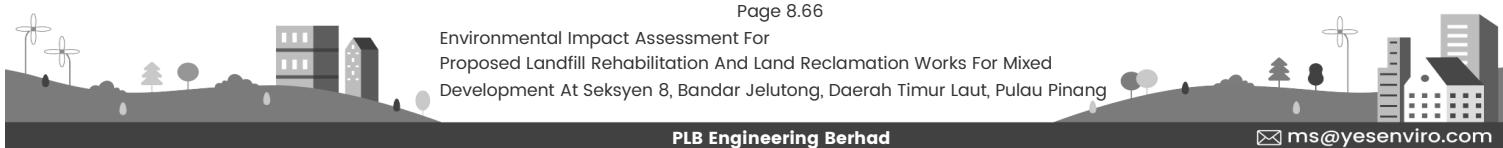




Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
		<ul style="list-style-type: none"> - It is also recommended that silt curtain be installed prior the construction of the sand bund. It is a flexible curtain membrane that is made of high woven polyester geotextiles; - With proper construction of containment measures within the area, there will be minimum spill of sediments into the surrounding waters; - The outflow from the dumping and dredging shall be limited to 50 mg/l. Regular monitoring must be carried out to ensure that this condition is met. If the suspended sediment concentration values exceed the stipulated limit, the Project Proponent shall immediately reduce the rate of dumping/dredging activity accordingly so that the sediment concentration adheres with the limit proposed; - Double silt curtains are to be provided during the land reclamation activities. For this purpose Type II silt curtains is recommended as the current speed is less than 1 m/s; • Installation of silt curtain:- - Silt curtain shall be installed to control the dispersion of silt suspended in water, whilst allowing the water to continue to flow though. Prior to the construction of sand bund, silt curtain shall be installed approximately 30 m from the reclamation boundary, or if the reclamation contractor commences with a smaller area the silt curtain perimeter may be reduced accordingly to contain the plume dispersed from the sand bund construction. • Construction of sand bund - Before proceeding with reclamation works, sand containment bund shall be filled in layers to above MSL (Mean Sea Level) to serve as a retaining structure to retain reclaimed materials and at the same time the bund serves to contain any sediment plumes arising from reclamation activities from being transported towards the adjacent marine environment. 	



Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
		<ul style="list-style-type: none"> - After the sand bund construction, sand will be discharged into the reclaimed area from the sand filling vessel consisting 4 conveyor belt vessel (3000 m³ to 8000 m³). Sand will be transported from conveyor vessel to project site. The vessel spread sand from North to South and keep the same parallel direction all the time to from a counting section. - For the area which water depth is insufficient, 2 platforms will be constructed for storing of sand, the subsequent sand bund will be formed up/ filled by lorries and excavators. • Water Quality Monitoring <ul style="list-style-type: none"> - TSS monitoring stations are JPS requirement proposed to be carried out to ensure compliance and the need for supplementary mitigation measures. • The value of suspended solids (ss) shall be determined at each designated monitoring stations on monthly basis according to the approved EMP; • The water quality monitoring shall be conducted on a monthly basis and the reports to be submitted to DOE, DOF and JPS on a monthly basis. • Shoreline Monitoring <ul style="list-style-type: none"> - Shoreline monitoring is recommended during the project implementation stage and post project to assess the impact of the proposed reclamation works on the adjacent coastline as per JPS requirement. - The survey of the shore profiles. The survey shall be carried out by licensed surveyor. The cross-shore profiles shall be measured with spot levels along the profile taken at 50 m spacing. - The landward limit of the shore profile should be set at 10 m beyond the existing coastline whereas the seaward limit at approximately 400 m to 800 m from the coastline, depending on the site condition. Reference Bench Mark must be set up for every cross-section as reference for later surveys. The shoreline monitoring shall be carried out every three (3) month during reclamation period and every six (6) month after project completed. The monitoring can be discontinued if the shoreline is found to be stable (3) years after completion of the project. 	

Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
		<ul style="list-style-type: none"> • Maintenance Dredging – If the monitoring results shows that the reclamation have significant impacts to the adjacent marine environment especially to the adjacent jetty and river, maintenance dredging shall be carried out. The periodic removal of sediments from existing river mouth and jetty shall be carried out to maintain an appropriate safe depth of water for navigation at the jetty area. 	
<u>Construction on Rehabilitated And Reclaimed Lands</u>	<ul style="list-style-type: none"> • Soil erosion & sedimentation • Spillage of hydrocarbon & chemical substances from machinery / equipment • Untreated sewage discharge into water bodies • Disposal or rubbish/construction debris into water bodies 	<ul style="list-style-type: none"> • Increase in turbidity and suspended solids due to earthworks, etc. this will lead to a reduction in light penetration thus affecting aquatic life – due to lower concentration of DO (dissolved oxygen) and increase of BOD (biological oxygen demand); • Gastroenteric micro organism in the sewage discharge can cause outbreaks of water borne diseases i.e. Cholera, typhoid, etc.; • Contamination of receiving waters due to untreated sewage; and • Increase sediment concentrations in coastal water thus affecting the aquatic life forms and generates noxious odour. <ul style="list-style-type: none"> • LD-P2M2 (land disturbance pollution prevention and mitigation measures) is to be in place; LD-P2M2 shall contain the following:- <ul style="list-style-type: none"> – Details of the phasing schedule, staging and sequencing; – Site meetings shall be conducted prior to start of any activity or land disturbing activity to be attended by Project Proponent, Project EO (Environmental Officer), Project contractors and sub-contractors to discuss in details all the relevant scope of work that have relevance to pollution prevention and mitigating measures; – Perimeter controls to be provided as per ESCP (Erosion and Sediment Control Plan); – ESCP to be in place before land disturbing activities are executed; and – Site inspection to be conducted on routine basis. – ESCP of LD-P2M2 shall be adopted; – Erect site hoarding and sediment basin/siltraps and tyre washing bay prior to commencement of earthworks; – Construct temporary drains/earth bunds along the boundaries prior to excavation. Channel flows to the stilling basin; – Construct temporary access to the intended land parcel. Clear the site along the access only; – Do not excavate at random, designate the site into planned zones of cut and fill for construction control; – Spot level checks frequently to avoid over excavation; – Filling to be done in layers not exceeding 450mm and properly compacted with roller compactor. Filled earth must be free from shrubs and debris; 	None



Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
		<ul style="list-style-type: none"> - Regularly check and maintain the sediment basin/silt-traps to ensure muddy water is not discharged to the existing water body; - Regularly clean and maintain the tyre wash basin and to ensure all earth moving vehicles go through the basin to have their tyres cleaned up before entering public road. To regularly clean the public road. - The site involved with the Proposed Project will be cleared to cater for earthworks and subsequently construction works. To minimize the land disturbing activity the following shall be in place:- - To implement the ESCP before, during and after the execution of the earthwork to prevent contamination and disturbance to the surrounding area and the existing river; - Minimizing Soil Erosion through controlling site clearing and excavation schedule; - To stockpile excavated topsoil for use in vegetation later on; - To maintain road access and to provide stabilization measure as well as tyre wash basin at strategic locations; - To provide temporary drainage system, including cut off drains to direct the run-off away from crossing the disturbed and unstable area; - To direct run-off from disturbed area to sediment control BMPs for treatment before discharging out to natural waterway; - To design site formations and slopes with proper stabilization measures and drainage system to channel surface run-off to sediment ponds for erosion control; - To design sediment control BMPs and provide adequate sediment ponds and/silt-traps at the strategic location within the site; - To provide adequate check dams along the steeper temporary drains to control flow velocity, hence sediment transportation; 	



Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
		<ul style="list-style-type: none"> - To prepare and provide site control, inspection and maintenance programme to be followed throughout the earthwork construction period and upon completion of earthwork for the protection of the site and public areas and interests; - To ensure surface run-off shall be properly diverted by constructing adequate permanent concrete channels to be discharged to the final discharge point and to avoid draining away of fine material due to inherent underground water after filling up of the depressions ,it is recommended that underground curtain wall be constructed across the original depression area near the outlet to filter and prevent loss of fine material which may result in possible settlement of the fill ground. - Soil eroded during land disturbance can wash away and contaminate stormwater if contaminated stormwater enters a drainage line or stormwater drainage system, it will eventually discharge into an adjacent waterway and pollute it; - Type of sediment controls suitable for a particular situation depend on the nature of the site, in terms of such factors as rainfall patterns, soil type and topography. These factors need to be taken into account when selecting appropriate controls and ensuring that designs are adequate; - Ways of minimising sediment run-off are to be take into consideration as follows:- - Reduce stormwater on the site If uncontaminated water enters part of the site that has been cleared, it will quickly pick up sediment and need to be treated. Additional water way also add to the erosion potential, increasing the risk of pollution. It is therefore desirable to divert clean stormwater away from those parts of the site where soil is to be exposed. This can be done by constructing intercept drains around the site while ensuring that the water discharging from such drains is disposed of without causing erosion. 	

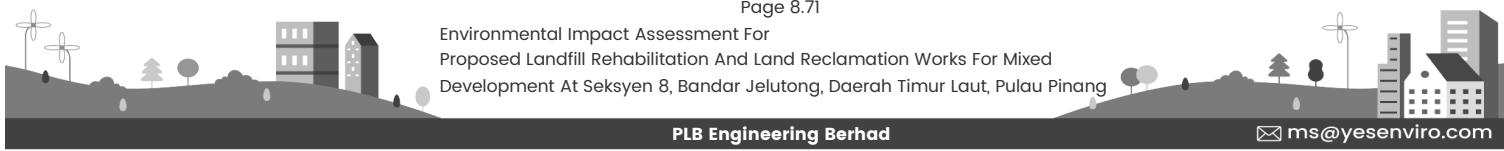


Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
		<p>Wherever possible, the new stormwater drainage system should be installed before any land disturbance activities commence. If possible on-site inlets should not be connected until the site has been stabilised. In this way, silt-laden stormwater cannot escape the site via this route and pollute surface waters. It will have to be treated onsite.</p> <ul style="list-style-type: none"> - There is a direct relationship between the velocity of water flowing over exposed soil and the rate of erosion. Installation of checkdam on the site to retard water flows is an effective measure to reduce erosion in areas where high water flows are expected. - To prevent scouring, drainage lines may need to be lined or velocity-reducing structures, such as crushed rock or geotextile placed in the drainage line. - ESCP of LD-P2M2 as outlined in details of this EIA report proposed to serve as working document for erosion and sediment controls in providing detailed design specifications for ESCP for implementation during engineering stage include:- - Most damage is done in the initial part of a storm, between 30 minutes and two hours into a storm, and during prolonged storms. - Designs of control structures, therefore, need to account for peak run-off flows. - Where it is not possible to schedule works to avoid times of the year when high rainfall is expected, then additional controls may be required, such as installing extra sediment traps or enhancing the capacity of existing controls. - Sediment ponds or basins hold sediment-contaminated run-off long enough for suspended sediment to settle out. Clarified water can then be discharged to river or stream; - Permanent structures that will provide ongoing sediment control, after a site has been rehabilitated, should be designed using a 50-year-recurrence interval or deem required; 	



Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
		<ul style="list-style-type: none"> - Temporary sediment control structures should be designed to take predicted flows, based on a one-in-two-year storm (two-year ARI with intensity for six hours) and sub-catchment areas, while contingency plans should be in place to account for extreme storm events. Use the Universal Soil Loss Equation at all time during implementation to estimate long-term average annual yield of sediment from small uniform sections of catchments. Run-off and sediment control structures should be designed and constructed to accept the expected peak flows and sediment loads; - Fine colloidal clays suspended in run-off require a long time to settle, often exceeding the economic or practical detention storage capacity especially in area where space is limited. Flocculants may need to be added to hasten settlement; - Adequate controls should be placed on all drainage lines. Silt loads should be treated as close to their source as possible using effective sediment traps such as geotextile fences; - Effectiveness of sediment control devices depends on an adequate inspection, maintenance and cleaning program. Inspections, particularly during storms, will show whether devices are operating effectively. Where a device proves inadequate, it should be quickly redesigned to make it effective; and - Some of the proposed BMP's as discussed above to be used for the individual plots to be developed are outlined. 	
<u>Operational Stage On Reclaimed Land</u>	<ul style="list-style-type: none"> • Operational failure of the sewage treatment plant (STP) • Stormwater runoff 	<ul style="list-style-type: none"> • Water pollution if sewage not treated properly; • Odour would occur if the system is not functioning properly; and • Surface runoff upon completion of the project that contains pollutants i.e. Oil, grease, rubbish, etc. may increase pollutant. <ul style="list-style-type: none"> • Permanent drains and on site storage shall be provided at site to cater for the increase in stormwater pollution load. Gross pollution trap will be provided at the final discharge manhole to trap all leaves and rubbish from entering the drain; • Engineering details shall be submitted to the JPS for approval; and • Ensure maintenance of drains, oil and silt trap conducted on a routine basis to ensure the continuous performance of these structures and to detect any potential areas of concern. 	<ul style="list-style-type: none"> • Generate of urban stormwater is residual

Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
		<ul style="list-style-type: none"> In line with the need to control sewage, sewage from the Proposed Project will be collected and conveyed to the proposed manhole which will convey sewage to the pumping station which will be upgraded (NPS) according to IWK's requirement conveying sewage to the regional sewage treatment plant at Jelutong; The sewage reticulation network shall be approved by SPAN or its agent, IWK; The reticulation network to be maintained accordingly by the service provider; and Discharges from the regional sewage treatment plant are to be monitored by service provider. 	
Air Quality			
Rehabilitation and Reclamation Works	<ul style="list-style-type: none"> Gaseous emission release during excavation work on Jelutong Landfill Compaction of reclamation area 	<ul style="list-style-type: none"> Capture residual gas includes methane which rehabilitation work is in progress by drilling perforated tubes down into the excavation layer depth and extended for continuation of monitoring at final platform level to collect residual gas which is piped to where gas flow is flared and is thus to be sampled regularly to determine concentration to ensure no harmful content; Open flaring consist of a pipe through which the gas is release as a means to regulate the gas flow; Each 2m layer of excavation during rehabilitation is thus to be installed with 150mm diameter perforated steel pipe for this purpose; After completion of landfill rehabilitation works and prior to any future top side development, there shall be no methane gas release; and Nonetheless, where there is still release of methane gas, additional pipes are to be installed and no future top site development shall commence until there is no further release of methane gas observed. <p>Reduce air quality and visibility; and</p> <p>Increase in sea traffic volume could result in increasing releases of hydrocarbon pollutants.</p>	<ul style="list-style-type: none"> Vehicles transporting fill manual to be registered with the relevant authorities. Smoke emission from sea vessels to be controlled with the use of proper fuel.
Construction on Reclaimed Land			
Fugitive dust dispersion and emission especially during dry weather.	<ul style="list-style-type: none"> Land disturbance, earthworks and excavation activities Vehicular and heavy machinery movements 	<ul style="list-style-type: none"> Reduce air quality and visibility; Adverse effect on health for certain concentrations and particulates size i.e. Bronchitis, cardiovascular problem, etc; and 	<ul style="list-style-type: none"> Carry out regular surface damping or wetting at affected public roads or access to construction site; Ensure construction vehicles moving in and out of the site do not cause deposition of soil or dust on public roads by providing wheel-wash troughs and hose at the ingress and egress points wheel wash facilities shall be designed with the following features:-

Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
<ul style="list-style-type: none"> Vehicular emissions from incomplete combustion of vehicles and machinery Materials handling Buildings construction (concreting works) 	<ul style="list-style-type: none"> Increase in traffic volume could increase the releases of hydrocarbon pollutants and other hazardous compounds. 	<ul style="list-style-type: none"> Temporary concrete hard standing of sufficient size to accommodate a standard sized vehicle, laid to fall with drainage and sump; High pressure water jets; and Practice strict compliance with speed restriction for all vehicles operating within the construction site or on access roads to the site. A limit of 30 Km/hr shall be imposed. Written notification is to be submitted to the DOE 30 days prior to the installation of the generator set at the construction site; and Best operating practices and routine maintenance of generator sets required to reduce emission at site. 	
<u>Operational Stage on Reclaimed Land</u> <ul style="list-style-type: none"> Exhaust emissions from vehicles 	<ul style="list-style-type: none"> Exhaust emissions from vehicles will increase due to increase of number of vehicles. 	<ul style="list-style-type: none"> Landscape road curbs and project boundary with suitable plants to act as filters; and The only way to reduce emission is to practice engineering controls. 	
Noise			
<u>Rehabilitation and Reclamation Works</u> <ul style="list-style-type: none"> Transport of fill material using barges 	<ul style="list-style-type: none"> Noise generation 	<ul style="list-style-type: none"> All lorries and vehicles to be used for the reclamation works are to be approved by the relevant authorities and with a valid permit; The engines are to be covered to reduce the sound pressure level from the engines; and Switch off the engine during filling works or when the vehicle are not moving or stationed at site. 	<ul style="list-style-type: none"> None
<u>Construction on Reclaimed Land</u> <ul style="list-style-type: none"> Heavy machinery and construction activities Vehicles movements on site Piling activities Buildings construction 	<ul style="list-style-type: none"> Increase noise levels due to frequent flow of heavy vehicles; Noise generated by piling and construction machinery/equipment can be harmful to the workers if precautions is not taken; Noise impact is expected to be insignificant and will only be temporary and confine to the construction period; and Uncontrolled piling activities will cause vibration levels which may cause structural damages. 	<ul style="list-style-type: none"> Temporary signs to indicate speed for vehicle entering and exiting the project site to be placed at strategic locations along main access road; and All contractors involved in transporting material to the project site as well as those involved in transporting waste out of the project site shall be made aware of the requirements in relation to controlling the speed of vehicles. Provide hoarding along the boundary of the site; Use less noisy construction method; Maintain plants and equipment that are used on site regularly; Shut down plant and equipment used intermittently between work periods or throttled down to a minimum; Oriентate plants and equipments known to emit noise strongly in one direction, so that the noise is directed away from the receivers; Use suitable noise suppression or abatement measures in proximity close to receptors such as provision of noise screen; 	<ul style="list-style-type: none"> Community noise will be residual

Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
	<ul style="list-style-type: none"> • 	<ul style="list-style-type: none"> • Use silencers or mufflers for all noisy plants and equipments used on site; • Site mobile plants and equipments as far away as possible from sensitive receivers; • Utilize material stockpiles and other structures effectively where practicable to screen receivers from noisy on site construction activities; • Impose workers spending long hours on site operating machinery and equipment to wear protective ear mufflers to prevent hearing impairment; • Limit construction activities to daytime hours only where ever possible; • Monitor noise levels at the boundary of the construction site; • Schedule deliveries to the site so that disruption to local amenity and traffic are minimized; • Advice local residents when unavoidable out of work hours will occur; and • Adhere to 55 dBA Leq noise pressure level during the daytime. 	
<u>Operational Stage on Reclaimed Land</u>	<ul style="list-style-type: none"> • Human activities 	<ul style="list-style-type: none"> • No significant impact is anticipated. 	<ul style="list-style-type: none"> • Landscaped road shoulder and project boundary with suitable vegetation to act as noise barrier.
Ecology/Habitats			
<u>Rehabilitation and Reclamation Works</u>	<ul style="list-style-type: none"> • Filling works 	<ul style="list-style-type: none"> • Impacts to Water Quality <p>If the control measures to address issues on water quality are implemented effectively impacts to the marine resources will be minimal. Nonetheless, as the Penang waters are used as a fishing ground in the vicinity the following additional mitigation measures are also suggested:-</p> <ul style="list-style-type: none"> • Conduct continuous monitoring of the water quality and aquatic life, preferably over at least on a monthly basis is recommended; and • Set up a special in house committee to look into any compensation to be made to the local fishermen for any loses in their activity as a result of the Proposed Project. For this purposes the Persatuan Nelayan shall be made aware of any complaints or compensation to be given to the fishermen for any loses faced by the fishermen due to the Proposed Project of which the flow chart to cater for such issues. • Mitigating measures for the marine fish impact are directly dependent on the mitigating measures for the water quality impact. Water quality will be monitored frequently during reclamation activities to ensure the sediment level is below the acceptable limit for fisheries; 	

Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
		<ul style="list-style-type: none"> Implementation of sand bund and double layered silt curtain with 70% effectiveness can significantly reduce the potential short-term impacts to the surrounding environment. Silt curtains are able to control the dispersion of turbid water by diverting the flow under the curtain, thereby minimizing turbidity in the upper layer of the water column outside the silt curtain; Sufficient site drainage will be installed to guarantee that wastewater and runoff from the construction site to ensure it is appropriately controlled and treated before being released into the surrounding water; Specific provisions for upgrading fishery infrastructure facilities such as maintenance and repair of the nearby fishing jetties should be conducted; and Awarding compensation directly to registered fishermen who are adversely affected by the reclamation area. 	
<u>Construction on Reclaimed Land</u> • Land clearing activity	• Increase of biomass generation	<ul style="list-style-type: none"> Adequate silt/sediment control measures should be implemented as outlined in the ESCP to minimize SS entering into the water body; and Disposal of clearing wastes should only be at approved disposal site. 	None
<u>Operational Stage on Reclaimed Land</u> • Sewage discharge	• Discharge of sewage or any wastes into the water body will affect the water quality hence its life form.	<p>Besides soil erosion and sediment which can affect water quality, sewage from the construction workforce and base camps can also affect water quality. Thus the mitigation measures to be in place to address sewage from the construction workforce are as follows:-</p> <ul style="list-style-type: none"> Provide a temporary sewage treatment facility in the form of septic tanks or mobile toilets with SPAN's approval for any construction camps provided at site; Routine desludging to be conducted for the septic tank or mobile toilet; and Any discharges from the septic tank is to comply with Standard B, Environmental Quality (Sewage Regulations) 2009. 	<ul style="list-style-type: none"> Increase generator of treated sewage will be residual
Human Environment			
<u>Rehabilitation And Reclamation Works</u> • Safety and health issues	• Safety issues during rehabilitation works	<ul style="list-style-type: none"> All provision of the Factories and Machinery (Building Operators and Works of Engineering Construction Safety) Regulations 1986 shall have to be followed accordingly in order to provide a safe working environment for he workers; Proper safety warning signs shall be erected; 	

Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
<ul style="list-style-type: none"> • Socio economy 	<ul style="list-style-type: none"> • Generate employment opportunities; • Safety and health of workers on site; • Nuisance and discomfort to surrounding environment due to noise, dust and fumes generation; and • Safety issues due to the movement and presence of barges in the area. • Impacts to fishermen due to lose in fishing area 	<ul style="list-style-type: none"> • All passageway or scaffold platform or other elevated working surface shall be kept free of slippery items to provide slip-safe footing; • Suitable eye protection equipment shall be provided for workers engaged in welding or cutting operations; • All workers working within areas where there is a danger of being struck by falling objects or materials shall be provided with a safety helmet; • Every worker required to work in water, wet concrete or other wet footing shall be provided with suitable waterproof boots; • Safety officers shall be appointed to ensure operations adhere to safe operating practices at all times. Safety Officers shall:- <ul style="list-style-type: none"> – Review safety aspects of construction activities; – Ensure conducive working environment; – Ensure that all personnel conform to strict codes of personal protection such as PPE, etc; and • Assist in the preparation, and upgrading of safe working procedures for all personnel. <p>The local fishermen in the vicinity may be affected with the reclamation works. Thus to address the issues faced by the fishermen the following shall be in place:-</p> <ul style="list-style-type: none"> • Continuous consultation with the local fishermen on any deleterious effect or losses is recommended and to establish causes and to enable remedial action to be taken at the earliest possible time; <ul style="list-style-type: none"> • A list of the registered fishermen staying in the area is to be obtained from the Department of Fishery or Persatuan Nelayan prior to any reclamation works for monitoring purposes; and • Facilitation with those facing loses as affected by the land reclamation activities is to be carried out. • Suitable compensation/ex-gratia shall be provided for the affected fishermen. Compensation/ex-gratia will be varied for different fishermen groups based on the severity of project impact to their fishing operations. The eligibility criteria for these benefits shall be studied and recommended by a subcommittee formed by LKIM, Department of Fisheries, local fishermen units and the State Government. 	



Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
		<ul style="list-style-type: none"> • Awareness and formal engagement Set up open discussion so that joint consent can be recorded . This two-way interaction should involve the consultation of the project proponent with LKIM, the fishermen's association (PNK) and representative from the affected fishing community. • The contents of public dialog should contain the following: <ul style="list-style-type: none"> - Detailed information and briefing describing the project components and its implementation processes. - Fishermen and their representative parties are given equal opportunity to express their concern and any relevant claims. - Stating the responsibility and commitment of project proponent to ensure the fishermen's well-being will be emphasize and the accepted report should be distributedto the LKIM as well as PNK for general references. - Scientific study on marine life at the project site - Scientifically prove for any disturbance for environment at particular places. Respondent request the detail description regarding the environmental impact of marine life and the extent to which the sandflow may occur. - The results of this report should be publicly disclosed to both the LKIM and the local fishermen's association (PNK's). - If the Project Proponent finds that there is a probability that the environmental damage will occur, then discussions with the LKIM should be made and the needs to convey such information to thePNKs. So that, some sort of mutual agreement can be agreed on from both parties. - Channeling complaints An appropriate complaints channel are needed so the official liaison person can convey critical messages or concerns effectively. The affairs of the proponents should be addressed to LKIM and should involve local PNK as it is the main source of reference by most fishermen. 	

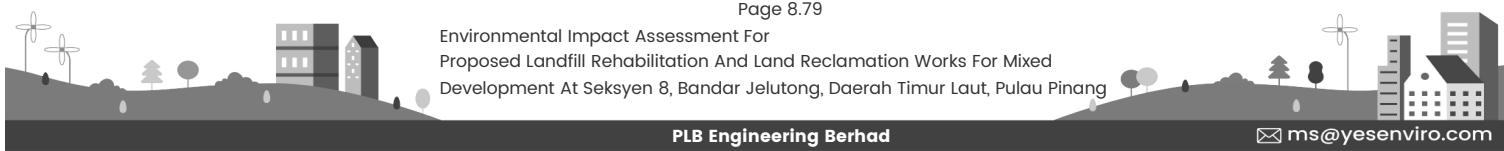


Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
		<ul style="list-style-type: none"> - Monitoring The reclamation operations should be carefully monitored by third party so that the shaded depth is in accordance with the permitted specifications to avoid severe environmental impacts and disturbance to marine habitats adjacent to the project site. Fishermen are concerned some of the popular fish species caught like stingray may be difficult to catch when the project is launched. • Safety issue The probability of a clash between barges and TSHD operations and fishermen's boats, especially during peak hours or during night hours. Buoy as a border marker can be installed at project boundary where it can be clearly seen during day and night. • Corporate Social Responsibility (CSR) by the project proponent. Such activity can enhance the well-being of the fishing community so that a good relationship can be formed. Some of the activities that can be conducted include the release of fish spawns at suitable areas identified by DOF, additional aquaculture farm or other suitable projects to be identified with DOF. 	
<u>Construction on Reclaimed Land</u>	<ul style="list-style-type: none"> • Safety and health 	<ul style="list-style-type: none"> • Generate employment opportunities; • Safety and health of workers on site; • Social and cultural problems, if foreign workers are employed; • Crime rate may increase; • Spread of communicable and parasitic diseases; • Increased demand on current infrastructures; and • Nuisance and discomfort to surrounding environment due to noise, dust and fumes generation. <ul style="list-style-type: none"> • Safety Officers shall be appointed to ensure that operators adhere to safe operating practices at all times. Safety Officers shall:- <ul style="list-style-type: none"> - Review safety aspects of construction activities; - Ensure all works are carried out according to procedures approved by relevant authorities; - Ensure conducive working environment; - Ensure that all personnel conform to strict codes of personal protection include PPE, etc; and - Assist in the preparation, and upgrading of safe working procedures for all personnel. • Hire workers, with preference to the local labor force shall be given; • Hire foreign workers that meet the requirements outlined by the relevant authorities; 	None



Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
	.	<ul style="list-style-type: none"> • Provide strict instructions to the foreign workers to ensure the well being of both foreign workers and local community; and • Monitor the movement of all foreign workers to ensure their safety as well as the safety of the local community. <p>The mitigation measures required during the construction stage to address potential traffic hazards are as follows:-</p> <ul style="list-style-type: none"> • Traffic to be controlled entering and exiting project site especially during earthworks by limiting 10 lorry trips per hour to minimize issues relating to traffic; • Transport of heavy equipment to be conducted during off peak traffic hours. (i.e between 9.30 am to 4.30 pm); • Transport heavy equipment during daytime only; • Vehicles transporting machinery to be serviced on a routine basis; • Employ experienced transport companies to transport heavy equipment to the site; • Lead car to be used to direct vehicle transporting heavy equipment; and • All equipment transported to the site to be secured safely during transport of equipment. • Implement an emergency response plan and proved service to the road users in case of accidents or abnormal situations. The emergency response plan is to be submitted to the related agencies prior to any works at site. <p>Safety at the construction site is to be ensured as follows:-</p> <ul style="list-style-type: none"> • All provision of the Factories and Machinery (Building Operators and Works of Engineering Construction Safety) Regulations 1986 shall have to be followed accordingly in order to provide a safe working environment for the workers; • Proper safety warning signs shall be erected; • All passageway or scaffold platform or other elevated working surface shall be kept free of slippery items to provide slip-safe footing; • Suitable eye protection equipment shall be provided for workers engaged in welding or cutting operations; • All workers working within areas where there is a danger of being struck by falling objects or materials shall be provided with a safety helmet; • Every worker required to work in water, wet concrete or other wet footing shall be provided with suitable waterproof boots; 	

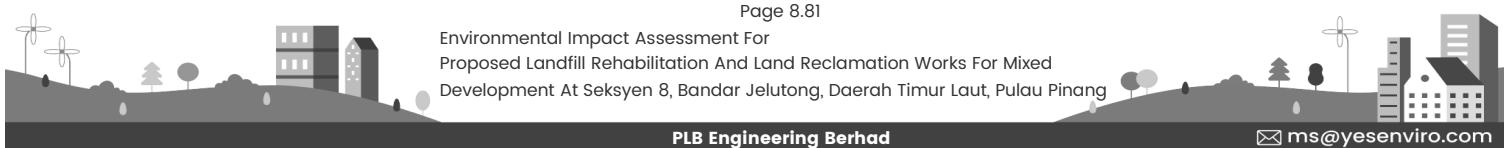


Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
		<ul style="list-style-type: none"> Safety officers shall be appointed to ensure operations adhere to safe operating practices at all times. Safety Officers shall:- <ul style="list-style-type: none"> Review safety aspects of construction activities; Ensure conducive working environment; Ensure that all personnel conform to strict codes of personal protection such as PPE, etc; and Assist in the preparation, and upgrading of safe working procedures for all personnel. 	
<u>Operational Stage on Reclaimed Land</u> • Transient population • Public safety and health	<ul style="list-style-type: none"> In-migration of families and transient population from various background; and Breeding of disease vectors due to poor maintenance of public utilities and infrastructure system. 	<ul style="list-style-type: none"> Regular maintenance of drainage, retention pond, waste management within the project site; and Security control to prevent unauthorized access to the restricted or prohibited area. 	Change in demographic profile
Transportation and Sea Traffic			
<u>Rehabilitation and Reclamation Works</u> • Sea going vessels	<ul style="list-style-type: none"> Traffic from sand source and reclamation activities. 	<ul style="list-style-type: none"> Fleet operators transporting material to the site are to be controlled stringently. Amongst the control include the following:- <ul style="list-style-type: none"> Only reputable fleet operators to be given tenders to transport the fill material; Inventory of the lorries used by the fleet operators, names of license drivers and permits from SPAD are to be provided to main contractor supervising the reclamation works to monitor performance of the fleet operators; and Penalty to be imposed on the fleet operators for any summonses issued by JPJ for offenses conducted during the transport of fill material to the site and vice versa. Control the speed of vehicles moving at the temporary access road; All vehicles transporting soil are to be covered prior to moving on public road; Restrict the time for vehicles transporting soil to the site to cater for off peak hours, namely from 9.00 am to 5.00 pm; and Flagmen is to be station so as to warn the public that lorries are moving in and out at Persiaran Bayan Indah towards and from the temporary access road and the reclamation site. 	None

**Table 8.15 (Continue)**

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
		<ul style="list-style-type: none"> • Identify the routes to be used in transporting the fill material to the reclamation site if the source is from the sea. Mark these routes on the Admiralty Chart Datum and obtained the necessary approvals from the Harbor Master prior to notification in the Mariner's Notification or other notification channels; • Close liaison will have to be maintained with the port authority in respect of drawing up the schedule of vessel movements to chart hydraulic fill to the reclaimed area; • Provide adequate signs, safety lights and navigational markers at the dredging site according to the Convention on the International Regulation for Prevention of Collision at Sea 1972 and the Merchant Shipping Ordinance 1952 if the fill material is from the sea; • Avoid the creation of material transfer basins as they can create navigation interferences with local fishing crafts; • Reclamation works to be conducted from 8.00 am to 6.00 pm only; • Install a global positioning system on the barge and submit recordings of the barge on a routine basis to the relevant authority if the fill material from the sea; • Surveillance monitoring of sea traffic plying the area shall also be conducted; and • Identify the routes to be used in transporting the fill material in total enclosure to the reclamation site. Mark these routes on the Admiralty Chart Datum and obtain the necessary approvals from the Harbor Master prior to notification in the Mariner's Notification or other notification channels. Close liaison will have to be maintained with the port authority in respect of drawing up the schedule of vessel movements to chart hydraulic fill to the reclaimed area. • Passage From Sand Source Area To Reclamation Site <ul style="list-style-type: none"> – Sand carriers en-route to the Jelutong Landfill reclamation site may access it via the northern channel of Penang Port. Licensed harbour pilots are required to guide these sand carriers when navigating within the mandatory pilotage area of Penang Port. Sand carriers with a draft of less than 7 meters should remain outside the dredged channel at all times. • North Channel – In Bound <ul style="list-style-type: none"> – The North Channel is entered at Latitude 05°35'N and Longitude 100°13'E, about 1.5 nautical miles southeast of the Fairway Buoy. 	

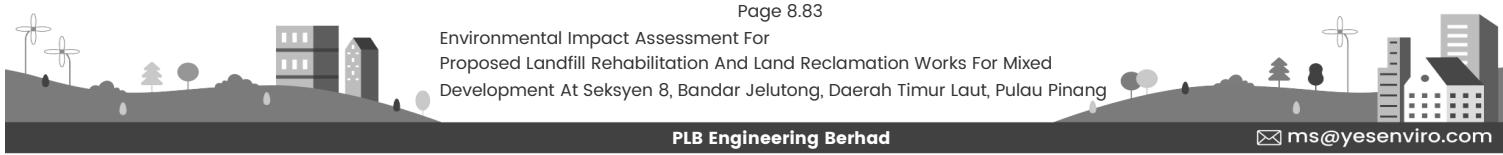




Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
		<ul style="list-style-type: none"> - It is marked by seven (7) pairs of IALA Region A lateral buoys. A maximum of 10% of draught as under keel clearance is needed at all times during the passage whilst transiting the channel. For deep draught vessels, due allowance for course alteration into the channel at buoy no. 1 should be given so as not to arrive at too acute an angle. - Between buoy no. 1 and buoy no. 2, vessel will experience a bodily drift to the north or south depending on the prevailing tidal condition. This drift is especially pronounced during periods of spring tides. Upon reaching buoy no. 1, the course is 127°T thence course is altered to 145°T at buoy no. 5 to pass between no. 6 pair of buoys. Vessel drawing more than 10m draught are advised to pass through buoy no. 7 before leaving the channel. Inbound vessels with a draught of less than 7m may proceed without using the channel by staying close to the buoys. An alternative route for shallow draught vessels, upon reaching buoy no. 5 is to alter course to 160°T, keeping buoy no. 6 and buoy no. 7 to port. • North Channel – Out Bound <ul style="list-style-type: none"> - Russian Wreck Buoy should be kept to port and upon reaching it, course is altered to 340°T direct to buoy No. 5, keeping Tokong Buoy and buoy No. 6 to starboard. For deep draft vessels, it is advisable to do dog leg upon reaching Tokong Buoys and steer towards buoy No. 6 to enter the channel. • The Project Proponent should employ a competent Marine Traffic Supervisor responsible for day-to-day supervision of marine operations, including traffic control, liaising with maritime authorities, and responding to marine-related emergencies. The Marine Traffic Supervisor should, unless otherwise specified by the Marine Department, hold a minimum qualification of Watchkeeping Officer <3000 GT Near Coastal; • Prior to mobilization to the project site, sand carriers or barges should undergo inspection by the Marine Traffic Supervisor; • It is preferable for barges to be registered under the Malaysian Flag and classed by members of the IACS (International Association of Classification Societies); • Crew members must possess appropriate certification and competence in accordance with STCW (Standard Training and Certification Watchkeeping) regulations; 	

Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
		<ul style="list-style-type: none"> The Captain of the vessel should be proficient in English; Sand carriers or barges should be fully equipped with safety and pollution prevention equipment as specified in the SOLAS (Safety of Life at Sea) and the MARPOL (International Convention for the Prevention of Pollution from Ships) regulations, as applicable; and Port State Control inspections are to be conducted upon arrival at the project site to ensure compliance with regulations and safety standards. 	
<u>Construction on Reclaimed Land</u> <ul style="list-style-type: none"> Increased in traffic volume Increased in vehicular emissions 	<ul style="list-style-type: none"> Increase in traffic volume from construction transporting vehicles; Increase risk of accidents; Deterioration of local conditions; and Traffic congestion and inconvenience to other road users. 	<p>In order to reduce annoyance to the road users during the construction stage, the contractor has to carry out the traffic management study and propose an integrated and comprehensive Traffic Management Plan is to be in place. This is to be expedited during the construction period, which may include the followings, but not least:-</p> <ul style="list-style-type: none"> Traffic management plan at selected sectors of the alignment: <ul style="list-style-type: none"> Manning and control of traffics at the main access roads to the roadside premises; Providing alternative roads or service roads; and Rerouting of local traffic movements if necessary. Accessibility to Respective Premises <ul style="list-style-type: none"> Providing alternative lanes for vehicles to egress or ingress into business premises or kiosks or parking areas in front of shopping areas. The provision of alternative lane shall be carried out before any major construction works are carried out. Implement an emergency response plan and proved service to the road users in case of accidents or abnormal situations. The emergency response plan is to be submitted to the related agencies prior to any works at site. 	None
<u>Operational Stage on Reclaimed Land</u> <ul style="list-style-type: none"> Increased in localized traffic volume Increased in vehicular emissions 	<ul style="list-style-type: none"> Increased localized traffic volume due to increase in activities; Increased risk of accidents to public road user; and Increased vehicular emissions into the atmosphere. 	<ul style="list-style-type: none"> Modification/upgrading of existing junctions as recommended by Traffic Consultants. Provision of adequate road safety signages; Plant roadside trees for filtration of vehicular dust; and The only way to reduce exhaust emission is to practice engineering controls. 	<ul style="list-style-type: none"> Increase traffic and emission from mobile sources will be residual

Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
Waste Management			
<u>Rehabilitation and Reclamation Works</u>			
<ul style="list-style-type: none"> • Filling works 	<ul style="list-style-type: none"> • Unsuitable fill material will cause poor filling and contamination. 	<ul style="list-style-type: none"> • Only suitable fill material sourced from approved sand dredging sites shall be used as fill material for the reclamation works. 	
<u>Construction on Reclaimed Land</u>			
<ul style="list-style-type: none"> • Construction wastes • Domestic wastes from workers camps • Generator of scheduled waste 	<ul style="list-style-type: none"> • Potential drainage blockage from the improper disposal of solid wastes. • Improper management of domestic wastes from worker camps could promote disease vector breeding and cause health hazards. 	<ul style="list-style-type: none"> • Waste management plan is to be formulated to be used to manage the biomass and wastes at site; • Site clearing to be conducted only at identified areas for the Proposed Project; • All biomass cleared from site shall be disposed off site at approved landfill site with approval from MBPP; • Waste management plan is to be implemented; • Open burning is prohibited on site; • Provide adequate garbage bins for the site office and construction camps; • Dispose solid wastes regularly or; • Appoint a licensed vendor to dispose solid wastes; and • Practice good housekeeping at site. • Any excess material, PVC trimmings, pipes etc to be disposed off site at approved sites; • Scheduled waste such as used oil to be collected and stored in containers. These containers shall be coded with label such as Code SW305 for spent lubricant oil, Code SW306 for spent hydraulic oil, SW409 for contaminated drums and SW417 for spent paint according to the Environmental Quality (Scheduled Wastes) Regulation 2005. All scheduled wastes are to be disposed at DOE's licensed facilities and an inventory and notification via the DOE's electronic scheduled waste inform system (eSWIS) shall be in place; • Good housekeeping practices are to be practiced at site; • All bins, containments, holes etc that can contain stagnant water is to be checked on a daily basis so that they are kept dry and not be a mosquito breeding area; • MBPP is to be informed and approval obtained during earthwork stage pertaining to the disposal site for any excess earth generated from the earthwork activities; and • Waste minimization is to be introduced at site to minimise the waste load discharged to the environment; 	None



Table 8.15 (Continue)

Environment Component / Project Activities	Potential Impacts	Pollution Prevention And Mitigating Measures	Residual Impact
		<ul style="list-style-type: none"> • When choosing between waste minimisation options, the following hierarchy for waste management is preferred: <ul style="list-style-type: none"> • waste avoidance and/or reduction • reuse • recycling • Diverting the waste stream in these ways means that waste treatment and waste disposal options can be reduced; • Construction sites should pursue this hierarchy and seek out waste reduction opportunities; • Identify opportunities it is necessary to consider all aspects of the project and the wastes it generates; • Waste can be minimised by using improved technology, recycled or reused on-site, or by making purchasing decisions that favour recycled products; • Wherever possible, include performance measures and targets for reduction, reuse and recycling options in the environmental management plan; • Waste minimisation opportunities include: <ul style="list-style-type: none"> – obtaining construction materials, paints, lubricants and other liquids in reusable packaging or containers – using noise barriers made from recycled materials; – using overburden to construct temporary noise barriers; – using contaminated water out of sediment trap for dust suppression and irrigating adjacent vegetated land; – sending waste concrete to a concrete recycler instead of landfill; and – segregating and recycling solid wastes generated by construction activities, offices and mess-rooms – collecting lubricating oil from the construction vehicle fleet and sending it to a recycler. 	None
<u>Operation Stage on Reclaimed Land</u>	<ul style="list-style-type: none"> • Domestic wastes 	<ul style="list-style-type: none"> • Increase generation of solid wastes within the region; • Inefficient solid wastes handling can cause odour, visual aesthetic, infestation and human health problems; and • Improper solid waste management could also cause surface water contamination. 	<ul style="list-style-type: none"> • To ease solid waste collection and disposal, a central refuse collection area will be provided meeting MBPP's standard requirements; and • All solid wastes will be disposed by the service provider on a routine basis at the MBPP's approved landfill site. <ul style="list-style-type: none"> • Increase generator of domestic wastes will be residual

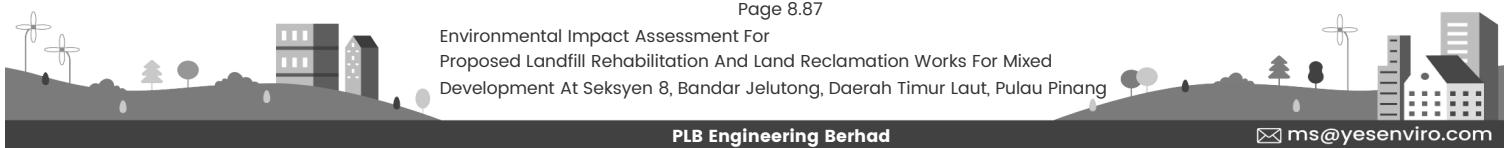


Table 8.16
Abandonment Plan

Stage	Impacts	Mitigation Measures
Planning Stage	<ul style="list-style-type: none"> • Cost only incurred for undertaking the various studies. 	<ul style="list-style-type: none"> • If abandonment is at the planning stage minimal measures are required as the costs that will be incurred is to the Project Proponent. • The costs that will be incurred is in relation to the time spent on planning including the costs for conducting the various studies and investigations. • Nevertheless, all report and studies conducted during the planning stage is to be kept properly to be reused when the project is reactivated in the future. • The Project Proponent should also inform all the relevant parties especially the local authorities and the related government agencies that the project is abandoned. • All approvals obtained for the Proposed Project in the planning stage is to be kept safely and in proper order so that if the need arises the documents can be reused within the allowable period of validity. • If the project stays idle for more than 2 years, new studies will have to be undertaken including the EIA study.
Rehabilitation & Reclamation Stage	<ul style="list-style-type: none"> • Scenario 1 • Abandonment plan for incomplete reclamation works during sand filling before ground improvement works • Scenario 2: • Abandonment plan for incomplete reclamation works during installation of prefabricated vertical drain (PVD). • Scenario 3: • Abandonment plan for incomplete reclamation works upon the completion of necessary ground improvement works before rip-rap revetment construction. 	<ul style="list-style-type: none"> • The sand fills shall be trimmed to gentler slope with slope gradient of not steeper than 1V:12H for slope stability of partial reclaimed land • The sand containment bund shall be trimmed to gentler slope with slope gradient of not steeper than 1V:12H for slope stability of reclaimed land. • The sand fills above water level shall be trimmed to gentler slope with slope gradient of not steeper than 1V:5H. • The sand containment bund shall be trimmed to gentler slope with slope gradient not steeper than 1V:12H for slope stability of reclaimed land.