

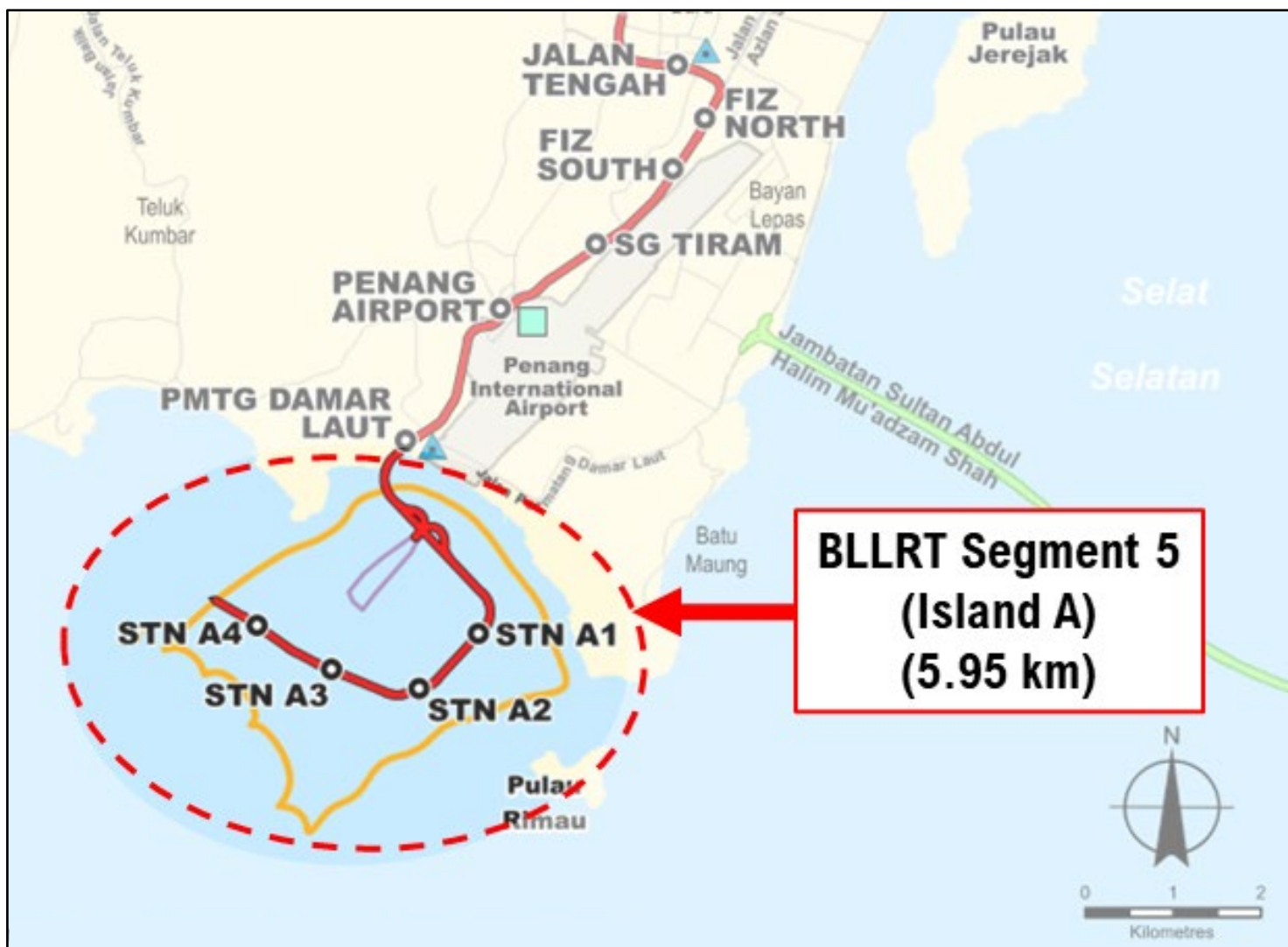
Bayan Lepas LRT (BLLRT) Project

Segment 5 (Island A)

Second Schedule Environmental Impact Assessment

EXECUTIVE SUMMARY

This Environmental Impact Assessment (EIA) report was prepared for the Bayan Lepas Light Rail Transit (LRT) Segment 5 on the Penang South Reclamation (PSR) Island A (hereinafter referred to as the “Project” or “Bayan Lepas LRT Segment 5 (Island A)”). The Project involves the construction of a **5.95 km elevated light rail transit line** continuing from Permatang Damar Laut and ending at proposed Station A4 on proposed Penang South Reclamation (PSR) Island A, on the southern coast of Penang Island. The Project comprises of four (4) stations on Island A, and a depot that serves the entire Bayan Lepas LRT system.



Project Proponent



Penang State
Government

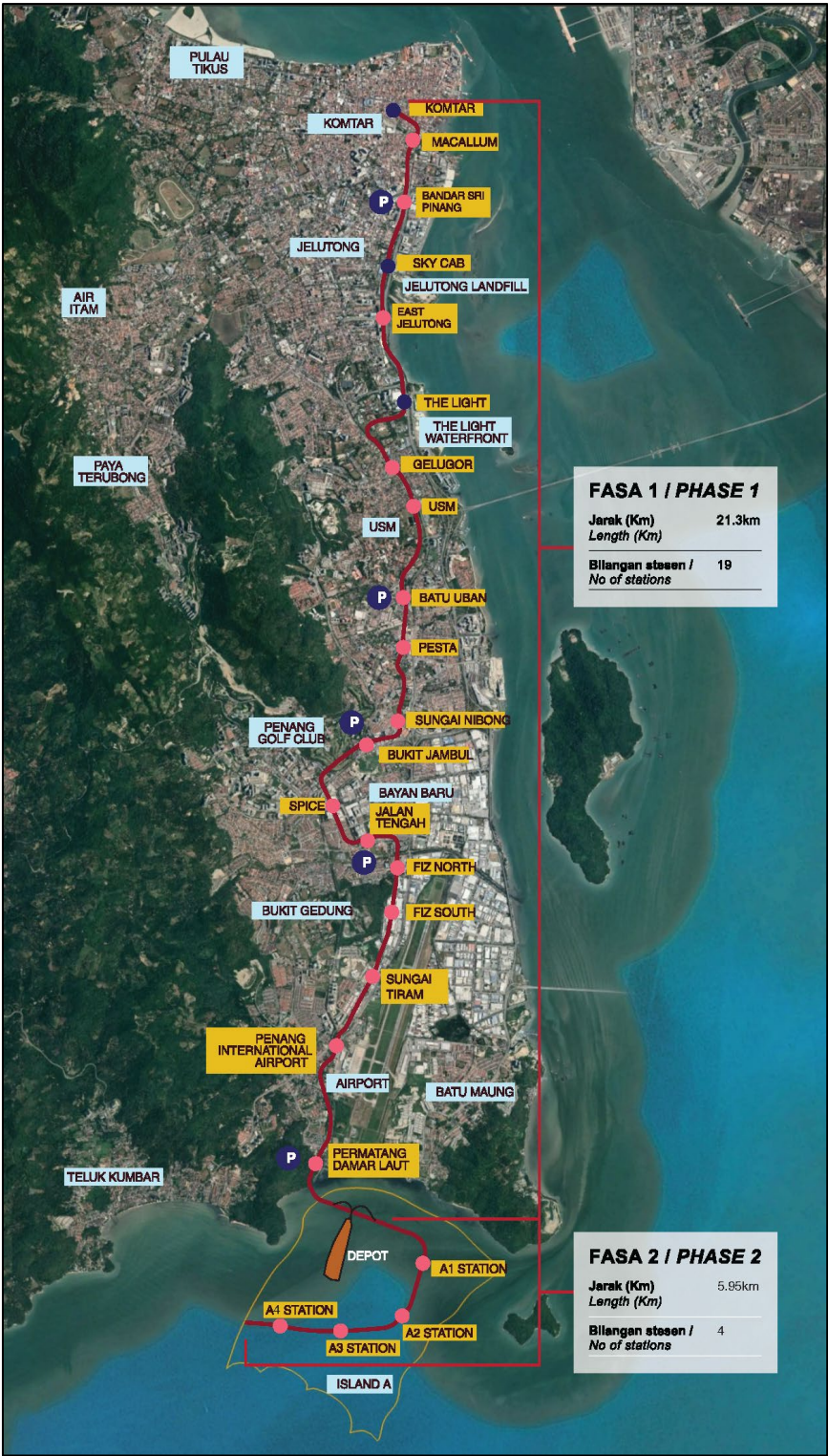
EIA Consultant

aurecon

Aurecon Lestari Sdn Bhd

PENANG TRANSPORT MASTER PLAN (PTMP)

- A comprehensive strategy of improving the transport system in Pulau Pinang emphasizing on increase in public transit availability, connectivity and integration, to overcome traffic congestion issues.
- Bayan Lepas LRT identified in the PTMP as a flagship project to spearhead the overall PTMP. Also included in the Rancangan Struktur Negeri Pulau Pinang 2030.



Connectivity Between PSR Island A and Penang Island

- Allows rapid, fluid movement of commuters throughout the entire Penang Island
- Increases interconnectivity of destinations on the PSR Island A and provide better integration between existing public transit and future rail lines.
- Alleviates road traffic congestion problems through a comprehensive, interconnected, reliable and safe LRT service on PSR Island A

Depot for the entire Bayan Lepas LRT system

- The entire BLLRT system relies on the depot on PSR Island A
- Although other options were evaluated, the depot option on PSR Island A is the most optimally located and designed (least land acquisition, social and environmental impacts).
- Other depot options in other locations would result in greater social and environmental impacts.

PROJECT OPTIONS

Various Project modal and alignment options were identified and evaluated in the process of selecting the preferred alignment and transport mode for the Project

MODAL OPTION

Four modal options were considered for the Bayan Lepas Light Rail Transit (LRT) corridor. LRT remains the preferred option because:

- LRT can fulfill ridership demand (15,999 persons per hour per direction (PPHPD) by 2057), achieving 40% public transport mode share target by 2030
- Dedicated elevated track avoiding conflicts with roads
- Medium to high capacity compared to AGT and Maglev which are suited for low to medium passenger flows
- Proven technology with high reliability and low maintenance for steel wheels

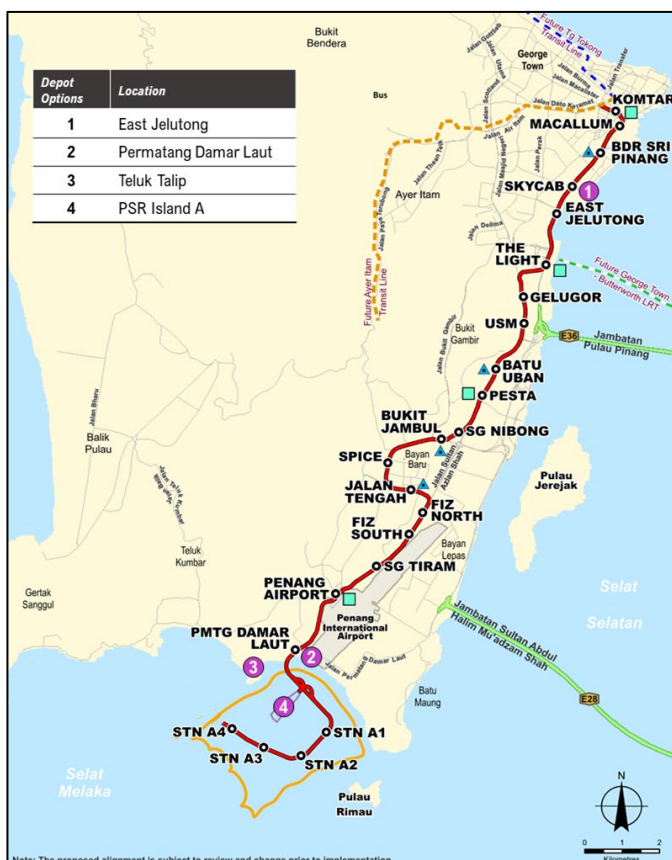
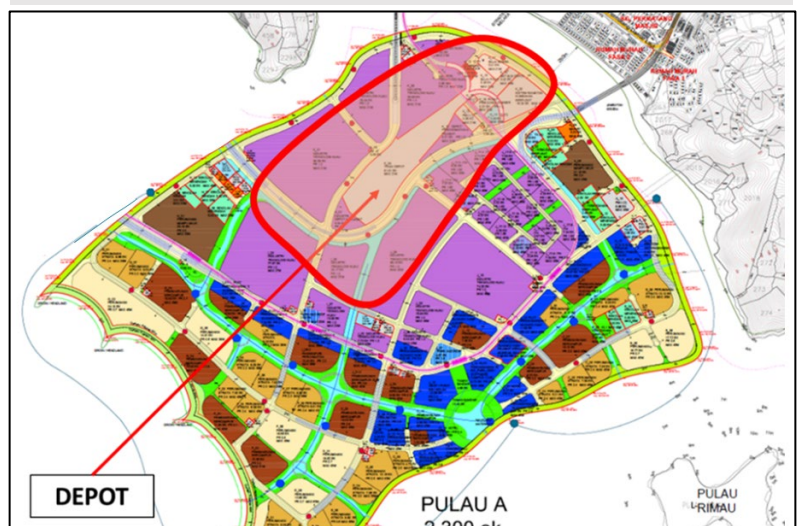
	Typical LRT	Typical Tram	AGT	Maglev
Typical Capacity (PPHPD)	18,500	4,500	15,800	10,800
Average Speed (km/h)	35	20	35	35
Journey Time (minutes)*	40	70	40	40
Headway (minutes)	2	4	2.5	2
No. of cars per train ("veh")	4	2	6	3
No. of pax per car @4.8pax/sq m	160	160	110	121 - 166

ALIGNMENT OPTION

The Bayan Lepas LRT Segment 5 (Island A) was designed together with the overall topside development of the PSR Island A. This allows for designation of compatible land uses along the LRT alignment and around the depot, and better integration of transit system with the overall layout of PSR Island A.



- PSR Island A is the preferred location for the depot at it has the **least** social impacts, land acquisition, earthworks, and zoning issues compared to other potential depot locations.
- Land use surrounding the depot is predominantly industrial, thus it is compatible with the depot.



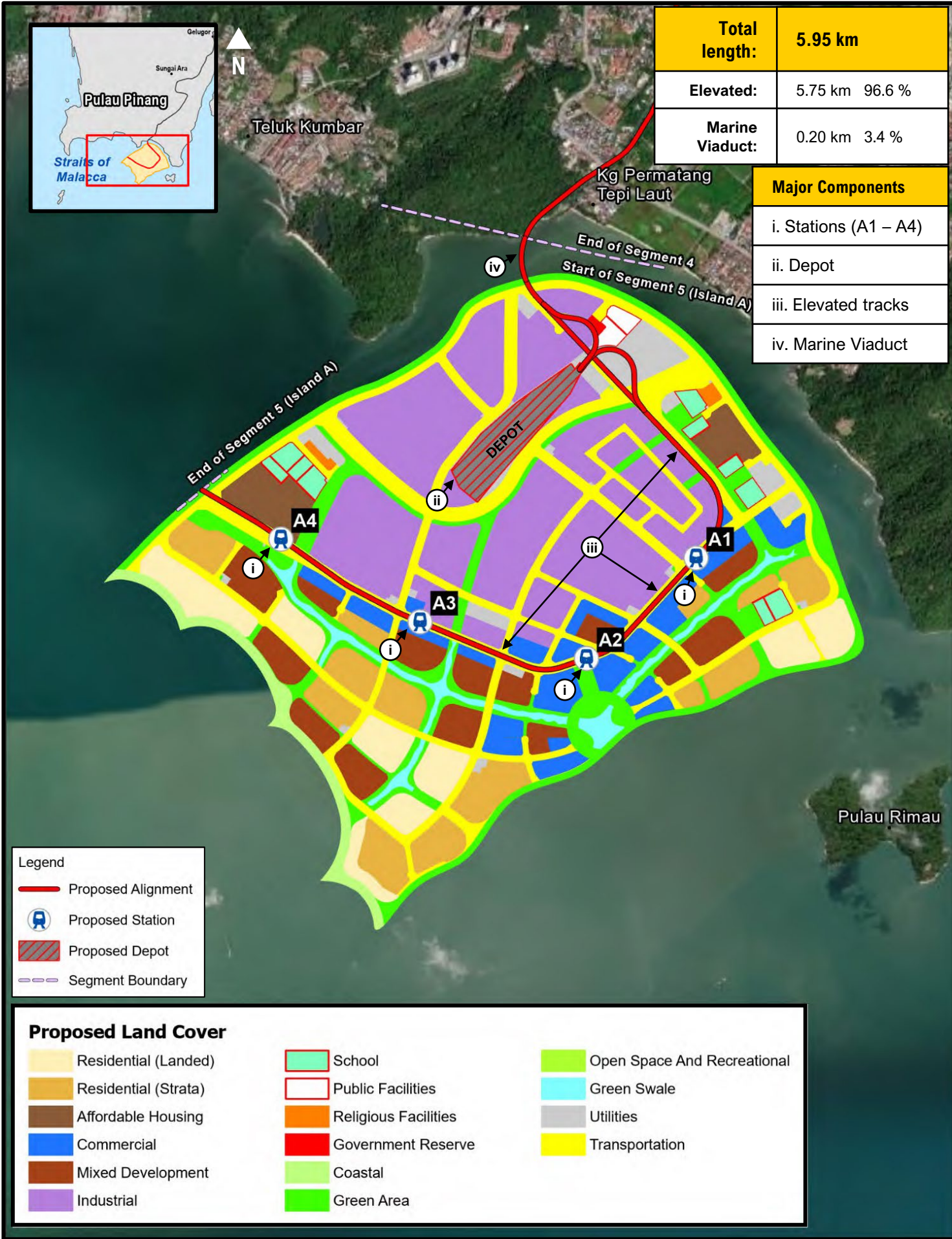
DEPOT OPTION

Four (4) potential sites for the BLLRT Depot were assessed:

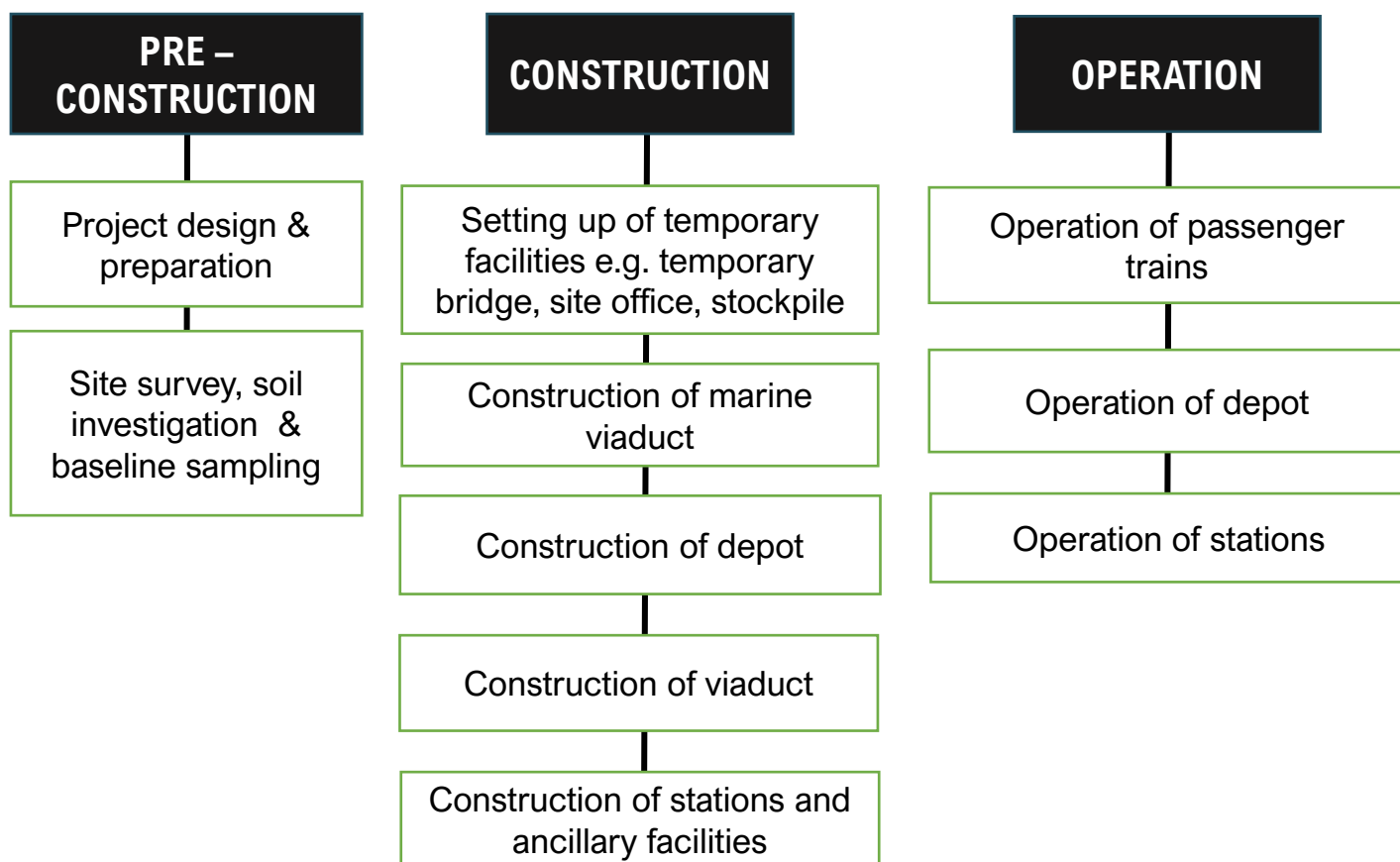
- East Jelutong
- Permatang Damar Laut
- Teluk Talip
- PSR Island A

PROJECT DESCRIPTION

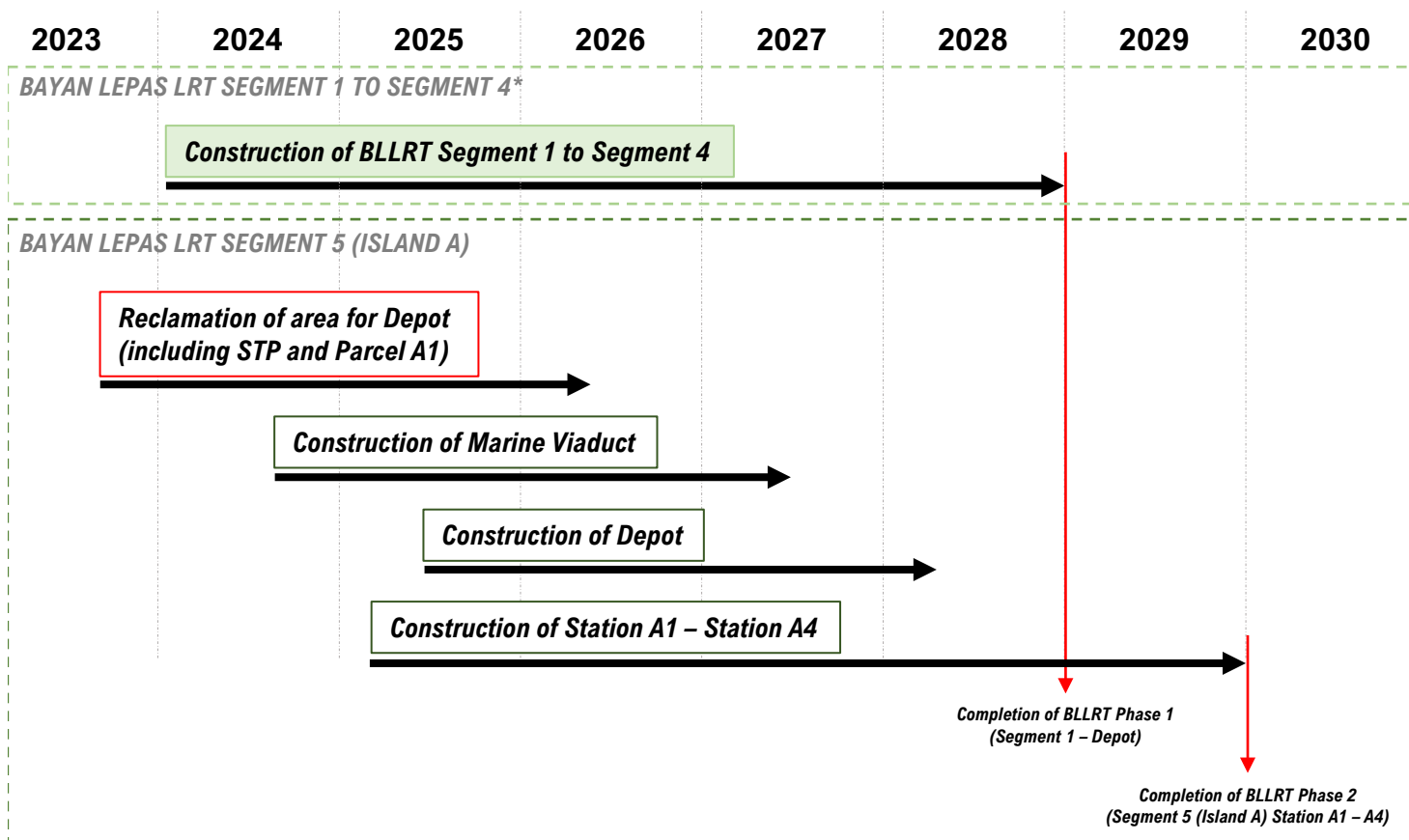
The 5.95 km Bayan Lepas LRT Segment 5 (Island A) alignment starts from Permatang Damar Laut coastline to the PSR Island A through a marine viaduct, past the depot, then traverses through PSR Island A and ends at proposed Station A4.



PRINCIPAL PROJECT ACTIVITIES



PROJECT TIMELINE

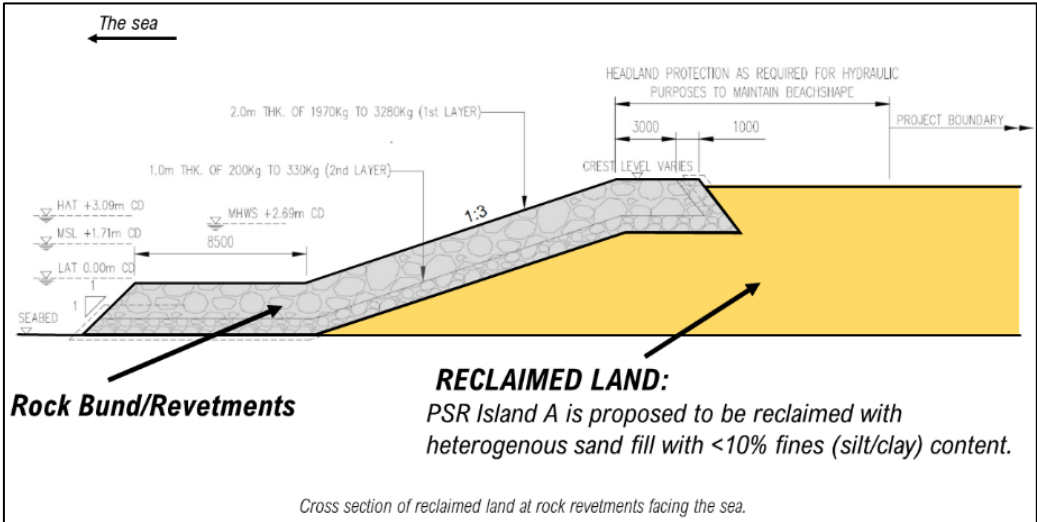
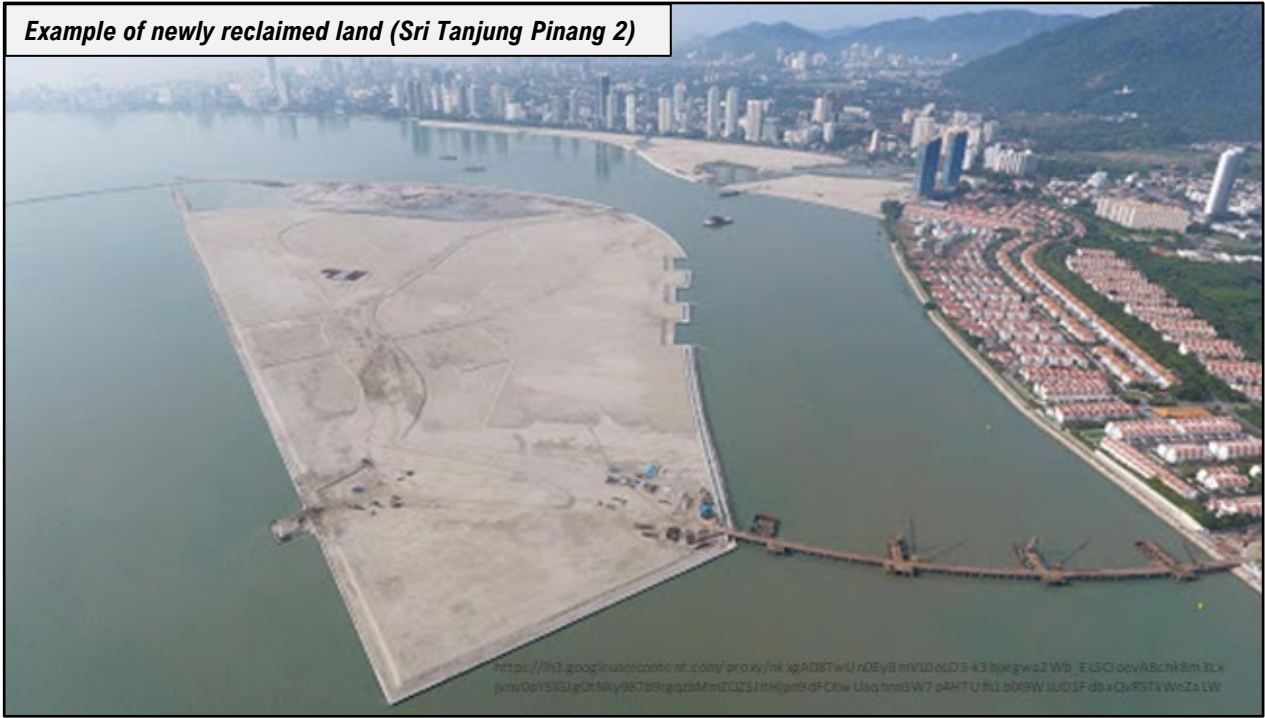


*EIA approved in February 2020

PHYSICAL ENVIRONMENT

The **BLLRT Segment 5 (Island A)** will be sited on the future reclaimed PSR Island A. At the time of this EIA submission, the PSR Island A reclamation is on-going. The following assumptions form the basis for this EIA:

- i. BLLRT Segment 5 (Island A) will be one of the first infrastructure to be constructed on the PSR Island A after reclamation is completed.
- ii. During construction stage, the existing environment along the BLLRT corridor will be vacant (newly reclaimed) land, or construction sites of topside common infrastructure concurrently under construction (e.g., roads, drains, utilities). Thus there will not be residents on Island A during construction of the depot, stations and viaduct for BLLRT Segment 5 (Island A).
- iii. During BLLRT Segment 5 (Island A) operation stage, the existing environment and sensitive receptors are assumed to be the land use zoning proposed in the PSR Island A topside master plan.



TOPOGRAPHY

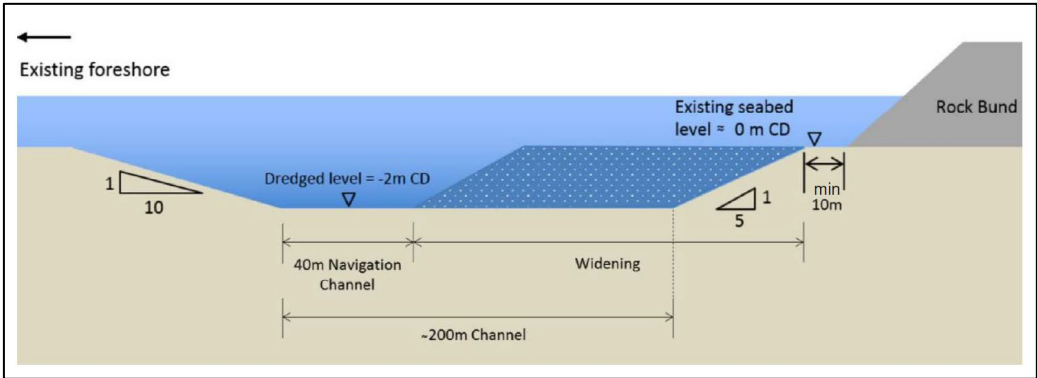
Gently sloping from the island's core towards coastlines.
Gradient allows water to drain through waterways and drainage system to the outlets around the island

Platform Level

Lowest* platform level on PSR Island A:
4.7 m CD = 2.8 m a.s.l

**Determination of minimum platform level:*

3.09 m CD (Highest astronomical tide (HAT))
+ 0.6 m (storm surge with 100-year return period)
+ 0.63 m (projected sea level rise to year 2100 (climate change factor))



GEOLOGY



17 Boreholes drilled at proposed PSR Island A.

Termination depths between 30 m – 60 m b.g.l.

Topsoil layer comprise of marine soft clayey soil, medium stiff/medium dense soil, and hard/dense soil.

Bedrock encountered between 27 – 38 m, up to 43 m below seabed.

Bedrock inferred to be extension of **Batu Maung Granite**.

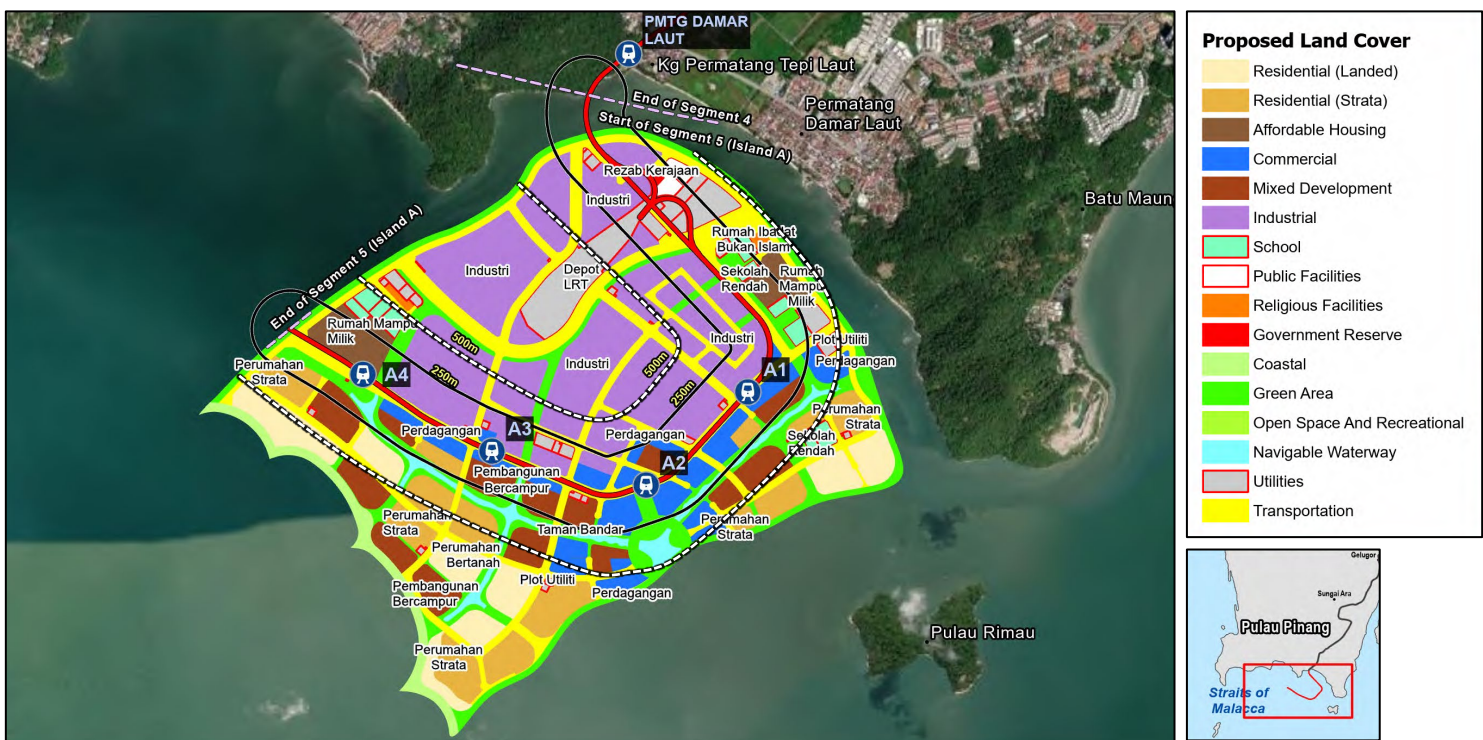
SPT-N > 50 encountered between 21 m – 43.50 m b.g.l.

5% g Peak Ground Acceleration (PGA) Value across Penang island and PSR Island A.

5% g PGA ≈ V (Mercalli Scale) where:
Perceived shaking = Moderate,
Potential damage = Very light



LAND USE



The primary land use categories of the PSR Island A topside development are infrastructure and utilities (25.16 %), industry (24.63 %), open spaces and recreational areas (17.64 %), residential (16.88 %), mixed developments (7.14 %), commercial (6.07 %) and public amenities (2.5 %). Land use adjacent to the BLLRT alignment is mostly industrial and commercial.

ENVIRONMENTAL QUALITY



9 Marine water quality sampling points (MWQ)
Within and surrounding Project site.
One DOE Marine Water Quality Station (MMPR004) at Pulau Rimau.

2 Air quality, one (1) noise and vibration sampling points
Kg. Permatang Tepi Laut (ANV1) and Permatang Damar Laut (A3)

Baseline air quality and noise are below guideline limits.

Overall quality:	66 (moderate) to 96 (excellent)
Highest value:	MWQ1 (surface) (ebbing) MWQ4 (bottom) (ebbing)
Lowest value:	MWQ7 (bottom) (ebbing) MWQ7 (surface) (flooding)
DO level:	41 – 7.2 mg/L (Class III MMWQS)
BOD level:	Below detection limit
COD level:	Highest at 12 mg/L at MWQ7 and MWQ8
Turbidity:	0.4 – 24.1 NTU
TSS level:	Below detection limit (<1 mg/L) – 60 mg/L Class III MMWQS for all stations

	ANV1	A3	MAAQS (Standard 2020)
PM ₁₀ (µg/m ³)	53	50	100
PM _{2.5} (µg/m ³)	29	26	35

Parameter	ANV1	Permissible sound level
LA _{eq} Day time (dBA) 7:00 a.m. – 10:00 p.m.	57.4	65
LA _{eq} Nighttime (dBA) 10:00 p.m. – 7:00 a.m.	46.1	60

WASTE MANAGEMENT



General flow of solid waste management by Majlis Bandaraya Pulau Pinang (MBPP)

SOCIO-ECONOMICS

Population in Daerah Barat Daya, Pulau Pinang

197,131 (2010)



237,735 (2020)

20.6% increase in 10 years

13.7% of total Pulau Pinang population

Nearby Settlements along the Alignment

Residential areas within 500 m of the BLLRT Segment 5 (Island A) alignment are found at:

- | <ul style="list-style-type: none"> • Kg. Permatang Tepi Laut: Fishermen community are most concentrated at Kg. Permatang Tepi Laut. • Kg. Binjai • Permatang Damar Laut | <table border="1"> <thead> <tr> <th>Fishermen Association</th> <th>No of Fishermen</th> <th>Vessel owners</th> <th>Vessel crews</th> </tr> </thead> <tbody> <tr> <td>1. Permatang Damar Laut</td> <td>10</td> <td>10</td> <td>10</td> </tr> <tr> <td>2. Kg. Binjai</td> <td>10</td> <td>10</td> <td>10</td> </tr> <tr> <td>3. Kg. Permatang Tepi Laut</td> <td>10</td> <td>10</td> <td>10</td> </tr> </tbody> </table> | Fishermen Association | No of Fishermen | Vessel owners | Vessel crews | 1. Permatang Damar Laut | 10 | 10 | 10 | 2. Kg. Binjai | 10 | 10 | 10 | 3. Kg. Permatang Tepi Laut | 10 | 10 | 10 |
|---|--|-----------------------|-----------------|---------------|--------------|-------------------------|----|----|----|---------------|----|----|----|----------------------------|----|----|----|
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| 2. Kg. Binjai | 10 | 10 | 10 | | | | | | | | | | | | | | |
| 3. Kg. Permatang Tepi Laut | 10 | 10 | 10 | | | | | | | | | | | | | | |

Fishermen Association	No of Fishermen	Vessel owners	Vessel crews
Permatang Damar Laut	76	39	115

Social Perception towards Project

Public Perception Survey

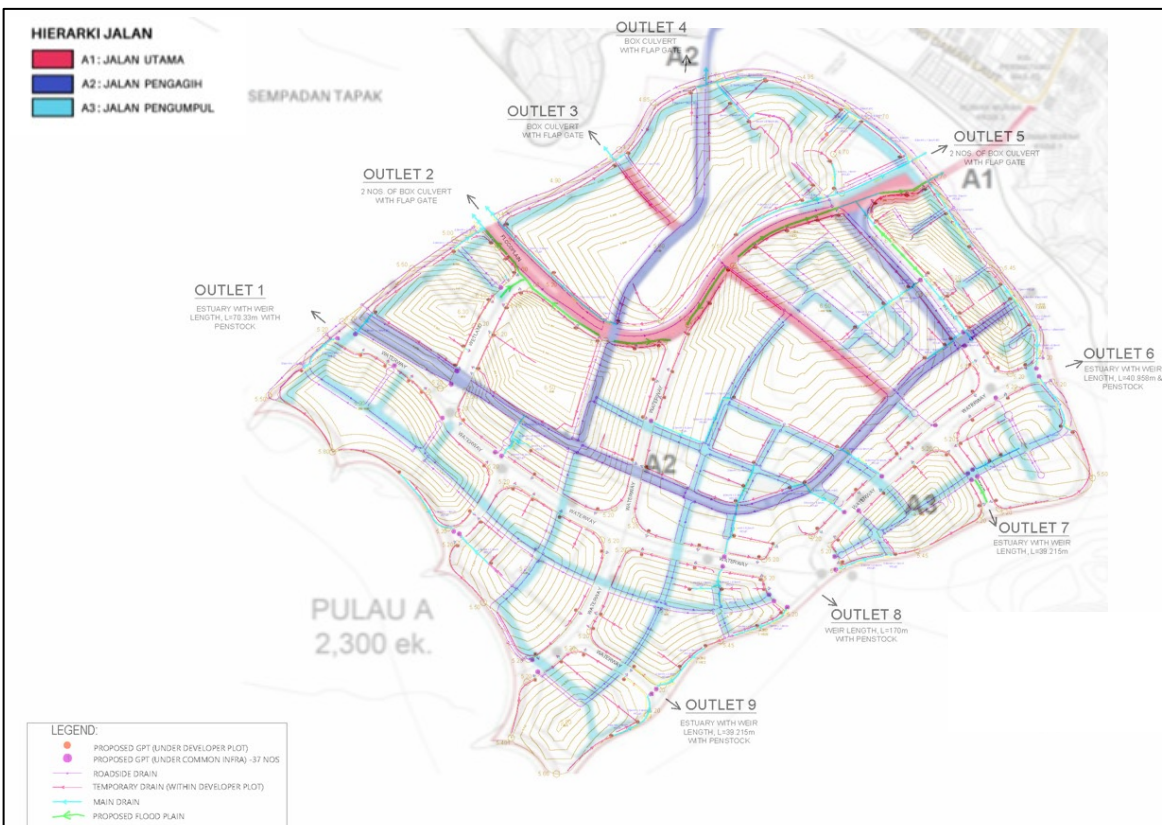
- **174** households & commercials respondents

Focus Group Discussions (FGD)

- **4 FGD sessions** involving state agencies, private entities and local communities.

- BLLRT construction will increase real estate price and demand
- Provide job opportunities to residents
- Increase demand for housing and rented properties
- Provides more public transportation options as it also improves public transit service
- Damage to roads due to heavy vehicle movements in and out of site during construction
- Increase in foreign workers during construction

DRAINAGE AND TRAFFIC



Nine (9) drainage outlets on Island A.
The drainage system consist of:

- Waterways
- Main & roadside drains
- swales or 'wetlands' in the green area reserve

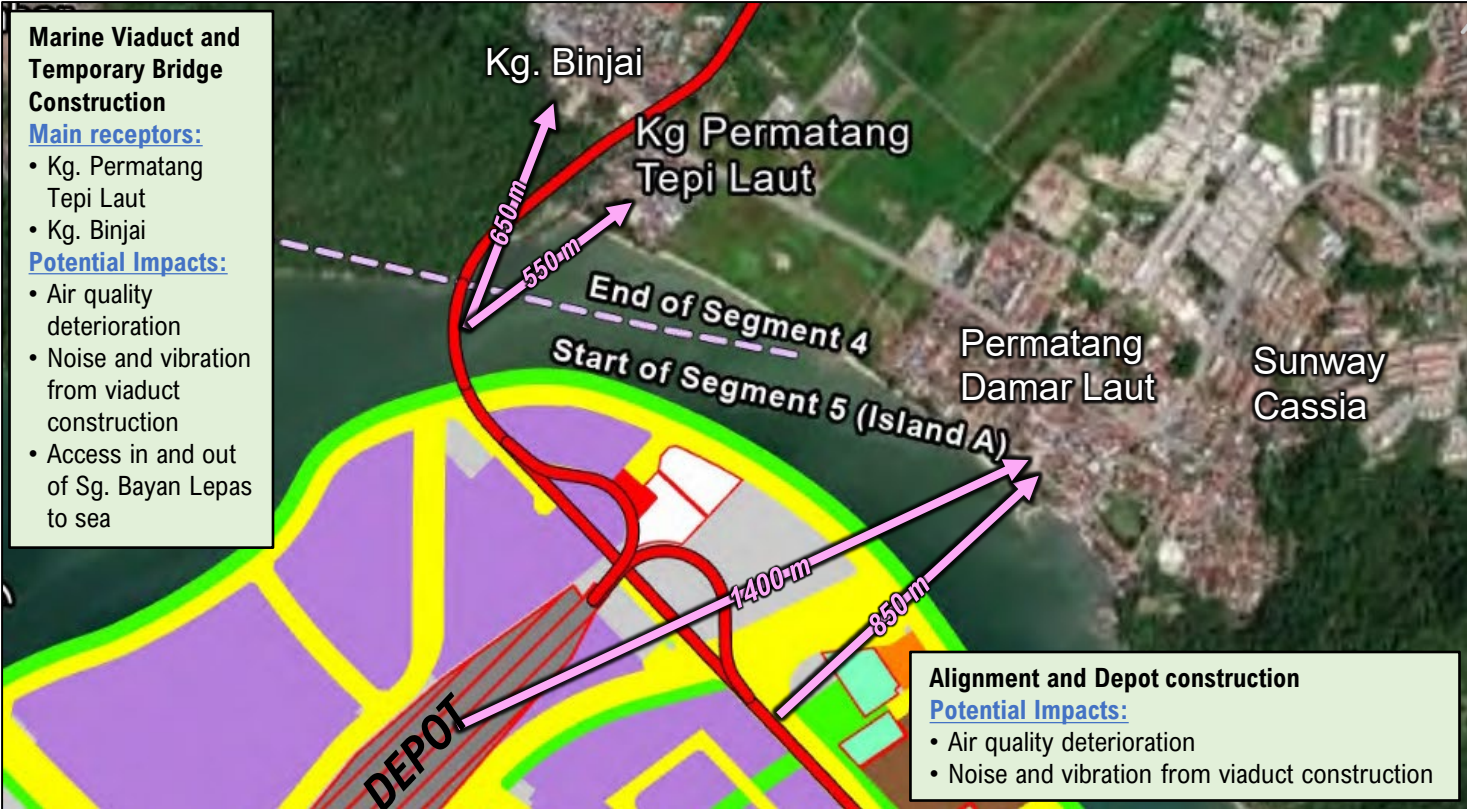
Swales integrated into environment to create ecological bio-drainage system.

Outlets will be equipped with tidal flap gates (where necessary) to prevent sea water entry into drainage system.

Three (3) types of roads designed on PSR Island A:

- A1: Main road that connects Penang Island to PSR Island A
- A2: Distributor road serves as a feeder route connecting smaller roads or streets to larger ones providing access to destinations within a neighborhood. BLLRT Segment 5 (Island A) alignment will run in the median or side of A2 roads.
- A3: Collector road is a type of road that serves to collect traffic from local streets and distribute it to arterials or highways

KEY IMPACTS AND SENSITIVE RECEPTORS



ASSUMPTIONS OF IMPACT EVALUATION

Based on assumptions of existing environment described in page 6 of the Executive Summary, the following approach are adopted for impact assessment and formulation of mitigation measures:

- i. During construction, there will not be any residents within the zone of impact (500 m on both sides of BLLRT viaduct) on PSR Island A as the LRT will be constructed and completed before the topside residential and mixed development.
- ii. Impact assessments during operations, the PSR Island A topside master plan will be considered as the existing environment and sensitive receptors will be identified based on the land use zoning in the master plan
- iii. Mitigation measures to address environmental and social impacts have been incorporated into PSR Island A topside master plan, to prevent and mitigate negative impacts through proper planning, such as compatible land use and buffer zones.

IMPACTS FROM NOISE AND VIBRATION

CONSTRUCTION

ACTIVITIES	: Site Clearing, Earthwork & Construction of Marine Viaduct, Viaducts, Depot, and Stations
RECEPTORS	: Residential areas in Kg. Permatang Tepi Laut, Kg. Binjai, Permatang Damar Laut

Impacts



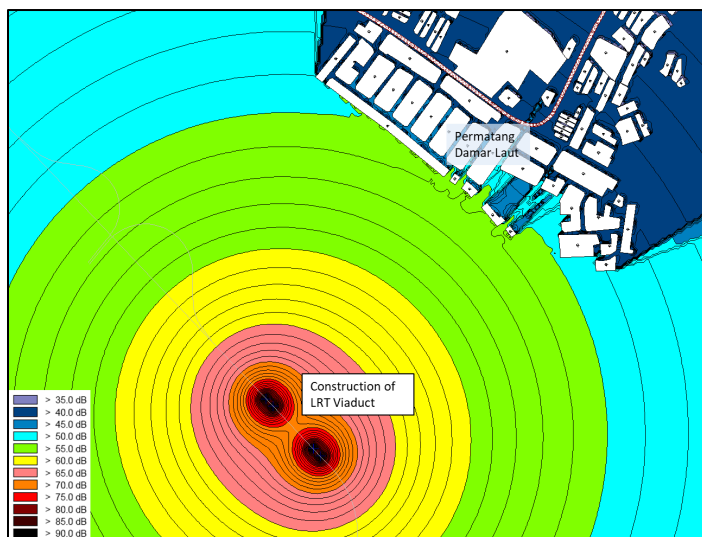
Increased noise and vibration level from:

- piling works*
- civil and structural works*
- platform preparation works*
- heavy vehicle movements*
- construction machinery*

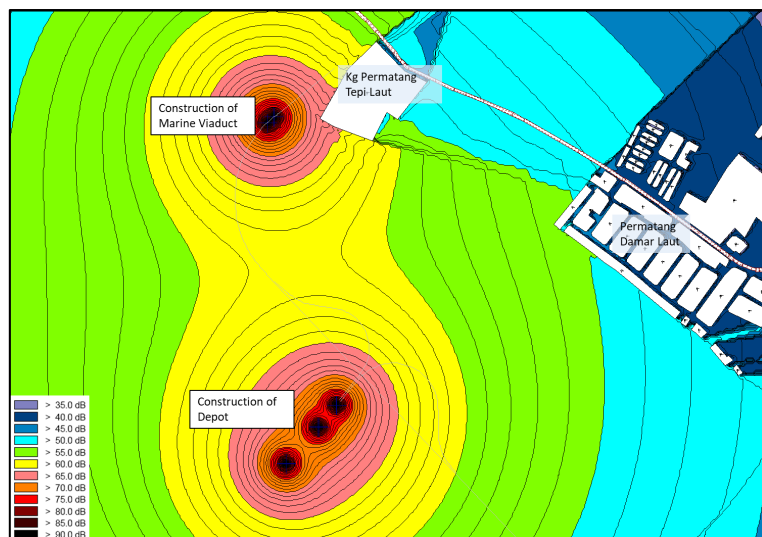
Pollution Prevention & Mitigation Measures

- Adopt **low impact piling** methods near receptors
- Carry out noisy construction activities during **daytime only**. Avoid heavy vehicle movement at night or weekends near residential areas.
- **Temporary noise barriers** and high perimeter **hoardings** near built up areas
- Use **diaphragm sheet piles** at sites with longer construction period (stations) to control vibration
- **Maintenance** of vehicles and machinery
- Continuous **monitoring** during piling works

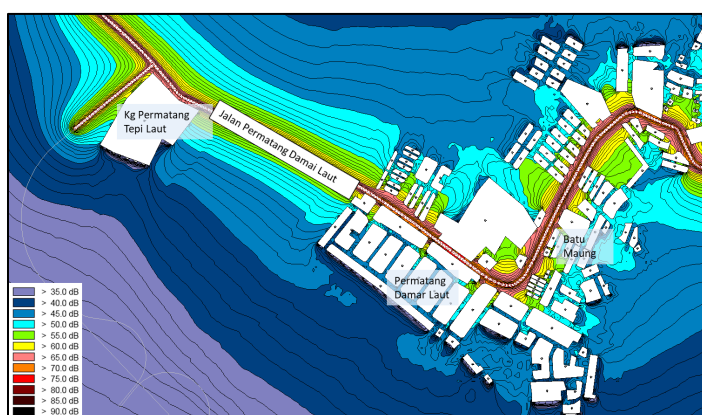
IMPACTS FROM NOISE AND VIBRATION



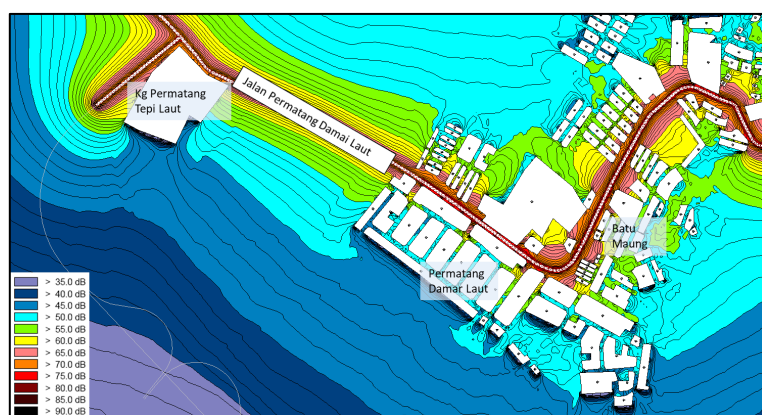
Noise contour during construction of BLLRT Segment 5 (Island A) viaduct facing Permatang Damar Laut. Noise propagated are within 50 – 55 dBA at the receptor.



Noise contour during construction of marine viaduct and depot near Kg. Permatang Tepi Laut. Noise propagated are within 50 – 55 dBA except at the start of marine viaduct construction where noise may reach 65 dBA at the receptor.



Typical noise contour at Jalan Permatang Damar Laut (baseline)



Noise contour at Jalan Permatang Damar Laut during construction BLLRT Segment 5 (Island A), with an increase of average 5 dBA along the road leading to construction access road at Kg Permatang Tepi Laut.

OPERATION

ACTIVITIES	: Operation of BLLRT Segment 5 (Island A)
RECEPTORS	: Residential areas in Kg. Permatang Tepi Laut, Kg. Binjai, Permatang Damar Laut and future residential areas on Island A



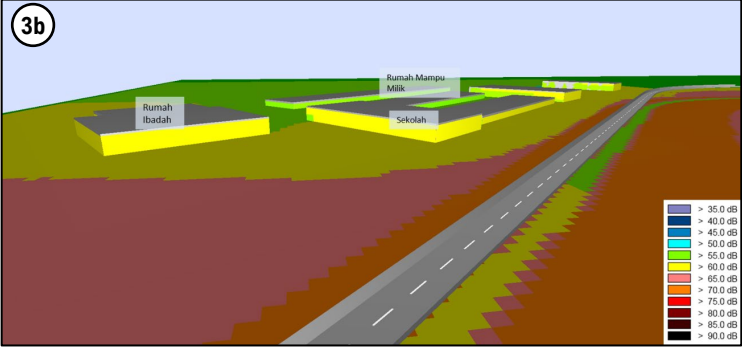
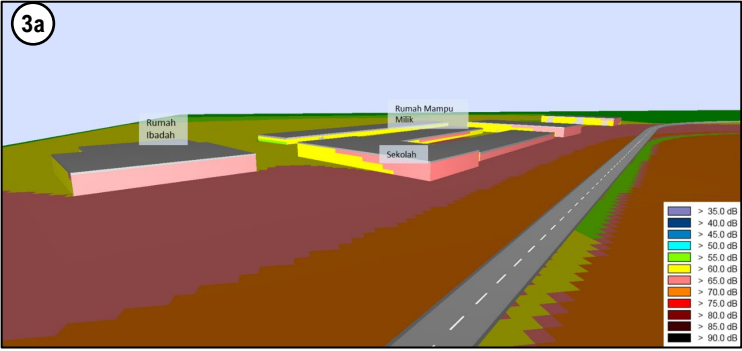
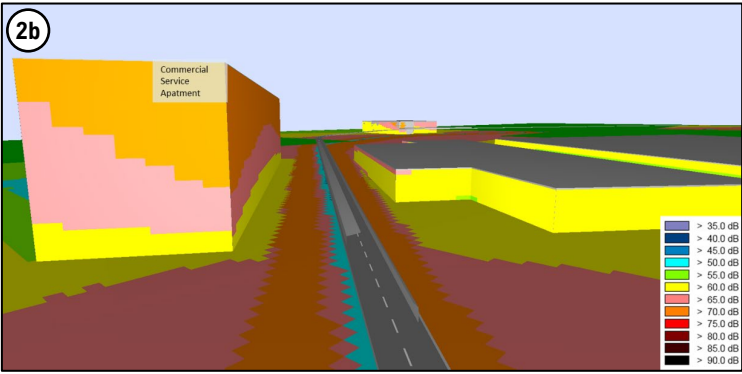
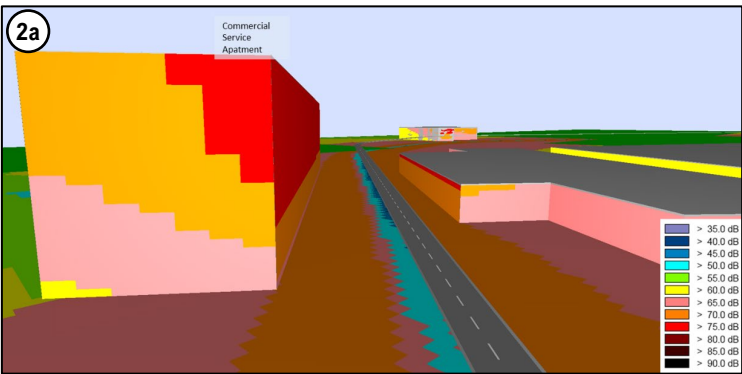
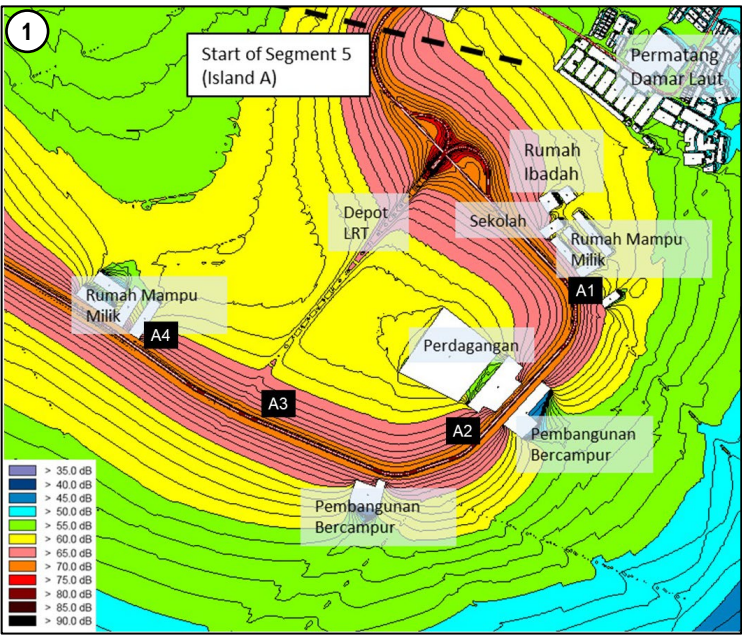
Impacts

- Noise and vibration from trains passing through or near inhabited areas
- Residual noise impacts **generally "little"** at most receptors, with some receptors having **"medium" impact** due to existing low ambient noise levels especially at rural areas during nighttime.
- All sensitive receptors (residential land use including places of worship) are anticipated to be **within acceptance limits for trains pass by vibrations**, except limited locations where some dwellings are located within 25m.
- Receptors that may require mitigation for noise and vibration were identified near **Station A1** and **Station A4**.

Pollution Prevention & Mitigation Measures

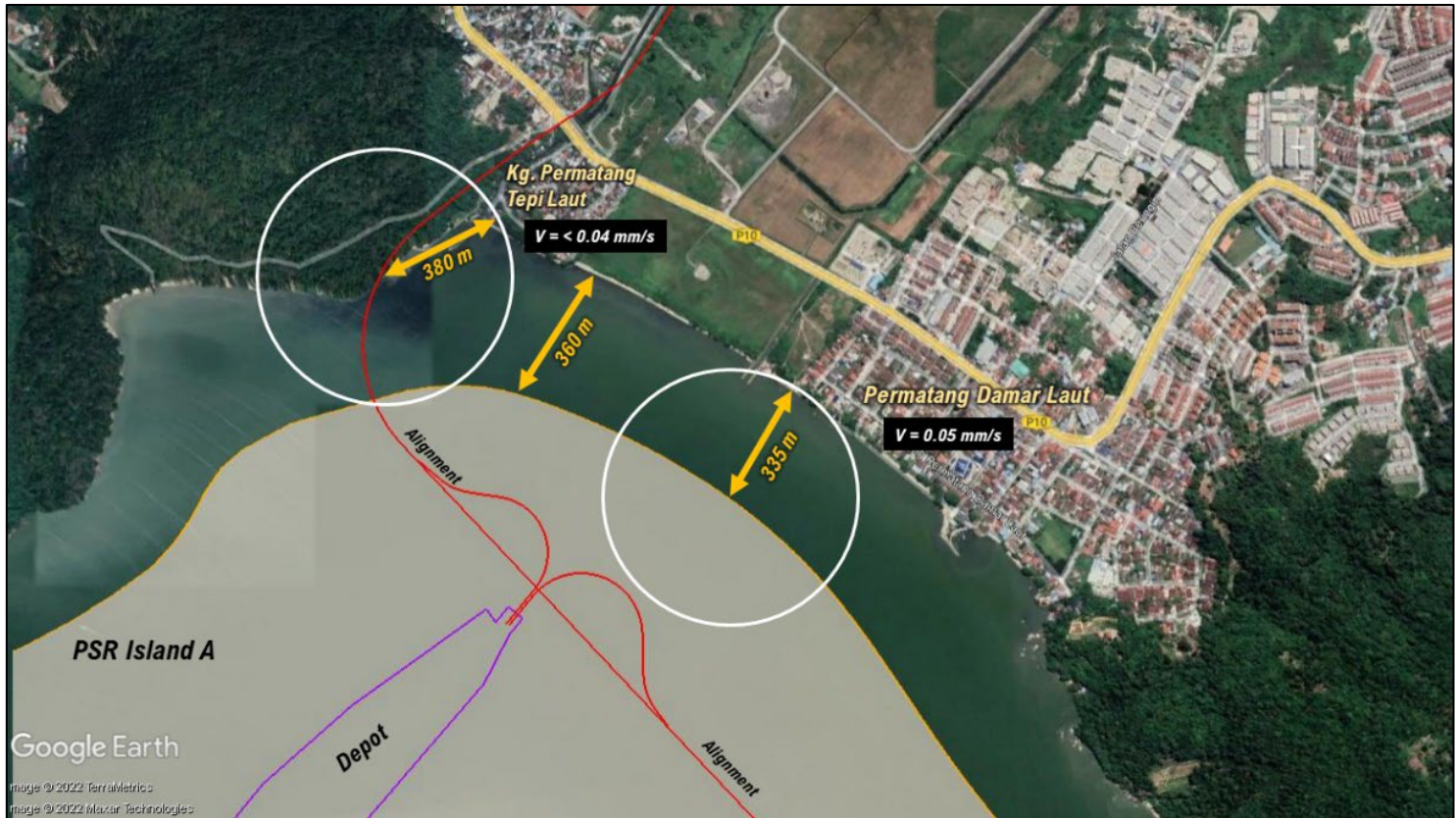
- Overall, noise impacts from the LRT have been avoided and mitigated through **proper planning and layout design** of the Island A topside development to provide sufficient reserves for the LRT.
- LRT viaducts are situated within major road corridors, and run mostly on the road median, thus sufficient **buffer zones** are allocated in the Island A master layout plan.
- Noise barriers** are proposed at **3 locations** on Island A where the LRT alignment passes near receptors at Station A1, Station A2, and Station A4.
- Noise barrier requirements at these locations are **subject to further refinement** during the detailed design stage.
- Generally, no requirements for additional vibration mitigation more than the use of **ballast tracks** along the alignment
- Selections and extent of vibration mitigation are subject to design of trackwork during detailed design stage.

IMPACTS FROM NOISE AND VIBRATION

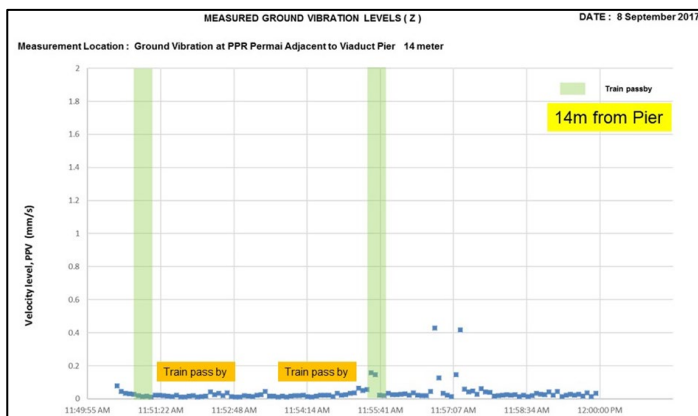
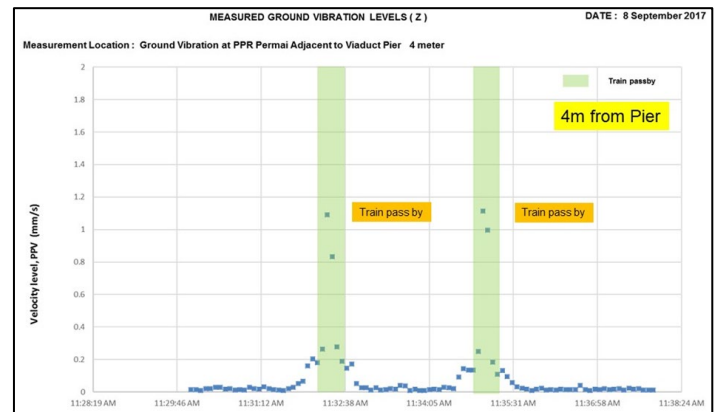
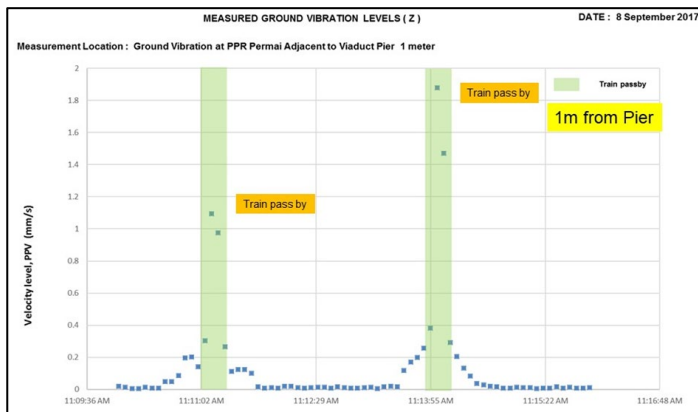


- 1) Noise contour along BLLRT Segment 5 (Island A) during train operations
- 2a) Noise propagation model at proposed "Pembangunan Bercampur" near Station A2 (without mitigation)
- 2b) Noise propagation model at proposed "Pembangunan Bercampur" near Station A2 (*with* mitigation), reducing noise to within acceptable limits
- 3a) Noise propagation model at proposed "Rumah Ibadah" and "Rumah Mampu Milik" near Station A1 (without mitigation)
- 3b) Noise propagation model at proposed "Rumah Ibadah" and "Rumah Mampu Milik" near Station A1 (*with* mitigation), reducing noise to within acceptable limits.
- 4a) Example of noise barriers and mitigation to noise propagation
- 4b) Example of double-glazed window application to reduce noise impact at receptor.

IMPACTS FROM NOISE AND VIBRATION



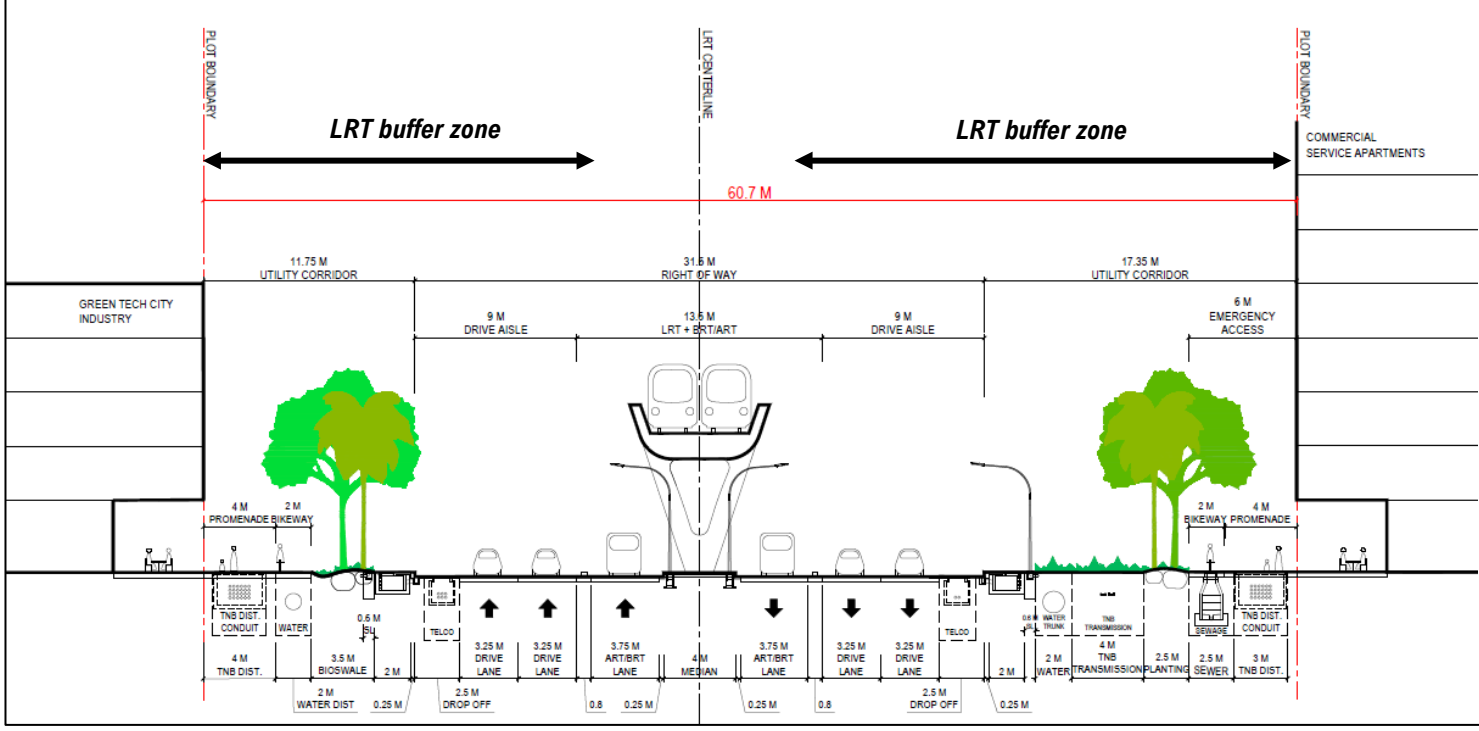
Modelled ground vibrations from construction works were demonstrated to be well below human perception levels at the nearest sensitive receptors from construction works at the marine piers and reclaimed island.



Vibration measurements at variable distances for MRT and LRT EMUs

Distance to Receptors (m)	MRT Kajang Line Persiaran Surian	LRT Ampang Line PPR Permai
1	0.15 to 0.70 mm/s	0.95 to 1.88 mm/s
4	Not measured	0.82 to 1.11 mm/s
14	Not measured	0.05 to 0.16 mm/s
25	<0.10 mm/s*	Not measured

ground vibrations from the elevated viaducts alignment perceived at receptors at 30 m away were **within** the DOE Guidelines night-time vibration limits for intermittent vibrations during trains pass by events ($R=4$, 0.4 mm/s), even for worn tracks conditions.



Cross section of road near Station A2 showing mitigation measures for LRT operations are considered in the planning of PSR Island A topside development. Compatible land uses (mixed development, commercial, industrial) are lined along the BLLRT Segment 5 (Island A) alignment. Residential areas are generally set back and shielded from noise and vibration propagated during LRT train operations.

IMPACTS TO AMBIENT AIR QUALITY

CONSTRUCTION

ACTIVITIES	: Site clearing, earthwork & construction of access road, embankment, viaducts, tunnel & adit portals, stations
RECEPTOR	: Workers at PSR Island A, communities along Permatang Damar Laut

Impacts



- **Fugitive Dust** (PM₁₀) generation from earthworks (**low impacts to communities along Permatang Damar Laut due to distance**)
- **Dust** and **gaseous** emissions from construction equipment & vehicles (PM₁₀, PM_{2.5}, CO, NO₂ and SO₂)

Pollution Prevention & Mitigation Measures

- Regular **water spraying** of construction sites, particularly along haul roads and entrance to construction site
- **Wheel washing facility** shall be provided
- Vehicles which carry particle-type materials shall be covered with **tarpaulin**
- Frequent **maintenance** of construction vehicles to minimize exhaust pollution

OPERATION

ACTIVITY: Operation of the Bayan Lepas LRT

No air pollution expected as the trains are electric-powered



Water browser to dampen access road

Wheel washing bay at the entrance/exit of the site



IMPACTS FROM WASTE GENERATION

CONSTRUCTION

ACTIVITIES : Earthworks, Construction of marine viaduct, alignment, depot, and stations
RECEPTORS : Marine environment and communities along Permatang Damar Laut

Impacts



Generation of **biomass** from site clearing activities



Generation of **municipal and construction wastes** from construction activities



Generation of **scheduled waste** from maintenance of machinery at and **domestic waste** at base camps

Mitigation Measures

- **Reuse and recycle** mulched on site as **LDP2M2**, sell commercially valuable parts
- **Disposal** : excess to be disposed at **approved landfills** or private dumping grounds
- Reuse & recycle **segregate waste** onsite for **recycling** at other construction sites, sell valuable resources to recycling facilities
- Disposal of unsuitable material at **approved landfills**
- Scheduled waste to be managed in accordance with the **EQ (Scheduled Waste) Regulations 2005**
- Domestic waste should be **recycled** (provision of recycle bins) where possible or disposed at **approved landfills**

OPERATION

ACTIVITIES : Operation of trains and stations
RECEPTORS : PSR Island A, depot, stations

Impacts



Generation of **domestic waste** at stations (minimal impacts - small amount of waste generation expected at 288 kg/day for each station)



Generation of **scheduled waste** from maintenance of trains and **domestic waste** at depot

Pollution Prevention & Mitigation Measures

- Domestic waste should be **recycled** (provision of recycle bins) where possible or disposed at **approved landfills**
- Scheduled waste to be managed in accordance with the **EQ (Scheduled Waste) Regulations 2005**
- Domestic waste should be **recycled** (provision of recycle bins) where possible or disposed at **approved landfills**

IMPACTS TO TRAFFIC

ACTIVITIES : Transportation of materials, machineries, and wastes, operation of stations
RECEPTORS : P10 Jalan Permatang Damar Laut, Distributor roads where Stations A1 – A4 are located

Impacts



Increased heavy vehicle traffic along P10 Jalan Permatang Damar Laut towards site and PSR Island A during construction

Increased traffic near Stations A1 – A4 from passenger drop-off and pick-ups during operation

Mitigation Measures

- To implement proper signage, lighting, and roadside manning at the road to ensure safety for workers and road users.
- Sufficient layby and drop-off/ pick-up lanes allocated in topside layout plan for infrastructure.
- Localised road widening with a road shoulder.
- Access to be constructed based on ATJ standards.
- Optimised junction layout in topside layout plan.

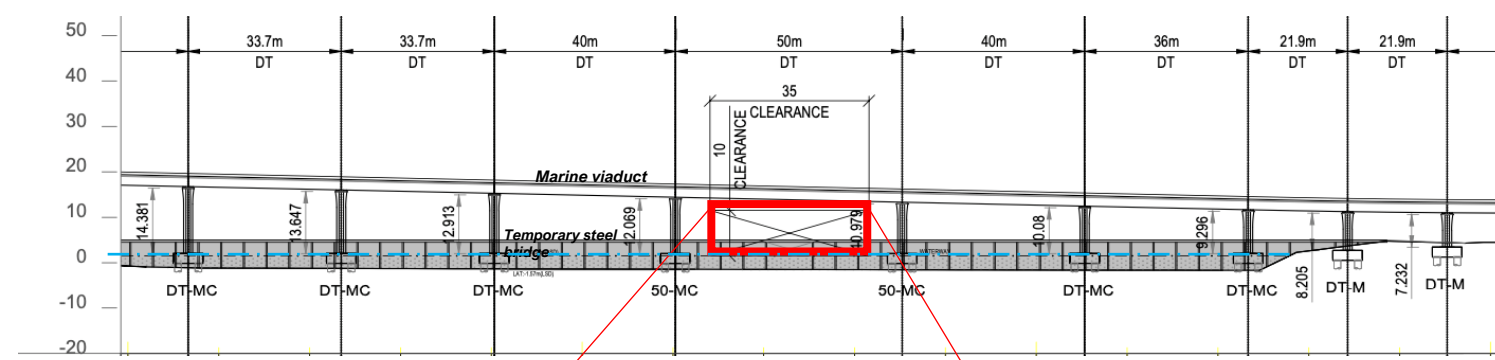
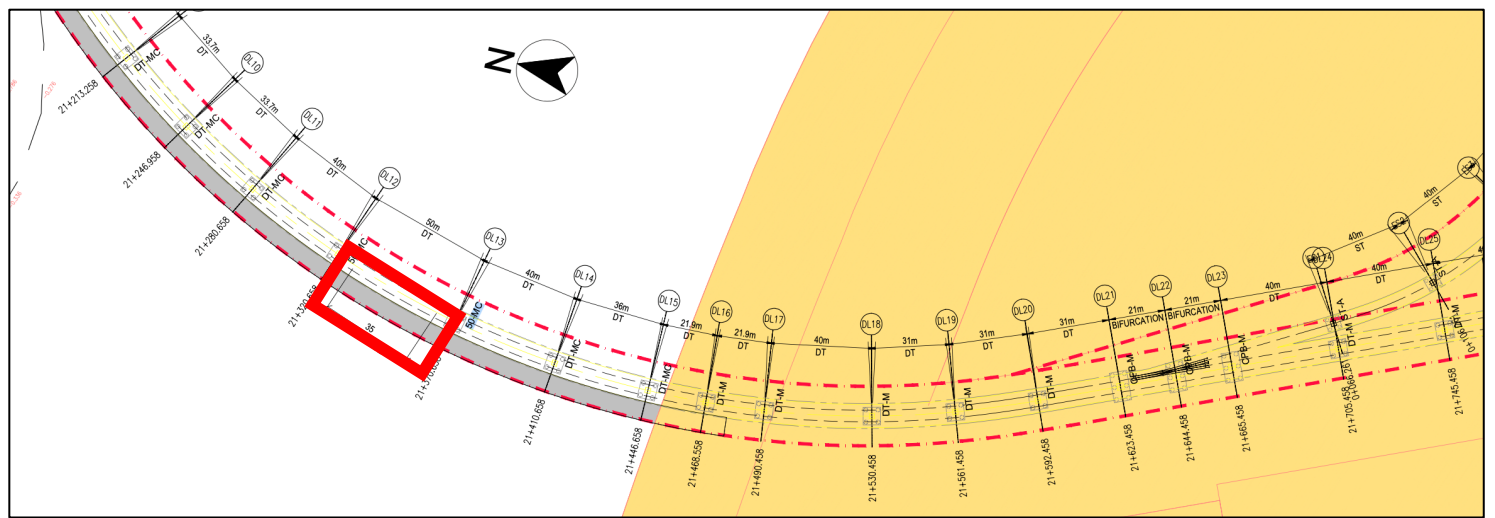
	Scenario	Hazardous Event	Score*			Ranking
			Likelihood	Severity	Risk	
(A) Transportation of Pre-Cast Segment	A1	Vehicular accident	2	5	10	Medium
	A2	Occupational and safety hazard	1	5	5	Medium
(B) Construction of Temporary Construction Access Route	B1	Vehicular accident	2	5	10	Medium
	B2	Occupational and safety hazard	1	5	5	Medium
(C) Construction of Temporary Bridge	C1	Navigational risk	1	3	3	Low
	C2	Occupational and safety hazard	2	5	10	Medium
(D) Construction of Marine Viaduct	D1	Navigational risk	1	4	4	Medium
	D2	Occupational and safety hazard	3	5	15	High
(E) Construction of Viaduct	E1	Occupational and safety hazard	3	5	15	High
(F) Construction of Stations and Depot	F1	Occupational and safety hazard	3	5	15	High

high-risk ranking events are mostly related to the occupational and safety hazards specifically for the construction of marine viaduct, viaduct, stations, and depot

Medium risk activities whereby risk controls for the hazard are already As Low as Reasonably Practicable (ALARP).

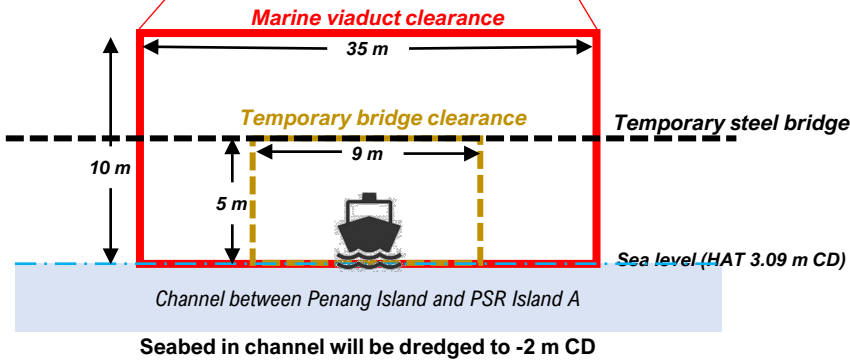
Navigational risk during construction of temporary bridge is categorised under low-risk ranking, whereas risk during construction of marine viaduct is categorised under medium risk ranking.

MARINE VIADUCT SPECIAL SPAN AND CLEARANCE FOR VESSELS



Temporary bridge will have sufficient clearance (5 m height and 9 m width) to allow uninterrupted passage for fishermen during construction stage.

Permanent marine viaduct conforms to navigational requirements of Marine Department (minimum 10 m vertical clearance).



SOIL EROSION AND SEDIMENTATION

ACTIVITIES : Earthworks, Construction of Depot, Viaducts and Marine Viaduct
RECEPTOR : Marine environment off Permatang Damar Laut, waterways on PSR Island A

As the Bayan Lepas LRT Segment 5 (Island A) will be entirely on PSR Island A, the following are the assumptions taken in assessing potential soil erosion and sedimentation:

- Assessment is based on flat reclaimed land with platform level ranging between 4.7m CD and 6.5m CD
- The island surface is fully covered with sand (fill material for the reclamation)
- Pre-construction and worst-case scenarios are assumed to have the same surface condition (bare sand surface with no cover)

Overall, the BLLRT Segment 5 on Island A is predicted to have a low erosion risk.

Activities Contributing to Soil Erosion



Viaduct construction

- Pit excavation for piling and piers installation

Depot and Station construction

- Pit excavation for pilings
- Earthworks and platform levelling

Marine Viaduct construction

- Pit excavation for piling and piers installation

Mitigation Measures

Viaduct construction

Depot and station constructions

- Integrated with PSR Island A Topside master LD-P2M2
- Implementation of erosion control, surface runoff control, sediment control along with periodic inspections and remediations

Marine Viaduct construction

- Installation of cofferdams to minimise disturbances to seabed

IMPACTS FROM GEOLOGICAL CONDITIONS

ACTIVITIES : Excavations and piling for Viaducts and Marine Viaduct
RECEPTOR : Bayan Lepas LRT Segment 5 (Island A) Structures and Components

The Bayan Lepas LRT Segment 5 (Island A) structural stability is related to the PSR Island A's platform integrity i.e., compactness of fill material, strength of rock revetments. Excavation and piling on reclaimed land usually have lower risks unless the fill materials or the bunds that retains the fill materials experiences failure, or to an extent seabed failure that could cause platform failures.

CONSTRUCTION

Geological Risks:

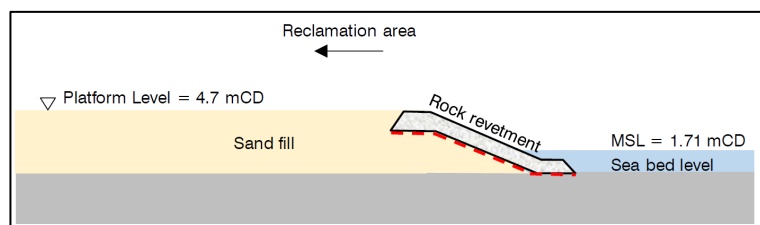
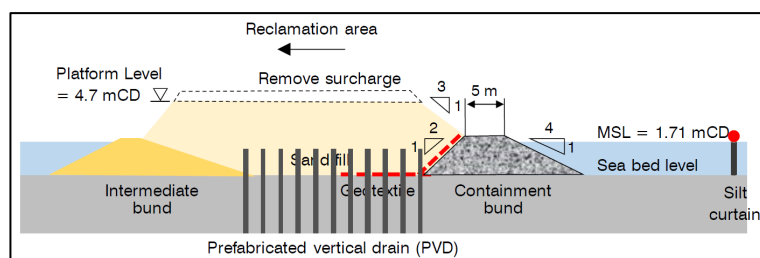
Instability of fill materials

- Regional seismicity may cause instability in PSR Island A platform fill materials
- Instability can also be caused by high water table infiltrating into the PSR Island A platform
- Seismic vibration and high-water table may cause fill materials to be liquefied/ eroded.

Seabed compression from compressible clay and subsoil layers

- Overbearing load from PSR Island A platform may exert pressure towards compressible clay and soil materials that could cause compression to seabed, causing instability to PSR Island A platform.

Mitigation Measures:



- Ground treatment by application of Prefabricated Vertical Drains (PVD) to ensure uniform settlement of PSR Island A platform, adequate surcharging and sufficient time for surcharging to settle.
- Platform designed according to **Malaysia National Annex to MS EN 1998-1: 2015, Eurocode 8: Design of structures for earthquake** and other standards detailing structural designs to seismicity.
- Construction of rock revetments withstanding up to 5.55% g PGA value (5.05% g above Pulau Pinang average 0.5% g PGA value)

IMPACTS TO SOCIOECONOMY

CONSTRUCTION

RECEPTORS: Communities in Kg. Binjai, Kg. Permatang Tepi Laut, Permatang Damar Laut

Impacts



Potential restricted access for fishermen in and out of Sg. Bayan Lepas

Mitigation Measures

- Provision of **special span for marine viaduct and temporary bridge clearance** for fishing boats into and out of Sg. Bayan Lepas jetty, for continual accessibility. (refer page 16 of Executive Summary)



Influx of **foreign construction workers** causing security and social concerns

- Workers will be housed at centralized labour quarters to minimize conflict with local communities
- Project proponent to conduct training to workers and monitor worker activities



Positive Impacts

- Stimulates **economy growth** at the national, regional and local levels
- Savings in travelling time from traffic congestion avoidance

- Generate economic value to surrounding areas especially near stations
- Fluid commuter movements between Southwest District and Northeast District of Pulau Pinang.

OPERATION

Benefits



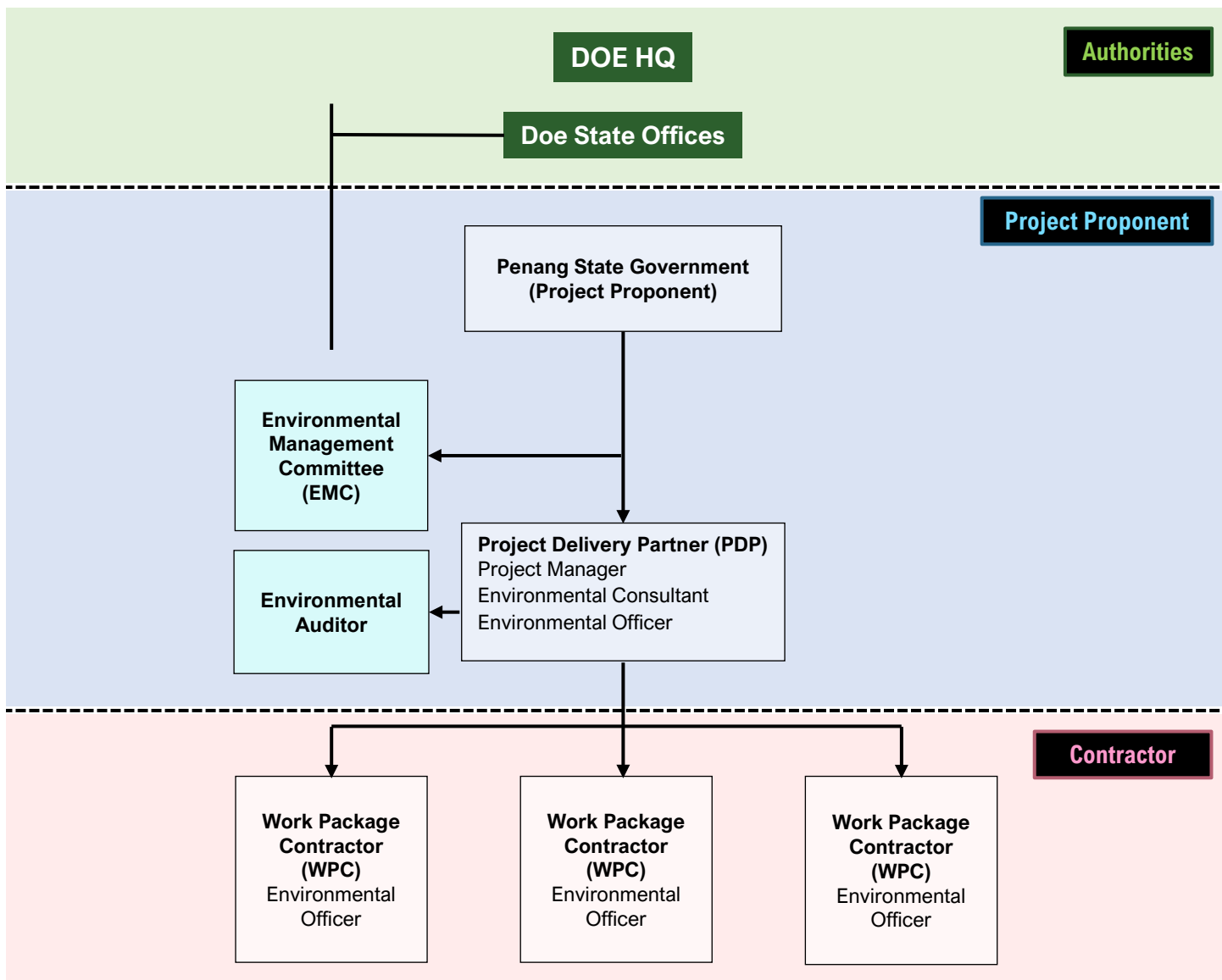
- Improved **transport connectivity** throughout Penang Island
- Reducing severe congestion on Penang Island especially Georgetown
- Saving commuters' travel times
- Fast, seamless travel from George Town to FIZ to Penang International Airport
- Increased **accessibility and capacity** throughout PSR Island A
- Stimulation of **economy growth** at areas along the entire BLLRT
- increase the interconnectivity of destinations on PSR Island A and provide better integration between existing public transits and future rail lines
- **Accelerate** employment and business opportunities

PROPOSED ENVIRONMENTAL MONITORING PROGRAMME

CONSTRUCTION

   	Locations	Parameter	Frequency
	9 Marine Water Quality Sampling Stations - Sediment Basin Discharge Points	- Temp., pH, DO, COD, BOD, TSS, Turbidity, O&G, NH₃-N & E.coli - TSS, Turbidity (Sediment Basins)	Monthly
	2 Air Sampling Stations	PM₁₀, 24 hour	Quarterly
	2 Noise and Vibration Sampling Stations - Construction Audit	- L_{aeq} & L_{max}, 24-hour - Peak Particle Velocity, on 1-hour monitoring - As per EIA Conditions of Approval	Weekly Once every 4 months

PROPOSED ENVIRONMENTAL MANAGEMENT ORGANISATIONAL STRUCTURE



Bayan Lepas LRT (BLLRT) Project

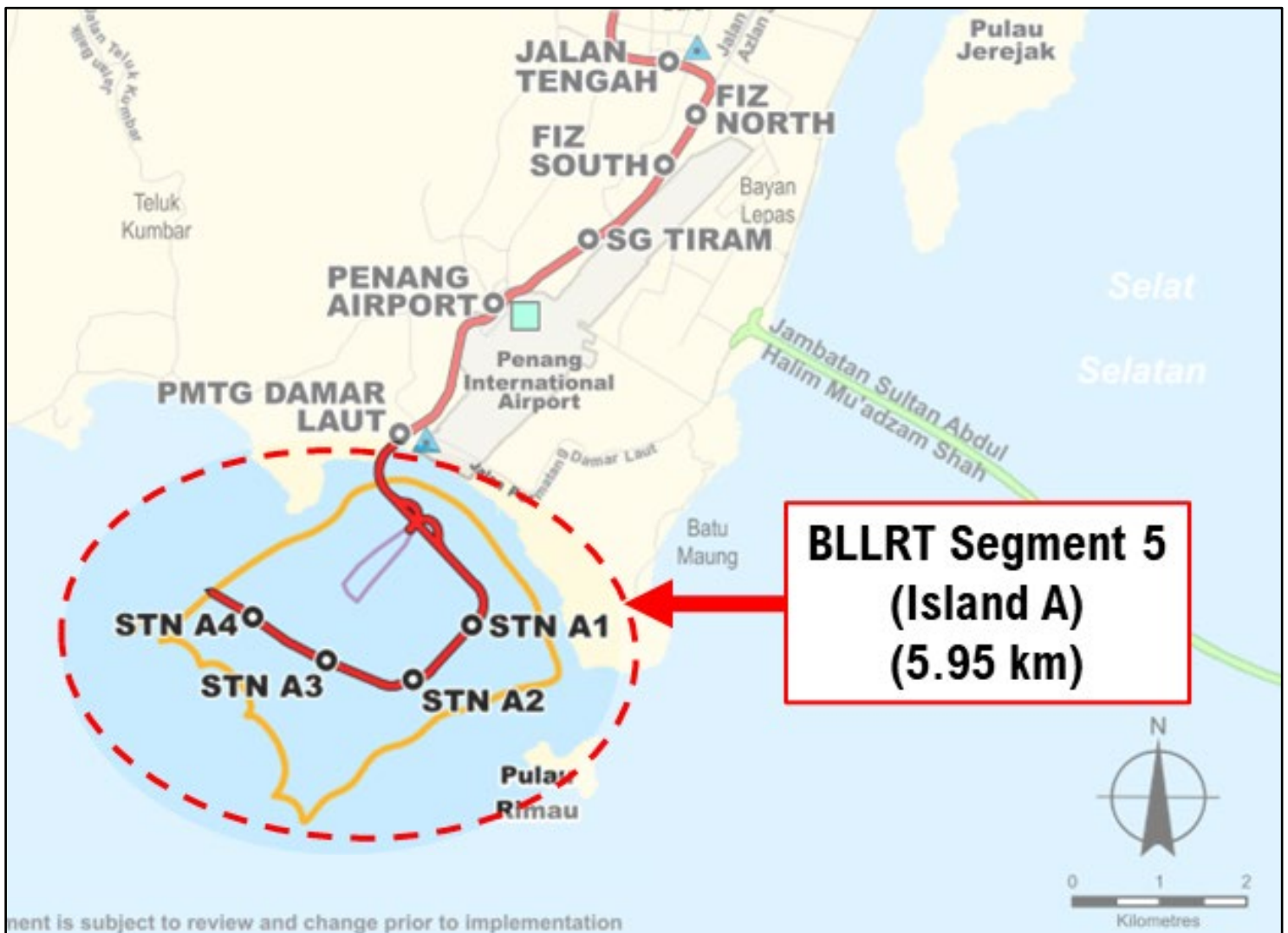
Segment 5 (Island A)

Penilaian Kesan Alam Sekeliling Jadual Kedua (Second Schedule EIA)

RINGKASAN EKSEKUTIF

Laporan EIA telah disediakan untuk cadangan projek Bayan Lepas Light Rail Transit (LRT) Segment 5 di atas Pulau A *Penang South Reclamation* (PSR) (hereinafter referred to as the “Project” or “Bayan Lepas LRT Segment 5 (Island A)”).

Projek ini melibatkan pembinaan **laluan keretapi *Light Rail Transit* bertingkat (elevated) berukuran 5.95 km** yang menyambungkan Stesen Permatang Damar Laut di Selatan Pulau Pinang ke depot di atas Pulau A PSR, dan berakhir di Stesen ‘A4’ yang dicadangkan. Projek ini juga melibatkan pembinaan empat (4) stesen dan sebuah depot di Pulau A PSR. Depot ini akan diguna pakai oleh keseluruhan sistem LRT Bayan Lepas dari Georgetown sehingga Stesen ‘A4’.



Penggerak Projek



Kerajaan Negeri
Pulau Pinang

Perunding EIA

aurecon

Aurecon Lestari Sdn Bhd

PENANG TRANSPORT MASTER PLAN (PTMP)

- Sebuah pelan menyeluruh dalam menambah baik sistem pengangkutan awam dan jalanraya di Pulau Pinang yang menitikberatkan peningkatan kemudahan pengangkutan awam di Pulau Pinang yang sering menghadapi masalah kesesakan lalu lintas
- LRT Bayan Lepas serta *Penang South Reclamation* (PSR) dikenal pasti sebagai projek pemacu kepada keseluruhan **Penang Transport Master Plan (PTMP)**



Perhubungan antara PSR Island A dengan Pulau Pinang

- Membolehkan pergerakan awam yang rancak dan lancar di sepanjang Pulau Pinang
- Meningkatkan keterhubungan antara destinasi-destinasi di Pulau A PSR serta menyediakan integrasi menyeluruh antara pengangkutan awam sedia ada dengan laluan-laluan LRT akan datang.
- Mengurangkan masalah kesesakan lalu lintas melalui kemudahan LRT yang menyeluruh, saling berhubung, dan selamat di Pulau A PSR dan Pulau Pinang.

Depot bagi keseluruhan sistem LRT Bayan Lepas

- Keseluruhan sistem BLLRT bergantung kepada depot di PSR Island A
- Walaupun pilihan lain lokasi depot telah dikenal pasti dan dinilai, lokasi depot di Pulau A PSR Island A merupakan lokasi yang terbaik (tidak melibatkan pengambilan tanah, ketiadaan kesan kepada alam sekeliling dan masyarakat).
- Pilihan lain lokasi depot di Pulau Pinang akan melibatkan kesan yang ketara kepada alam sekeliling dan masyarakat.

JAJARAN DAN REKA BENTUK PILIHAN

Beberapa pilihan mod dan penjajaran telah dikenal pasti dan dinilai dalam proses pemilihan jajaran dan mod pengangkutan terbaik untuk Projek ini.

PILIHAN MOD

Empat pilihan mod telah dipertimbangkan untuk koridor Bayan Lepas Light Rail Transit (LRT). LRT tetap menjadi pilihan utama kerana:

- LRT mampu memenuhi permintaan pengangkutan (15,999 orang sejam satu arah (PPHPD) menjelang 2057), mampu mencapai sasaran 40% perkongsian mod pengangkutan awam menjelang 2030
- Trek bertingkat yang khusus untuk LRT Dapat mengelakkan konflik dengan lalu lintas
- Berkapasiti sederhana dan tinggi berbanding AGT dan Maglev
- Teknologi yang berkesan dengan kebolehpercayaan yang tinggi dengan kos penyelenggaraan yang rendah

	LRT Tipikal	Tram Tipikal	AGT	Maglev
Kapasiti (PPHPD)	18,500	4,500	15,800	10,800
Kelajuan purata (km/h)	35	20	35	35
Masa perjalanan (minit)*	40	70	40	40
Headway (minit)	2	4	2.5	2
Bilangan gerabak (“veh”)	4	2	6	3
Bil. penumpang satu gerabak @4.8pax/sq m	160	160	110	121 - 166

PILIHAN JAJARAN

Bayan Lepas LRT Segment 5 (Island A) telah direka bentuk bersama dengan pelan pembangunan *topside* Pulau A PSR. Kaedah ini membolehkan penetapan guna tanah yang sesuai di sepanjang jajaran LRT dan di sekitar depot, serta penyepaduan sistem transit yang lebih baik dengan pelan susun atur Pulau A PSR.



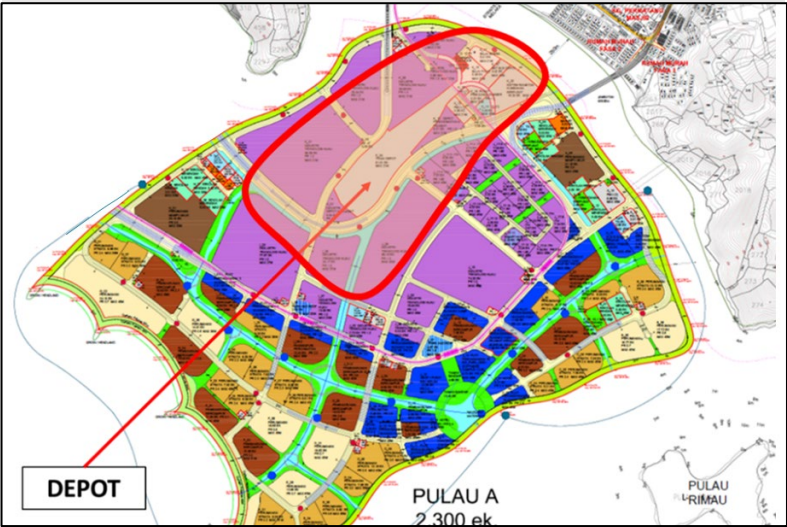
PILIHAN DEPOH

Empat (4) lokasi berpotensi untuk depoh BLLRT telah dinilai:

- Jelutong Timur
- Permatang Damar Laut
- Teluk Talip
- Pulau A PSR

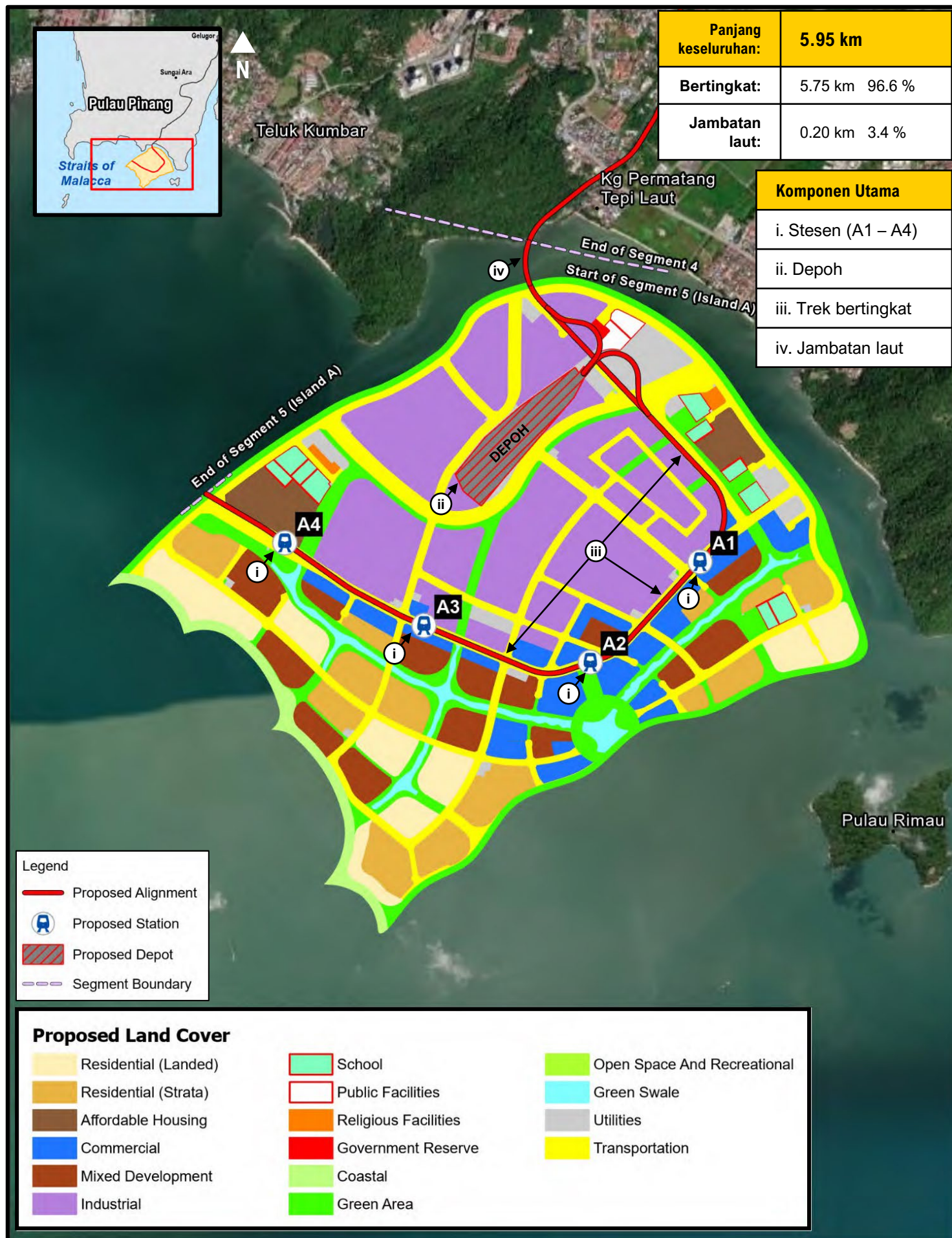


- Pulau A PSR dipilih sebagai lokasi pilihan kerana potensi kesan alam sekeliling dan sosial yang rendah, dan serta tiada keperluan pengambilan tanah.
- Guna tanah sekeliling kebanyakannya adalah tanah industri, sesuai dengan pembinaan depoh.

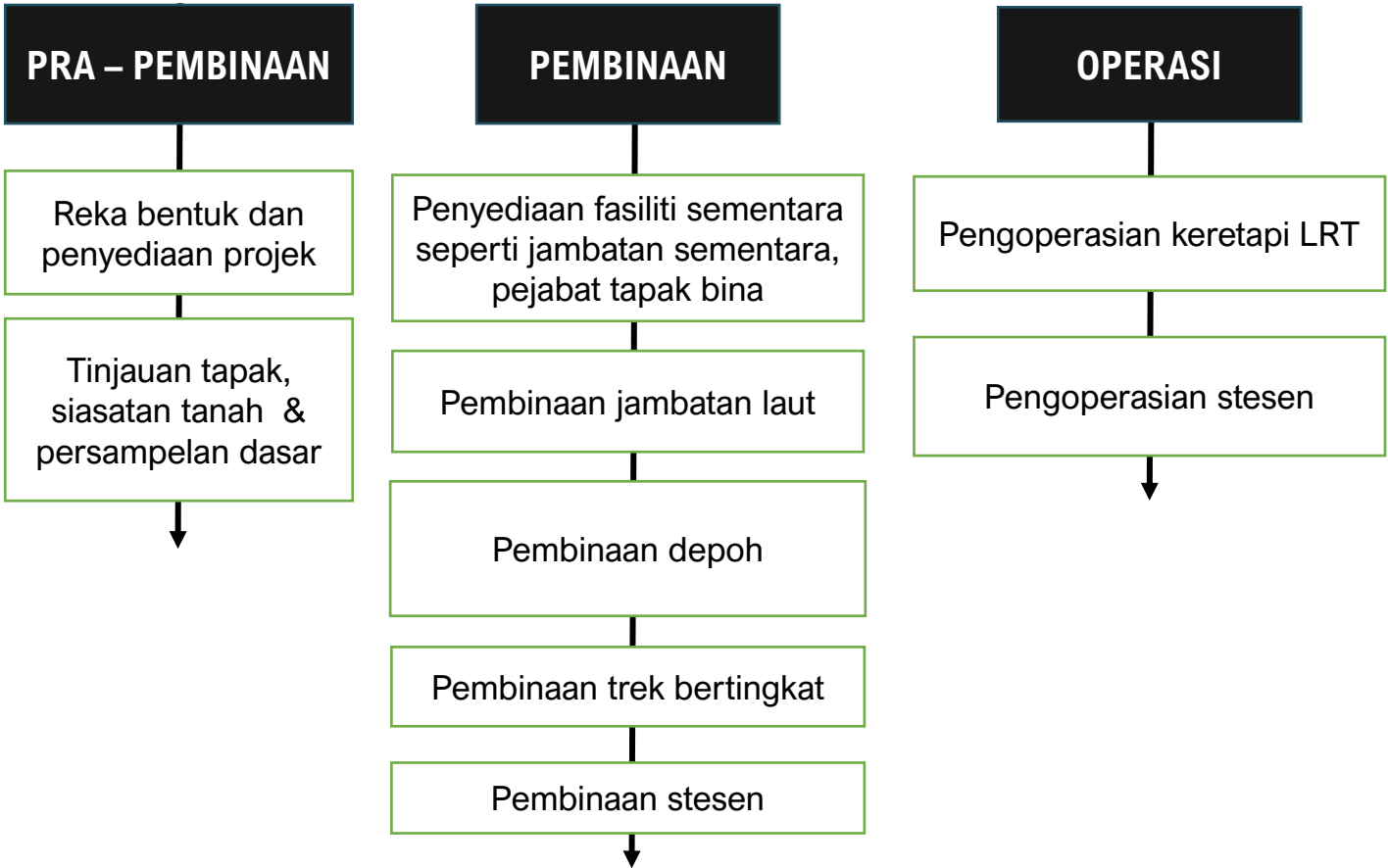


PENERANGAN PROJEK

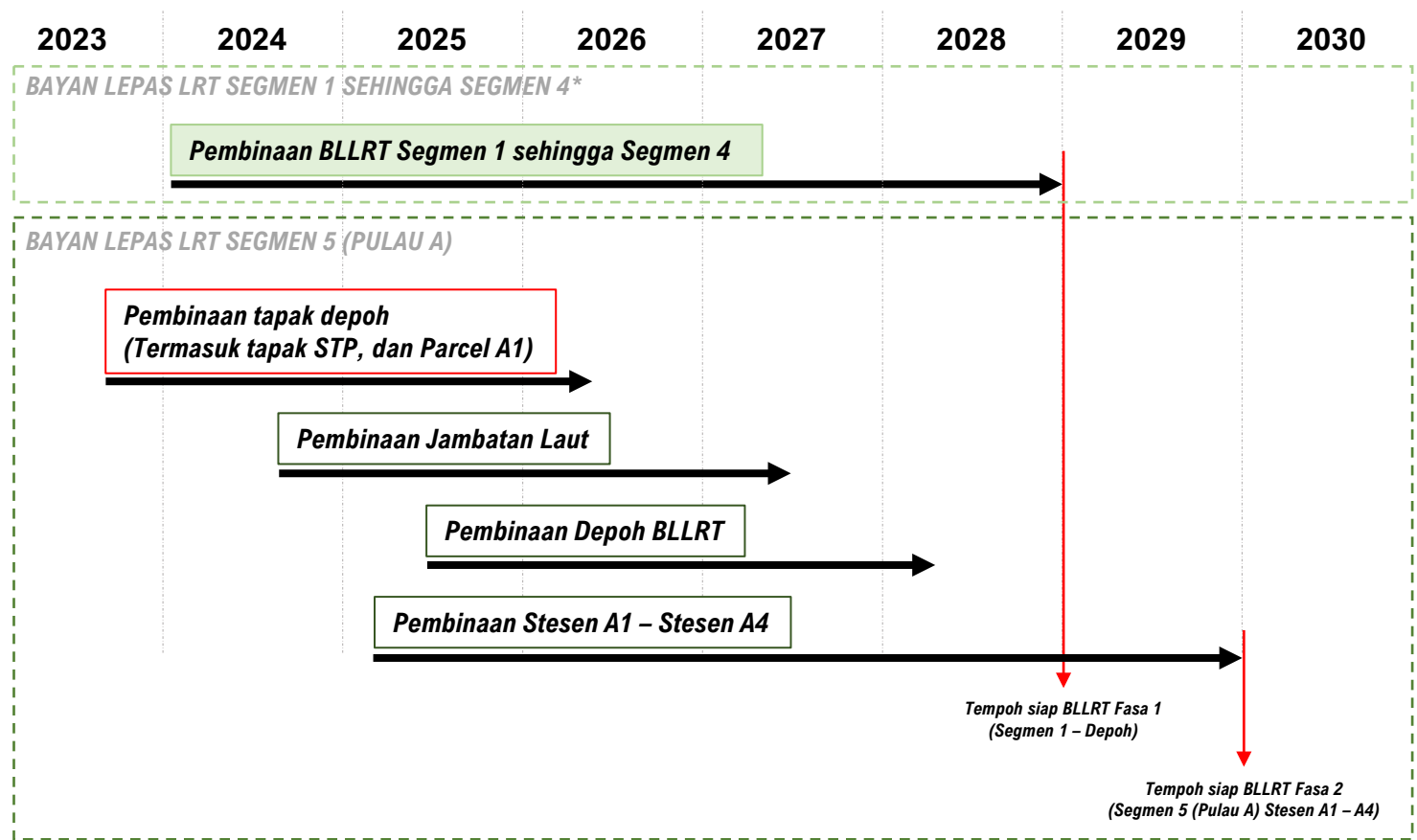
Jajaran Bayan Lepas LRT Segmen 5 (Pulau A) yang berukuran 5.95 KM bermula dari stesen Permatang Damar Laut bersambung ke Pulau A PSR melalui jambatan laut, kemudian ke depoh, dan seterusnya merentasi Pulau A PSR dan berakhir di stesen 'A4' yang dicadangkan.



AKTIVITI UTAMA PROJEK



GARIS MASA PROJEK

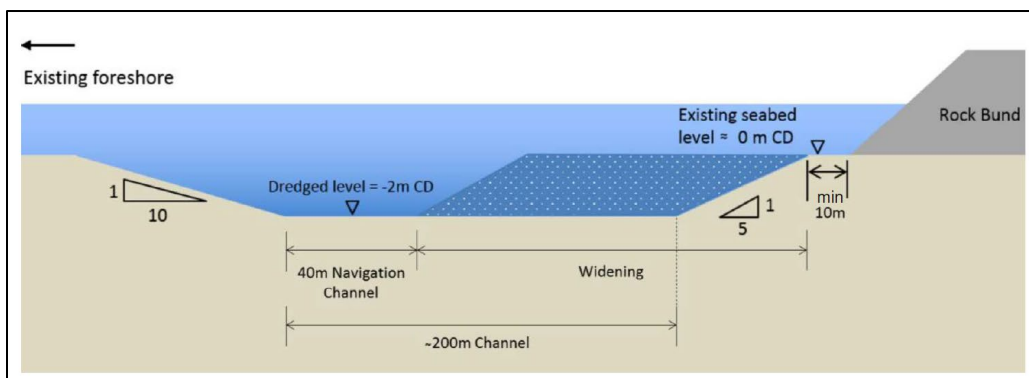


*EIA diluluskan pada February 2020

PERSEKITARAN FIZIKAL

BLLRT Segmen 5 (Pulau A) akan dibina di atas Pulau A PSR yang akan siap ditambah. Dalam tempoh pengemukaan EIA ini, Pulau A PSR masih lagi dalam pembinaan. Oleh itu, anggapan dasar yang telah diguna pakai dalam penyediaan EIA ini adalah seperti berikut:

- BLLRT Segmen 5 (Pulau A) merupakan antara pembangunan terawal yang akan dijalankan di atas Pulau A PSR setelah kerja-kerja penambakan pulau serta pengorekan dasar telah siap.
- Persekitaran sedia ada yang lapang ketika pembinaan Projek ini, atau dengan tapak-tapak pembinaan infrastruktur awam yang dijalankan serentak (seperti jalan dan sistem perparitan).
- Di peringkat operasi BLLRT Segmen 5 (Pulau A), persekitaran sedia ada serta penerima sensitif adalah berdasarkan pelan induk guna tanah dan pembangunan Pulau A PSR.



TOPOGRAFI

Cerun landai dari kawasan tengah pulau hingga ke pesisiran.

Kecerunan bertujuan untuk penyaliran air melalui sistem perparitan pulau ke saluran luar pulau.

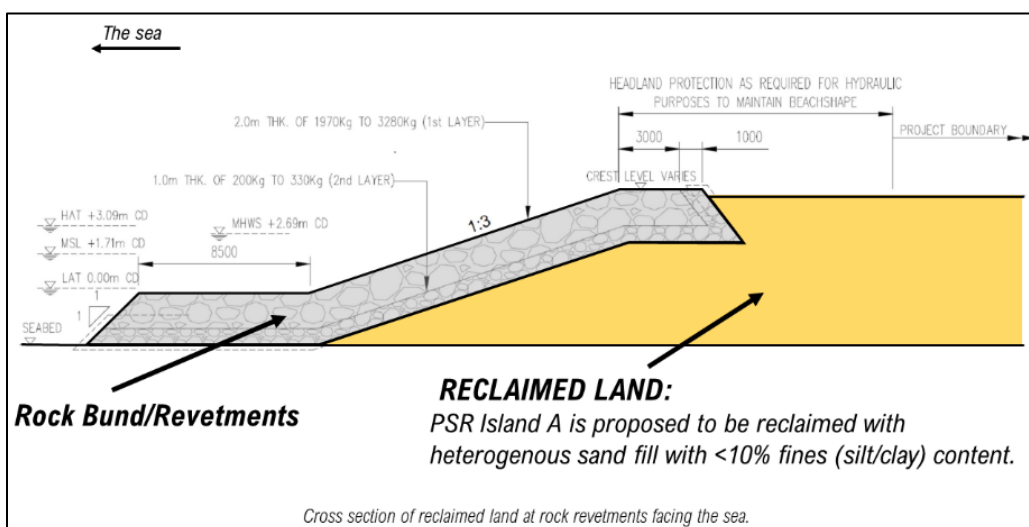
Paras platform

Paras terendah* platform di Pulau A:

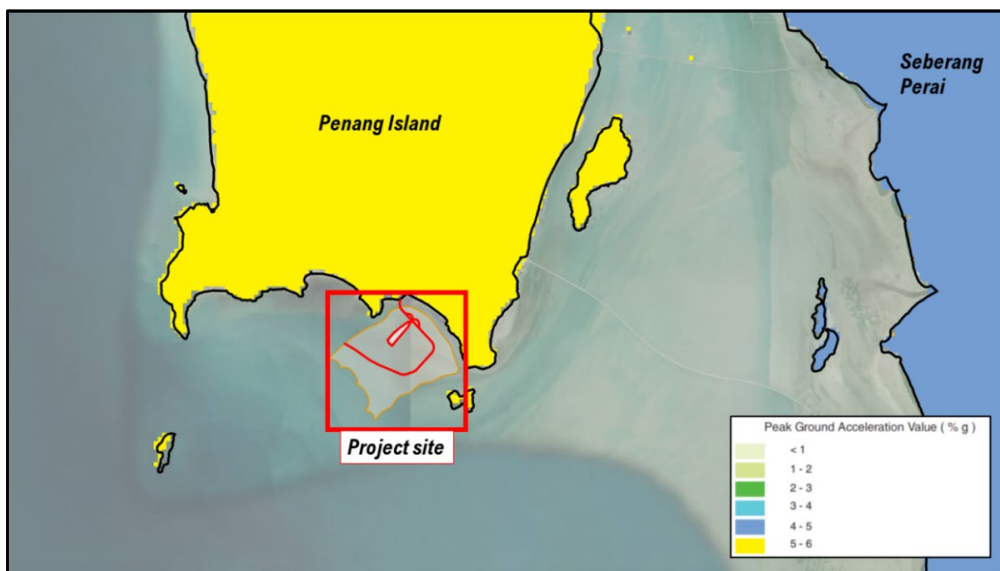
$$4.7 \text{ m CD} = 2.8 \text{ m a.s.l}$$

*Penentuan paras minima platform:

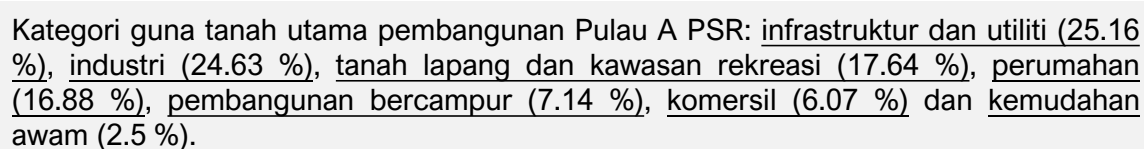
3.09 m CD (air pasang penuh astronomi (HAT)) +
0.6 m (luruan ribut dengan tempoh ulang 100 tahun) +
0.63 m (unjuran peningkatan paras air laut tahun 2100 (factor perubahan iklim))



GUNA TANAH



5% g PGA $\approx$ V (Skala Mercalli)
dimana:
Tanggapan getaran = Sederhana,
Potensi kerusakan = Rendah



KUALITI ALAM SEKELILING



9 Titik sampel kualiti air marin di sekitar Teluk Selatan Pulau Pinang. Satu stesen kualiti air marin JAS di Pulau Rimau.

2 Titik sampel kualiti udara, satu (1) titik sampel bunyi bising dan getaran Kg. Permatang Tepi Laut (ANV1) dan Permatang Damar Laut (A3)

Kualiti Keseluruhan: 66 (sederhana) hingga 96 (baik)

Nilai tertinggi: MWQ1 (permukaan) (surut)
MWQ4 (dasar) (surut)
Nilai terendah: MWQ7 (dasar) (surut)
MWQ7 (permukaan) (pasang)

Takat DO: 41 – 7.2 mg/L (Kelas III MMWQS)
Takat BOD: Bawah had pengesanan
Takat COD: Tertinggi – 12 mg/L di MWQ7 dan MWQ8

Kekeruhan: 0.4 – 24.1 NTU
Takat TSS: Bawah had pengesanan (<1 mg/L) – 60 mg/L
Kelas III MMWQS bagi kesemua titik sampel

	ANV1	A3	MAAQS (Standard 2020)
PM₁₀ ($\mu\text{g}/\text{m}^3$)	53	50	100
PM_{2.5} ($\mu\text{g}/\text{m}^3$)	29	26	35

Parameter	ANV1	Permissible sound level
LA _{eq} Day time (dBA) 7:00 a.m. – 10:00 p.m.	57.4	65
LA _{eq} Nighttime (dBA) 10:00 p.m. – 7:00 a.m.	46.1	60

PENGURUSAN SISA



Aliran am pengurusan sisa pepejal oleh Majlis Bandaraya Pulau Pinang (MBPP)

Populasi di Daerah Barat Daya, Pulau Pinang

Aktiviti Ekonomi Utama

197,131 (2010)
↓
237,735 (2020)

Penambahan 20.6% dalam 10 tahun
13.7% dari jumlah populasi Pulau Pinang



Perikanan
Komersil

Penempatan Terdekat Di Sepanjang Jajaran

Kawasan penempatan dalam lingkungan 500 m dari jajaran terdapat di kawasan-kawasan berikut:

- **Kg. Permatang Tepi Laut:** Komuniti nelayan berpusat di Kg. Permatang Tepi Laut.
- **Kg. Binjai**
- **Permatang Damar Laut**

Persatuan nelayan	Bilangan nelayan	Pemilik kapal	Anak kapal
Permatang Damar Laut	76	39	115

Tanggapan Sosial Terhadap Projek

Tinjauan Persepsi Awam

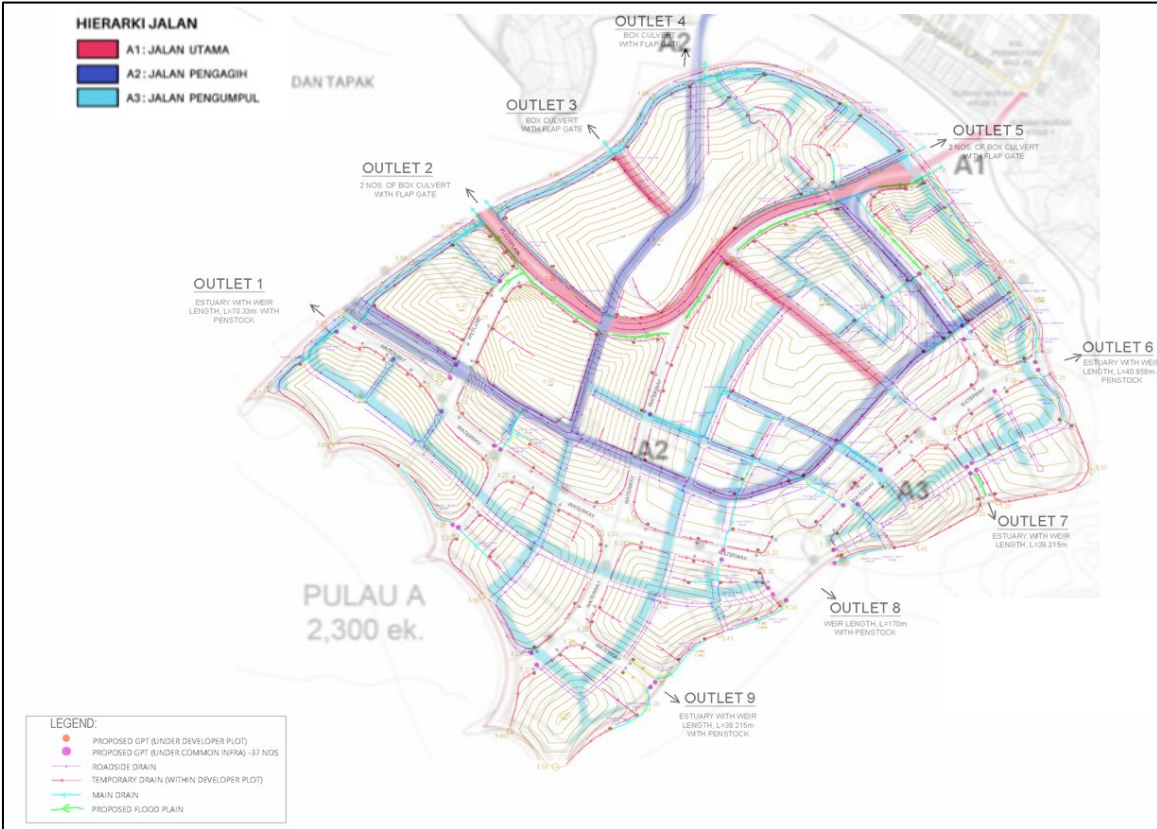
- 174 responden kediaman dan komersil

Perbincangan Berkumpulan (FGD)

- 4 sesi FGD melibatkan agensi kerajaan negeri, entity swasta dan komuniti setempat.

- Peningkatan harga dan permintaan hartanah sekitar
- Penyediaan peluang pekerjaan kepada penduduk tempatan
- Peningkatan permintaan pemilikan serta penyewaan hartanah.
- Penyediaan pilihan mod pengangkutan awam sebagaimana ia menambah baik sistem pengangkutan awam
- Kerosakan jalan raya akibat peningkatan kemasukan kenderaan berat pembinaan.
- Kemasukan serta keberadaan pekerja asing.

SISTEM PERPARITAN DAN ALIRAN TRAFIK



Sembilan (9) saluran keluar.

Sistem perparitan merangkumi:

- Tali air
- Parit utama dan parit tepi jalan
- swales atau 'tanah bencah' di rizab kawasan hijau

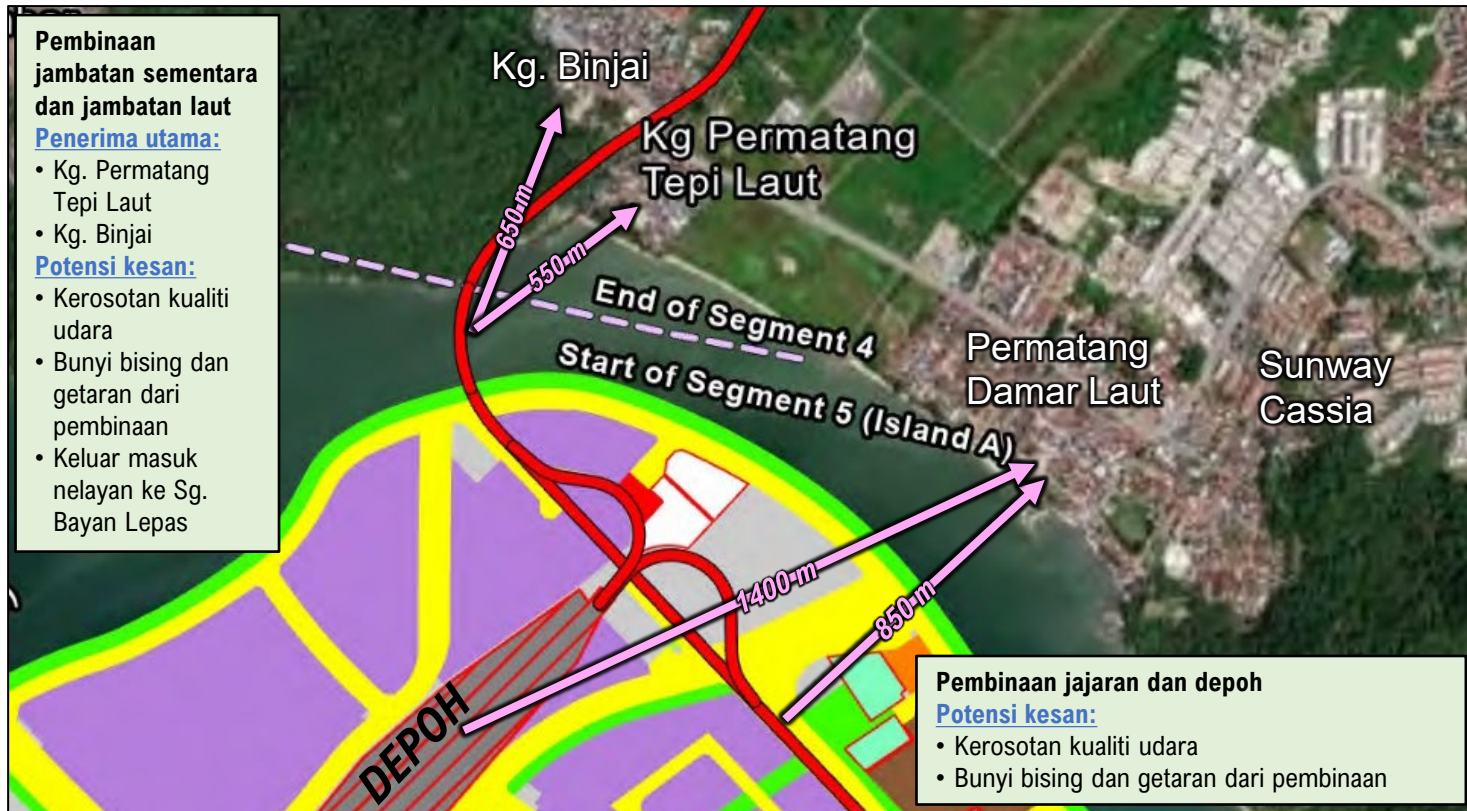
Swales diintegrasikan ke persekitaran menghasilkan sistem ecological bio-drainage.

Saluran keluar dilengkapi dengan kunci pasang surut (di mana perlu) untuk mencegah kemasukan air laut ke sistem perparitan..

Tiga (3) jenis jalan raya yang direka bentuk di atas Pulau PSR:

- A1: Jalan utama yang menghubungkan Pulau A PSR dengan Pulau Pinang.
- A2: Jalan Pengagih bertujuan menghubungkan jalan-jalan kecil ke jalan besar yang menyediakan akses ke kawasan kejiranan. Jalan A2 berada selari dengan jajaran BLLRT Segmen 5 (Pulau A).
- A3: Jalan pengumpul bertujuan mengumpulkan trafik dari jalan tempatan untuk diagihkan ke jalan utama atau lebuh raya

IMPAK UTAMA DAN PENERIMA SENSITIF



ANGGAPAN DALAM PENILAIAN KESAN

Berdasarkan anggapan dasar persekitaran semasa yang diterangkan pada muka surat 25 Ringkasan Eksekutif, berikut adalah pendekatan yang diguna pakai dalam penilaian kesan serta formulasi langkah-langkah mitigasi:

- Di peringkat pembinaan, tidak akan ada kawasan penempatan dalam zon penerima kesan (500 m di setiap sisi jajaran) di Pulau A PSR memandangkan Projek ini akan dibina dan disiapkan sebelum pembinaan kawasan perumahan dan Pembangunan bercampur.
- Pengenalpastian penerima sensitif dan penilaian kesan di peringkat operasi berdasarkan pelan induk guna tanah Pulau A PSR
- Perancangan bandar yang rapi menerapkan langkah mitigasi serta pencegahan kesan alam sekeliling dan sosial dalam pelan induk Pulau A PSR

KESAN UTAMA DARI BUNYI BISING DAN GETARAN

PEMBINAAN

AKTIVITI : Kerja-kerja tanah, Pembinaan jambatan laut, trek bertingkat, depoh, dan stesen
PENERIMA : Kawasan penempatan di Kg. Permatang Tepi Laut, Kg. Binjai, Permatang Damar Laut

Kesan



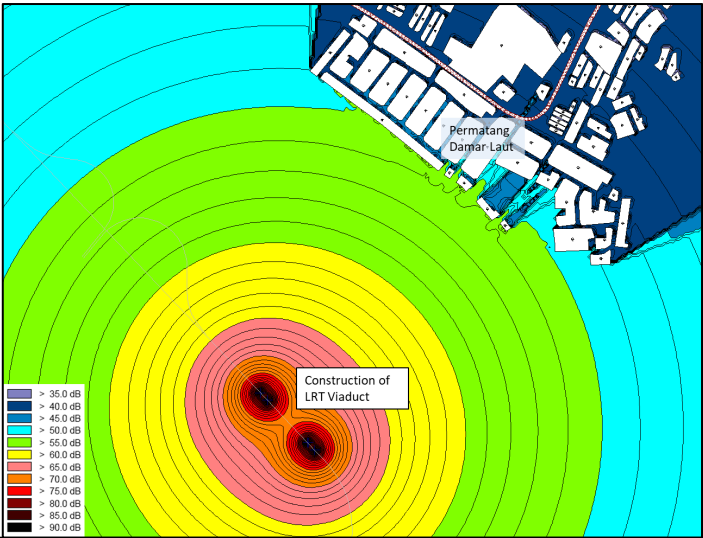
Peningkatan bunyi bising dan getaran dari:

- Kerja-kerja piling
- Kerja-kerja struktur
- Kerja-kerja penyediaan platform
- Kenderaan berat
- Mesin-mesin pembinaan

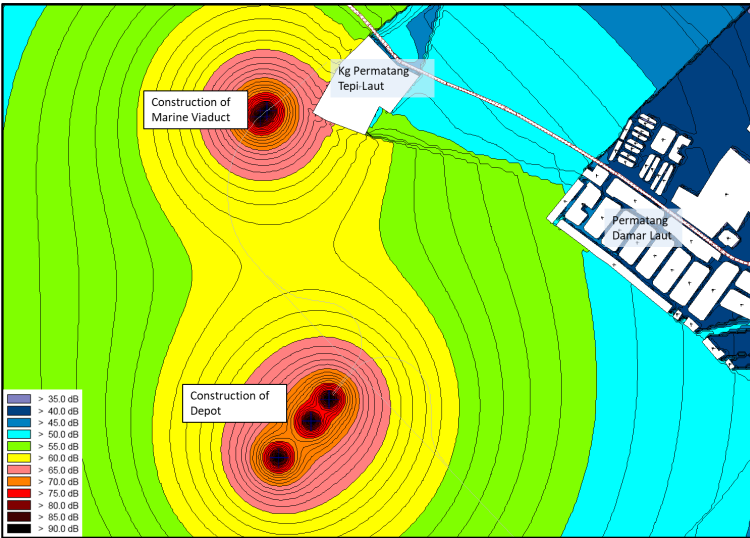
Pencegahan Pencemaran & Langkah Mitigasi

- pelaksanaan *low impact piling* berhampiran penerima
- Manjalankan aktiviti pembinaan yang bising di waktu siang sahaja. Elakkan pergerakan kenderaan berat berhampiran penerima di waktu malam atau hujung minggu
- Pemasangan penghadang bunyi dan *hoardings* berhampiran penerima
- Penggunaan *diaphragm sheet piles* di tapak pembinaan untuk mengawal penghasilan getaran
- Penyelenggaraan kenderaan dan mesin
- Pemantauan berterusan ketika *piling* dijalankan

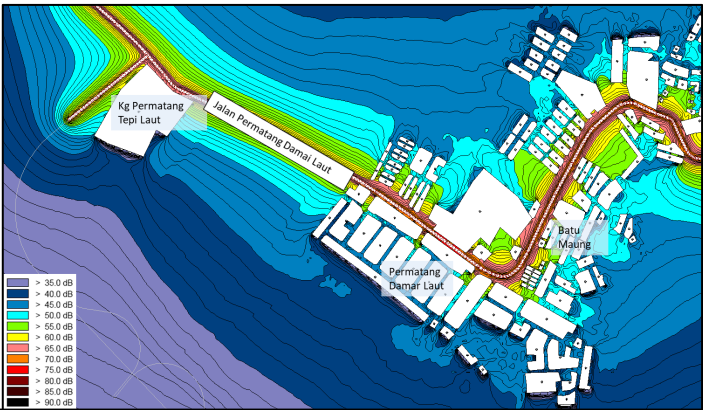
KESAN UTAMA DARI BUNYI BISING DAN GETARAN



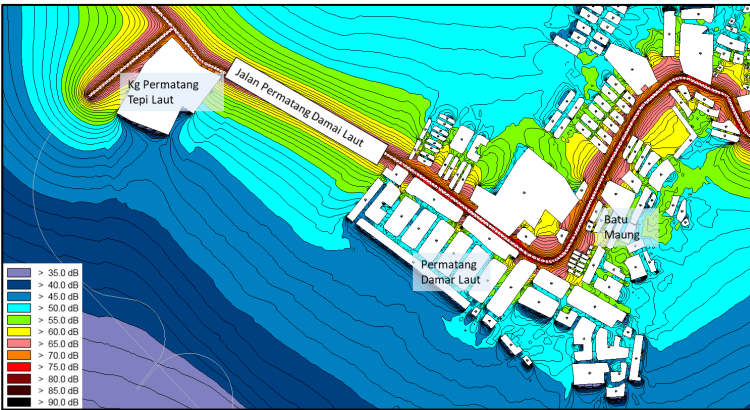
Kontur bunyi ketika pembinaan trek bertingkat BLLRT Segmen 5 (Pulau A) berhampiran Permatang Damar Laut. Bunyi tersebar antara 50 – 55 dBA



Kontur bunyi ketika pembinaan jambatan laut dan depoh berhampiran Kg. Permatang Tepi Laut. Bunyi tersebar antara 50 – 55 dBA kecuali bahagian jambatan laut berhampiran stesen Permatang Damar Laut dimana bunyi tersebar sehingga 65 dBA.



Kontur bunyi kebiasaan di Jalan Permatang Damar Laut



Kontur bunyi di Jalan Permatang Damar Laut ketika pembinaan BLLRT Segmen 5 (Pulau A), dengan peningkatan purata 5 dBA sepanjang jalan menuju laluan masuk pembinaan bersebelahan stesen Permatang Damar Laut.

OPERASI

AKTIVITI : Operasi BLLRT Segmen 5 (Pulau A)
PENERIMA : Kawasan perumahan Kg. Permatang Tepi Laut, Kg. Binjai, Permatang Damar Laut

Kesan

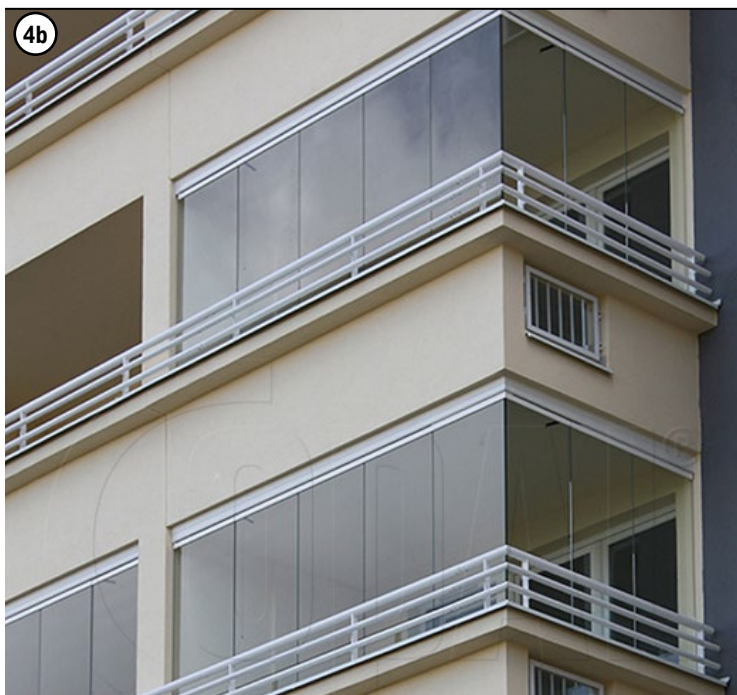
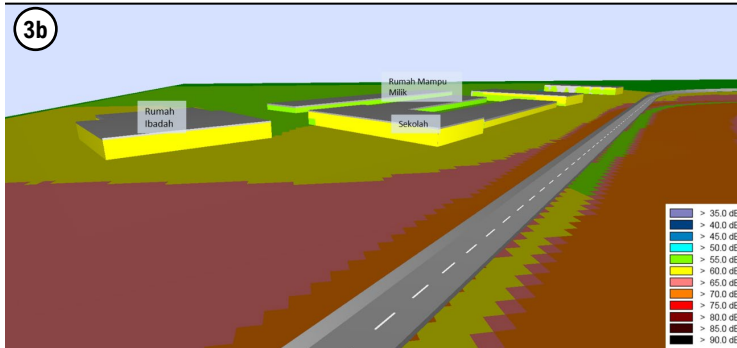
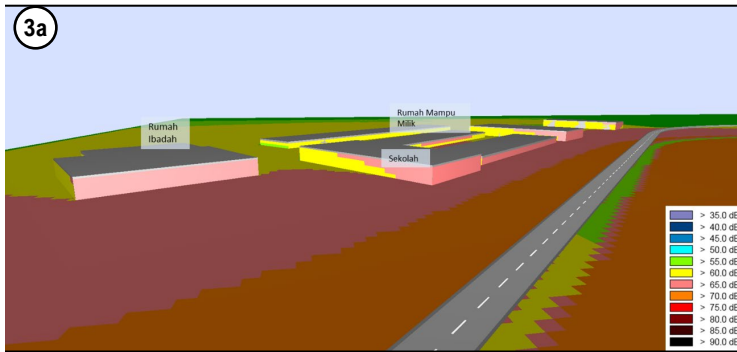
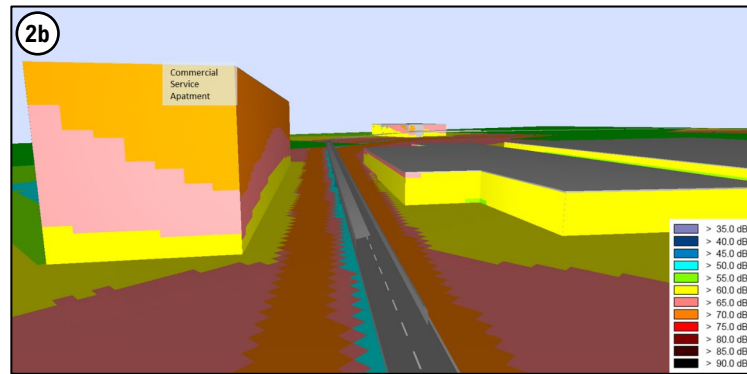
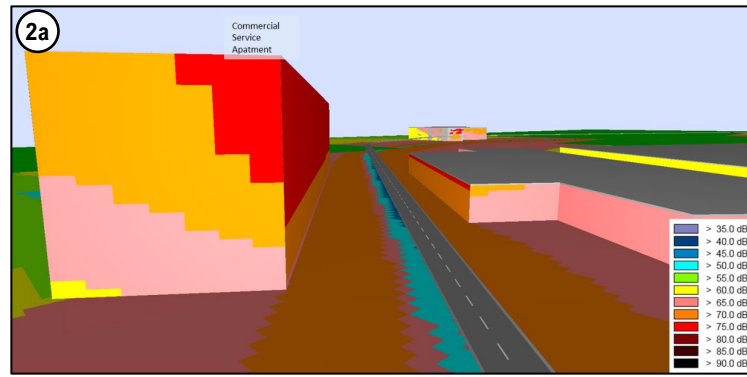
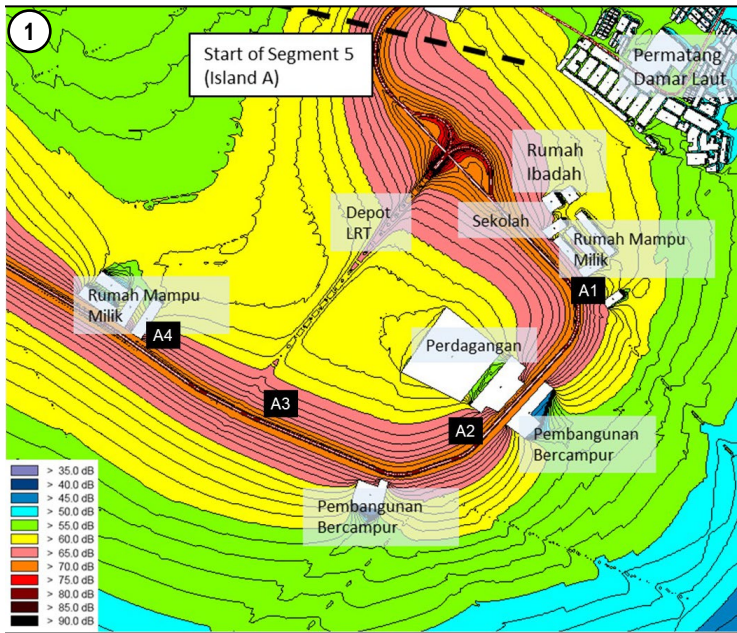


- Bunyi bising dan getaran dari operasi kereta api berhampiran kawasan perumahan
- Kesan lebih bunyi dijangka **sangat rendah** di kebanyakan penerima, segelintir penerima akan mengalami kesan lebih “sederhana”.
- Getaran yang dihasilkan dari kereta api secara amnya berada di bawah had penerimaan getaran di kesemua penerima (kawasan perumahan dan rumah-rumah ibadat)
- Penerima yang memerlukan mitigasi bunyi dan getaran telah dikenal pasti di **Stesen A1** dan **Stesen A4**.

Pencegahan Pencemaran & Langkah Mitigasi

- 3 kawasan cadangan penghadang bunyi** telah dicadangkan di jajaran yang berhampiran dengan penerima-penerima di Stesen A1, Stesen A2, dan Stesen A4.
- Lokasi-lokasi penghadang dan rekabentuk akan diperhalusi di peringkat rekabentuk terperinci Projek.
- Secara amnya tiada keperluan untuk mitigasi tambahan untuk getaran selain dari penggunaan *ballast tracks* di sepanjang jajaran
- Pemilihan dan had mitigasi getaran adalah tertakluk kepada perubahan rekabentuk jajaran di peringkat rekabentuk terperinci.

KESAN UTAMA DARI BUNYI BISING DAN GETARAN



1) Kontur bunyi di sepanjang BLLRT Segmen (Pulau A) ketika beroperasi

2a) Model penyebaran bunyi di tapak "Pembangunan Bercampur" berhampiran Stesen A2 (tanpa mitigasi)

2b) Model penyebaran bunyi di tapak "Pembangunan Bercampur" berhampiran Stesen A2 (*dengan* mitigasi)

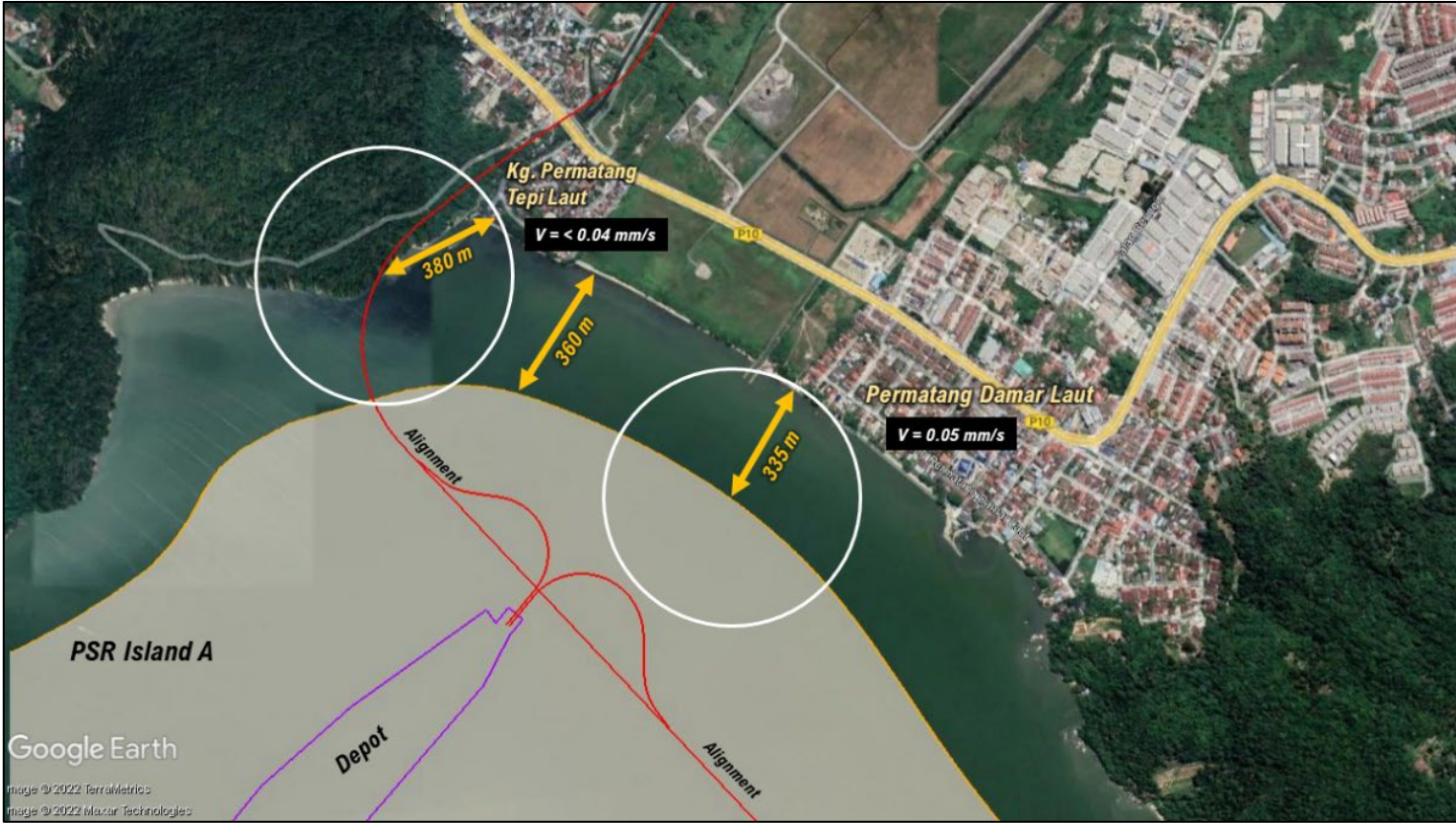
3a) Model penyebaran bunyi di tapak "Rumah Ibadah" dan "Rumah Mampu Milik" berhampiran Stesen A1 (tanpa mitigasi)

3b) Model penyebaran bunyi di tapak "Rumah Ibadah" dan "Rumah Mampu Milik" berhampiran Stesen A1 (*dengan* mitigasi)

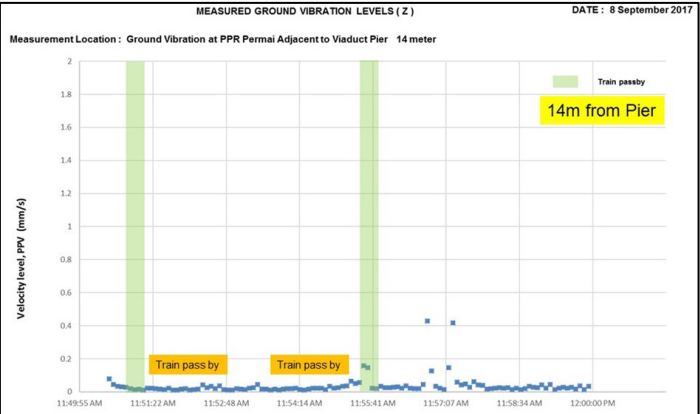
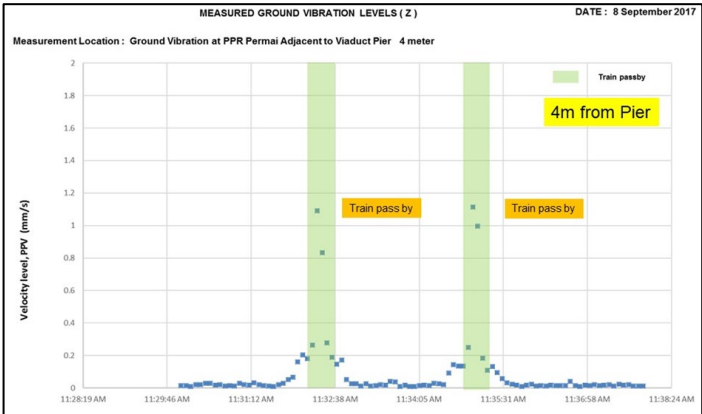
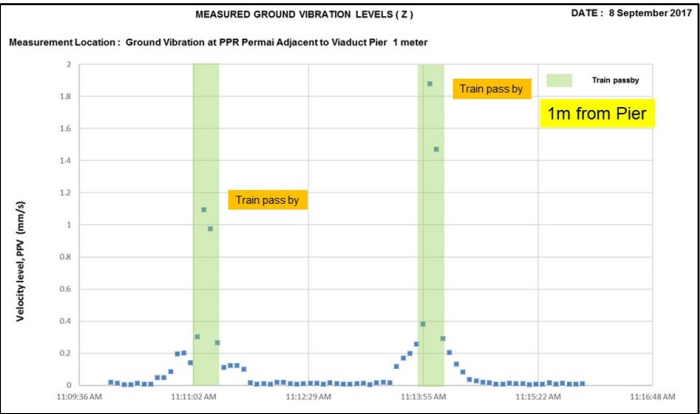
4a) Contoh penghadang bunyi sebagai langkah mitigasi penyebaran bunyi.

4b) Contoh pemasangan tingkap *double-glazed* untuk mengurangkan kemasukan bunyi operasi keretapi ke dalam kediaman

KESAN UTAMA DARI BUNYI BISING DAN GETARAN



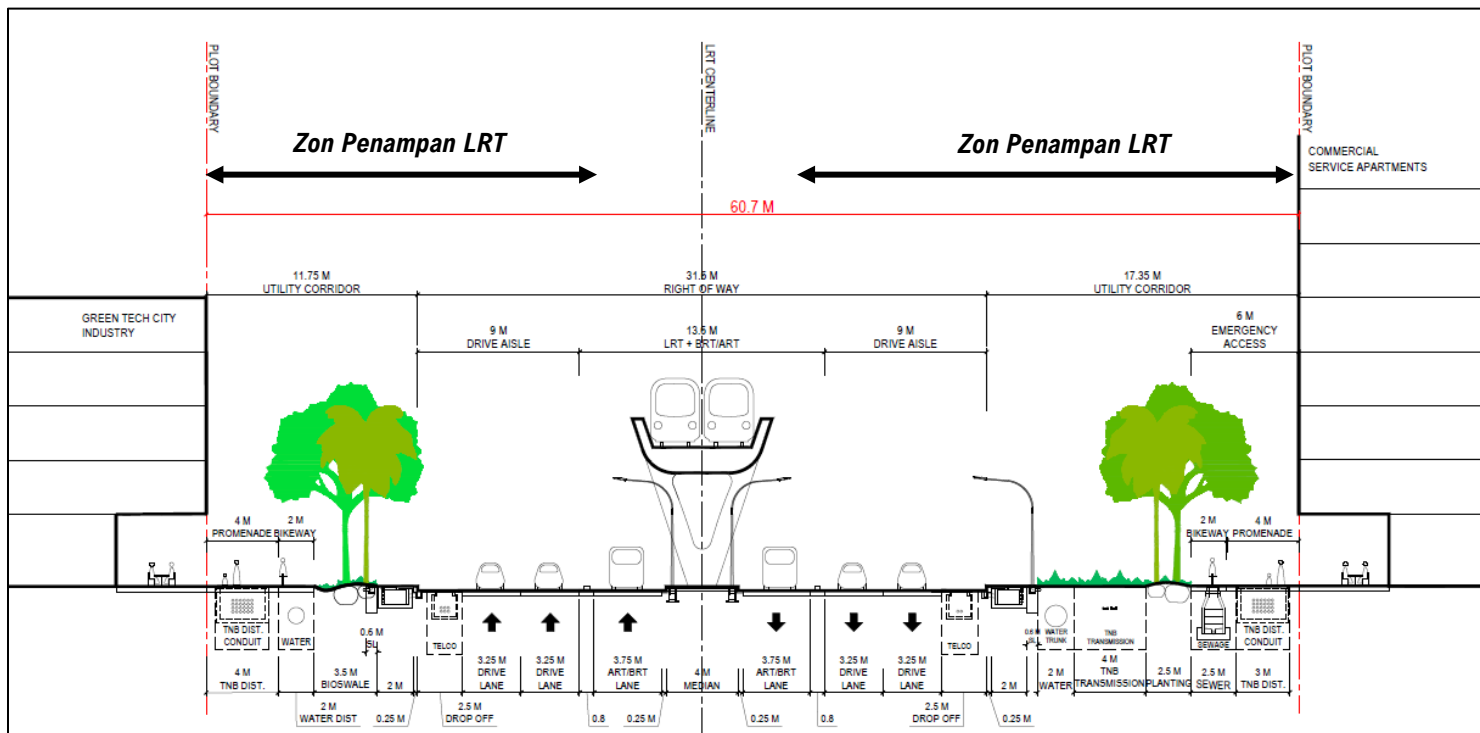
Model getaran kerja-kerja pembinaan menunjukkan getaran yang terhasil berada di bawah takat persepsi manusia di lokasi penerima sensitive terdekat dengan tapak pembinaan jambatan laut dan di Pulau A PSR.



Pengukuran getaran EMU MRT dan LRT pada jarak berbeza

Distance to Receptors (m)	MRT Kajang Line Persiaran Surian	LRT Ampang Line PPR Permai
1	0.15 to 0.70 mm/s	0.95 to 1.88 mm/s
4	Not measured	0.82 to 1.11 mm/s
14	Not measured	0.05 to 0.16 mm/s
25	<0.10 mm/s*	Not measured

Getaran dari pengoperasian LRT di trek bertingkat yang dirasai oleh penerima berjarak 30 m adalah dalam lingkungan had getaran selang-seli dari laluan keretapi pada waktu malam dalam Garis Panduan JAS (R=4, 0.4 mm/s), juga untuk pengoperasian keterapi di atas trek terpakai.



Keratan rentas pembinaan berhampiran Stesen A2 menunjukkan langkah mitigasi pengoperasian keretapi yang diambil kira dalam perancangan Pembangunan Pulau A PSR. Guna tanah bersesuaian (Pembangunan bercampur, komersil, dan industri) direka bentuk selari dengan jajaran BLLRT Segmen 5 (Pulau A). Kawasan perumahan terselindung dibalik kawasan guna tanah yang disebutkan dari bunyi bising dan getaran.

KESAN UTAMA TERHADAP KUALITI UDARA

PEMBINAAN

AKTIVITI : Kerja-kerja tanah & pembinaan jalan masuk, trek bertingkat, stesen, dan depoh
 RECEPTOR : Pekerja pembinaan di Pulau A PSR, komuniti di sepanjang Permatang Damar Laut

Kesan



- Penghasilan **Fugitive Dust** (habuk kabur) (PM_{10}) dari kerja-kerja tanah (**berkesan rendah kerana jarak tapak pembinaan yang berjauhan**)
- Pelepasan **habuk** dan **gas** penggunaan kenderaan dan peralatan pembinaan (PM_{10} , $PM_{2.5}$, CO, NO_2 and SO_2)

Pencegahan Pencemaran & Langkah Mitigasi

- Penyemburan air berkala** di pintu masuk tapak pembinaan dan jalan pengangkutan
- Penyediaan **fasiliti pencucian tayar**
- Kenderaan yang mengangkut bahan-bahan jenis zarah (*particle-type*) akan dilutupi dengan **tarpaulin**
- Penyelenggaraan berkala** kenderaan pembinaan untuk mengurangkan pencemaran dikeluarkan melalui ekzos

OPERASI

AKTIVITI : Pengoperasian Bayan Lepas LRT

Tiada pencemaran udara yang dijangkakan memandangkan keretapi dikuasai oleh elektrik.



Water browser untuk melembapkan jalan masuk



Wheel washing bay di pintu masuk tapak pembinaan

KESAN UTAMA DARI PENGHASILAN SISA

PEMBINAAN

AKTIVITI : Kerja-kerja tanah, Pembinaan jambatan laut, trek bertingkat, stesen, dan depoh
PENERIMA : *Penang South Bay*, komuniti di sepanjang Permatang Damar Laut, Pantai Esen, Pantai Kapor Bakar

Kesan



Penghasilan **biomas** dari kerja pembersihan tapak



Penghasilan **sisa pembinaan** dari aktiviti kerja-kerja tanah dan pembinaan struktur



Penghasilan **sisa terjadual** dari aktiviti penyelenggaraan mesin serta penghasilan **sisa domestik** di bengkel dan pejabat tapak.

Pencegahan Pencemaran & Langkah Mitigasi

- **Guna atau kitar semula** biomas sebagai sungkupan untuk **LDP2M2**
- **Pembuangan:** lebihan akan dilupuskan di **tapak pelupusan sampah yang diluluskan**
- **Pengasingan sisa** di tapak untuk diguna semula di tapak pembinaan lain, atau dilupuskan di fasiliti kitar semula
- Pelupusan sisa tidak bersesuaian di **tapak pelupusan sampah yang diluluskan**
- Sisa terjadual akan diuruskan berpandukan **EQ (Scheduled Waste) Regulations 2005**
- Sisa domestik seharusnya **dikitar semula** (penyediaan bakul kitar semula) di mana bersesuaian atau dilupuskan di **tapak pelupusan sampah yang diluluskan**.

OPERASI

AKTIVITI : Pengoperasian Keretapi dan Stesen
PENERIMA : *Penang South Bay*, tapak pelupusan sampah yang diluluskan

Kesan



Penghasilan **sisa domestik** di stesen (impak minima – Kadar penghasilan sisa yang kecil – 288 kg/hari di setiap stesen)



Penghasilan **sisa terjadual dan sisa domestik** dari aktiviti penyelenggaraan keretapi di depoh

Pencegahan Pencemaran & Langkah Mitigasi

- Sisa domestic seharusnya **dikitar semula** (penyediaan bakul kitar semula) di mana bersesuaian atau dilupuskan di **tapak pelupusan sampah yang diluluskan**.
- Sisa terjadual akan diuruskan berpandukan **EQ (Scheduled Waste) Regulations 2005**
- Sisa domestic seharusnya **dikitar semula** (penyediaan bakul kitar semula) di mana bersesuaian atau dilupuskan di **tapak pelupusan sampah yang diluluskan**

KESAN UTAMA TERHADAP TRAFIK

AKTIVITI : Pengangkutan bahan binaan, mesin-mesin, dan sisa, pengoperasian stesen
PENERIMA : P10 Jalan Permatang Damar Laut, Jalan pengagih di mana Stesen A1 – Stesen A4 terletak

Kesan



Pembinaan
Peningkatan kadar trafik kenderaan berat di sepanjang P10 Jalan Permatang Damar Laut menuju tapak pembinaan di Pulau A PSR.

Operasi
Peningkatan kadar trafik di Stesen A1 – Stesen A4 dari aktiviti penurunan dan pengambilan penumpang

Langkah Mitigasi

- Penggunaan papan tanda yang jelas, pencahayaan jalan dan papan tanda, serta pengawalan trafik menggunakan pekerja untuk memastikan kelancaran trafik serta keselamatan awam.
- Pelebaran jalan setempat dengan bahu jalan
- Cadangan pembinaan jalan masuk berdasarkan standard ATJ.
- Penambahbaikan persimpangan jalan.

BAHAYA DAN KESELAMATAN AWAM

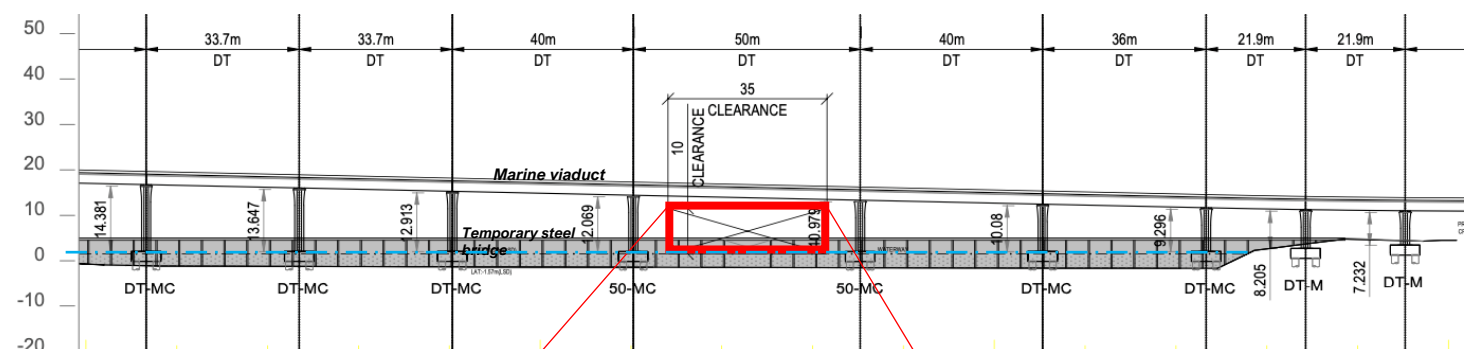
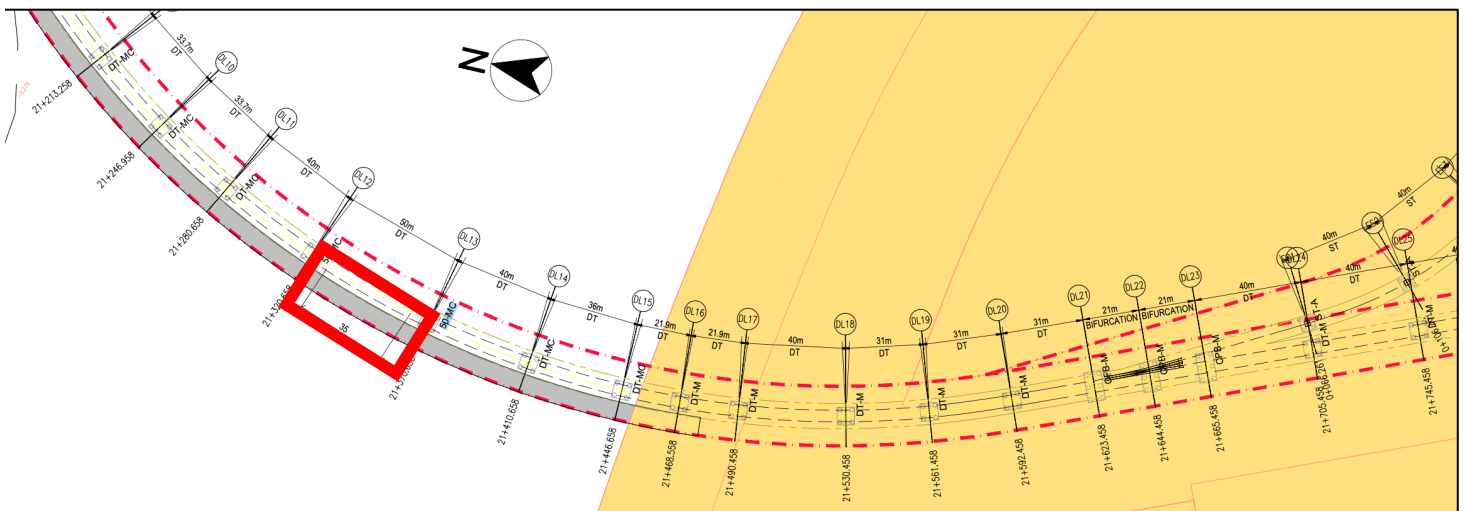
	Scenario	Kejadian Berbahaya	Skor*			Ranking
			Likelihood	Severity	Risk	
(A) Pengangkutan segmen <i>pre-cast</i>	A1	Kemalangan melibatkan kenderaan	2	5	10	Sederhana
	A2	Bahaya dan keselamatan pekerjaan	1	5	5	Sederhana
(B) Pembinaan jalan masuk sementara pembinaan	B1	Kemalangan melibatkan kenderaan	2	5	10	Sederhana
	B2	Bahaya dan keselamatan pekerjaan	1	5	5	Sederhana
(C) Pembinaan jambatan sementara	C1	Risiko pengemudian	1	3	3	Rendah
	C2	Bahaya dan keselamatan pekerjaan	2	5	10	Sederhana
(D) Pembinaan jambatan laut	D1	Risiko pengemudian	1	4	4	Sederhana
	D2	Bahaya dan keselamatan pekerjaan	3	5	15	Tinggi
(E) Pembinaan jajaran bertingkat	E1	Bahaya dan keselamatan pekerjaan	3	5	15	Tinggi
(F) Pembinaan stesen dan depoh	F1	Bahaya dan keselamatan pekerjaan	3	5	15	Tinggi

Kejadian-kejadian berisiko tinggi kebanyakannya melibatkan bahaya dan keselamatan pekerjaan berkaitan kerja-kerja pembinaan jambatan laut, jajaran bertingkat, stesen, dan depoh.

Aktiviti berisiko sederhana dimana kawalan risiko terhadap kejadian berbahaya telah mencapai ke tahap 'As Low as Reasonably Practicable (ALARP)'.

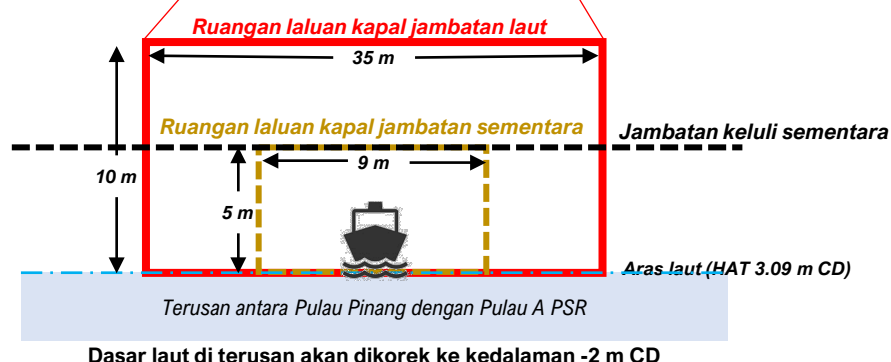
Risiko pengemudian berkaitan kerja-kerja pembinaan jambatan sementara dikira sebagai kerja-kerja berisiko rendah, manakala kerja-kerja pembinaan jambatan laut pula dikira sebagai kerja-kerja berisiko sederhana.

RUANGAN LALUAN KAPAL JAMBATAN SEMENTARA DAN JAMBATAN LAUT



Jambatan sementara akan mempunyai ruangan yang mencukupi (ketinggian 5 m dan lebar 9 m) untuk membenarkan laluan kapal tanpa sebarang gangguan.

Ruangan laluan kapal jambatan laut menepati keperluan Jabatan Laut (vertical clearance sekurang-kurangnya 10 m).



HAKISAN TANAH DAN PENGELODAKAN

AKTIVITI	: Kerja-kerja tanah, Pemasangan cerucuk jajaran bertingkat, jambatan laut, depoh, dan stesen
PENERIMA	: Persekitaran marin Permatang Damar Laut, Laluan Air di Pulau A PSR

Memandangkan keseluruhan Bayan Lepas LRT Segmen 5 (Pulau A) akan berada di Pulau A PSR, berikut adalah anggapan dasar yang telah diguna pakai dalam penilaian takat hakisan tanah dan pengelodakan:

- Penilaian dilakukan berdasarkan permukaan platform tambakan yang rata diantara 4.7 m CD dan 6.5 m CD
- Permukaan pulau dilitupi penuh dengan pepasir (bahan pengisian platform tambakan Pulau A PSR)
- Penilaian pra-pembinaan dan scenario-scenario terburuk juga berdasarkan keadaan permukaan yang sama (permukaan berpasir yang tidak dilitupi).

Kerja-Kerja Berpotensi Menghakis Tanah	Mitigation Measures
 Pembinaan jajaran bertingkat • Pengorekan lubang untuk pemasangan cerucuk dan tiang jambatan Pembinaan depoh dan stesen • Pengorekan lubang untuk pemasangan cerucuk dan pendasaran • Kerja-kerja tanah Pembinaan jambatan laut • Kerja-kerja pengorekan untuk pemasangan cerucuk dan tiang jambatan	Pembinaan jajaran bertingkat Pembinaan depoh dan stesen • Disatukan dengan LD-P2M2 Induk <i>Topside</i> Pulau A PSR • Pemasangan kawalan hakisan, kawalan air larian, kawalan kelodak serta pemantauan dan penyelenggaraan berkala alat-alat kawalan. Pembinaan jambatan laut • Pemasangan <i>cofferdam</i> untuk mengurangkan gangguan gugat dasar laut.

KESAN UTAMA DARI PERSEKITARAN GEOLOGI

AKTIVITI	: Pengorekan, pemasangan cerucuk dan tiang jambatan laut dan jajaran bertingkat
PENERIMA	: Struktur dan komponen Bayan Lepas LRT Segmen 5 (Pulau A)

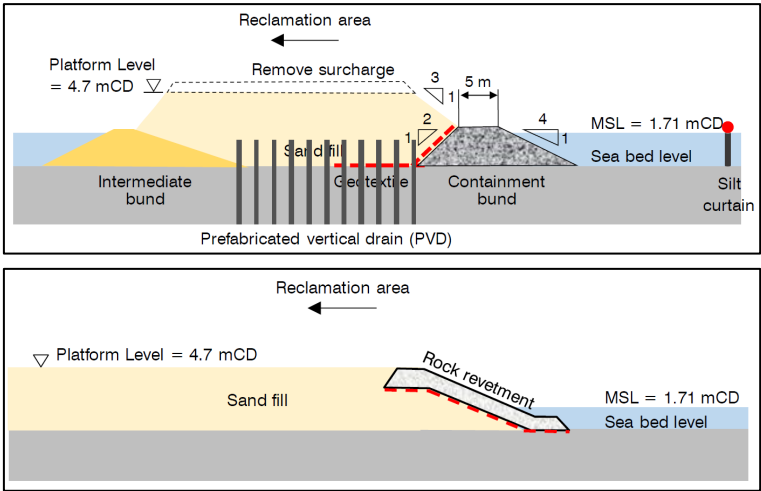
Kestabilan struktur Bayan Lepas LRT Segmen 5 (Pulau A) berhubung kait dengan keutuhan platform Pulau A PSR i.e., kemampatan pasir isian, kekuatan lapis lindung (*revetment*) platform. Kerja pengorekan dan pemasangan cerucuk di tanah tambakan lazimnya berisiko rendah kecuali pasir isian atau ban penghadang pasir isian mengalami kegagalan, atau kegagalan dasar laut bawah platform yang mungkin akan menyebabkan kegagalan platform.

PEMBINAAN

Risiko Geologi:

Ketidakstabilan pasir isian • Keseismosan serantau berpotensi menyebabkan kegagalan platform Pulau A PSR. • Ketidakstabilan juga boleh disebabkan oleh muka air tanah yang terlalu tinggi dalam platform Pulau A PSR • Getaran seismik serta muka air tanah yang terlalu tinggi berisiko menyebabkan pasir isian terlerai.	Pemampatan dasar laut disebabkan oleh pemampatan lapisan-lapisan lempung lembut bawah tanah • Berat berlebihan dari platform Pulau A PSR berpotensi menekan dan memampat lempung dan tanah bawah platform dan menyebabkan pemampatan dasar laut, menjadikan platform Pulau A PSR tidak stabil..
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Langkah Mitigasi:



- Platform direka bentuk berpandukan **Malaysia National Annex to MS EN 1998-1: 2015, Eurocode 8: Design of structures for earthquake** dan piawaian lain yang memperincikan pembinaan struktur menepati aktiviti seismik tempatan dan serantau.
- Penggunaan sistem *Prefabricated Vertical Drains* (PVD) untuk mempercepat proses pemendapan dan pemampatan platform Pulau A PSR.
- Pembinaan lapis lindung (*revetments*) yang mampu menahan getaran bernilai 5.55% g PGA (5.05% g diatas purata nilai 0.5% PGA serantau Pulau Pinang)

KESAN UTAMA TERHADAP SOSIOEKONOMI

PEMBINAAN

PENERIMA: Komuniti-komuniti di Kg. Binjai, Kg. Permatang Tepi Laut, Permatang Damar Laut



Kesan

Pergerakan nelayan keluar masuk ke Sg. Bayan Lepas yang terbatas

Langkah Mitigasi

- Penyediaan **pengemudian kapal pada jambatan sementara dan jambatan laut** untuk pergerakan keluar masuk jeti Sg. Bayan Lepas. (sila rujuk muka surat 16 Ringkasan Eksekutif)



Kenaikan bilangan **pekerja asing** yang berpotensi menyebabkan masalah keselamatan dan sosial

- Penyediaan penempatan berpusat untuk mengurangkan interaksi antara pekerja binaan dengan masyarakat tempatan
- Penyediaan latihan serta pemantauan aktiviti pekerja binaan pada hari cuti dan waktu malam.



Kesan Positif

- Memacu **pertumbuhan ekonomi** di peringkat negeri, serantau, dan tempatan
- Penghasilan **peluang pekerjaan**

- Menjana nilai ekonomi lebih tinggi terutamanya di kawasan sekitar stesen
- Pergerakan penumpang yang lebih lancar antara Daerah Barat Daya dengan Daerah Timur Laut Pulau Pinang.

OPERASI

Faedah Projek



- Panambahbaikan **perhubungan pengangkutan awam** ke seluruh Pulau Pinang
- Pengurangan kesesakan lalu lintas di Pulau Pinang
- Penjimatan masa perjalanan
- Perjalanan yang senang dan lancar dari George Town dan Pulau A PSR ke FIZ dan Lapangan Terbang Antarabangsa Pulau Pinang
- Peningkatan **kapasiti dan ketersampaian** di seluruh Pulau A PSR
- Memacu **pertumbuhan ekonomi** di kawasan-kawasan sekitar BLLRT
- Meningkatkan keterhubungan destinasi-destinasi di Pulau A PSR serta menyediakan perhubungan dengan transit awam sedia ada serta jajaran keretapi di masa hadapan



CADANGAN PROGRAM PEMANTAUAN KUALITI ALAM SEKELILING

PEMBINAAN

   	Lokasi	Parameter	Kekerapan
	• 9 stesen pensampelan kualiti air laut • Titik pelepasan di kolam enapan	• Suhu., pH, DO, COD, BOD, TSS, kekeruhan, O&G, NH₃-N & E.coli • TSS, kekeruhan (kolam-kolam enapan)	Bulanan
	• 2 stesen pensampelan kualiti udara	• PM₁₀, 24 jam	Suku tahunan
	• 2 stesen pensampelan bunyi dan getaran • Audit pembinaan	• L_{aeq} & L_{max}, 24-jam • <i>Peak Particle Velocity</i>, pemantauan 1-jam • Berdasarkan syarat kelulusan EIA	Mingguan Setiap 4 bulan

CADANGAN STRUKTUR ORGANISASI PENGURUSAN ALAM SEKELILING

