



EAST COAST RAIL LINK PROJECT

ENVIRONMENTAL IMPACT ASSESSEMENT REPORT



VOLUME 1 : EXECUTIVE SUMMARY & RINGKASAN EKSEKUTIF

Prepared by :



March 2017

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INTRODUCTION

1. The East Coast Rail Link (hereinafter known as “The ECRL” or the Project”) involves the construction of a rail link from Wakaf Bahru in Kelantan to the Integrated Transport Terminal (ITT) in Gombak, Selangor (**Figure ES-1**). The ECRL traverses Kelantan, Terengganu and Pahang (**Table ES-1**) and passes near major towns such as Wakaf Bharu, Kota Bharu, Kuala Besut, Kuala Terengganu, Dungun, Chukai, Kuantan, Gambang, Maran, Mentakab and Bentong, before crossing under the Main Range into Selangor. In addition to the main line, there will also be six spur lines.

Table ES-1 : Alignment Lengths

State	Main Alignment Length (km)	Spur Line Length (km)
Kelantan	55.0	
Terengganu	227.9	43.7
Pahang	233.0	22.2
Selangor	16.4	
Total	532.3	65.9

2. The East Coast Rail Link (ECRL) is a vital **national infrastructure** that is expected to stimulate growth and help **bridge the economic gap between the East and West Coasts** of Peninsular Malaysia. The ECRL will **strengthen connectivity** of State capitals, major urban centres and industrial clusters, sea and inland ports, airports and tourism zones; and enhance transport accessibility of the people in the East Coast. The ECRL will **increase freight transport capacity** between the East Coast and West Coast; and within the East Coast, facilitate increased trade and more efficient logistics.
3. The ECRL supports the aspirations of many national and state plans and policies. It represents the culmination of transport policies laid down in the National Physical Plans 1, 2 and 3 as well as the State Structure Plans of Kelantan, Terengganu, Pahang and Selangor. The ECRL is a key infrastructure in the East Coast Economic Region (ECER) Master Plan, which aims to accelerate economic growth in the East Coast. The ECRL also represents fulfilment of the strategic objective of the National Land Public Transport Master Plan for Peninsular Malaysia, that is to ensure that the nation is physically well-connected and the rural and inter-city connectivity is enhanced.

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4. The Project Proponent is Malaysia Rail Link Sdn Bhd (MRL), a company wholly owned by the Ministry of Finance Malaysia.

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5. The Consultant undertaking the Environmental Impact Assessment is ERE Consulting Group Sdn Bhd.

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6. The Project is a Prescribed Activity (Construction of New Railway Route) under the Second Schedule of the Environmental Quality (Prescribed Activities) (Environmental Impact Assessment) Order 2015, and Section 34A of the Environmental Quality Act 1974, which stipulates that an Environmental Impact Assessment (EIA) report is required to be submitted to the Director-General of Environmental Quality for review and approval prior to project implementation.

TERMS OF REFERENCE

7. The Terms of Reference (TOR) and Environmental Scoping Information for this EIA were submitted to the Department of Environment (DOE) on 25 January 2017. The TOR was presented and discussed at the DOE on 16 February 2017 and endorsed on 22 February 2017.

STATEMENT OF NEED

8. The ECRL is expected to stimulate the economy of the East Coast Economic Region (ECER) and help balance the economic development between the East and West Coasts, specifically between the ECER and the Greater Klang Valley (GKV). The disparity in development of the ECER and GKV is apparent, where the Gross Domestic Product (GDP) of the GKV in 2010 was RM 215.9 billion, or four times the GDP of the ECER at RM 49.6 billion,

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although the land area of the ECER is eight times larger than that of the GKV. The ECER also lags behind in development and economic growth compared to the nation as a whole.

9. The ECRL is needed as there is currently no direct railway connection between the East Coast and the West Coast except for the KTMB railway line from Tumpat to Kuala Lumpur via Gemas. The ECRL will improve connectivity to state capitals, major urban centres, industrial clusters, sea ports, internal container depots, airports and tourism zones, and will enhance transport accessibility for the people in the East Coast. It will also traverse a significant part of the ECER Special Economic Zone, which is the most significant centre of manufacturing in the East Coast, and hosts numerous industrial parks. The ECRL will
 - reduce travel time between major centres and reduce freight cost.
 - reduce heavy truck volume and improve safety on the road.
 - free up road capacity, hence reducing traffic congestions and pollution.
10. The ECRL will increase freight transport capacity between the East Coast and West Coast, and within the East Coast, facilitating increased trade and more efficient logistics. The ECRL will also increase freight transport capacity and trans-shipment between inland areas and Kuantan Port, enabling economic development in the hinterland. ECRL line between Kertih and Kuantan will serve the market for the movement of containers and commodities including steel and polyethylene between Kuantan Port, Kemaman Port and Kertih. Similarly, iron ore and other commodities from the interior regions can be more efficiently transported to ports.
11. The ECRL will serve the high demand for passenger service between Kuala Lumpur and Kota Bharu. Passenger services will also be enhanced with the links to the bus and LRT services at the ITT Gombak. The ECRL will provide direct connectivity between the East Coast and Kuala Lumpur, as opposed to the existing circuitous railway route via Gemas. This direct connection will shorten the journey from Kuala Lumpur to Wakaf Bharu to 4 hours, much faster than the 15 hours on the existing route via Gemas.
12. The ECRL will bring about benefits not only to passenger and freight movement within the East Coast but also link the region with the rest of Peninsular Malaysia by means of an efficient rail network system. The ECRL is expected to bring about significant development benefits to the East Coast of Peninsular Malaysia as well as the rest of the nation.

PROJECT OPTIONS

13. Various alignment options were identified and evaluated in the process of selecting the optimum alignment for the ECRL. The options varied according to the physical characteristics, socio-economic constraints and transport network design requirements. In addition to the alignment options, options for the type of railway gauge were also considered.

Options considered during Feasibility Study

14. The ECRL Feasibility Study, commissioned by the ECERDC in 2010, examined four main alignment options comprising combinations of different railway routes and gauges for the main line :
- Metre gauge via Gemas
 - Metre gauge via Bentong
 - Standard gauge via Gemas
 - Standard gauge via Bentong
15. The various options for alignment, railway gauge and traction system during the Feasibility Study were evaluated through multi-criteria evaluation process and consultation with government agencies and other interested parties.
16. The Standard Gauge via Bentong option was eventually selected as the preferred alignment and this was endorsed by the National Economic Council in February 2013. The main factors for the selection of the Bentong standard gauge option were:
- The Bentong option will provide a direct route to the Klang Valley and shorten the journey by 2 hours compared to the Gemas route.
 - The higher ridership of the Bentong option will result in higher passenger revenue.
 - The Bentong option will create the highest employment opportunities among the four options considered.
 - The standard gauge would enable higher operating speeds, more stability and wider options of rolling stock from international suppliers as the standard gauge is more widely used globally.
17. In addition to the four main alignment options, various alignment alternatives were also considered at Kota Bharu, Kuala Terengganu and Kuantan.
18. Two traction system options were considered, namely electric and diesel traction systems. The electric traction system was the preferred option for passenger trains, while the traction system for freight trains was for either electric or diesel options.

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Options considered during Railway Scheme

19. The next stage of planning and design commenced in November 2016 to improve the design based on more detailed data and technical criteria such as (geometry, constructability, social and environmental constraints) as well as the preferences and requirements of the State governments.
20. The locations of stations were revised based on state government preferences and accessibility to existing urban centres and future development nodes. Certain stretches of the alignment were revised to avoid cutting through forest reserves and environmentally sensitive areas.
21. In addition to alignment options, design options for hilly terrain and low-lying areas were also evaluated. The construction of 19 tunnels to reduce hill cutting and avoid fragmentation of forests and wildlife habitats as well as over 70km of elevated tracks to reduce flood risk represents a major investment on the part of MRL.

PROJECT DESCRIPTION

22. The ECRL will be an electrified single track railway line built on a double track formation, approximately 532.3 km for the main line with another 65.9 km of spur lines (**Table ES-2**). About 16.5% of the alignment will be elevated. The ECRL will have 23 stations.

Table ES-2 : Project Overview

Description		Length/Quantity	
Main line	Elevated	88.0km	532.3km
	At-grade	395.8km	
	Tunnels	48.5km	
Spur Line	1. Bukit Besi - 25.2 km 2. Kerteh* - 10.8 km 3. Kemaman - 7.7 km 4. Kuantan Port City - 10.2 km 5. Kuantan Sentral* - 5.8 6. Mentakab - 6.2 km		65.9km
Stations	Passenger	12	23**
	Freight	2	
	Passenger & Freight	9	

* Provisional spur line

** including three provisional stations

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Alignment

23. The alignment is divided into six main segments for ease of description :

- Segment 1 : Kelantan
- Segment 2 : Terengganu North (MD Besut – MD Setiu – MD Kuala Nerus - MB Kuala Terengganu)
- Segment 3 : Terengganu South (MD Marang – MP Dungun – MP Kemaman)
- Segment 4 : Pahang East (MP Kuantan – MD Maran)
- Segment 5 : Pahang West (MP Temerloh – MP Bentong)
- Segment 6 : Selangor

MD – Majlis Daerah, MP – Majlis Perbandaran

Segment 1 : Kelantan

24. The alignment starts at the Wakaf Bharu Station and moves southwest through Pasir Mas before turning east and crossing Sg. Kelantan. It then comes to the Kota Bharu Station and continues east, passing Kota Bharu on its left. After entering Bachok district, the alignment turns southeast and passes agricultural land before it comes to the Jelawat Station. The alignment continues southeast through Bachok and Pasir Puteh, passing through sparsely populated areas before arriving at the Tok Bali Station, located about 5 km north of the Royal Malaysian Air Force base at Gong Kedak (**Figure ES-2**).

Segment 2: Terengganu North

25. From the Kelantan – Terengganu state border, the alignment traverses in a south-easterly direction passing through mostly agricultural land. It crosses Sg. Besut and several roads, namely Jalan Kuala Besut, Jalan Kampung Raja and Jalan Masjid, all within the Besut district before reaching the Kampung Raja station about 5 km south of Kuala Besut.

26. The alignment then continues southeast through mostly agricultural land and enters the Setiu district where the Penarik Station is located. The alignment continues southeast, passing densely populated areas in Batu Rakit and Kuala Nerus before turning south and coming to the Kuala Terengganu Station, which is about 3 km southwest of the Sultan Mahmud Airport and 8 km northwest of Kuala Terengganu town (**Figure ES-3**).

Segment 3: Terengganu South

27. After Kuala Terengganu, the alignment crosses Sg Terengganu and enters the Marang district. It passes through populated and agricultural land before coming to the Kuala Telemong Station, near Bukit Payung. The alignment then continues to the Pengkalan Berangan Station, which is near

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the future Silica Valley development. After that, the alignment passes through mostly agricultural land in southern Marang district and heads south to the Dungun Station near Kuala Dungun. The inland spur line from Bukit Besi meets the main alignment here. As the alignment continues south of Kerteh, the alignment will run on the existing Petronas-owned Kerteh-Kuantan Port railway corridor which will be rehabilitated and upgraded. A provisional spur line to the Kerteh industrial area starts from south of the Dungun Station.

28. After leaving Dungun district, the alignment enters Kemaman district and continues south to the Kemasik Station. The alignment then heads to the Chukai Station, where a 7.7km spur line will go to the Kemaman Port. The alignment crosses Sg. Kemaman before heading south to Pahang (**Figure ES-4**).

Segment 4 : Pahang East

29. As the alignment enters Pahang along the existing Kerteh-Kuantan Port railway corridor, it comes to the Cherating Station. It then continues south through mostly agricultural land before coming to the Kuantan Port City Station near the Gebeng Industrial Estate, where a spur line heads to Kuantan Port. A short distance after the Kuantan Port City Station, the existing Kerteh-Kuantan Port railway corridor ends and the alignment then heads southwest on a new corridor, reaching the Kuantan Port City (KPC) Depot.
30. After the KPC depot, the alignment heads southwest and runs alongside the TNB transmission line before coming to the KotaSAS Station. There will be a 5.8km spur line to Kuantan Sentral. The alignment then continues southwest, crosses Sg Kuantan and passes Felda Sg. Pancing Timur, skirting 2.5km north of Sultan Ahmad Shah Airport. The alignment continues in a southwest direction and comes to the Gambang Station, located near the East Coast Expressway. The alignment continues west, generally following the Federal Route 2 before reaching the Maran Station about 10 km west of Maran town (**Figure ES-5**).

Segment 5 : Pahang West

31. The alignment continues west to Temerloh district where it crosses Sg. Pahang before arriving at the Mentakab Station, near the Temerloh Industrial Area, where a short spur line provides interconnection to the KTMB Tumpat-Gemas railway. The alignment continues west, passing through mostly agricultural land, before crossing the East Coast Expressway and arriving at the Bentong Station near the Bentong Barat exit of the East Coast Expressway (**Figure ES-6**). The alignment then heads in a southwest

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direction through the hilly terrain of Bukit Tinggi and enters the 17.8km long Genting tunnel, crossing under the Main Range towards Selangor.

Segment 6 : Selangor

32. The ECRL alignment tunnels through the Main Range, roughly following the East Coast Expressway alignment, and exits the tunnel in northern Gombak before turning south along edge of the Sg. Gombak valley, where the provisional Gombak North station is proposed. The alignment then crosses Jalan Gombak and then the Middle Ring Road 2 and ends at the ITT Gombak Station (**Figure ES-7**). The Selangor portion of the ECRL alignment is 16.7km long.

Spur Lines

33. There will be six spur lines along the ECRL alignment (**Table ES-3**).

Table ES-3 : ECRL Spur Lines

No.	Location	Length (km)	Description
1	Bukit Besi	25.2	Spur line branches off from main line at Dungun station and heads westward to Bukit Besi to enable transport of iron ore.
2	Kerteh	10.8	Provisional spur line branches off from main line on existing Petronas railway corridor heading to Kerteh industrial area for freight transport.
3	Chukai	7.7	Spur line branches off the main line and heads eastward to Kemaman Port for freight transport.
4	Kuantan Port City	10.2	Spur line branches near KPC station and heads towards Kuantan Port for freight transport. Within Kuantan Port, another spur line branches off towards the wharf area.
5	Kuantan Sentral	5.8	This spur line will connect to the Kuantan Sentral transport terminal for passenger movement.
6	Mentakab	6.2	Double spur lines branch off from main line at Mentakab station to link existing KTMB Tumpat-Gemas railway line to enable transport of freight from KTMB railway to ECRL.

Stations

34. The ECRL will have 23 stations (**Table ES-4**). Of these, 12 will be passenger stations, 2 freight stations and 9 mixed passenger and freight stations.
35. Three stations will serve as interchange stations, i.e. enabling transfer of passenger and/or goods between the ECRL and other existing transport modes. The three interchange stations are:

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- Wakaf Bharu – Passenger & freight transfer with existing KTMB Gemas-Tumpat line.
- Mentakab – Freight transfer with existing KTMB Gemas-Tumpat line.
- ITT Gombak – Passenger transfer with Kelana Jaya LRT.

Table ES-4 : ECRL Stations

No.	Station Name	State	Station Type
1	Wakaf Bharu	Kelantan	Passenger & Freight
2	Kota Bharu	Kelantan	Passenger
3	Jelawat	Kelantan	Passenger
4	Tok Bali	Kelantan	Passenger & Freight
5	Kampung Raja	Terengganu	Passenger
6	Penarik	Terengganu	Passenger
7	Kuala Terengganu	Terengganu	Passenger
8	Kuala Telemong*	Terengganu	Passenger
9	Pengkalan Berangan	Terengganu	Passenger
10	Dungun	Terengganu	Passenger & Freight
11	Kerteh*	Terengganu	Freight
12	Kemasik	Terengganu	Passenger & Freight
13	Chukai	Terengganu	Passenger & Freight
14	Cherating	Pahang	Passenger
15	Kuantan Port City	Pahang	Passenger & Freight
16	KotaSAS	Pahang	Passenger
17	Kuantan Sentral	Pahang	Passenger
18	Gambang	Pahang	Passenger
19	Maran	Pahang	Passenger & Freight
20	Mentakab	Pahang	Passenger & Freight
21	Bentong	Pahang	Passenger & Freight
22	Gombak North*	Selangor	Freight
23	ITT Gombak	Selangor	Passenger

*Provisional station

Tunnels and Bridges

36. The ECRL will have 19 tunnels with a total length of 48.5km to minimise earth cutting, to ensure integrity of wildlife habitats and to ensure the gradient along the ECRL alignment is not be greater than 0.9%. The longest tunnel will be the 17.8 km Genting tunnel. The other tunnels range from 0.65km – 4.96 km.
37. There will be a total of 80 bridges along the ECRL. Some of the bridges, crossing Sg. Kelantan, Sg. Terengganu, Sg. Dungun, Sg. Kemaman and Sg. Pahang will be over 300 m long.

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Depot, Yards and Maintenance Bases

38. The Kuantan Port City (KPC) Depot, which will be located near the Kuantan Port City Station, will be equipped to deliver all levels of maintenance, including heavy maintenance, as well as being the Operational Control Centre for the ECRL. The main functions of the KPC Depot will be:
- Management of rolling stock maintenance.
 - Operation management of locomotives, wagons and EMUs.
 - Freight locomotives, EMU & wagon stabling.
 - Freight locomotives body washing.
 - Freight locomotives routine inspection, servicing & cleaning.
 - Maintenance for locomotives, EMUs & wagons.
 - Storage for spare parts, components & materials.
39. The Wakaf Baru Yard and ITT Gombak Yard will each have the same functions namely for stabling, interior cleaning, body washing, routine inspection, servicing and temporary repair of EMUs. Mentakab Locomotive yard will have two main functions namely locomotive stabling and locomotive routine inspection and servicing.
40. Six light maintenance bases will be established at Penarik, Kuala Terengganu, Kertih, Gambang, Mentakab and ITT Gombak stations. Four medium maintenance bases will be established near Jelawat, Kuala Terengganu, Maran and Bentong stations.

Rolling Stock and Systems

41. Passenger trains will be power-centralised EMUs comprising of one motor car and seven trailer cars with a seating capacity of 600 passengers and design speed of 160km/h. The total length of a train will be 206m.



Plate ES-1 Example of Passenger Train

42. Freight trains, which will have up to 45 wagons, will be powered by electric locomotives, having 3500t traction power and design speed of 80km/h. The main wagons that will be used are open top box cars, closed box cars, tanker wagons and flat-bed wagons.



Plate ES-2 Example of Freight Train

43. The trackworks will be designed for a speed of 160 km/h for passenger trains and 80 km/h for freight trains. The maximum axle load will be 25 tonnes and the rails will generally be continuously welded. Ballasted track will be adopted for the majority of the main line. However, at some locations (e.g. Genting Tunnel), low vibration ballastless track may be used.
44. The electric power supply for all railway facilities will be sourced from the nearest 132kV consumer bulk supply system. Dedicated 11/0.4kV substations will be installed at each station to cater for communications, signals loads and its facilities. For crucial systems such as communications, signals equipment, fire equipment and emergency lighting, a second totally independent source of power supply will be provided. Traction power supply for the trains will be fed from the 132kV TNB stations to traction power substations. The incoming 132 kV supply will be converted to AC 25kV and connected to the Overhead Catenary System.
45. The ECRL Operation Control Centre (OCC) will be established within the Kuantan Port City Depot, which is roughly at the centre of the ECRL alignment. The OCC will ensure the efficiency of the transport along the railway. Its major components will be Operation Dispatching Management, Centralised Traffic Control and a Power Supervisory Control and Data Acquisition system. All systems and subsystems will, wherever possible, be provided with duplicated and back-up facilities to ensure that the railway can continue to function at all times.

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Principal Project Activities

46. The key activities related to construction and operations of the ECRL include the following activities (**Table ES-5**).

Table ES-5 : Principal Project Activities

Stage	Activities
Pre-Construction	• Land acquisition • Utilities relocation
Construction	• Site clearing • Labour camps and site offices • Access roads • Earthworks and embankment construction • Railway bridge and viaduct construction • Tunnel construction • Station construction • Installation of railway tracks and systems
Operation	• Train operations • Station operations • Depot operations

Land Acquisition

47. In areas where the alignment passes through private land and property, land acquisition will be required to secure the right-of-way for the railway tracks, railway reserve, stations, depots and maintenance facilities. It is estimated that a total of 8,699 lots of land (or parts of it) will be affected (**Table ES-6**). 54% of the land required for the Project will be state land while 46% will be private land. The land acquisition will be handled by the respective Pejabat Tanah & Galian of each state.

Table ES-6 : Land Acquisition

Type of Land	No. of Lots/ Locations	Area Affected	
		Acres	Hectares
Private Land	8,699	8,376.88	3,390.00
State Land/ Road/ JPS/ Utility/ Reserve	-	7,195.67	2,911.99
TOTAL	8,699	15,572.55	6,301.99

Source : MRL Railway Scheme

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Utilities relocation

48. Before the construction begins, relocation of utilities will be carried out. Utilities located along the alignment will be detected and piloted. The types of utilities include electricity transmission line, water and sewer mains, electrical cables, telecommunication cables, gas pipes and other surface and underground utility lines. Certain roads and junctions and irrigation infrastructure may also need to be realigned and reconfigured to accommodate the railway.

Labour camps and site offices

49. Labour camps and site offices will be established at various locations along the alignment, depending on the phasing and intensity of the construction.

Site Clearing

50. Site clearing and earthwork will be carried out for the rail alignment, station and depots. Site clearing will involve the removal of trees and shrubs and vegetation within the Project boundary by means of bulldozers or equivalent machinery. Major earthworks will be carried out at certain location in order to achieve the platform level. Fill material will be transported from the designated borrow areas and unsuitable material will be disposed at approved dumping sites.

Embankment Construction

51. Most of ECRL alignment will be built on earth embankment. The unsuitable subsoil will be excavated and replaced with compacted suitable fill that will provide a stronger foundation for the railway track. Embankment or retaining walls will be built either side of the track. The ballast will then be laid on the track foundation.
52. For some high embankments, stone columns will be used as ground treatment if the combination of temporary surcharge and geotextile basal reinforcement is not viable. The presence of stone columns creates a composite material of lower compressibility and higher shear strength than the in-situ soft clay. Certain roads and junctions and irrigation infrastructure may also need to be realigned and reconfigured to accommodate the embankments.

Railway Bridge and Viaduct Construction

53. Post-tensioned or pre-tensioned precast beams will be used for the viaduct superstructure construction. About 88.8 km of the alignment will be elevated at urbanised locations, flood prone areas and at areas with

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swampy/poor ground. In addition, bridges and culverts will be constructed to carry the rail line over existing roads and rivers or streams.

54. The viaduct substructures will generally comprise of reinforced concrete piers, with flared pier heads to support the deck, and reinforced concrete abutments. All piers and abutments will be founded on large diameter in-situ bored piles with diameters between 1.0 m and 1.5 m or precast spun piles.
55. The span decks will be erected on a span-by-span basis, using cranes. The beams will be transported to the construction site and later lifted into position using cranes. After the beam has been positioned onto the bearing, cast in-place deck slab will be done using formwork.

Tunnel Construction

56. Two tunneling methods, namely the New Austrian Tunnelling Method and the Tunnel Boring Machine, are expected to be used. The method will depend on the geological conditions at the site and will be determined during the detailed design stage. In addition to the geology, specific conditions such as tunnel length and cross section acutely influence the choice of the tunneling method.
57. Most of the tunnels will be constructed using the New Austrian Tunnelling Method. This drill and blast method involves drilling of blast holes, charging, ignition, mucking and scaling. The blast material will be transported out via trucks and suitable material will be used for other construction. After removal of blast material, scaling will be carried out to bring down potentially unstable blocks of rock around the tunnel and to prepare the rock surface for shotcreting and tunnel lining.

Station Construction

58. The construction of station will involve the demolition of existing structures, preparatory earthworks, foundation and substructure works, superstructure works and utility works. Earthworks will be carried out either cutting or filling to achieve the design platform levels. At areas where imported earth is required, dump trucks will bring in the material where bulldozers spread the earth which will then be compacted by rollers to the required density.
59. Ground treatment works will be carried out at areas where required and the foundation works will include piling. The main structure will be constructed using steel beams and the building frame. Steel beams and columns will be delivered to site from the casting factory and installed at the site. The floor shall be concrete slab and will be cast from concrete delivered to the site.

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Installation of Tracks and Systems

60. After the earthworks and civil and structural works for the alignment have been completed, the railway tracks and systems for control and signalling will be installed. The trackworks system covers the track network that provides support and guidance to the rolling stock, including the major elements such as rails, rail fastenings, sleepers and ballast. The system will ensure safe train separation functionality and allows the trains to travel at maximum consistent speed safely. After the installation of these components, testing and commissioning will be carried out.

ECRL Operation

61. During the operation of the ECRL, trains will be running at regular intervals. The train operations will consist of passenger trains operating at 160 km/h and freight trains operating at 80 km/h. At passenger stations, the typical activities will occur, such as retail, pick-up and drop-off of passengers, with the associated road traffic connecting to the stations. At freight stations, cargo in various forms will be transported and transferred.

Ridership

62. The ridership for the ECRL (**Table ES-7**) has been estimated based on population, employment, GDP, transit times – railway/highway, tariff, cost of highway transport, value of travel time and upgrade plans for highway. In 2024, when the ECRL commences operations, there will be seven daily passenger train departures from ITT Gombak, one running to KotaSAS, two running to Kuala Terengganu, and four running to Wakaf Baru. Passenger service will operate between 5am – 1am.

Table ES-7 : ECRL Passenger Journey Forecast

Year	Passenger Journeys (Million)	Year	Passenger Journeys(Million)
2025	4.49	2033	6.10
2026	4.66	2034	6.35
2027	4.83	2035	6.62
2028	5.01	2036	6.90
2029	5.19	2037	7.19
2030	5.39	2038	7.49
2031	5.61	2039	7.80
2032	5.85	2040	8.13

Source : MRL Railway Scheme

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Freight Operations

63. Freight trains, which will have up to 45 wagons, will operate 22.5 hours per day, 7 days per week. In 2024, the heaviest traffic demand is forecast to be on the Maran-Kuantan Port City section (**Table ES-8**). There will be 25 trains each day.

Table ES-8 : Freight Operation Pairs during Study Years (Trains Per day)

Section	2024	2030	2035	2040
Gombak North - Mentakab	0	0	0	3.5
Mentakab - Maran	9.5	10.0	11.0	12.0
Maran - Kuantan Port City	12.5	17.5	19.5	23.0
Kuantan Port City - Chukai	2.0	2.5	5.0	6.0
Chukai - Kemasik	6.5	6.5	6.5	7.0
Kemasik - Dungun	6.0	6.5	6.5	6.5
Dungun - Wakaf Baru	1.0	1.0	1.5	1.5

Note: A “train pair” is one service on the stated route in the stated direction and one return service.

64. The type of goods to be carried by the freight trains include containers, coal, cement, steel, rubber, polyethylene and palm biomass (**Table ES-9**), which may be transported in various forms such as containers, packages, dry bulk and liquid bulk.

Table ES-9 : Summary of Annual Freight Traffic

Commodity	Freight Traffic	
	2030 (Million Tonnes)	2040 (Million Tonnes)
Export / Import Containers	18.94	21.46
Iron Ore	8.38	7.97
Coal	2.00	3.50
Cement	0.33	3.33
Steel Industry	0.50	0.50
Rubber (containers)	0.47	0.63
Polyethylene	0.66	0.69
Palm Biomass	6.00	6.00
Total	37.28	44.08

Source : MRL Railway Scheme

Project Implementation Schedule

65. Construction of the ECRL will commence in July 2017. The construction of the Bentong to the Genting Tunnel segment will start first. Construction is expected to take 7 years. Testing and commissioning will begin in 2023 and the ECRL is expected to be operational in 2024.

EXISTING ENVIRONMENT

Terrain

66. The ECRL traverses a range of terrain – from low lying areas in Kelantan to the hilly areas in Pahang and Selangor (**Figure ES-8a & Figure ES-8b**). In Kelantan and northern Terengganu, the alignment traverses flat and low-lying areas with elevations less than 10m. As it approaches Kuala Terengganu, the alignment skirts around sporadic hills. The slopes are mostly within Class I (0° - 15°).
67. As the alignment moves into the Dungun district, the terrain is still mostly flat except for two locations at Bukit Bauk and Paka where tunneling is required. The slopes along the alignment here are mixed, with mostly Class I slopes with sporadic Class II (16° - 25°) and Class III (25° - 35°) slope areas.
68. As the alignment enters Pahang, it passes through relatively flat areas in Cherating up to the Gebeng Industrial Area. After that, the terrain is mostly undulating as the alignment traverses Kuantan and Maran districts. There will be several tunnels at this stretch to avoid cutting the hills. The areas traversed by the alignment are mostly Class I slopes. The stretch between Gambang and Maran Station has some Class II and Class III slopes.
69. The terrain traversed by the alignment in Temerloh district is undulating to hilly. The alignment tunnels through several hills before it reaches Bentong Station. After the Bentong station, the alignment follows the Sg. Benus valley, before tunneling through the Main Range near Bukit Tinggi. The slopes along Mentakab to Bentong Station are mostly Class I while after Bentong, the slopes are mostly Class II with some Class III slopes.
70. The alignment in Selangor is undulating to hilly. After exiting the Genting Tunnel, the alignment traverses on hilly terrain before tunneling through (2km) another hill near Kg. Sungai Salak. After exiting the 2nd tunnel, the alignment follows the undulating terrain of the Sg. Gombak valley. The slopes along the alignment are a mix of Class I, II and III slopes.

Geology and Soils

71. The alignment in Kelantan is completely on Quaternary deposits (**Figure ES-9**). Most of the alignment is on undifferentiated alluvium made up of clay, silt, sand and gravel layer especially near Kota Bharu. North of Tok Bali, there is some peat which will require treatment during construction.
72. The alignment in Terengganu North up to Kuala Terengganu is mainly in Quaternary deposits of alluvium and made up of sand and clay of marine

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environment. However, in small area north of Kuala Terengganu, the rail line will be sitting on the granite and phyllite.

73. The alignment in Terengganu South sits on various sedimentary rocks ranging from sandstone to phyllite, slate and shale of varying age. In a number of locations especially south of Kerteh, the alignment is sited on granite. The spur line from Dungun to Bukit Besi will also encounter the sandstone, phyllite, slate and shale.
74. The few tunnels near Pengkalan Berangan and south of Kuala Terengganu will be constructed in granitic terrain. The tunnel north of Dungun will be on sandstone and phyllite while those south of Dungun will be on granite.
75. In Cherating and Kuantan area, the alignment will be on alluvium while from Kuantan to Maran, it will be on various types of sedimentary rocks. In Kuantan, there are also areas where the alignment will be underlain by Quaternary basalt. The proposed tunnels near Gambang and Maran are expected to encounter the sedimentary rocks. After Gambang, the alignment will pass through the Lebir Fault and Lepar Fault.
76. In Pahang West, the alignment will be on the Central Belt geology comprising of various types of rock i.e. sandstone, siltstone, shale as well as widespread of volcanics mainly tuff. West of Bentong, granite is the main rock type. The proposed tunnels near east and west of Bentong are expected to be in the phyllite but in the western part of Bentong, there will be granite.
77. Major geological lineaments would be the Bentong Raub Suture Zone in Bentong area. Bukit Tinggi Fault occur in the granite terrain and will be intersected by the alignment. Granite of Mesozoic age is dominant along the alignment in Selangor (mostly tunnel) and western most parts in Pahang. Boreholes drilled in Selangor suggest that the tunnel alignment will be constructed in granitic bedrock.

Climate

78. The general climate of the Project site is similar to the rest of Peninsular Malaysia being equatorial with high annual rainfall (2500 mm – 3000 mm) and relatively uniform high humidity and temperature. The following monsoon seasons are experienced throughout the year:
 - (a) Northeast monsoon (November/ early December until March)
 - (b) Inter-monsoonal or transitional season (April to May)
 - (c) Southwest monsoon (June to September/ early October)
 - (d) Inter-monsoonal or transitional season (October to early November)

Kelantan and Terengganu are more affected by the Northeast Monsoon and experience heavy rainfall in the months of November till January.

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Land Use

79. The ECRL traverses mostly on agricultural and forested land in areas under the jurisdiction of 20 local authorities. The land use composition in the ECRL corridor (500m either side of the alignment) is 42% agriculture, 36% forest, 10% built up and 12% other uses (**Table ES -10**).

Table ES-10 : Land Use within 500 m corridor

Segment	Agriculture	Forest	Built up	Others
Kelantan	55%	0.4%	11%	33%
Terengganu North	45%	27%	6%	22%
Terengganu South	34%	53%	7%	7%
Pahang East	33%	46%	13%	9%
Pahang West	61%	21%	11%	7%
Selangor	28%	47%	21%	4%
Total	42%	36%	10%	12%

River system, water quality and beneficial uses

80. The ECRL traverses 27 river basins (**Table ES-11**) (**Figure ES-10a** to **Figure ES-10f**). In addition to these, the alignment will also cross numerous tributaries, irrigation canals, earth drains, small streams and ponds.

Table ES-11 : River Basins Traversed by the ECRL

State	Catchment	Size (ha)
Kelantan	Sg. Kelantan	1,317,768
	Sg. Pengkalan Datu	3,903
	Sg. Kemasin	35,376
	Sg. Tekoh Dua	4,906
	Sg. Semerak	50,898
Terengganu	Sg. Besut	96,856
	Sg. Keluang Besar	29,242
	Sg. Setiu	88,996
	Sg. Merabang Banghung	1,632
	Sg. Merabang Besar	990
	Sg. Terengganu	46,6315
	Sg. Ibai	12,610
	Sg. Marang	41,779

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State	Catchment	Size (ha)
	Sg. Mercang	26,306
	Sg. Dungun	185,261
	Sg. Sura	3,590
	Sg. Kemaman	221,779
	Sg. Paka	84,316
	Sg. Kertih	25,209
	Sg. Kemasik	4,854
	Sg. Cendur	4,475
Pahang	Sg. Cherating	8,959
	Sg. Balok	9,895
	Sg. Ular	1,002
	Sg. Kuantan	170,378
	Sg. Pahang	2,901,506
Selangor	Sg. Klang	130,996

81. A substantial part of the alignment in Kelantan, Terengganu and Pahang is in flood prone areas. The east coast of Peninsular Malaysia is frequently affected by floods during November to March when the northeast monsoon prevail. The ECRL alignment has been designed to be above the flood levels and large sections of the alignment in Kelantan and Terengganu will be elevated.
82. River water samples collected at 46 locations in the four states showed that the water quality of the rivers along the ECRL alignment ranges from Class II to Class III. As most of the rivers along the alignment drain agricultural land, the main source of pollution is Total Suspended Solids. Organics, heavy metals and other parameters were at very low levels.
83. The rivers along the alignment are used for a variety of purposes including for drinking water supply, irrigation water supply, aquaculture and recreational purposes. There are 8 water intakes and water treatment plants downstream of the alignment (**Table ES-12**). In addition to these, there are also several intake and treatment plants located near but upstream of the alignment including several tubewells near Wakaf Bahru and Kota Bahru.

Table ES-12 : Water Intakes downstream of Alignment

Water Intake/ Treatment Plant	Source	Supply Area	Design Capacity (mld)	Distance from alignment (km)
Kepong I	Sg. Terengganu	Kuala Terengganu	90	1.2
Kepong II	Sg. Terengganu	Kuala Terengganu & Marang	180	1.2
Bukit Losong	Sg. Terengganu	Kuala Terengganu	43	4.8
Bukit Bauk	Sg. Paka	Dungun	64	0.5
Lepar Hilir	Sg. Lepar	Kuantan	20	11
Semambu	Sg. Kuantan	Kuantan	291	3
Bukit Ubi	Sg. Kuantan	Kuantan	36	3
Benus Bt 4	Sg. Benus	Kg. Gementi & Ketari	4	0.1

Source: Suruhanjaya Pengurusan Air Negara, 2016

84. The alignment also traverses many irrigation schemes in Kelantan and Terengganu. These include some important granary areas such as the Kemasin Semarak IADP and Kemubu IADA in Kelantan and the KETARA IADA in Terengganu as well as many smaller irrigation schemes.
85. There are aquaculture activities in some rivers along the alignment in Kelantan, Terengganu and Pahang. In Kelantan, there are fish farms near the Kemasin Semarak IADA. In Terengganu, fish aquaculture is being carried out at several areas (e.g. Kg. Pak Kiang Besut, Kg. Fikri and Kg. Gong Batu) some 7 - 15 km downstream of the alignment. There are also some floating fish cages along Sg. Terengganu. Similarly, in Pahang, there are cage fish farming at several locations.
86. There are recreational spots in Pahang that are close to the alignment such as the Lentang Forest Recreational Park near Sg. Benus. In Selangor, Kem Alang Sedayu which is a Training Centre is located about 130m from the alignment. Sg. Gombak is also used by the Orang Asli community.

Air quality, noise and vibration levels

87. Measurements carried out at 28 locations showed that the air quality is generally within the Interim I limit of Malaysia Ambient Air Quality Standard 2013. The PM₁₀ concentrations ranged from 17 - 73 µg/m³ while the PM_{2.5} concentrations ranged from 2 - 35 µg/m³. SO₂ and Ozone level were below the detention limit of 5 µg/m³ and 20 ug/m³ respectively at all locations. NO₂ ranged from not detected to 19 ug/m³ while CO ranged from not detected to 5.7 mg/m³.

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88. 24-hour noise level monitoring, carried out at 38 locations, showed that the L_{eq} levels ranged from 50.7 – 71.1 dBA (day time) and 44.3 – 65.9 dBA (night) as governed by existing land use at these locations. Noise levels at numerous locations exceeded the recommended limits for suburban residential area (55 dBA for daytime and 45 dBA during nighttime) and urban residential area (60 dBA during daytime and 50 dBA during nighttime).
89. Vibration levels, measured at the same 38 locations, ranged from 0.01 mm/s to 0.96 mm/s depending on time and local activities. Vibration response curves were typically Curve 4 to 8. The vibration levels measured were well below level of structural damage concern and within human comfort level as assessed against limits stipulated in the DOE's Guidelines.

Ecology

90. The alignment will traverse 11 Permanent Reserved Forests (PRF) in Terengganu, Pahang and Selangor (**Figure ES-11**) (**Table ES-13**). The 11 PRFs comprise of various natural habitats such as Lowland and Hill Dipterocarp Forests, Coastal Hill Forests, Mangrove Forests, and Gelam Forests. The alignment will not cut through any PRFs in Kelantan but will pass through small patches of state land forests at Pasir Puteh and Bachok.
91. The alignment will not directly traverse through any PRFs in Terengganu North, but will come close to Pak Kancil, Bukit Terendak and Jambu Bongkok PRFs which comprise of a mixture of habitat types but are mostly dominated by gelam putih (*Melaleuca cajaputi*). They are important sites to conserve the remaining gelam forests in the East Coast. Pak Kancil Forest Reserve is also part of the CFS1-SL5 secondary linkage, which serves to connect the Taman Negara Forest Complex to the forests along the east coast, specifically at the Setiu district.
92. In Terengganu South, the alignment will traverse Bukit Bauk, Kuala Paka and Kuala Kemaman PRFs. The main line will traverse Bukit Bauk PRF (via a 900m tunnel) and Kuala Paka Forest Reserve, while the Kemaman spurline will traverse the eastern part of the Kuala Kemaman PRF. Additionally, the Bukit Besi spurline will traverse the western sections of the Bukit Bauk Forest Reserve. Bukit Bauk Forest Reserve is part of the CFS1-SL4 secondary linkage and is a biodiversity hotspot.
93. In Pahang East, the alignment will traverse through Balok (A), Bukit Galing, Berkelah and Lepar PRFs, mostly tunnel except for Balok (A). These PRFs, although have been logged over, contain numerous wildlife including the Asian elephant and Malayan tapir. The Lepar PRF is an important component of the CFS2-SL1, which serves to connect the Chini PRF with the other forest reserves south of Pahang.

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94. In Pahang West, the alignment will traverse Kemasul, Klau (Tambahan) and Bukit Tinggi PRFs. The Kemasul PRF is considered as a wildlife hotspot due to the numerous wildlife as well as the high number of human-wildlife conflicts. In Selangor, the alignment will tunnel through the Hulu Gombak PRF which is a part of the Selangor Heritage Park.

Table ES-13 : PRF traversed by the ECRL

PRF	Area (ha)	Type	Notes
Bukit Bauk	7,616	Protection Forest Amenity Forest	Main line crosses through Amenity Forest section for about 900m via tunnel. Spurline cuts through the western section of the PRF.
Kuala Paka	356	Protection Forest	Alignment crosses through shrub lands for about 800m
Kuala Kemaman	2,741	Protection Forest	Spurline crosses through estuarine mangroves for about 3.5km
Balok (A)	6,369	Production Forest	Alignment and Kuantan Port City station cross a small section of the PRF for about 1.5 km
Bukit Galing	383	Production Forest	Alignment tunnels through for 1.55 km and at-grade for 370 m.
Berkelah	30,825	Production Forest	Alignment will traverse in the south for 900 m followed by a tunnel for 1.2km.
Lepar	24,923	Production Forest	Alignment will tunnel through for 2.2km and cut through western edges for about 1.5km
Kemasul (Temerloh)	22,006	Production Forest	Alignment cuts through northern section of the PRF for about 7.3km
Kemasul (Bentong)	21,477	Production Forest	Alignment cuts through northern tip for about 500m
Klau (Tambahan)	214	Production Forest	Alignment will traverse via a 400m tunnel
Bukit Tinggi	3,352	Production Forest	Alignment will cut 400m along the northern edge before entering Bentong-Gombak tunnel
Hulu Gombak	16,838	Protection forest	Alignment will tunnel through for about 8 km

Socio-economic

95. The population within 1 km on either side of the alignment is estimated to be about 412,000 persons in 2016. A perception survey involving 2600 respondents and 27 focus group discussions were carried out to obtain feedback from the population along the alignment.

Table ES-14 : Population Distribution Within the 2-km Corridor

State	Population in 2010 (‘000)	%	Population in 2016 ^e (‘000)	%
Kelantan	89.9	24.1	101.8	24.6
Terengganu	140.2	37.6	156.1	37.8
Pahang	97.5	26.1	103.5	25.0
East Coast Region	327.6	87.7	361.3	87.5
Selangor	45.8	12.3	51.8	12.5

POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION DURING PRE-CONSTRUCTION AND CONSTRUCTION STAGES

96. A range of potential impacts can be expected during the pre-construction and construction phases of the Project (**Table ES-15**). The receptors of these potential impacts include various communities and land uses located close to the line, stations, depots and yards.

Table ES-15 : Potential Impacts During Pre-Construction and Construction Stage

Potential Impacts	Activities
Relocation/displacement	Land acquisition
Soil erosion and sedimentation	Utilities relocation
Soil erosion and sedimentation	- Site clearing and earthworks - Excavation works and spoil disposal - Tunneling works - Concreting and piling works
Flooding	- Construction of embankments - Stream crossings
Waste generation	- Site office and workers camp - Site clearing (biomass) - Demolition of structures - Spoil/unsuitable material disposal
Increased noise level for receptors located close to construction zones	- Concreting and piling works - Use of high noise generating machinery such as generator sets, power tools, hydraulic breaker, grinding and cutting equipment
Increased vibration for receptors located close to construction zones	- Movement of construction vehicles - Operation of construction machinery - Blasting
Air pollution/ dust	- Earthworks - Movement of construction vehicles and machinery
Habitat destruction, fragmentation and disturbance to wildlife	Site clearing and earthworks
Disruption in road traffic flow	- Construction vehicle traffic at alignment, stations, yards and depot - Road diversions
Hazards & Public Safety	Hazards to public due to construction activities

Pre-construction phase

97. The main potentially significant impacts expected during the pre-construction phase are related to the following activities:
- Land and property acquisition
 - Utilities relocation
98. Land and property acquisition is the main impact during the pre-construction phase. At this stage, based on the proposed alignment, 8,699 lots (or parts of it) may be affected. The Government is expected to compensate the affected parties in a fair manner. Nevertheless, people affected by the acquisition could potentially endure problems such as disruption to lives and loss of social cohesion.
99. The majority of the stakeholder engagement sessions raised land acquisition as an important issue. The vital question for all of them is whether they could be affected by acquisition. Some of the concerns include:
- Not able to relocate to a similar property due to lack of availability or affordability
 - Loss of social cohesion, sense of community and current lifestyle for long standing communities
 - In the case of businesses, there will be potential loss of customers – particularly businesses that rely on the local neighbourhoods.
100. In the case of land where there is active cultivation, farming may be disrupted and livelihood may be negatively affected if acquisition leads to loss of farm lands or reduced size of holdings to make it uneconomic to continue production. In the case of acquisition of farm lands, it should not leave farmers with uneconomically plot holdings because it would be unproductive for them to continue cultivation.
101. In order to minimise impacts from acquisition, MRL will provide early and adequate information to the affected parties to ensure that they are well-informed about acquisition process and ensure continuous engagement. Some of the mitigating measures proposed include:
- Ensure a fair valuation of land or properties that will be acquired.
 - Provide due notice, information and assistance to the affected parties, giving them ample time to make alternative plans and minimise inconveniences.
 - Maintain continuous engagement with the affected parties to address and attend to any queries to the whole spectrum of acquisition.
102. Before the construction proper begins, affected utilities along the Project corridor will be relocated or protected. Some of these relocation works may

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cause traffic congestion, soil erosion and pose risks to public safety. Mitigation measures include having an effective safety management plan during utilities relocation, relocation of utilities by appropriate method to minimise threat or risk and traffic management plans.

Construction Phase

103. The potential environmental impacts during the construction phase include soil erosion and sedimentation from site clearing and earthworks, flooding due to restriction of waterways, waste and spoil generation from construction activities, geological risks, increased noise and air pollution levels, ecological impacts, disruption to traffic, social impacts and issues related to public safety.

Soil erosion and sedimentation

104. The project traverses almost 600km on a variety of terrain. Earthworks will be a major activity. In flat and low-lying areas, especially in Kelantan and Terengganu, earth embankment will be built which will require substantial movement of earth. In undulating and hilly terrain, earth cutting will be a major activity. Although 19 tunnels will be constructed, hill cutting will remain as a major activity throughout the alignment. Based on the soil erosion risk map for Peninsular Malaysia, the erosion risks along the alignment are as follows :
- Kelantan : Low (Jelawat to Tok Bali) - Moderate (Wakaf Bahru to Jelawat) erosion risk
 - Terengganu North : Majority low erosion risk (Kg. Raja to Kuala Terengganu) with moderate erosion risk (Kuala Terengganu to Pengkalan Berangan)
 - Terengganu South : Majority low erosion risk (Kerteh and Cherating) with patches of moderate erosion risk (Dungun and Chukai) and very high erosion risk (Kemasik)
 - Pahang East : Moderate to high erosion risk (KotaSAS and Gambang to Maran)
 - Pahang West : High to very high erosion risk (Maran and Bentong) with patches of low to moderate erosion risk (Mentakab)
 - Selangor : Very high erosion risk (north of Gombak) with moderate - high erosion risk (ITT Gombak)
105. Calculations along the alignment have shown that erosion rates can be very high if pollution prevention and mitigation measures (P2M2) are not implemented. The expected impacts from soil erosion and sedimentation includes reduced water quality, reduced carrying capacity of rivers, increased flood risks, reduced efficiency of water treatment plants, reduced recreational value and reduced aquaculture productivity of impacted water bodies.

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106. To mitigate soil erosion and sedimentation, Land Pollution Prevention and Mitigating Measures (LD-P2M2) have been prepared for erosion hotspots along the alignment. The LD-P2M2 address planning and phasing of works, surface run-off control, provision of temporary earth drainage system, silt fence, interceptor drain, berm drain, cascading drain and toe drain. Other erosion control measures include temporary slope protection, turfing, compaction and silt traps. Active Treatment System (ATS) may be considered if sediment discharge is very high and silt traps not able to treat TSS to 50mg/l or soil analysis results show that the dispersible fine grained clay contains more than 10% of dispersible material.
107. The other sources of water pollution are sewage and sullage from workers' camp, waste water from tunneling works, runoff from batching plants, maintenance of plants and vehicles, and improper discharge or spillage. Potential water pollution impacts from the Project could affect the water quality of rivers, surrounding drainage and irrigation canals which the alignment will cross. The impact on receiving waterways can subsequently affect sensitive receptors located downstream of the Project alignment.
108. Water pollution reduction measures include sewage and sullage management – temporary sanitation facilities (toilets) will be provided in accordance with DOSH requirements to address public health hazards related to sewage. Wastewater from tunneling works and batching plant will be treated using either settling ponds and/or wastewater treatment system to reduce the TSS content to below 50 mg/l. All machinery maintenance works to be carried out at designated areas to ensure that any spillage or leakage can be contained. Good housekeeping including proper storage and management of oil, used oil, lubricants and other materials at the site. Storage and handling of scheduled wastes will be carried out according to the Environmental Quality (Scheduled Wastes) Regulation, 2005.
109. Site clearing, tunnelling, hill cutting and demolition will generate substantial amount of excess/spoil material. Disposal of excess earth material has the potential to cause sedimentation, alteration of water bodies and localised flooding. Some 4.5 million m³ of rocky and other unsuitable material will be generated from the tunnels and demolition works. It has been estimated that about 600,000 tonnes of biomass will generated from the site clearing along the alignment – consisting of forest trees, oil palm trees, shrubs and bushes and paddy fields.

Table ES-16 : Estimated Wastes Quantity

Category of Wastes	Kelantan	Terengganu North	Terengganu South
Biomass	12,000 tonnes	30,000 tonnes	150,000 tonnes
Spoil material from tunnelling	-	-	1.3 million m ³
Demolition wastes	280,000 tonnes	170,000 tonnes	150,000 tonnes

Category of Wastes	Pahang East	Pahang West	Selangor
Biomass	160,000 tonnes	230,000 tonnes	13,000 tonnes
Spoil material from tunnelling	1 million m ³	1.5 million m ³	750,000 m ³
Demolition wastes	21,000 tonnes	50,000 tonnes	68,000 tonnes

110. Where suitable, the tunnel material be reused in the construction works while the unusable portion will be disposed at approved disposal sites or landscaped. The process of excavating, transporting and final disposal will be done systematically and carefully to ensure the residual impacts are minimal. Biomass generated from the project will be used for temporary slope protection and left on site to decompose. There will be no open burning of any forms of waste.
111. There is potential risk of flooding from the construction of the ECRL, especially in low-lying areas in Kelantan, Terengganu and Pahang due to:
- The hindrance or diversion of floodwaters due to presence of embankments.
 - The presence of buildings (e.g. stations) and structures (e.g. piers) in the flood path.
 - The inadequacy of culverts and bridges.
 - Possible conflicts between the ECRL and the existing/ on-going flood mitigation works.
 - Blockage or diversion of drains and streams during construction.
 - Increased in surface runoff due to impervious area.
112. A substantial proportion of the alignment in Kelantan and Terengganu is elevated above the current flood levels. However, the construction of the embankments and stations could restrict the flow of water and aggravate flooding. Although 80 bridges have been provided and most of the embankments have been provided with balancing culverts to enable movement of flood waters, the risk of flooding has to be treated seriously.
113. Potential hotspots for flooding have been identified and MRL is currently developing the detail engineering design and flood mitigation measures. The basic flood mitigation design philosophy that will be adopted is that the “ECRL will not increase the flood levels after its construction”.

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Engagements will be carried out with JPS and other relevant agencies to ensure that the design for drainage and flood mitigation fulfills all the requirements. Options for flood mitigation include :

- Elevated viaducts – will be constructed to cross the floodplain to allow flood waters to flow relatively unhindered. A total of 71.84 km of elevated section will be constructed along the alignment. Where possible, the section of the alignment passing through irrigation canals will be elevated to avoid disruption to the existing irrigation drainage system.
- Cross-culverts and balancing culverts – will be constructed at multiple locations along embankment to enable uninterrupted flow of floodwaters. A detailed hydraulic study will be carried upon completion of detailed ground survey (on-going) to determine the exact location and design of the culverts.
- Bridges – piers of for crossings will be constructed and located as far as possible from the dominant flow channel to minimise backwater from occurring. Backwater analysis using cross-section survey data will be carried out for the design.
- On-site detention storage (OSD) – will be provided at depot, maintenance base stations, stations and yards. Design of the OSD at each location will be determined during the detailed design stage.
- Temporary drains – temporary drainage system will be constructed to accommodate the change in surface runoff.
- Stream crossings – install culverts at stream crossings to allow effective stream. The culvert will be designed to handle peak runoff.
- Good housekeeping – good practices to ensure that BMPs are implemented and the drainage system is functioning properly

114. The alignment passes through irrigation schemes and could potentially impact the irrigation infrastructure (canals, pipelines, pumphouses, tidal gates) that provide irrigation water to the paddy fields in the granary belt of Kelantan and Terengganu including the Kemubu Agricultural Development Authority, Kemasin-Semarak IADA and Northern Terengganu IADA and other irrigation schemes. The paddy fields in southern Pasir Puteh district could also be affected by the Project alignment passing through. There are also new irrigation schemes, such as the Semerak South irrigation scheme, where pump houses, irrigation canals and pipelines, are being planned, and/or under construction. A key mitigation measure is to avoid constructing viaduct on irrigation infrastructure such as irrigation canals, irrigation pipes and pump house.

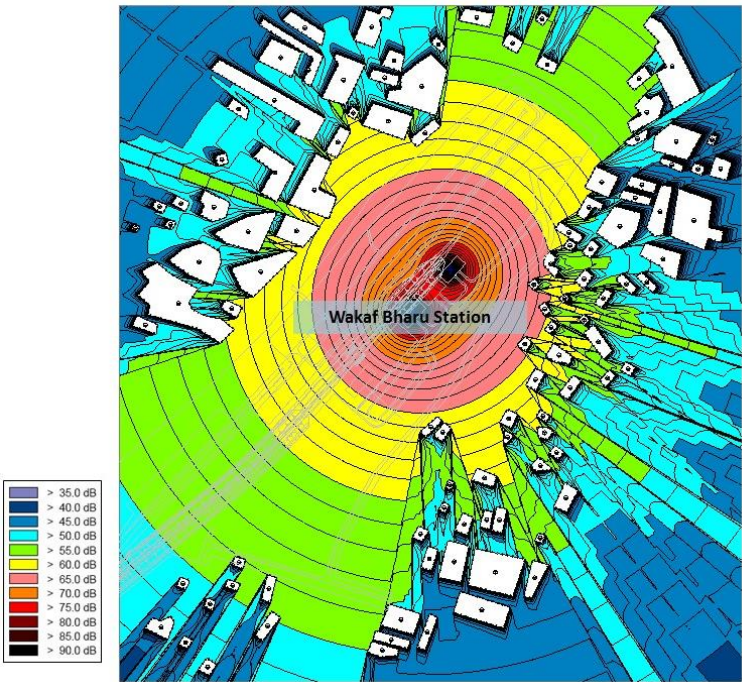
115. The alignment will traverse through a range of geological formations and soils including peat areas, steep slopes and areas important for groundwater. About 48km of the alignment will be tunnelled. There are several risks associated with tunnelling, particularly in the Bukit Tinggi area and the 17.8km Genting Tunnel. These risks must be considered in selecting

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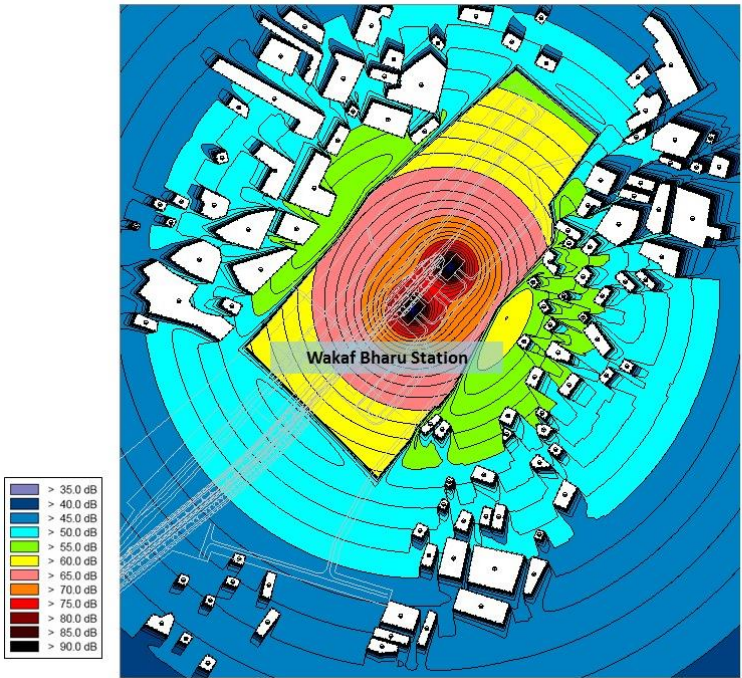
suitable construction techniques for the tunneling, excavation and retaining structures. Any ground movements due to the construction works must be properly controlled within acceptable limits. Peat areas will be treated prior to construction. Groundwater seepage will be controlled as not to interfere with excavation works. Most importantly, comprehensive soil investigation will be carried out throughout the Project site to fully understand the geotechnical and geological profiles.

116. Noise impacts from the construction works are anticipated at the stations, railway tracks along alignment, tunnelling works and depot and yard construction. Noise generation during construction stage is anticipated from earth moving equipment (dozers, tractors), heavy vehicles (lorries), diesel generator sets and piling works. At the tunnel sections, there will also be blasting works.
117. The construction of piers supporting the elevated sections will require piling. Piling vibrations and noise represent potential areas of concern as confirmed from past experiences of construction works within residential areas. Construction works are progressive in linear segments along the entire alignment. It is therefore inevitable that there are issues of concern for noise and vibration affecting residential receivers near the alignment.
118. Measures to minimise noise and vibration include:
 - Traffic diversion plan to avoid local roads (where possible) and movement of construction vehicles during off-peak hours
 - Temporary noise barrier/ hoardings
 - Equipment shielding and enclosures
 - Use of low noise piling methods i.e. bored piling
 - Flexible noise shroud for piling machine
 - Trenches and oscillating type casting
 - Restrict piling activities to day time only
 - Continuous monitoring programme

Chart ES-1 : Noise mitigation during construction phase



Noise Propagation from Piling at Wakaf Bharu Station without Mitigation



Noise Propagation from Piling at Wakaf Bharu Station with 4m hoarding

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Air pollution

119. The construction activities could lead to potential impacts in terms of air pollution particularly at the depots, yard and stations which involve large work areas. It has been calculated that the earthworks activities at Wakaf Bharu Station, Wakaf Baru Yard and Kota Bharu Station located in Kelantan State has higher potential to cause fugitive dust impact to the sensitive receptors. The fugitive dust impact during construction is not expected to cause residual impact as it will be occurred temporary during construction period.
120. With the implementation of mitigating measures such as phasing development instead of total site clearing, watering of access road, wash trough, hoarding around the work area and control movement of construction vehicles, the dust concentration is expected to be controlled within the Malaysian Ambient Air Quality Guidelines.

Ecology

121. The alignment has undergone number of revisions in the planning and designing stage. Originally, the alignment was cutting through 25 PRFs via at-grade railway and only one tunnel was proposed. This would have required more than 2,000 ha of forest reserves to be cleared and cause severe fragmentation of habitats. After field surveys, design improvements and consultation with stakeholders, the alignment was redesigned and now only traverse 12 PRFs. Out of the 12 PRFs affected, the alignment would traverse seven PRFs via tunnels. As such, the area of PRF to be cleared has been reduced substantially from more than 2,000 ha to about 357 ha, while fragmentation has also been reduced significantly.
122. The potential ecological impacts include (i) habitat fragmentation; (ii) habitat loss and disturbance; and (iii) human-wildlife conflicts. The rail line will also fragment some important forest areas such as Bukit Bauk, Kuala Kemaman, Kemasul and Lepar PFRs.
123. Fragmentation could potentially lead to human-wildlife conflicts. Some of the areas that the ECRL traverses are known to harbor wildlife including large mammals such as elephants and tapirs. In this regard, MRL will provide adequate wildlife crossings, both overpasses and underpasses to enable wildlife to move across the ECRL safely.

Table ES-17: Permanent Reserved Forests traversed by the ECRL

PRF	Type	Alignment Impacts	Area Cleared
Bukit Bauk	Protection Forest	• Tunnel through for approx. 900 m	2.2 ha
	Amenity Forest	• Spurline at-grade for approx. 16 km	150 ha
Kuala Paka	Protection Forest	• At-grade for approx. 800 m	3.8 ha
Kuala Kemaman	Protection Forest	• Spurline at-grade for approx. 3.5 km	41 ha
Balok (A)	Production Forest	• Alignment and proposed Kuantan Port City station crosses a small section in the south of the PRF at-grade for approx. 1.5 km	29.2 ha
Bukit Galing	Production Forest	• Tunnel through for approx. 1.1 km	<0.5 ha
		• At-grade for approx. 370m	7 ha
Berkelah	Production Forest	• At-grade approx. 900m	6.2ha
		• Tunnel through for approx. 1.2km	<0.5 ha
Lepar	Production Forest	• Alignment will tunnel through the Reserve for approx. 2.2km	<0.5 ha
		• Cuts through western edges of the PRF at-grade for approx. 1.5km	13.2 ha
Kemasul (Temerloh)	Production Forest	• at-grade for approx. 7.2 km	91 ha
Kemasul (Bentong)	Production Forest	• at-grade for approx. 500m	2.4 ha
Klau (Tambahan)	Production Forest	• tunnel for 400m	1.5 ha
Bukit Tinggi	Production Forest	• at-grade for approx. 400m	2.9 ha
Hulu Gombak	Protection forest	• tunnel	-

124. Mitigation measures that will be implemented include wildlife crossing structures which will help facilitate wildlife movement within the forest habitats. These include viaducts, culverts and wildlife overpasses. There will be 19 tunnels along the ECRL alignment. These tunnels will mostly traverse undulating to hilly terrain, most of which are still covered in forests. These tunnels will help minimise habitat fragmentation throughout the landscape along the alignment corridor and retain ecological connectivity, especially in critical areas. In addition to the mitigation measures above, a Wildlife Management Plan will be formulated to address matters pertaining to wildlife management along the alignment.

EXECUTIVE SUMMARY

Traffic

125. Traffic congestion due to construction works that will take place along existing roads in all four states is a potential problem. Such works result in road diversion, closures and lane size reduction which will inevitably reduce the capacity of the existing roads. Since some portions of the alignment are along busy roads, the traffic congestion along these roads could be expected to worsen. Detailed Traffic Management Plans are being prepared for each construction site to ensure that traffic is properly managed.
126. Measures proposed to minimise traffic congestion include:
- Proper traffic management with adequate warning signs and flagmen
 - Maintain number of lanes of major roads as much as possible
 - Minimum lane width of 2.75m-3.0m should be maintained for all the roads which involves reduction in lane width for construction activities
 - Dump trucks to operate at off-peak traffic hours
 - Specific traffic management plan for each construction site shall be prepared.

Public Safety

127. Blasting activities during tunnelling and occupational and safety hazard for the construction poses high risk resulting in fatality. Other hazard scenarios such as utilities relocation, flash floods and vehicular accident poses medium risk. Underground works pose safety concerns in the likes of sudden settlement or cavity underground, blasting effect, flooding in tunnel and also safety hazard to the public and workers directly involved in the construction.
128. Mitigation measures include precise timing delays and proper explosive charge to avoid blast damage or over-break. Blasting time schedule will be notified to the nearest residential or sensitive receptors prior to the blasting event. Proper ventilation will be provided within the tunnel construction area.

Social impacts

129. In terms of social impacts, public perception survey and stakeholder engagements have indicated that the people's main concerns are safety and security and land acquisition. Potential risks of accidents from heavy vehicles moving around during construction which could endanger the people, schoolchildren and livestock have been raised. Presence of construction workers in their neighbourhood during construction is a major concern. People are also concerned over the potential changes to the rural landscape, the architectural characteristics and values of traditional villages

here. It calls for careful thoughts over the design of proposed stations and the railway structures as it meanders through the region.

Table ES-18 : Five Top Ranked Concerns during Construction

Rank	Kelantan	Terengganu	Pahang	Selangor	Overall
1	Safety and security	Safety and security	Safety and security	Worries over relocation	Safety and security
2	Worries over relocation	Acquisition of properties	Worries over relocation	Safety and security	Worries over relocation
3	Acquisition of properties	Worries over relocation	Acquisition of properties	Too close to construction site	Acquisition of properties
4	Dust and air pollution	Dust and air pollution	Noise	Acquisition of properties	Dust and air pollution
5	Noise	Noise	Dust and air pollution	Dust and air pollution	Noise

Source: EIA East Coast Rail: Perception Survey (February 2017)

130. Increase in economic activities and employment are the major positive impacts during the construction stage. At the national level, the construction sector is expected to benefit from the Project due to its size and magnitude. The main beneficiaries in this sector include:
 - Construction sector
 - Construction material supplier (demand for construction material such as cement and steel is expected to increase)
 - Engineering and support services companies that provide civil and structural works, survey works, transport planning and other related services.
131. Significant number of employment will be generated to fulfill the demand for the construction needs of the Project. Other spin-offs and business opportunities can also be expected at local level in terms of job creation and demand for property or housing, food and other services.
132. Consultation and engagement with affected communities is crucial to minimise impacts from the Project. People need to be consulted, informed and updated about the Project on a regular basis.
133. It is important that the local population, where possible, are provided with opportunities to work on the Project. In the discussions held with local communities throughout the alignment, many communities have requested for jobs to be given to local youth. While it is acknowledged that locals may not have the right skills now but with adequate training many will be able to contribute positively to the project in various capacities.

EXECUTIVE SUMMARY

134. There will be thousands of construction workers during the peak of construction – located at various locations along the alignment, depots and stations. Many of the depots and stations are relatively close to sub-urban areas. In areas like Wakaf Bahru, Kota Bahru, Kuala Terengganu and Kuantan, the alignment is close to residential areas and commercial centres. Presence of large number of construction workers in rural settings could result in social conflicts between them and the locals. This may arise from the difference in lifestyle between the workers and the locals.
135. To minimise conflicts and potential housing shortages, centralised workers accommodation may be considered. This will enable the MRL and the contractor to monitor workers activities and minimise any potential social conflicts with local population. Similarly, the hygiene and cleanliness levels at the workers' accommodation needs to be maintained at a high level to prevent outbreak of diseases.
136. Aesthetics are another aspect to be considered. Unlike the West Coast of Peninsular Malaysia, the East Coast states have their traditional and cultural values that are closely linked to their natural landscape and communities. These characteristics are important to the people here so they have to be incorporated into detailed designing of the railway and its stations.

POTENTIALLY SIGNIFICANT IMPACTS & MITIGATING MEASURES DURING THE OPERATIONAL STAGE

137. A range of potential impacts can be expected during the operational phases of the Project (**Table ES-19**). The receptors of the potential impacts from the Project would include various communities and land uses located close to the line, stations, depots and yards.

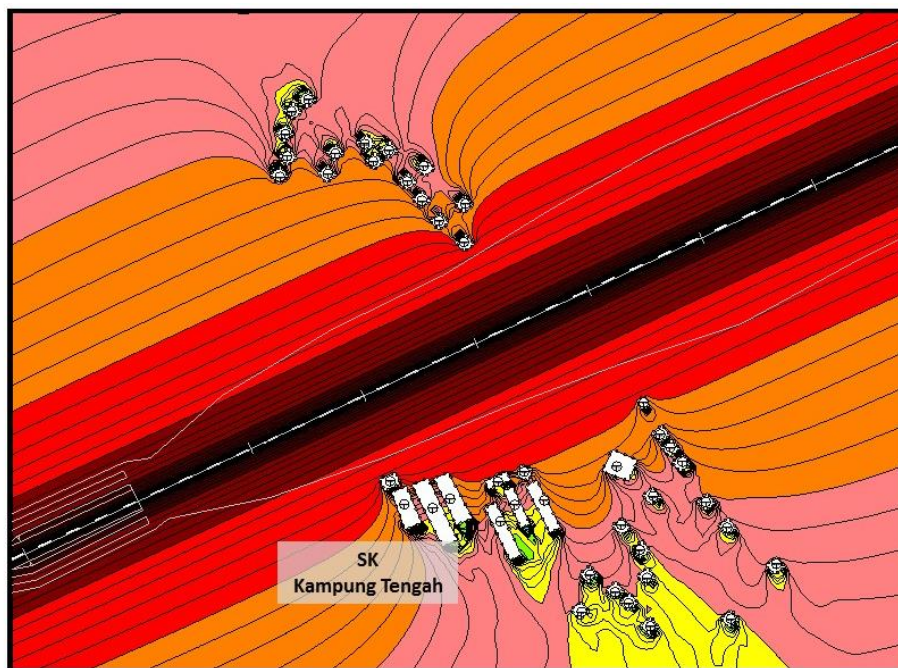
Table ES-19 : Potential Impacts During Operational Stage

Potential Impacts	Activities
Catalyst for development in the East Coast	Improved connectivity and accessibility for East Coast communities and businesses
Enhanced economic activities and opportunities in the East Coast; Economic multiplier and spin-off due to improved transport system	- Increased passenger and freight transport capacity between East and West Coast, and within East Coast - Reduced travel time
Increased noise level for receptors located close to the tracks and stations	Train movement
Vibration impacts to receptors close to the railway tracks & stations	Train movement
Fragmentation of forest and threats to biodiversity	Presence of railway track cutting through forests
Barriers to wildlife movement;	Train movement
Fragmentation of land use and settlements; Physical barrier splitting existing communities	- Presence of railway tracks cutting through existing communities and settlements - Railway tracks being restricted and off-limits to the public
Reduced greenhouse gas emissions	- Increased efficiency of transport system - Reduction in road traffic
Hazards & public safety	Hazards to public due to railway operations

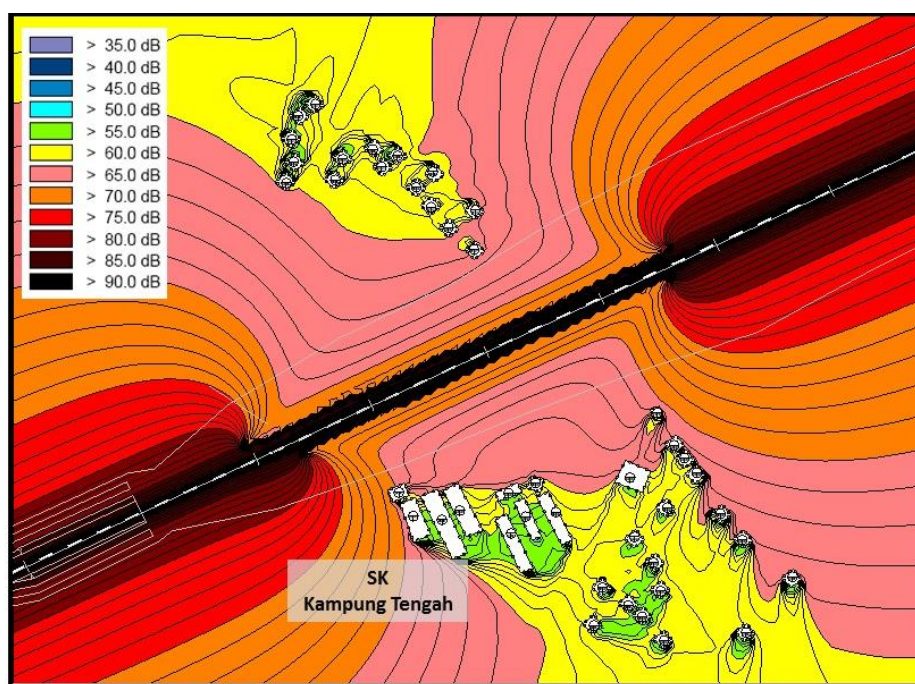
Noise

138. Noise modelling shows that the increase in L_{eq} is generally not significant due to the short term nature of train pass-bys except at several locations. The cumulative L_{eq} noise from the trains combined with the ambient noise typically increases by less than 5 dB during the day in most locations. However, at some locations, especially in the quieter rural areas of Kelantan and Terengganu, there could be increases between 10 – 16 dBA.
139. It is pertinent that noise barriers are installed to reduce the noise levels at the sensitive noise recipients. Without noise barriers, noise disturbance is anticipated for many dwellings located within 50m from the alignment with a line of sight to the tracks, and also dwellings even without a direct line of sight but close to the alignment.
140. Noise mitigation for the ECRL Line shall include the use of continuous welded tracks, noise barriers and acoustic absorption. The most common and practical mitigation of airborne noise transmission is the use of noise barriers – either at the railway ROW or at receptor boundary. Noise barrier design and constructions can either be of the absorptive type used in combination with diffusive or reflective panels.

Chart ES-2 : Mitigating noise level with noise barriers
(example at Kg Tengah off Temerloh)



Noise map at Kg Tengah off Temerloh without mitigation, passenger train at 160 km/hr



Noise map at Kg Tengah off Temerloh with noise barrier 4m height, passenger train at 160 km/hr

EXECUTIVE SUMMARY

Vibration

141. Train-induced vibrations in buildings depend on the severity of the vibration generation at source, transmission through the ground (ground borne vibrations) and interaction with the building (vibration response).
142. The ground-borne vibration propagation analysis showed that receptors in houses (1 to 2 storey buildings) at 25m away could experience vibrations below Curve 1 with good condition wheels/tracks, but exceed Curve 2 with worn wheels/tracks without railways vibration mitigation. For a receptor (at 1st floor) in a high rise building on piles at 25m away, vibration levels were estimated to below Curve 1 good condition wheels/tracks but exceed Curve 2 with worn wheels/tracks without vibration mitigation. With vibration mitigation on the railway tracks (typically using under-sleeper pads or low vibration trackform fasteners) vibration levels were shown to be within recommended limits (Curve 1) even with worn wheels/rails conditions at 25m distance from the railway tracks for typical residential buildings.
143. The mitigation of the ground borne vibration requires the control of vibration transmission from the tracks to the ground. This involves a vibration isolation medium introduced between the tracks and supporting structure. Vibration reductions from standard rail strips are similar to rail pads are typically in the order of 3 – 6 dBV depending on rail pad stiffness. Resilient fixation devices or base plate may be necessary at some locations in the underground section of the alignment.

Water pollution

144. The operation of the Project, particularly the stations, depot, yards and maintenance bases, could lead to water pollution while water pollution along the alignment will be limited to accidental spills and leakages of cargo. As the ECRL trains are fully electric powered, the potential of spills and leakages of fuel from trains will be minimal. Toilet on-board trains will be equipped with wastewater holding tanks which will be emptied regularly at the depots or or maintenance bases.
145. The sewage treatment facilities at the stations will be designed to meet regulatory requirements and be adequate to cater for future expansion. Three types of sewage treatment facilities will be built, namely for 1400 PE, 250 PE and 150 PE. Adequate oil and grease traps will be installed at all premises. Oil interceptors will be installed at all maintenance bases, yards and depots.

EXECUTIVE SUMMARY

Air Quality

146. The ECRL is expected to contribute towards improving air quality. By reducing the vehicular traffic on roads, the ECRL will reduce the amount of pollutants that will be emitted into the atmosphere. The cumulative nett CO₂e emission avoided by the implementation of the ECRL for year 2024 and 2040 is 255,671 MT CO₂e/yr and 912,738 MT CO₂e/yr respectively. With the shift from private transport to rail, air pollution related to vehicular emission i.e. particulate matters (PM₁₀, and PM_{2.5}) and gaseous (NO_x, SO₂, CO_x) pollutants will also be reduced accordingly.

Waste

147. Waste will be generated from the operation of station, operation of yards and depot and maintenance works. Various types of waste will be generated including domestic wastes and scheduled wastes (**Table ES-20**). If the wastes are disposed indiscriminately and not managed properly, there could be the impacts to the surrounding areas including health and hygiene problems, blockage of the existing nearby drainage and watercourses, and water and land contamination. All municipal wastes will be disposed off at approved landfills.

Table ES-20 : Waste Generation from Stations

No.	Station	Average Passenger Flow in 2040 (Person/Year)	Estimated Quantity per passenger per year (kg/year)
1	Wakaf Baru	279,955	18,700
2	Kota Bharu	1,742,875	117,000
3	Jelawat	202,575	13,500
4	Tok Bali	208,050	14,000
5	Kg.Raja	186,880	12,500
6	Penarik	79,935	5,300
7	Kuala Terengganu	1,164,350	78,000
8	Kuala Telemong	186,515	12,000
9	Pengkalan Berangan	158,775	10,000
10	Dungun	33,215	2,200
11	Kemasik	108,405	7,000
12	Chukai	229,220	15,000
13	Cherating	56,210	3,600
14	Kuantan Port City	109,500	7,000
15	Kota SAS	1,215,085	78,000
16	Gambang	129,940	8,400
17	Maran	314,995	22,000
18	Mentakab	143,080	9,200
19	Bentong	85,045	5,400
20	ITT Gombak	1,532,635	98,000

EXECUTIVE SUMMARY

Ecology

148. There are potential ecological issues during the operational phase including restriction of wildlife movement, animal injury and mortality, and human-wildlife conflict. The presence of the railway will impact on wildlife movements, roaming habitat and migratory route especially for the larger mammals (tiger, elephants and tapirs) and primate (e.g. gibbon, monkeys). The potential of train-wildlife collision would be minimal since the rail tracks will be fenced with precast concrete base. The presence of railway line may cause human-wildlife conflicts if the animals are forced to roam elsewhere, including nearby human settlements and agricultural land. Certain areas such as in Kemasul in Pahang which is known to be elephant and tapir hotspots might be experiencing more conflicts of this nature.
149. Mitigation measures to minimise ecological impacts during the operational stage generally comprise of monitoring activities, specifically on habitat conditions and wildlife populations to assess if operational activities are resulting in significant impacts to these components. Barriers (precast walls with fencing) will be built along the alignment to prevent both human and wildlife encroachment onto the rail tracks. In areas where there are elephants (e.g. Kemasul PRF), the barriers will be fortified. Barriers will also be constructed around the entrance of the tunnels to deter wildlife, from encroaching into the tunnels. Habitat enrichment will be carried out in forested areas that have been disturbed during construction. Wildlife monitoring will also be carried out specifically in areas that are known to have high wildlife movement

Traffic

150. On the whole, the ECRL will help improve traffic conditions in the major roads of the region, particularly in the East Coast. It provides improved connectivity between urban centres. The biggest benefit from the ECRL is the improvement in public transport as it will significantly improve the rail connectivity within the East Coast as well between the East Coast and the West Coast. This is expected to encourage mode shift from private vehicle to public transport resulting in reduction of trips generated/attracted between urban centres.
151. During operations, localised traffic congestion may occur at certain stations due to their locations. Therefore, it is important to have proper station access plans. Proper access plans are beneficial to ensure smooth flow of traffic and minimise traffic congestion around the stations. It would also ensure proper integration of the ECRL services in the multi-modal transportation context. In addition, other facilities for pedestrians and vulnerable road users to access the stations are also important.

EXECUTIVE SUMMARY

Public safety

152. Public safety during the operations of the ECRL is an important matter. The ECRL will mostly carry iron ore, coal, cement, steel, rubber, polyethylene and palm biomass – which are generally not dangerous. Calculations have also been made to estimate risks should the ERL carry flammable cargo and shows that areas within 164m may be at risk if P2M2 is not implemented. Adequate safeguards have been built into the Project to minimise any risks to people and property.
153. The ECRL will be designed and operated in conformance with the relevant Health and Safety regulations such as the Occupational Safety and Health Act 1994, Factories and Machineries Act 1967 and by-laws of the relevant local authorities. Safety and hazard control management during the operations include safety management at stations and electric trains. Safety measures for fires, especially in tunnels will be instituted. The Genting Tunnel at 17.8 km long will require additional safety measures. Given the risk level, an Emergency Rescue Station will be constructed at the centre of the Genting Tunnel, and will be equipped with emergency lighting, fire-fighting, and signal and communications systems. During the detail design phase of the Project, an evacuation simulation will be run to assess and determine the necessary width of emergency rescue platform.
154. Emergency response plans will be formulated to handle accidents or emergency situations that occur such as fires at stations, in tunnels or on trains, derailment of trains, spillage of cargo, equipment failure and failure of the ATP system. The emergency response plan shall contain the following:
 - Fire Fighting and Evacuation Strategy for passengers from trains, stations and tunnels.
 - Fire Fighting and Spill Response for freight train accidents.
 - Steps and actions taken before evacuation.
 - Emergency training programs and security.
 - Roles and responsibilities of all staff levels shall be clearly defined for security and emergency management.
 - Lines of communication and reporting in the event of emergencies.
 - Public security and emergency awareness program for public.
 - Provision of first aid team during emergency.
 - Conduct functional drills to the possible events that might occur during operation.
 - Reporting process for any suspicious activity to facilitate in investigations .
 - Physical security inspections.
 - Security program audits.

EXECUTIVE SUMMARY

Socio-economic

155. A potential concern is the division of communities and villages by the ECRL line. Once operational, the railway line will be fenced and forms a barrier. This could affect access to farms, schools, shops and community facilities. The community division could also potentially affect community cohesion, increase the cost of local travel and in extreme cases, change lifestyles.
156. To minimise community division, the Project design has incorporated almost 200 vehicular box culverts that enable people to cross freely under the railway tracks and hence minimise the “barrier” effect. At various locations, including at stations, overpasses will also be provided. The design and location of the underpasses and overpasses will be determined based on consultation with affected communities.
157. Once operational, the ECRL is expected to bring a host of benefits both at regional and local levels. The ECRL will greatly benefit thousands of people in the East Coast in many ways. Besides enabling people to commute efficiently, the ECRL will boost freight capacity, enhance economic growth and boost the competitiveness of businesses in the East Coast. The ECRL will provide a more reliable and safe mode of transport and help increase productivity due to travel time saving. A key social benefit of the proposed ECRL is the reduction of traffic congestion between Klang Valley and the East Coast region during festive periods and school holidays.
158. The ECRL is built to spearhead freight transportation which underpins industrialization. It will facilitate access to key ports in the East Coast region, namely the Tok Bali Fishing Port, Kertih Port, Kemaman Port and Kuantan Port. This makes it attractive for investors to choose to invest in the East Coast region where industrial land is relatively cheaper than in the West Coast and access to major ports in Peninsular Malaysia is easily available. Growth in productivity is anticipated due to improved journey time, enabling more intense economic interactions between the East Coast businesses and those in the Klang Valley. This would affect productivity growth as it is faster now with the ECRL to conduct businesses and transport goods and services.
159. The ECRL will also generate new jobs. Apart from the creation of direct jobs, the operations of the ECRL are likely to spill over into the creation of indirect and induced jobs that are linked to its operations. Supplies firms in all kinds of goods and services have to be outsourced to meet the operational needs of the ECRL. These businesses, in turn, require manpower and hence, another round of job creation would have to take place. The anticipated economic growth and job creation from ECRL operations would have a positive impact on income growth.

EXECUTIVE SUMMARY

160. At Mentakab, the ECRL proposes to link with the KTMB Line that has a stop at Jerantut, allowing people who use the ECRL to gain access to Taman Negara, Malaysia's major eco-tourism attraction. More importantly, the proposed ECRL opens up the coastal tourism belt of the East Coast region.
161. The stakeholders' engagement programme initiated during the construction phase will be extended during operations, at least in the first year of operations. It would allow people living in the corridor and close to the alignment or stations to provide feedback on impacts on them. It also serves as a feedback channel for MRL to monitor potential implications on residents when the railway is operational.
162. Safety and security stands out as a key concern even when the railway is operational. During operations, there should be safety procedures in place to prevent untoward accidents and incidents. At stations, small police base can be set up and manned by auxiliary police. With the help of local authorities, residents' associations and the communities, safety and security measures can be put in place.
163. Additionally, there are concerns over proximity to the railway alignment, with an added fear that adults, school children and even livestock may wander onto tracks. Fencing would be in place to prevent this from happening but some are worried that people may not be able to cross over and could abuse the erected barriers. Where appropriate, crossings should be erected but where there are potential dangers, warning signboards including punitive measures have to be set up. The advice of local police and local authorities should be sought on these matters.
164. For many communities that are close to the alignment and stations, the major concerns are noise and vibration from the trains. Given this, it is therefore important that adequate noise and vibration mitigation measures be incorporated into the detailed design stage to reduce the impacts to the acceptable limits. It is expected that through proper noise barriers, such concerns over noise can be overcome and noise levels from operations can be maintained below the stipulated limits. Residents and other groups such as commercial and industrial operators are concerned that traffic congestion including parking problems could arise for them, especially if they are located near to stations.
165. During the ECRL operations, there will plenty of job and business opportunities, particularly at the stations, depots and yards. There will be opportunities for retail shops and provision of a variety of services. Where possible, the local population will be provided with opportunities to participate in these activities. Similarly, MRL, together with the respective state government, will identify job opportunities for the local populations.

ENVIRONMENTAL MANAGEMENT PLAN

Organization Structure

166. MRL will be ultimately responsible for the environmental performance and compliance of the ECRL Project. The other parties with responsibilities for environmental management and compliance include the EPCC contractor, sub-package contractors, environmental consultants and environmental officers (Figure ES-xx, Table ES-xx).
167. MRL will establish its Health, Safety, Security and Environment Department to ensure compliance to all relevant environmental requirements and its main responsibilities will include the formulation and communication of environmental policy, supervise the contractors to ensure compliance to all environmental requirements, chair the Environmental Performance Monitoring Committee and engage with relevant authorities on environmental related matters
168. The EPCC Contractor will establish an Environmental Management Team to ensure environmental compliance during the construction stage. Environmental consultants and environmental officers will also be appointed for each package to ensure environmental aspects are taken into consideration and P2M2 are implemented effectively.

Chart ES-3 : Proposed Environmental Management Organizational Structure

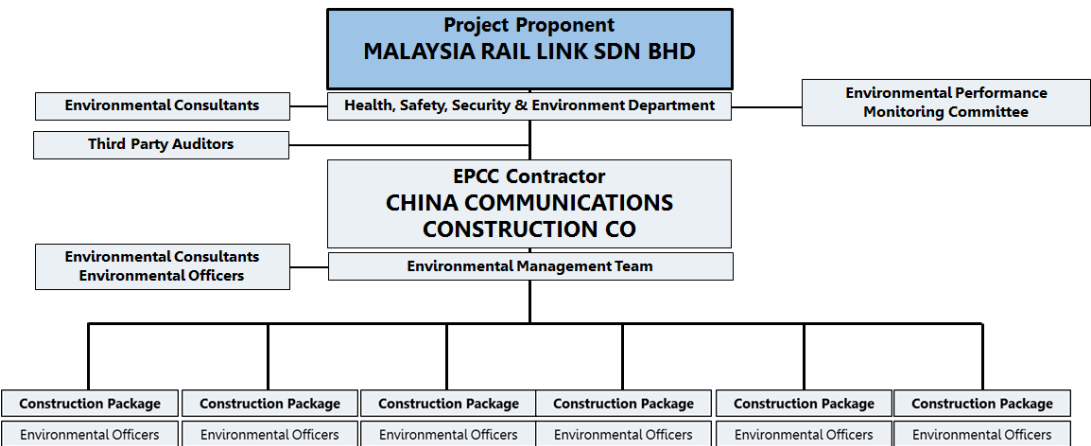


Table ES-21 : Roles and Responsibilities during Project Construction

Roles	Responsibilities
Project Proponent	• To comply with EIA approval conditions and other environmental requirements • To monitor environmental compliance by contractors • To ensure that relevant actions are taken to address any complaints • To submit the required environmental reports to DOE
EPCC Contractor:	• To comply with EIA approval conditions and other environmental requirements • To inform sub-contractors and consultants about environmental requirements • To ensure implementation of P2M2 • To prepare and submit relevant environmental reports to MRL • To ensure that relevant actions are taken to address any complaints
Construction Package Sub-Contractor	• To implement P2M2 • To ensure compliance to all environmental requirements
Environmental Consultant	• Provide technical expertise in the formulation of the EMP, P2M2 and Environmental Performance Monitoring Document • Advise MRL and CCCC on P2M2 and compliance requirements
Environmental Officer	• Implement the EMP and monitor the P2M2 • Prepare Environmental Performance Monitoring Document describing compliance and performance of the P2M2 • Supervise Performance Monitoring programme • Prepare Performance Monitoring Report which will evaluate the overall performance of the P2M2 • Communicate the status of compliance to MRL and CCCC. • Maintain records of incidences and all other relevant documents

169. Environmental management will be carried out based on sub-packages and the EMPs will be prepared and submitted to the respective State DOE offices for approval. Construction for each package will commence only after EMP approval is obtained. Each package will have a detailed LD-P2M2 document as part of the EMP. The Environmental Management Plan is proposed to be divided into six packages (**Table ES-22**).

Table ES-22 : EMP Packages

EMP Package	Length (km)	Number of tunnels	Number of spur lines
EMP 1 Kelantan	55.0	-	-
EMP 2 Terengganu North	85.3	-	-
EMP 3 Terengganu South	142.6	7	3
EMP 4 Pahang East	141.0	6	2
EMP 5 Pahang West	91.8	5*	1
EMP 6 Selangor	16.4	2*	-

* The Genting Tunnel is situated in both Pahang and Selangor.

EXECUTIVE SUMMARY

Reporting

170. Various types of environmental reports will be prepared during Project implementation. The main objective is to document environmental status/progress, compliance to environmental requirements including EIA Conditions of Approval, and the effectiveness of the P2M2 (**Table ES-23**).

Table ES-23 : Reports to be Submitted to DOE

Types of Report
Environmental Management Plan - to be prepared for each construction package - to submit to DOE for approval prior to commencement of construction
Quarterly Compliance and Monitoring Report - to be prepared and submitted to DOE during the construction stage - include form EIA 1-08 and EIA 2-08
Monthly Online Erosion and Sediment Control Inspection - to be submitted to DOE during the construction stage
Quarterly Environmental Audit Report (Third-Party) - to be submitted to DOE during the construction stage - Frequency of audit will be quarterly.

171. Internal reports will be prepared during the construction stage, including the Environmental Performance Monitoring Document and Performance Monitoring Report. In addition to these, other documents that will be prepared and maintained include the Checklist of P2M2s List Sheet, Installation Sheet, Maintenance Sheet, Site and P2M2 Inspection Sheet, Photograph Folder Sheet, Corrective Action Sheet and Performance Monitoring Sheet.

Communications

172. Effective communication with relevant stakeholders is crucial. Systematic and prompt response to any queries, feedback and complaints is important. The ECRL Project will maintain various communication channels for stakeholders. Stakeholder engagements will also be carried out before commencement of construction at various sites to inform stakeholders about the construction works that will be carried out. The engagement will be continuous in order to address different issues at different Project stages. MRL will also undertake engagement with the media to ensure that appropriate and correct information is disseminated to all stakeholders.

Monitoring Programme

173. A comprehensive environmental monitoring programme will be implemented during the construction to ensure that MRL is able to monitor the effectiveness of the P2M2 and compliance to the environmental requirements. The monitoring of these components will be categorised into

Performance Monitoring, Compliance Monitoring, and Impact Monitoring. The environmental monitoring programme will include water quality monitoring, silt trap discharge monitoring, air quality monitoring, noise and vibration monitoring and wildlife monitoring.

Environmental Auditing

174. Third-party environmental audits will be carried out every quarter during the construction stage. The main objectives of the audit are to determine non-compliances to the environmental requirements as well as to ensure that all the P2M2 are properly implemented, functioning as per designed and adequately maintained to ensure its performance.

CONCLUSIONS

175. The East Coast Rail Link (ECRL) is a vital **national infrastructure** that is expected to stimulate growth and help **bridge the economic gap between the East and West Coasts** of Peninsular Malaysia. The ECRL will **strengthen connectivity** of State capitals, major urban centres and industrial clusters, sea and inland ports, airports and tourism zones; and enhance transport accessibility of the people in the East Coast. The ECRL will **increase freight transport capacity** between the East Coast and West Coast; and within the East Coast, facilitate increased trade and more efficient logistics.
176. Land and property acquisition is the main issue faced during the pre-construction stage. The Government of Malaysia is expected to compensate the affected parties in a fair manner. To minimise the impacts of acquisition, MRL will provide early and sufficient information to the affected parties to ensure that they are well-informed about acquisition process. To ensure continuous engagement, MRL shall establish a dedicated team to assist those affected by acquisition.
177. Main potential impacts during the construction stages include soil erosion and sedimentation from earthworks, hill cutting and tunneling. Calculations have shown that these impacts will be severe if pollution prevention and mitigation measures (P2M2) are not implemented. In addition, site clearing, tunneling and, hill cutting and demolition are expected to generate large quantities of soil material and biomass which need to be reused or disposed off responsibly. There is potential risk of flooding due to the construction of the ECRL, especially in low-lying areas in Kelantan, Terengganu and Pahang. Even though 80 bridges have been provided and balancing culverts will be installed under most of the embankments, the risk of flooding has to be treated seriously.

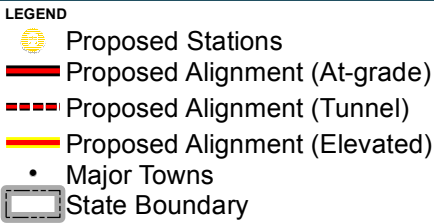
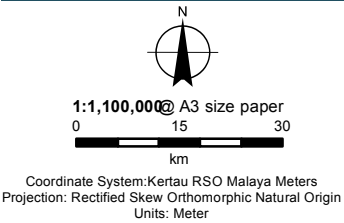
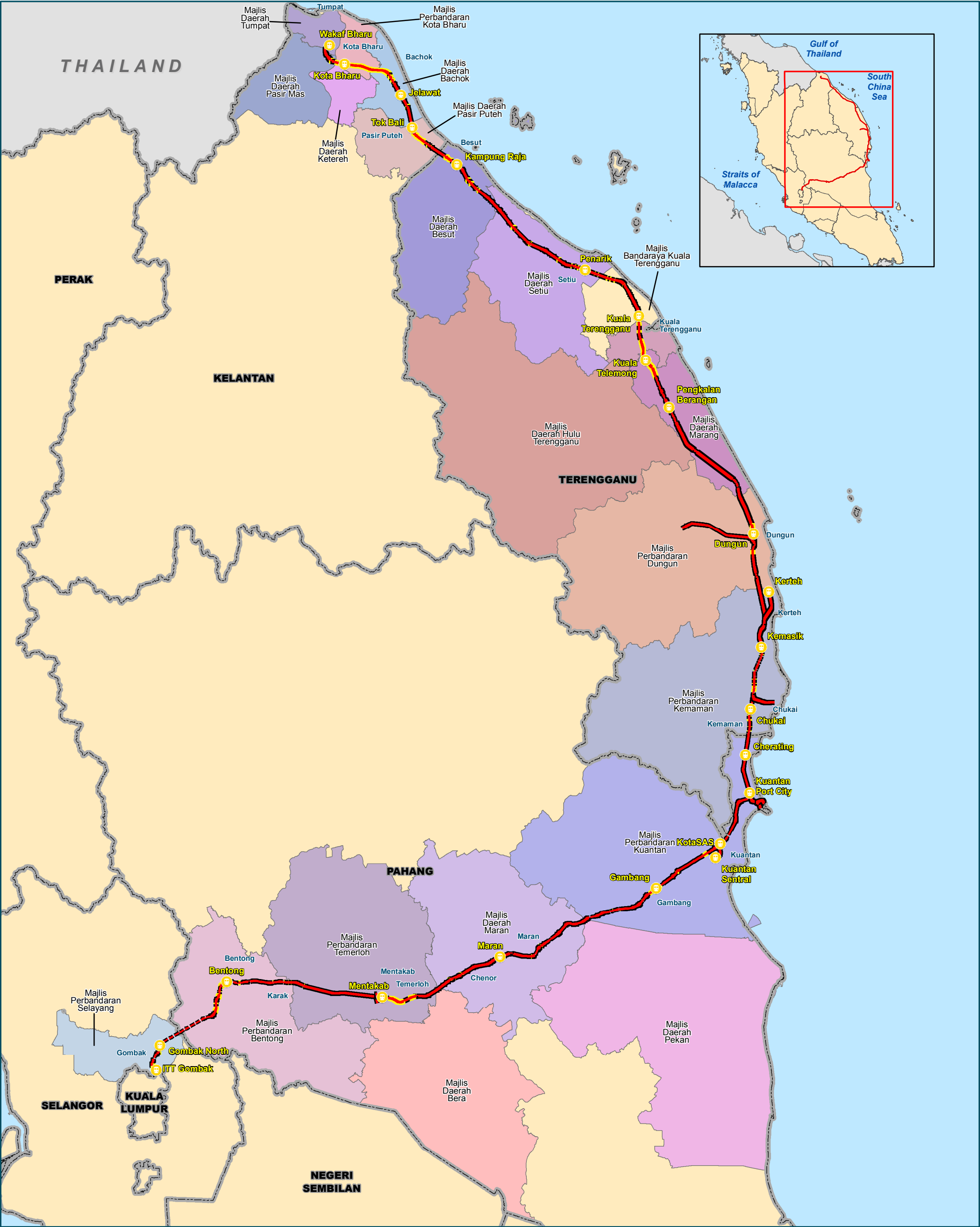
EXECUTIVE SUMMARY

178. The ECRL will cause habitat loss and fragmentation. While care has been taken to skirt around them, an estimated 357 ha of PRF will still need to be cleared; mostly in Terengganu and Pahang. The railway line will also fragment some forest reserves known to hold significant wildlife population. In this regard, provision of adequate wildlife crossings, including overpasses and underpasses is vital to limit the ecological impacts of the alignment.
179. Noise and vibration are a concern during the ECRL operations. Although the trains are electrical and designed to emit low noise levels, noise modeling has predicted that noise level will exceed the limits in some locations where noise barriers are needed. In addition to noise barriers, the adoption of continuous welded tracks and acoustic absorption on track sides will further reduce noise levels.
180. The ECRL is expected to contribute towards improving air quality. The cumulative nett CO₂e emission avoided by the implementation of the ECRL for year 2024 and 2040 is 255,671 MT CO₂e/yr and 912,738 MT CO₂e/yr respectively. Similarly, air pollution related to vehicular emission, i.e. particulate matters (PM₁₀, and PM_{2.5}) and gaseous (NO_x, SO₂, CO_x) pollutants will also be reduced accordingly.
181. When operational, the ECRL is expected to bring a host of benefits at both regional and local levels. The ECRL will greatly benefit thousands of people in the East Coast in many ways. Besides enabling people to commute efficiently, the ECRL will boost freight capacity, enhance economic growth and boost the competitiveness of businesses in the East Coast. The ECRL will provide a more reliable and safe mode of transport and help increase productivity due to travel time saving. A key social benefit of the proposed ECRL is the reduction of traffic congestion between Klang Valley and the East Coast region during festive periods and school holidays.
182. The ECRL will also generate new jobs. Apart from the creation of direct jobs, the operations of the ECRL are likely to spill over into the creation of indirect and induced jobs that are linked to its operations. Supplies firms in all kinds of goods and services have to be outsourced to meet the operational needs of the ECRL. These businesses, in turn, require manpower and hence, another round of job creation would have to take place. The anticipated economic growth and job creation from ECRL operations would have a positive impact on income growth.
183. In order to maximise the benefits of the Project and to minimise its economic and environmental costs, it is crucial that all the P2M2 identified in this report are implemented effectively and the construction process be monitored diligently. The governance mechanism (monitoring, reporting,

EXECUTIVE SUMMARY

auditing, etc) have been formulated and the MRL will implement them comprehensively.

184. MRL is committed to mainstreaming environmental protection into the Project and towards self-regulation to ensure that the quality of the environment is protected during the construction and operation of the ECRL. MRL will ensure organisational commitment to environmental regulatory compliance by all personnel at all levels of the organization, including its consultants, contractors, suppliers and all other parties involved in the Project implementation. MRL is also committed to continuous communication and engagement with all stakeholders throughout the life of the Project.

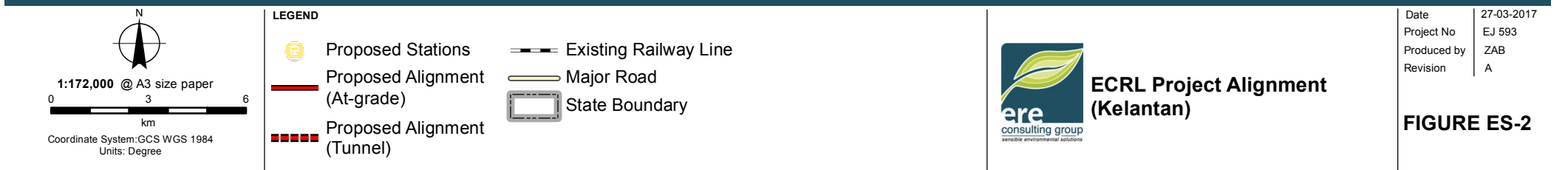
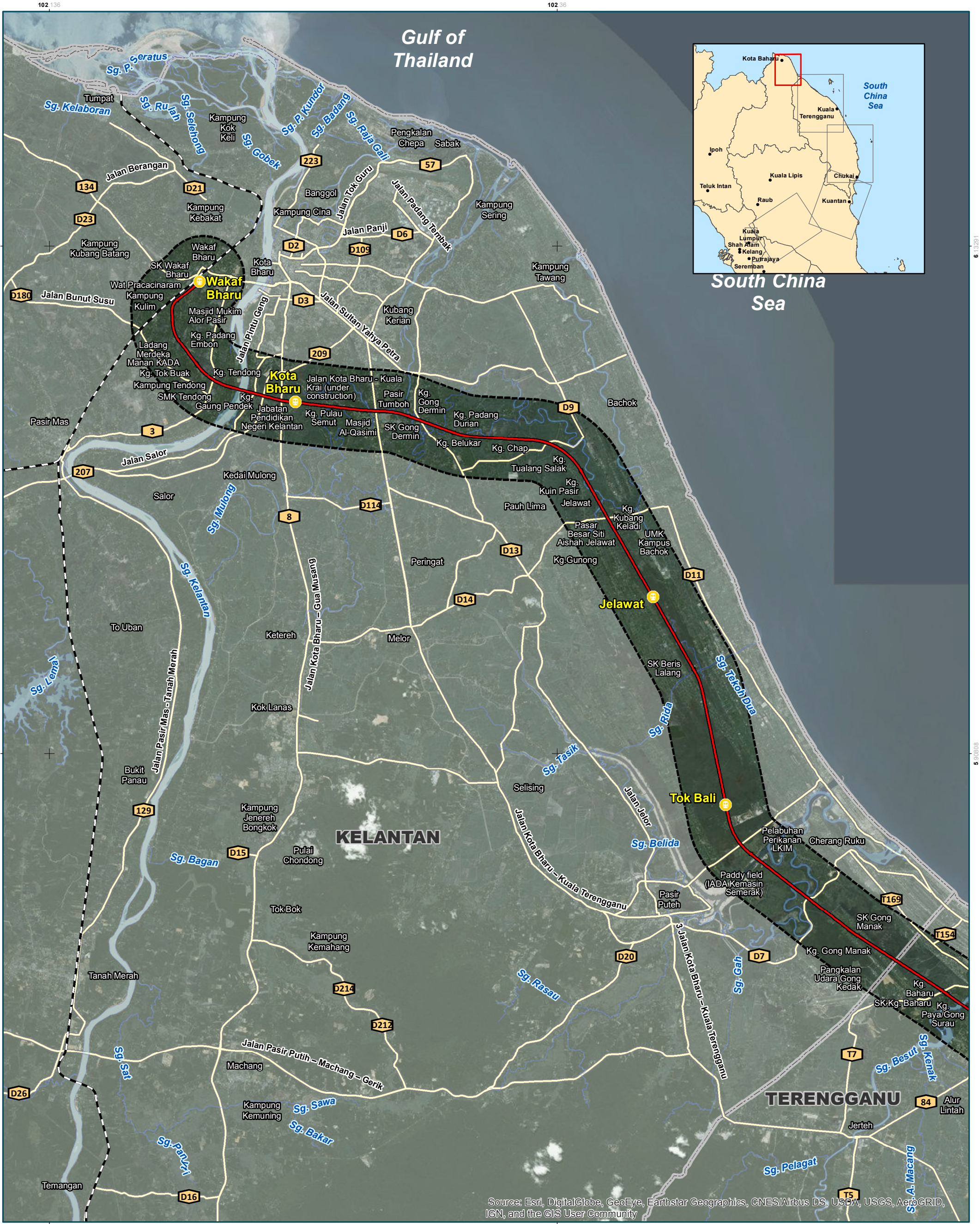


Overview of
ECRL Alignment

Date	27-03-2017
Project No	EJ 593
Produced by	ZAB
Revision	A

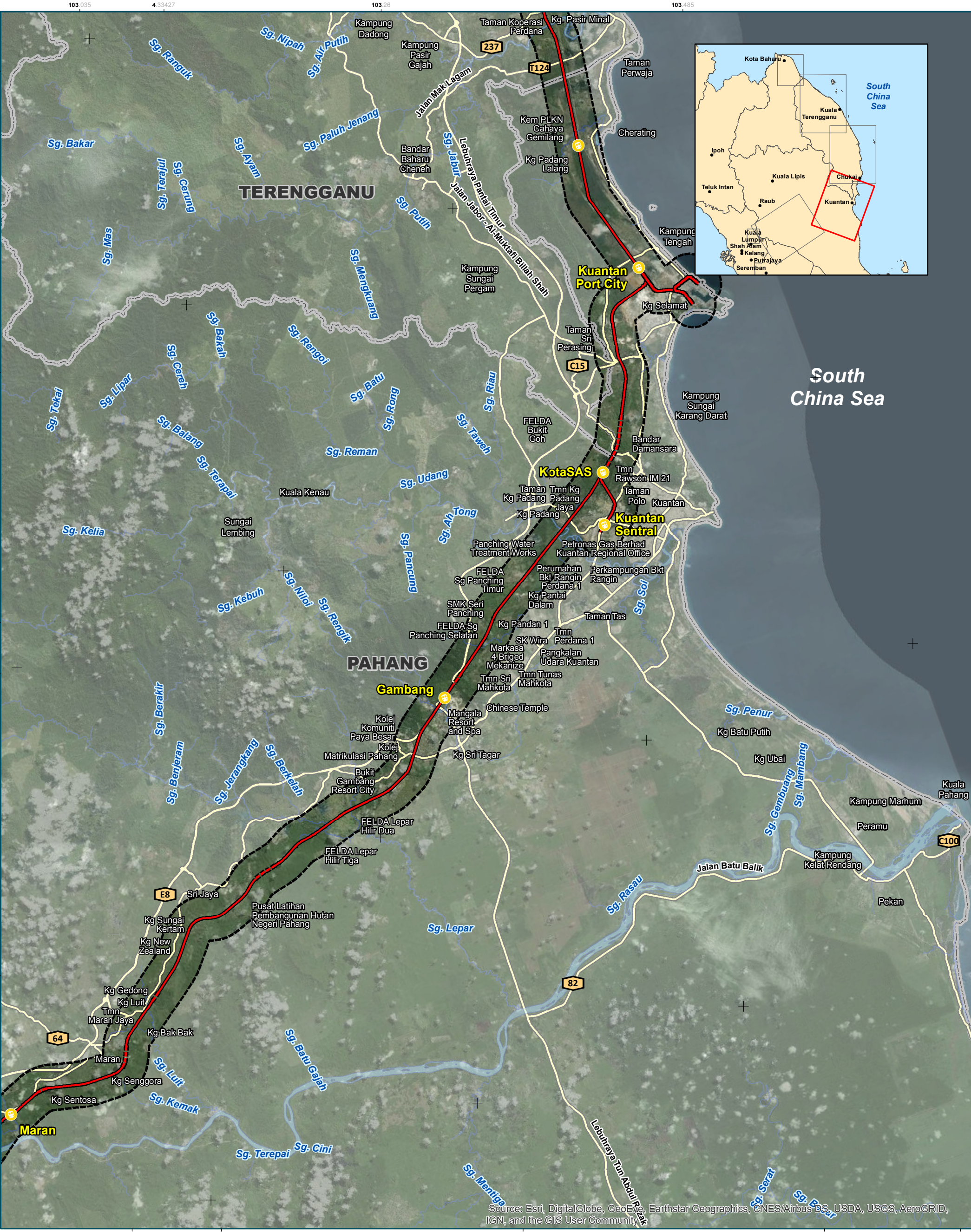
FIGURE ES-1

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Source: Jabatan Perancangan Bandar dan Desa, Semenanjung Malaysia, Sistem Maklumat Gunatanah Perancangan Bersepadu (i-Plan) (2016). E:\Project\EJ 610 ECRL Tumpat-Gombak\Maps\WXD\EJ 610 Overview of ECRL Alignment 12b.mxd



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Source: ERE Consulting Group (2015). E:\Project\EJ 610 ECRL Tumput-Gombak\Maps\MXD\EJ 610 ECRL Project Description 12b ES.mxd



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Coordinate System: GCS WGS 1984
Units: Degree

LEGEND

	Proposed Stations		Existing Railway Line
	Proposed Alignment (At-grade)		Major Road
	Proposed Alignment (Tunnel)		State Boundary

ECRL Project Alignment (Pahang East)

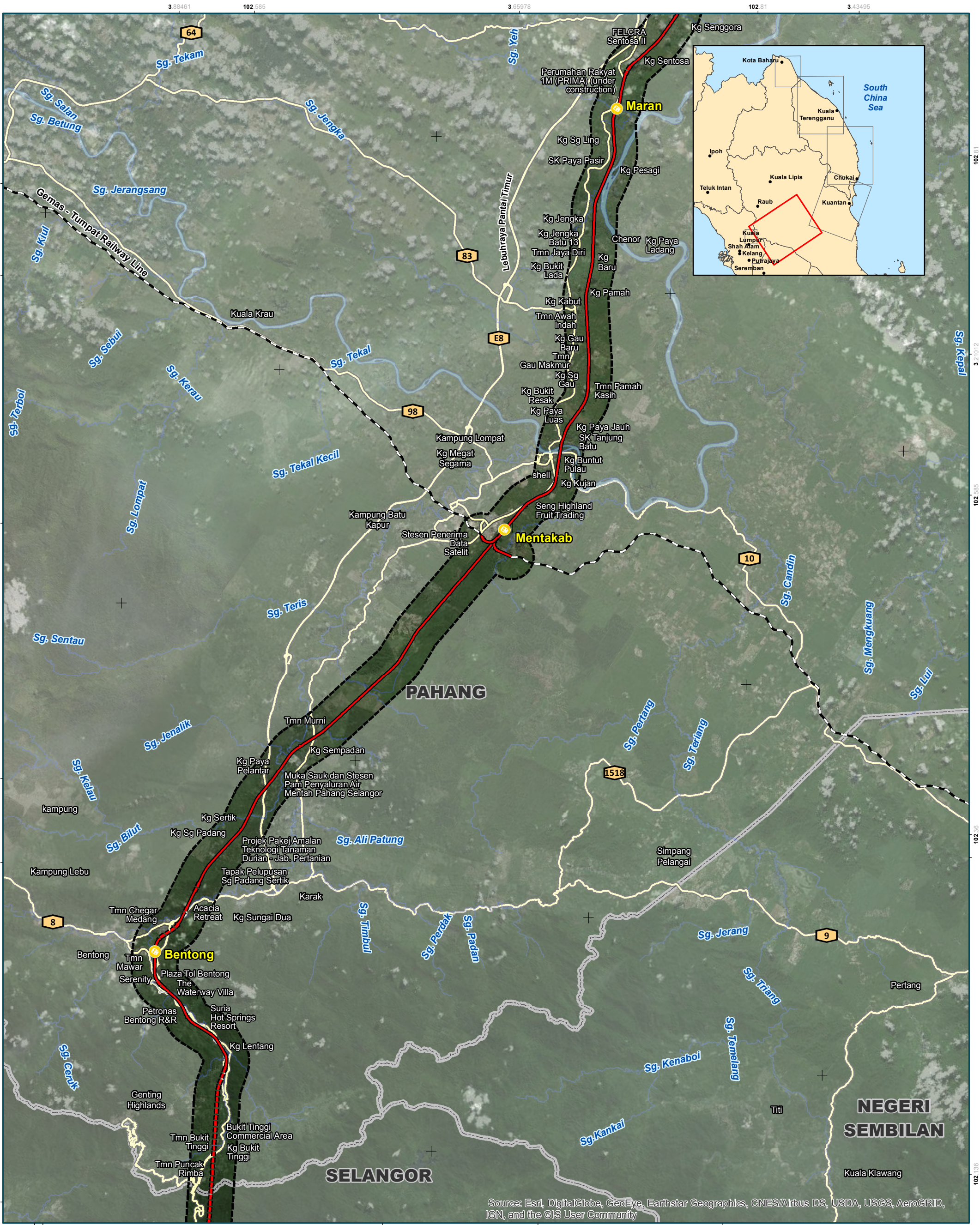
ere consulting group
sensible environmental solutions

Date	27-03-2017
Project No	EJ 593
Produced by	ZAB
Revision	A

FIGURE ES-5

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Source: ERE Consulting Group (2015). E:\Project\EJ 610 ECRL Tumpat-Gombak\Maps\MXD\EJ 610 ECRL Project Description 12b ES.mxd



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Coordinate System: GCS WGS 1984

Units: Degree

LEGEND

- Proposed Stations
- Proposed Alignment (At-grade)
- Proposed Alignment (Tunnel)
- Existing Railway Line
- Major Road
- State Boundary

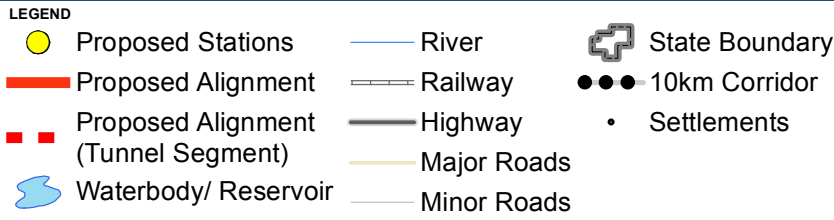
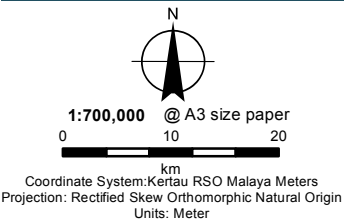
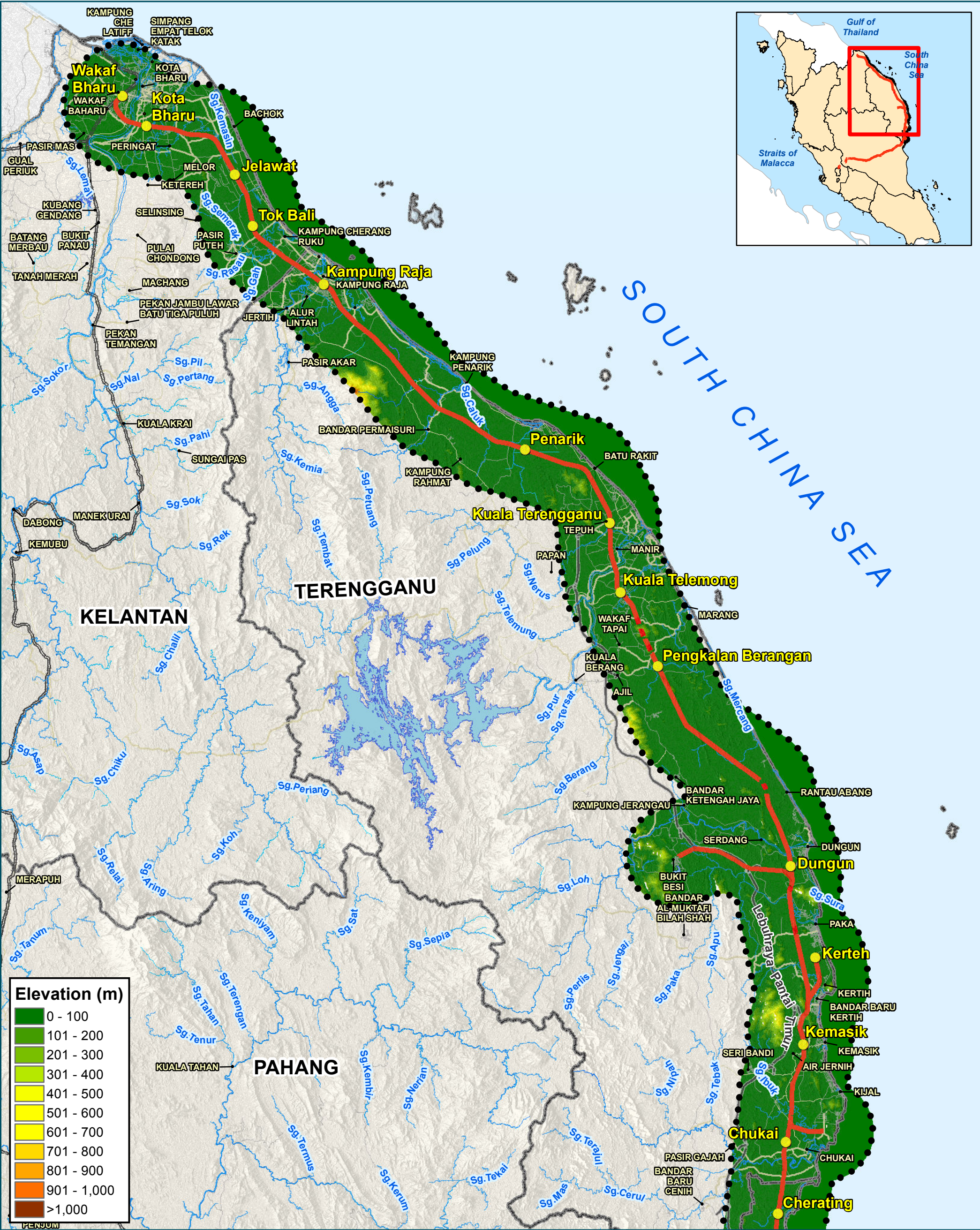
ECRL Project Alignment (Pahang West)

Date	27-03-2017
Project No	EJ 593
Produced by	ZAB
Revision	A

FIGURE ES-6

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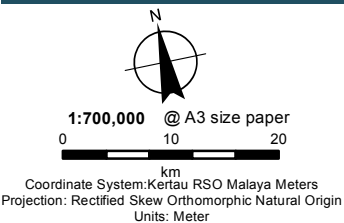
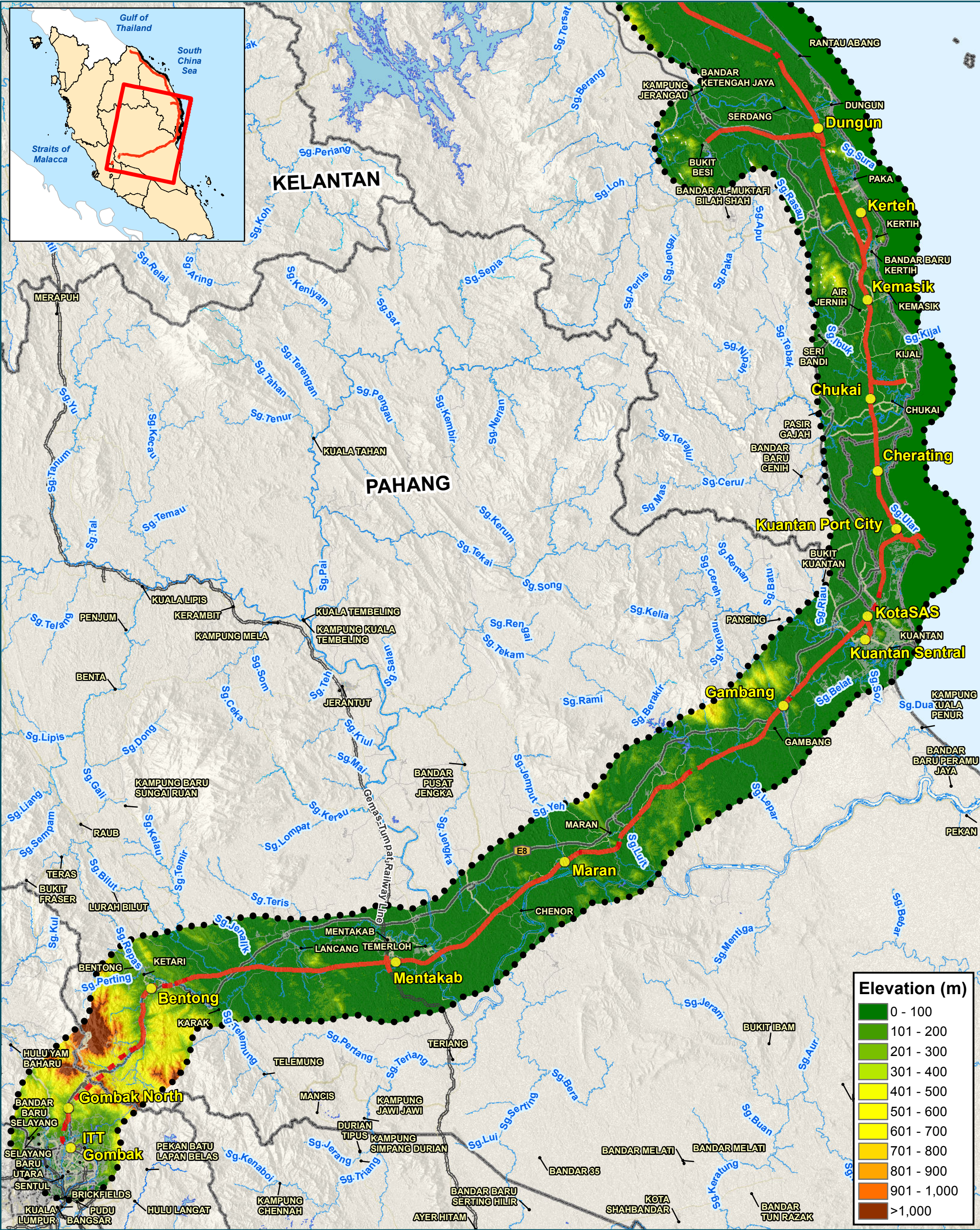
Source: ERE Consulting Group (2015). E:\Project\EJ 610 ECRL Tumpat-Gombak\Maps\MXD\EJ 610 ECRL Project Description 12b ES.mxd



Elevation Along the Alignment (Segment 1 to 3)

Date: 27-03-2017
Project No: EJ 610
Produced by: AFZ
Revision: A

FIGURE ES-8a



- LEGEND
- Proposed Stations
 - Proposed Alignment
 - Proposed Alignment (Tunnel Segment)
 - Waterbody/ Reservoir
 - River
 - Railway
 - Highway
 - Major Roads
 - Minor Roads
 - State Boundary
 - 10km Corridor
 - Settlements

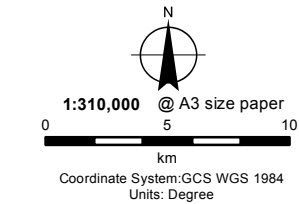
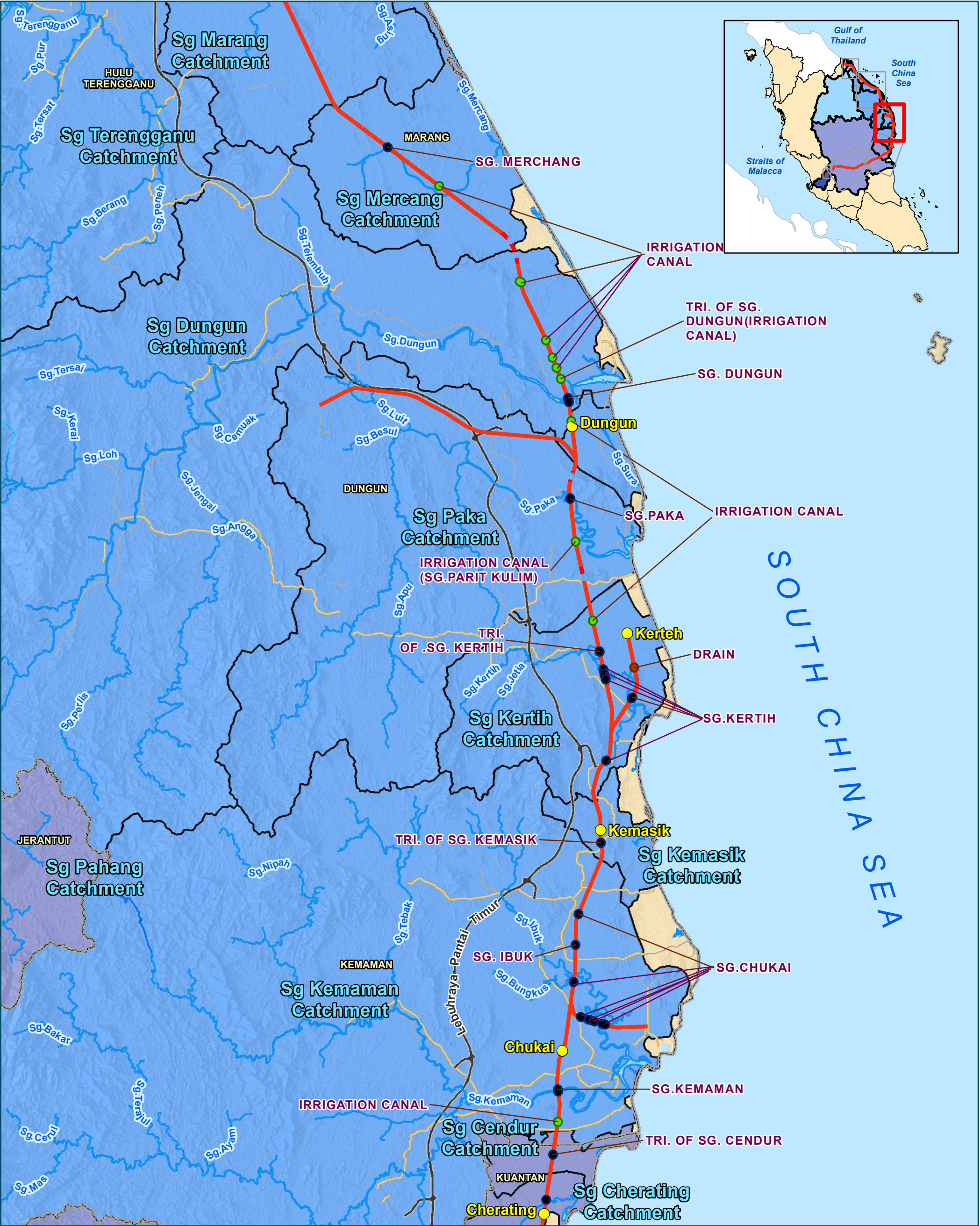


Elevation Along the Alignment (Segment 4 to 6)

Date 27-03-2017
Project No EJ 610
Produced by AFZ
Revision A

FIGURE ES-8b

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Source: ERE Consulting (2017), JPBD (2016), OpenStreet Map (2017), Department of Irrigation and Drainage (2016), Elevation by SRTM (2000) G:\Project\EJ 610 ECRL Tumpat-Gombak\Maps\MXD\EIA\EJ 610 ECRL_Elevation_ES_RE_south.mxd



LEGEND		River Basin		River Crossing	
	Proposed Stations		River		Irrigation Canal
	Proposed Alignment		Railway		River Crossing
	Proposed Alignment (Tunnel Segment)		Highway		Drain/ Canal
	State Boundary		Major Roads		
			Minor Roads		

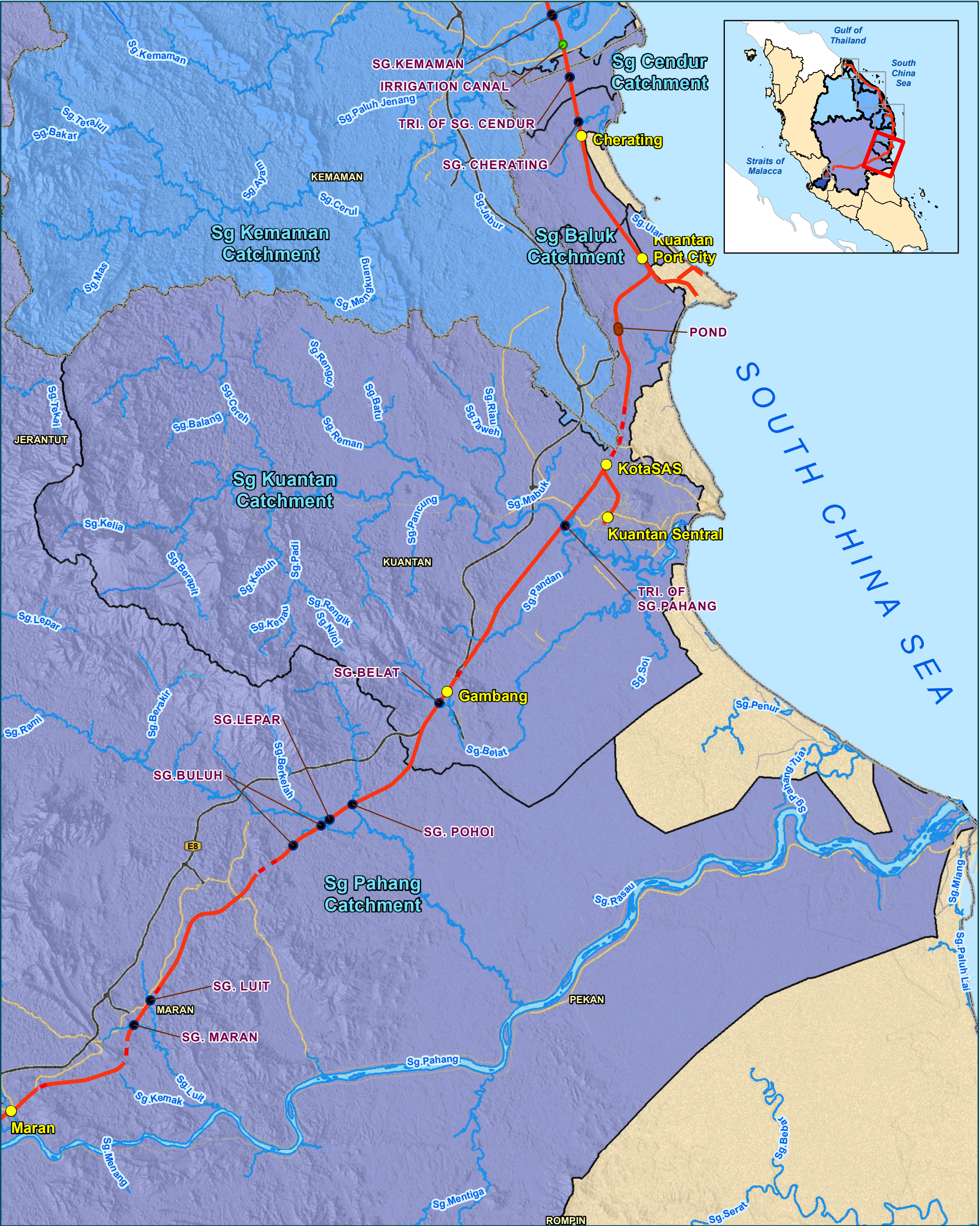


River Crossing and Water Catchment Areas (Terengganu South)

Date	27-03-2017
Project No	EJ 610
Produced by	AFZ
Revision	A

FIGURE ES-10c

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Source: ERE Consulting (2017), JPBD (2016), OpenStreet Map (2017), Imagery courtesy of USGS (2017), Department of Irrigation and Drainage (2016) G:\Project\EJ 610 ECRL Tumpat-Gombak\Maps\MXD\IE\IEJ 610 ECRL River_Crossing_Catchments_LABEL_Tganu_ES_RE.mxd



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Coordinate System: GCS WGS 1984
Units: Degree

LEGEND

Proposed Stations

Proposed Alignment

Proposed Alignment (Tunnel Segment)

State Boundary

River

Railway

Highway

Major Roads

Minor Roads

River Basin

Kelantan

Pahang

Selangor

Terengganu

River Crossing

Irrigation Canal

River Crossing

Drain/ Canal

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River Crossing and Water Catchment Areas (Pahang East)

Date: 27-03-2017

Project No: EJ 610

Produced by: AFZ

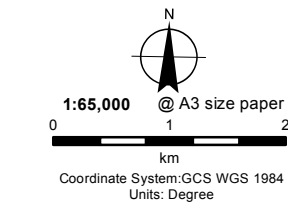
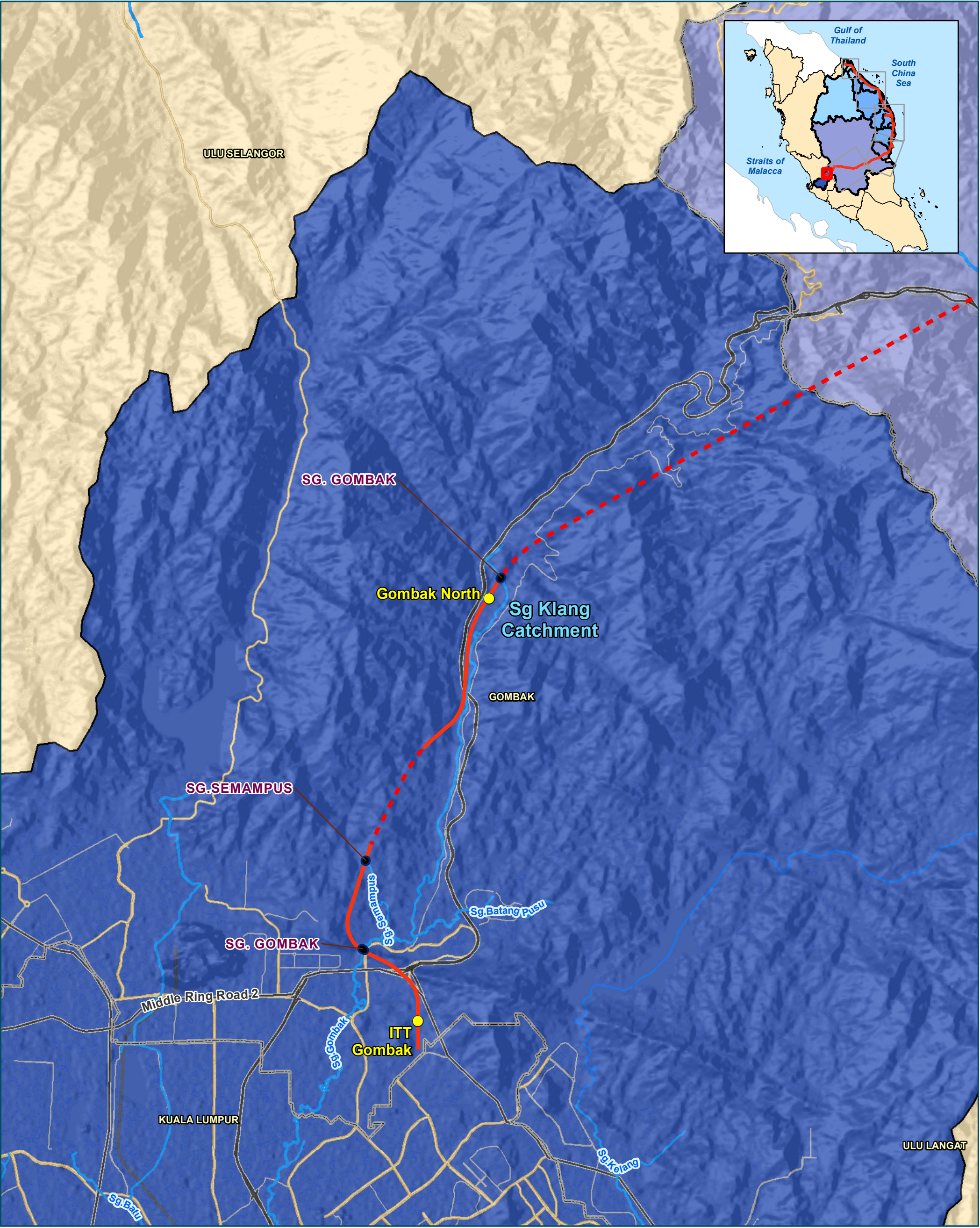
Revision: A

FIGURE ES-10d

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Source: ERE Consulting (2017), JPBD (2016), OpenStreet Map (2017), Imagery courtesy of USGS (2017), Department of Irrigation and Drainage (2016)

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LEGEND

- Proposed Stations
- Proposed Alignment
- Proposed Alignment (Tunnel Segment)
- State Boundary
- River
- Railway
- Highway
- Major Roads
- Minor Roads

River Basin

- Kelantan
- Pahang
- Selangor
- Terengganu

River Crossing

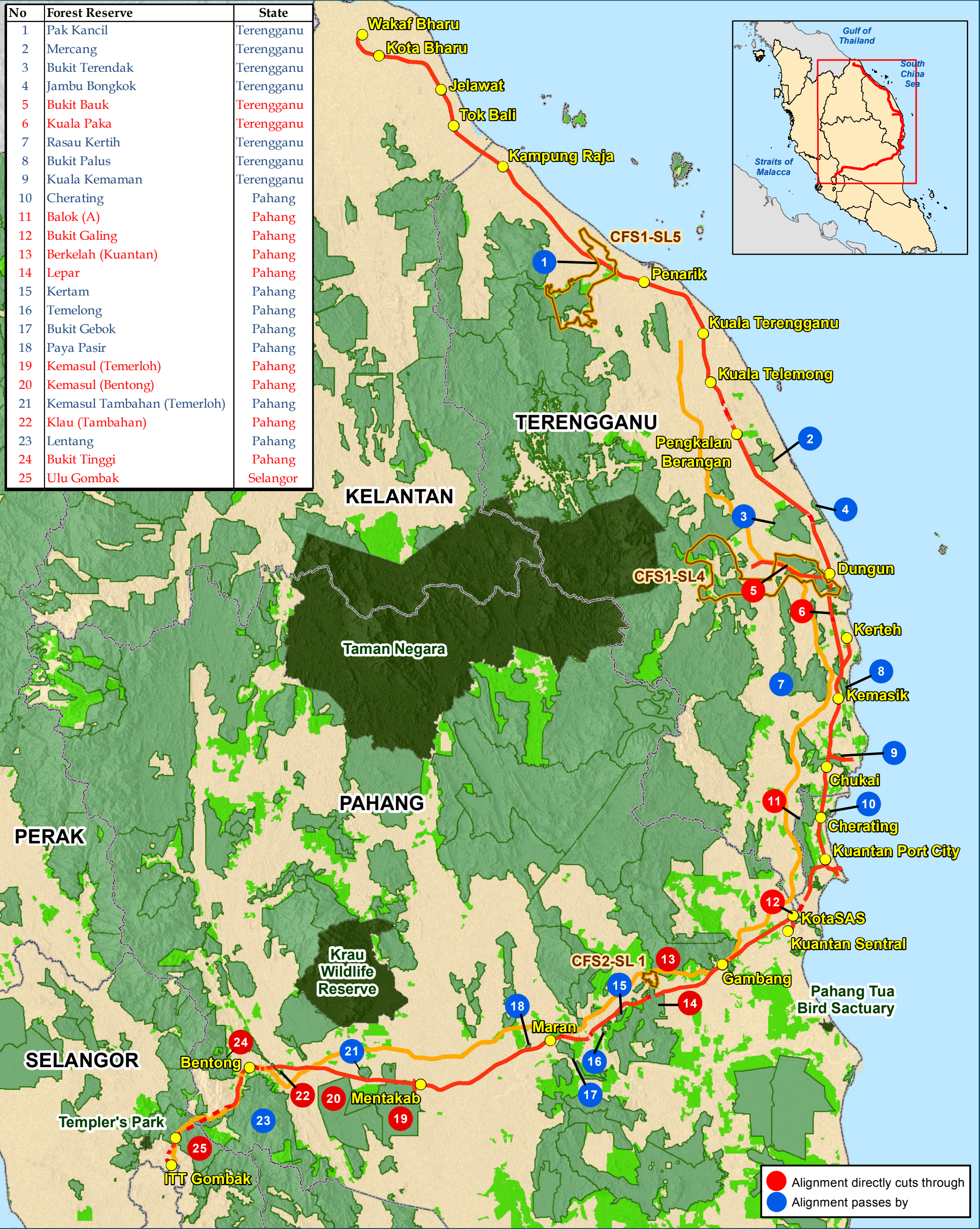
- Irrigation Canal
- River Crossing
- Drain/ Canal



River Crossing and Water Catchment Areas (Selangor)

Date	27-03-2017
Project No	EJ 610
Produced by	AFZ
Revision	A

FIGURE ES-10f



RE

RINGKASAN EKSEKUTIF

PENGENALAN

1. Laluan Rel Pantai Timur (ECRL) adalah projek pembinaan laluan kereta api dari Wakaf Bharu di Kelantan ke Terminal Pengangkutan Bersepadu (ITT) di Gombak, Selangor (**Rajah RE-1**). ECRL akan merentasi negeri Kelantan, Terengganu dan Pahang (**Jadual RE-1**) dan melalui bandar-bandar utama seperti Wakaf Bharu, Kota Bharu, Kuala Besut, Kuala Terengganu, Dungun, Chukai, Kuantan, Gambang, Maran, Mentakab dan Bentong, sebelum merentasi Banjaran Titiwangsa dan berakhir di Selangor. Selain daripada jajaran utama, ECRL juga mempunyai enam jajaran sisihan (**Jadual RE-1**).

Jadual RE-1 : Panjang Jajaran

Negeri	Panjang Jajaran Utama (km)	Panjang Jajaran Sisihan (km)
Kelantan	55.0	
Terengganu	227.9	43.7
Pahang	233.0	22.2
Selangor	16.4	
Total	532.3	65.9

2. Laluan Rel Pantai Timur (ECRL) adalah **infrastruktur nasional** yang penting untuk merangsang pertumbuhan serta **mengurangkan jurang ekonomi di antara Pantai Timur dan Pantai Barat** Semenanjung Malaysia. Projek ECRL ini akan **memperkukuhkan kesalinghubungan** antara ibu negeri, pusat bandar utama, kluster perindustrian, pelabuhan laut dan darat, lapangan terbang dan kawasan pelancongan dan meningkatkan kebolehpakaian pengangkutan untuk penduduk di Pantai Timur. ECRL juga akan **meningkatkan kapasiti pengangkutan barangan angkut** di antara Pantai Timur dan Pantai Barat. Ia juga akan mempermudah perdagangan yang dijangka akan meningkat serta memastikan logistik yang lebih efisien di kawasan Pantai Timur.
3. ECRL adalah selaras dengan pelan dan dasar di peringkat nasional and negeri yang berkaitan. Ianya telah dicadangkan dalam Rancangan Fizikal Negara 1, 2 dan 3 serta Rancangan Struktur Negeri Kelantan, Terengganu, Pahang dan Selangor. ECRL juga telah dikenal pasti dalam Pelan Induk Wilayah Ekonomi Pantai Timur (ECER) untuk menggalakkan pertumbuhan ekonomi wilayah ini. Rancangan Induk Pengangkutan Awam Darat Negara juga telah mencadangkan satu laluan rel kereta api di antara Pantai Timur dan Pantai Barat selaras dengan objektif strategiknya untuk memastikan negara mempunyai sistem perhubungan yang baik dan meningkatkan kesalinghubungan di antara luar bandar dan antara bandar.

RINGKASAN EKSEKUTIF

4. Penggerak Projek ialah Malaysia Rail Link Sdn Bhd (MRL), syarikat yang dimiliki sepenuhnya oleh Kementerian Kewangan Malaysia.

Malaysia Rail Link Sdn. Bhd.

Level 15, Menara 1 Dutamas, Solaris Dutamas

No.1, Jalan Dutamas 1

50480 Kuala Lumpur

Tel: 03- 2096 5079 Fax: 03- 2096 5078

Pegawai Bertanggungjawab: En. Darwis Abdul Razak

5. Perunding yang menjalankan kajian Penilaian Kesan Kepada Alam Sekeliling ialah ERE Consulting Group Sdn Bhd.

ERE Consulting Group Sdn. Bhd.

9, Jalan USJ 21/6, 47630 Subang Jaya,

Selangor Darul Ehsan.

Tel : 603-80242287 Fax : 603-80242320

Pegawai Bertanggungjawab: Raja Nur Ashikin / Lee Hwok Lok

6. Projek ini (Pembinaan Laluan Landasan Baharu Kereta Api) adalah tertakluk di bawah Jadual Kedua Perintah Kualiti Alam Sekeliling (Aktiviti Yang Ditetapkan) (Penilaian Kesan Kepada Alam Sekeliling) 2015 dan Seksyen 34A Akta Kualiti Alam Sekeliling 1974, yang menyatakan bahawa Laporan Penilaian Kesan Kepada Alam Sekeliling (EIA) perlu dikemukakan kepada Ketua Pengarah Kualiti Alam Sekeliling untuk kelulusan sebelum pelaksanaan projek.

TERMA RUJUKAN

7. Terma rujukan bagi Laporan EIA ini telah dikemukakan kepada Jabatan Alam Sekitar pada 25 Januari 2017. Terma rujukan telah dibentangkan dan dibincangkan pada 16 Februari 2017 dan diluluskan pada 22 Februari 2017.

KEPERLUAN PROJEK

8. ECRL dijangka akan merangsang perkembangan ekonomi bagi Wilayah Ekonomi Pantai Timur (ECER) dan membantu mengimbangi pembangunan ekonomi di antara Pantai Barat dan Pantai Timur, terutamanya di antara ECER dan *Greater Klang Valley* (GKV). Jurang pembangunan di antara ECER dan GKV amat ketara, di mana Keluaran Dalam Negara Kasar (KDNK) bagi GKV pada 2010 adalah RM 215.9 billion, atau empat kali ganda berbanding dengan KDNK untuk ECER iaitu RM 49.6 billion, walaupun keluasan ECER adalah lapan kali lebih besar daripada GKV. ECER juga dilihat ketinggalan dari segi pembangunan dan pertumbuhan ekonomi berbanding dengan pembangunan negara secara keseluruhannya.

RINGKASAN EKSEKUTIF

9. ECRL diperlukan kerana tiada ada laluan kereta api terus di antara Pantai Timur dan Pantai Barat melainkan laluan KTMB dari Tumpat ke Kuala Lumpur melalui Gemas. ECRL akan menambahbaik kesalinghubungan antara ibu negeri, pusat bandar utama, kluster perindustrian, pelabuhan laut, depoh kontena dalaman, lapangan terbang dan zon pelancongan serta meningkatkan kemudahan pengangkutan bagi penduduk di Pantai Timur. Ia juga akan melalui sebahagian besar Zon Ekonomi Khas ECER yang merupakan pusat utama bagi industri pembuatan di Pantai Timur dan beberapa taman perindustrian. ECRL juga akan :
 - mengurangkan masa perjalanan dan kos penghantaran barang di antara pusat pertumbuhan utama
 - mengurangkan jumlah kenderaan berat di jalanraya.
 - meningkatkan kapasiti penggunaan jalan raya, sekaligus mengurangkan kesesakan lalu lintas dan pencemaran alam sekitar.
10. ECRL akan meningkatkan kapasiti pengangkutan barangan di antara Pantai Timur dan Pantai Barat. ECRL dijangka dapat mempermudah aktiviti perdagangan dan rangkaian logistik yang lebih cekap. ECRL juga akan meningkatkan kapasiti penghantaran barangan angkut di antara kawasan pedalaman dan Pelabuhan Kuantan, serta merangsang pembangunan ekonomi di kawasan pedalaman. Laluan ECRL di antara Kertih dan Kuantan akan menyediakan kemudahan pengangkutan kontena dan komoditi termasuk keluli dan *polyethylene* di antara Pelabuhan Kuantan, Kemaman dan Kertih. Bijih besi dan komoditi lain dari kawasan pedalaman juga akan dapat diangkut ke pelabuhan dengan lebih cekap.
11. ECRL akan memenuhi permintaan perkhidmatan penumpang antara Kuala Lumpur dan Kota Bharu. ECRL akan menyediakan laluan perjalanan terus antara Pantai Timur dan Kuala Lumpur, berbanding laluan kereta api sedia ada melalui Gemas. Laluan secara langsung ini akan dapat mengurangkan tempoh perjalanan dari Kuala Lumpur ke Wakaf Bharu kepada 4 jam, jauh lebih cepat berbanding 15 jam dengan laluan sedia ada melalui Gemas.
12. ECRL akan mendatangkan faedah bukan sahaja kepada penumpang dan penghantaran barangan angkut di Pantai Timur malah menghubungkan wilayah ini dengan seluruh Semenanjung Malaysia dengan sistem rangkaian laluan kereta api yang cekap. ECRL dijangka akan memberikan manfaat yang ketara kepada pembangunan di Pantai Timur Semenanjung Malaysia dan seluruh negara.

PILIHAN PROJEK

13. Pelbagai pilihan jajaran telah dikenal pasti dan dinilai semasa proses untuk memilih jajaran yang paling optima untuk ECRL. Pemilihan ini bergantung kepada ciri-ciri fizikal, kekangan sosio-ekonomi dan keperluan reka bentuk rangkaian pengangkutan. Selain daripada pemilihan jajaran, penilaian untuk jenis landasan kereta api juga telah dijalankan.

Pilihan yang dipertimbangkan semasa Kajian Kebolehlaksanaan

14. Kajian kebolehlaksanaan yang dilaksanakan oleh ECERDC pada tahun 2010, telah mengkaji empat jajaran utama yang terdiri daripada gabungan jajaran kereta api dan jenis landasan atau '*gauges*' untuk laluan utama:
- '*Metre gauge*' melalui Gemas
 - '*Metre gauge*' melalui Bentong
 - '*Standard gauge*' melalui Gemas
 - '*Standard gauge*' melalui Bentong
15. Pelbagai pilihan jajaran, jenis '*railway gauge*' dan '*traction system*' telah diambilkira dan dinilai semasa kajian kebolehlaksanaan melalui proses penilaian '*multi-criteria*' dan juga rundingan bersama agensi-agensi kerajaan dan pihak-pihak berkepentingan.
16. Akhirnya, '*Standard Gauge*' dan jajaran melalui Bentong telah dipilih sebagai jajaran pilihan dan ianya telah disahkan oleh Majlis Tindakan Ekonomi Negara pada Februari 2013. Di antara faktor-faktor utama pemilihan '*standard gauge*' melalui Bentong ialah:
- Jajaran Bentong menyediakan laluan terus dari Pantai Timur ke Lembah Klang dan akan memendekkan 2 jam masa perjalanan berbanding dengan jajaran melalui Gemas.
 - Bilangan penumpang yang lebih tinggi melalui jajaran Bentong akan menghasilkan pendapatan penumpang yang lebih tinggi.
 - Jajaran Bentong dijangka dapat mewujudkan peluang pekerjaan yang lebih tinggi berbanding pilihan-pilihan lain.
 - '*Standard gauge*' boleh beroperasi dengan kelajuan yang tinggi, lebih stabil dan lebih banyak pilihan untuk '*rolling stock*' daripada pembekal antarabangsa kerana ianya digunakan secara meluas di seluruh dunia.
17. Selain daripada empat pilihan jajaran utama tersebut, pelbagai jajaran alternatif di Kota Bharu, Kuala Terengganu dan Kuantan juga telah dipertimbangkan.
18. Dua pilihan '*traction system*' telah dipertimbangkan, iaitu elektrik dan diesel. '*Traction system*' elektrik adalah pilihan utama untuk kereta api penumpang, manakala '*traction system*' elektrik atau diesel untuk kereta api barang.

RINGKASAN EKSEKUTIF

Pilihan yang dipertimbangkan semasa 'Railway Scheme'

19. Peringkat seterusnya yang bermula pada November 2016 memperhalusi pilihan jajaran berdasarkan data yang lebih terperinci dan kriteria teknikal (seperti geometri, kebolehbinaan ('*constructability*'), topografi, kekangan fizikal, sosial dan alam sekitar) serta pilihan dan kehendak kerajaan negeri.
20. Lokasi stesen telah disemak semula berdasarkan pilihan kerajaan negeri dan kebolehsampaian ke pusat-pusat bandar yang sedia ada serta nodus pembangunan masa hadapan. Beberapa bahagian jajaran telah disemak semula demi mengelakkan hutan simpan dan kawasan sensitif alam sekitar.
21. Selain daripada memilih jajaran yang paling optima, pilihan reka bentuk untuk kawasan berbukit dan kawasan-kawasan rendah juga turut dinilai. Untuk pembinaan yang melalui kawasan berbukit, terowong menjadi pilihan utama untuk mengelakkan pemotongan cerun secara besaran. Untuk pembinaan di kawasan rendah, pilihan benteng dan jejambat telah diambilkira.

HURAIAN PROJEK

22. ECRL ialah projek kereta api elektrik satu landasan yang dibina di atas formasi landasan berkembar - lebih kurang 532.3 km bagi jajaran utama dan 65.9 km untuk jajaran sisihan (**Jadual RE-2**). 16.5% daripada jajaran adalah bertingkat (*elevated*). ECRL akan mempunyai 23 buah stesen.

Jadual RE-2: Ringkasan Projek

Perihal	Jarak/Kuantiti		
Jajaran Utama	Bertingkat ('elevated')	88.0km	532.3km
	Searas ('at grade')	395.8km	
	Terowong	48.5km	
Jajaran Sisihan (6 Nos)	1. Bukit Besi - 25.2 km 2. Kerteh* - 10.8 km 3. Kemaman - 7.7 km 4. Kuantan Port City - 10.2 km 5. Kuantan Sentral* - 5.8 6. Mentakab - 6.2 km		65.9km
Stesen	Penumpang	12	23**
	Pengangkut	2	
	Penumpang & Pengangkut	9	

* Cadangan jajaran sisihan

** Termasuk tiga stesen *provisional*

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Jajaran

23. Jajaran ECRL dibahagikan kepada enam segmen untuk bagi memudahkan penerangan untuk projek ini:
- Segmen 1 : Kelantan
 - Segmen 2 : Terengganu Utara (MD Besut – MD Setiu – MD Kuala Nerus - MB Kuala Terengganu)
 - Segmen 3 : Terengganu Selatan (MD Marang – MP Dungun – MP Kemaman)
 - Segmen 4 : Pahang Timur (MP Kuantan – MD Maran)
 - Segmen 5 : Pahang Barat (MP Temerloh – MP Bentong)
 - Segmen 6 : Selangor

Segmen 1 : Kelantan

24. Jajaran di segmen ini bermula di Stesen Wakaf Bharu dan bergerak ke arah barat daya melintasi Pasir Mas sebelum menuju ke arah timur dan merentasi Sg. Kelantan. Ia seterusnya ke Stesen Kota Bharu dan meneruskan perjalanan ke arah timur, melalui Kota Bharu di sebelah kiri. Selepas memasuki Jajaran Bachok, jajaran melalui kawasan pertanian ke arah tenggara sebelum tiba di Stesen Jelawat. Jajaran kemudiannya melalui Bachok dan Pasir Puteh ke arah tenggara sebelum tiba di Stesen Tok Bali yang terletak kira-kira 5 km utara dari pangkalan Tentera Udara Diraja Malaysia di Gong Kedak. (**Rajah RE-2**).

Segmen 2: Terengganu Utara

25. Dari sempadan negeri Kelantan – Terengganu, jajaran bergerak ke arah tenggara melalui kebanyakan kawasan pertanian. Ia merentasi Sg. Besut dan beberapa jalanraya iaitu Jalan Kuala Besut, Jalan Kampung Raja dan Jalan Masjid yang kesemuanya berada dalam daerah Besut sebelum tiba di Stesen Kampung Raja kira-kira 5 km selatan dari Kuala Besut.
26. Jajaran terus menghala ke arah tenggara melalui tanah pertanian dan memasuki daerah Setiu di mana terletak Stesen Penarik. Seterusnya, jajaran menghala ke arah tenggara dan melalui kawasan yang padat dengan penduduk di Batu Rakit dan Kuala Nerus sehingga ke Stesen Kuala Terengganu yang terletak lebih kurang 3 km ke barat daya dari Lapangan Terbang Sultan Mahmud dan 8 km barat laut dari bandar Kuala Terengganu (**Rajah RE-3**).

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Segmen 3: Terengganu Selatan

27. Selepas melepasi Kuala Terengganu, jajaran merentasi Sg Terengganu dan memasuki daerah Marang. Ia melalui kawasan yang padat penduduk dan kawasan pertanian sebelum tiba di Stesen Kuala Telemong, berhampiran Bukit Payung. Jajaran meneruskan perjalanan hingga ke Stesen Pengkalan Berangan yang terletak berhampiran cadangan pembangunan '*Silicon Valley*'. Ia kemudian melalui kebanyakan kawasan pertanian di selatan daerah Marang dan menuju arah selatan hingga ke Stesen Dungun yang terletak berhampiran Kuala Dungun. Jajaran sisihan dari Bukit Besi bertemu jajaran utama di sini. Seterusnya, jajaran menuju ke selatan Kerteh di mana jajaran akan melalui koridor laluan kereta api Kerteh-Pelabuhan Kuantan sedia ada. Koridor milik pihak Petronas ini akan dibaikpuih dan dinaiktaraf. Jajaran sisihan *provisional* ke kawasan perindustrian Kerteh terletak di selatan Stesen Dungun.
28. Selepas meninggalkan daerah Dungun, jajaran memasuki daerah Kemaman dan terus menuju ke arah selatan sehingga tiba ke Stesen Kemasik dan seterusnya ke Stesen Chukai. Jajaran sisihan (7.7 km) dicadangkan dari Stesen Chukai ke Pelabuhan Kemaman. Jajaran terus menghala ke selatan dan melintasi Sg. Kemaman sehingga ke negeri Pahang (**Rajah RE-4**).

Segmen 4 : Pahang Timur

29. Jajaran memasuki Pahang melalui koridor kereta api Kerteh-Kuantan Port sedia ada sehingga tiba di Stesen Cherating. Ia terus menuju ke arah selatan melalui kawasan pertanian sebelum tiba di Stesen Kuantan Port City berhampiran Kawasan Perindustrian Gebeng di mana jajaran sisihan dicadangkan ke Kuantan Port. Koridor laluan kereta api sedia ada Kerteh-Kuantan Port tamat tidak jauh selepas Stesen Kuantan Port City di mana selepas ini jajaran melalui koridor baharu dan terus menuju ke arah tenggara sehingga tiba di depoh Kuantan Port City (KPC).
30. Dari depoh KPC, jajaran menuju ke arah barat daya dan selari dengan talian transmisi TNB sebelum tiba di Stesen KotaSAS. Jajaran sisihan sepanjang 5.8km dicadangkan dari KotaSAS ke Kuantan Sentral. Jajaran terus menuju ke arah barat daya, merentasi Sg Kuantan dan kawasan Felda Sg Pancing Timur dan menyusur sekitar 2.5 km ke utara daripada Lapangan Terbang Sultan Ahmad Shah. Kemudian, ia terus bergerak ke arah barat daya hingga ke Stesen Gambang yang terletak berdekatan dengan Lebuh raya Pantai Timur. Seterusnya, jajaran menghala ke arah barat dan mengikuti Jalan Persekutuan 2 hingga ke Stesen Maran yang terletak lebih kurang 10 km ke barat daripada pekan Maran (**Rajah RE-5**).

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Segmen 5 : Pahang Barat

31. Jajaran terus bergerak ke arah barat menuju daerah Temerloh di mana ianya merentasi Sg. Pahang sebelum tiba di Stesen Mentakab yang terletak berhampiran Kawasan Perindustrian Temerloh. Jajaran sisihan dicadangkan untuk menyediakan sambungan dengan laluan kereta api KTMB Tumpat-Gemas. Jajaran terus menuju ke arah barat dan melalui kawasan pertanian dan menyeberangi Lebuhraya Pantai Timur sehingga tiba di Stesen Bentong yang terletak berhampiran dengan susur keluar Bentong Barat Lebuhraya Pantai Timur (**Rajah RE-6**). Jajaran ini kemudian menuju ke arah barat daya dan melalui kawasan tinggi dan berbukit-bukau di Bukit Tinggi di mana terowong (Terowong Genting) dicadangkan. Terowong sepanjang 17.8 km ini akan merentasi Banjaran Titiwangsa ke arah Selangor.

Segmen 6 : Selangor

32. Jajaran terowong ECRL merentasi Banjaran Titiwangsa dan mengikuti jajaran Lebuhraya Pantai Timur sebelum ia berakhir di Gombak Utara. Dari Gombak Utara, jajaran menuju ke arah selatan di sepanjang pinggir lembah Sg. Gombak, di mana stesen Gombak Utara ('provisional') dicadangkan. Ia seterusnya melintasi Jalan Gombak dan seterusnya Jalan Lingkaran Tengah 2 sebelum berakhir di Stesen ITT Gombak (**Rajah RE-7**). Jajaran ECRL di Selangor adalah sepanjang 16.7 km.

Jajaran Sisihan

33. Enam jajaran sisihan dicadangkan di sepanjang ECRL (**Jadual RE-3**).

Jadual RE-3 : Jajaran Sisihan ECRL

No.	Lokasi	Panjang (km)	Huraian
1	Bukit Besi	25.2	Jajaran sisihan dari jajaran utama di Stesen Dungun dan menuju ke Bukit Besi untuk pengangkutan bijih besi.
2	Kerteh	10.8	Jajaran sisihan menuju ke kawasan perindustrian Kerteh melalui koridor laluan kereta api Petronas sedia ada untuk tujuan pengangkutan barangan angkut.
3	Chukai	7.7	Jajaran sisihan menuju ke Pelabuhan Kemaman bagi tujuan pengangkutan barangan angkut.
4	Kuantan Port City	10.2	Jajaran sisihan berdekatan stesen KPC menuju ke Kuantan Port bagi tujuan pengangkutan barangan angkut.
5	Kuantan Sentral	5.8	Jajaran sisihan ini akan dihubungkan dengan terminal pengangkutan Kuantan Sentral untuk pergerakan penumpang.
6	Mentakab	6.2	Jajaran sisihan berkembar bercabang dari jajaran utama di stesen Mentakab untuk dihubungkan dengan laluan kereta api Tumpat-Gemas sedia ada bagi pengangkutan barangan angkut dari laluan kereta api KTMB ke ECRL.

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Stesen

34. Terdapat 23 buah stesen ECRL yang terdiri daripada 12 stesen penumpang, 2 stesen kereta api pengangkut dan 9 stesen yang bercampur penumpang dan kereta api pengangkut (**Jadual RE-4**).
35. Tiga stesen akan dijadikan sebagai stesen pertukaran yang membolehkan pertukaran untuk penumpang dan/atau barangan angkut antara ECRL dengan mod pengangkutan sedia ada yang lain. Tiga stesen pertukaran ini adalah:
- Wakaf Bharu – Pertukaran penumpang dan barangan angkut dengan laluan KTMB Gemas-Tumpat sedia ada.
 - Mentakab – Pertukaran barangan angkut dengan laluan KTMB Gemas-Tumpat sedia ada.
 - ITT Gombak – Pertukaran penumpang dengan laluan LRT Kelana Jaya.

Jadual RE-4 : Stesen ECRL

No.	Nama Stesen	Negeri	Jenis Stesen
1	Wakaf Bharu	Kelantan	Penumpang & Barangan Angkut
2	Kota Bharu	Kelantan	Penumpang
3	Jelawat	Kelantan	Penumpang
4	Tok Bali	Kelantan	Penumpang & Barangan Angkut
5	Kampung Raja	Terengganu	Penumpang
6	Penarik	Terengganu	Penumpang
7	Kuala Terengganu	Terengganu	Penumpang
8	Kuala Telemong*	Terengganu	Penumpang
9	Pengkalan Berangan	Terengganu	Penumpang
10	Dungun	Terengganu	Penumpang & Barangan Angkut
11	Kerteh*	Terengganu	Pengangkut
12	Kemasik	Terengganu	Penumpang & Barangan Angkut
13	Chukai	Terengganu	Penumpang & Barangan Angkut
14	Cherating	Pahang	Penumpang
15	Kuantan Port City	Pahang	Penumpang & Barangan Angkut
16	KotaSAS	Pahang	Penumpang
17	Kuantan Sentral	Pahang	Penumpang
18	Gambang	Pahang	Penumpang
19	Maran	Pahang	Penumpang & Barangan Angkut
20	Mentakab	Pahang	Penumpang & Barangan Angkut
21	Bentong	Pahang	Penumpang & Barangan Angkut
22	Gombak North*	Selangor	Barangan Angkut
23	ITT Gombak	Selangor	Penumpang

* stesen provisional

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Terowong and Jambatan

36. Terdapat 19 terowong di sepanjang jajaran ECRL. Jumlah panjang untuk kesemua terowong adalah 48.5 km. Tujuan utama terowong adalah mengurangkan pemotongan tanah dan gangguan kepada habitat hidupan liar serta memastikan kecerunan jajaran ECRL tidak melebihi 0.9%. Terowong Genting adalah terowong terpanjang iaitu sepanjang 17.8 km. Terowong lain adalah di antara 0.65 – 4.96 km.
37. Terdapat sejumlah 80 jambatan di sepanjang jajaran ECRL. Terdapat beberapa jambatan yang merentasi sungai utama seperti Sg. Kelantan, Sg. Terengganu, Sg. Dungun, Sg. Kemaman dan Sg. Pahang dan panjang jambatan dijangka melebihi 300 m.

Depoh, Yards and Base Penyelenggaraan

38. Depoh Kuantan Port City (KPC) yang terletak berdekatan Stesen Kuantan Port City akan dilengkapi dengan pelbagai kelengkapan untuk memastikan penyelenggaraan dapat dilaksanakan untuk semua peringkat termasuk untuk penyelenggaraan berat. Pusat Kawalan Operasi bagi ECRL juga terletak di sini. Fungsi utama Depoh KPC adalah:
 - Pengurusan penyelenggaraan gerabak
 - Pengurusan operasi lokomotif, gerabak dan EMUs.
 - Penstabilan lokomotif kereta api pengangkut, EMU & gerabak
 - Cucian badan lokomotif kereta api pengangkut
 - Pemeriksaan berkala, servis & cucian lokomotif kereta api pengangkut
 - Penyelenggaraan lokomotif, EMUs & gerabak.
 - Tempat penyimpanan alat gentian, komponen dan barangan lain.
39. Wakaf Baru *Yard* dan ITT Gombak *Yard* masing-masing akan mempunyai fungsi yang sama iaitu 'stabling', pembersihan bahagian dalaman, cucian badan kereta api, pemeriksaan berkala, servis dan pembaikan sementara EMU. Mentakab *Locomotive Yard* mempunyai dua fungsi utama iaitu 'stabling' dan pemeriksaan berkala dan servis untuk lokomotif.
40. Enam *base* untuk penyelenggaraan ringan akan disediakan di stesen Penarik, Kuala Terengganu, Kertih, Gambang, Mentakab and ITT Gombak manakala empat *base* penyelenggaraan sederhana pula akan disediakan berdekatan stesen Jelawat, Kuala Terengganu, Maran dan Bentong.

Rolling Stocks dan Sistem

41. Kereta api penumpang akan menggunakan *power-centralized EMUs* yang terdiri daripada satu gerabak motor dan tujuh gerabak treler dengan

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kapasiti penumpang seramai 600 orang dan kelajuan rekabentuk 160 km/j. Panjang kereta api adalah 206m.



Plat RE-1: Contoh Kereta Api Penumpang

42. Kereta api pengangkut yang dicadangkan adalah lokomotif elektrik dengan 'traction power' setinggi 3500t dan kelajuan rekabentuk 80 km/jam. Ia juga akan mempunyai sehingga 45 gerabak. Gerabak-gerabak utama yang akan digunakan adalah gerabak terbuka ('open top box cars'), gerabak tertutup ('closed box cars'), gerabak tangki ('tanker wagons') dan 'flat-bed wagons'.



Plat RE-2 : Contoh Kereta Api Pengangkut

43. Landasan akan direkabentuk untuk kelajuan 160km/j bagi kereta api penumpang dan 80 km/j bagi kereta api pengangkut. Beban gandar maksima adalah 25 tan dan rel akan dikimpalkan secara berterusan. *Ballasted tracks* akan digunapakai untuk sebahagian besar jajaran utama. Namun, di beberapa lokasi (cth. Terowong Genting), *low vibration ballastless tracks* mungkin digunakan.
44. Bekalan kuasa elektrik untuk keseluruhan fasiliti kereta api akan diperolehi dari sistem bekalan pukal pengguna 132kV yang berdekatan. Sub-stesen khas 11/0.4kV akan dipasang di setiap stesen untuk memenuhi keperluan bagi tujuan komunikasi, beban isyarat dan fasiliti berkaitan. Bagi sistem-sistem penting seperti komunikasi, peralatan isyarat, peralatan kebakaran dan lampu kecemasan, sumber bekalan kuasa elektrik sokongan akan disediakan. Bekalan kuasa elektrik untuk *traction power* kereta api pengangkut akan dibekalkan daripada stesen 132 kV pihak TNB ke sub-

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stesen berkaitan. Bekalan 132kV akan ditukarkan ke AC 25kV dan disambungkan ke sistem *Overhead Catenary*.

45. Pusat kawalan operasi ECRL (OCC) terletak di Depoh Kuantan Port City (KPC). Depoh ini terletak di pertengahan jajaran ECRL. OCC akan memastikan pengangkutan sepanjang landasan diuruskan dengan cekap. Komponen utama bagi OCC adalah Operasi Pengurusan Penghantaran, Kawalan Trafik Berpusat dan Sistem Penyeliaan Kawalan Kuasa dan Pemerolehan Data. Kesemua sistem dan pencawang, sekiranya boleh, akan dilengkapi dengan fasiliti pendua dan 'back-ups' untuk memastikan operasi ECRL boleh berfungsi secara berterusan pada setiap masa.

Aktiviti-aktiviti Projek Utama

46. Aktiviti-aktiviti penting semasa peringkat pembinaan dan operasi ECRL adalah seperti berikut (**Jadual RE-5**).

Jadual RE-5 : Aktiviti-aktiviti Projek Utama

Peringkat	Aktiviti
Pra-Pembinaan	• Pengambilan tanah • Pengalihan utiliti
Pembinaan	• Pembersihan tapak • Kem pekerja dan pejabat tapak • Jalan masuk atau jalan pembinaan • Kerja tanah dan pembinaan benteng • Pembinaan jambatan dan <i>viaducts</i> • Pembinaan terowong • Pembinaan stesen • Pemasangan trek kereta api dan sistem
Operasi	• Operasi kereta api • Operasi stesen • Operasi depoh

Pengambilan Tanah

47. Di kawasan di mana jajaran melalui tanah dan/atau bangunan milik persendirian, pengambilan tanah diperlukan bagi memastikan '*right-of-way*' untuk trek kereta api, rezab laluan kereta api, stesen-stesen, depoh dan fasiliti penyelenggaraan. Sebanyak 8,699 lot tanah (atau sebahagian daripadanya) dianggarkan akan terlibat (**Jadual RE-6**). 54% daripada tanah yang diperlukan oleh ECRL adalah tanah milik kerajaan manakala 46% adalah tanah milik persendirian. Pengambilan tanah akan diuruskan oleh Pejabat Tanah & Galian negeri untuk setiap negeri yang terlibat.

Jadual RE-6 : Pengambilan Tanah

Jenis Tanah	Bil. Lot/ Lokasi	Keluasan Teribat	
		Ekar	Hektar
Tanah Milik Peribadi	8,699	8,376.88	3,390.00
Tanah Milik Negeri/ Jalan/ JPS/ Utiliti/ Simpanan	-	7,195.67	2,911.99
JUMLAH	8,699	15,572.55	6,301.99

Sumber : Skim Keretapi MRL

Pengalihan Utiliti

48. Sebelum aktiviti pembinaan bermula, pengalihan utiliti akan dijalankan. Sebelum itu, utiliti yang berada di sepanjang jajaran akan dikenal pasti. Jenis-jenis utiliti termasuk talian transmisi elektrik, paip air dan pembedungan, kabel elektrik, kabel telekomunikasi, paip gas dan talian utiliti di permukaan dan bawah tanah yang lain. Sebahagian jalan dan simpang dan infrastruktur pengairan mungkin perlu dijarsemula dan dikonfigurasi semula untuk projek ini.

Kem Pekerja dan Pejabat Tapak

49. Kem pekerja dan pejabat tapak akan disediakan di beberapa lokasi berhampiran jajaran ECRL bergantung kepada pakej dan fasa pembinaan yang akan dilaksanakan.

Pembersihan Tapak

50. Pembersihan tapak dan kerja tanah akan dilaksanakan untuk jajaran (termasuk terowong), stesen dan depoh. Pembersihan tapak melibatkan penebangan pokok-pokok dan tumbuh-tumbuhan yang ada di tapak pembinaan dengan menggunakan jentolak atau mesin yang bersesuaian. Kerja tanah yang utama akan dilaksanakan di beberapa lokasi untuk mencapai aras platform yang dikehendaki. Bahan timbus akan dibawa dari *borrow areas* manakala bahan yang tidak sesuai dicadangkan untuk dilupuskan di tapak pelupusan yang diluluskan oleh pihak berkuasa tempatan.

Pembinaan Benteng

51. Sebahagian besar dari jajaran ECRL akan dibina di atas benteng. Oleh yang demikian, *unsuitable subsoil* akan dikorek dan digantikan dengan *suitable material* yang akan dipadatkan untuk membina asas yang kukuh untuk landasan kereta api. Benteng atau tembok penahan akan dibina di sisi landasan dan selepas itu, *ballast* akan dipasang di atas landasan.

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52. Untuk benteng tinggi, tiang batu (*stone columns*) akan digunakan sebagai *ground treatment* sekiranya kombinasi *temporary surcharge* dan *geotextile basal reinforcement* tidak sesuai. Tiang batu akan membentuk bahan komposit yang mempunyai kebolehmpatan (*compressibility*) yang rendah dan kekuatan ricih (*shear strength*) yang tinggi berbanding dengan tanah liat lembut *in-situ*. Selain daripada itu, terdapat jalanraya dan simpang serta infrastruktur pengairan yang mungkin perlu dijarar dan dikonfigurasi semula untuk pembinaan benteng.

Pembinaan Jambatan dan Viaduct

53. *Post-tensioned* atau *post-tensioned precast beams* akan digunakan untuk pembinaan superstruktur *viaduct*. Jajaran bertingkat (*elevated alignment*) sepanjang 88.8 km akan dibina kawasan bandar, kawasan mudah banjir, dan kawasan berpayau/ tanah lembut. Di samping itu, jambatan dan parit (*culverts*) akan dibina untuk menyeberangi jalan raya, sungai atau saluran air yang sedia ada.
54. Pembinaan substruktur *viaduct* merangkumi tiang konkrit bertelulang (*reinforced concrete pier*), *flared pier heads* untuk mengukuhkan dek, dan *reinforced concrete abutments*. Kesemua *piers* dan *abutments* akan dibina di atas *in-situ bored piles* berdiameter besar dengan diameter di antara 1.0 m dan 1.5 m atau *pre-cast spun bored piles*.
55. *Span dek* akan dibina *span-by-span* menggunakan kren. Rasuk (*beams*) akan diangkut ke tapak pembinaan dan diangkat ke posisi menggunakan kren. Selepas rasuk tersebut sudah diletakkan ke dalam *bearing*, *cast in-place deck slab* akan dibina menggunakan *formwork*.

Pembinaan Terowong

56. Dua kaedah pembinaan terowong, iaitu *New Austrian Tunneling Method* (NATM) dan *Tunnel Boring Machine* (TBM), dijangka akan digunakan. Kaedah yang digunapakai akan bergantung kepada keadaan geologi di tapak dan akan ditentukan pada peringkat reka bentuk terperinci. Selain daripada aspek geologi, aspek terperinci lain seperti panjang terowong dan keratan rentas terowong juga akan mempengaruhi kaedah pembinaan terowong yang akan dipilih.
57. Sebahagian besar terowong akan dibina dengan menggunakan kaedah *New Austrian Tunneling Method*. Pengorekan terowong akan dijalankan dengan kaedah gerudi dan letupan (*drill and blast*). Kaedah gerudi dan letupan merangkumi aspek penggerudian lubang letupan, pengecasan, pencucuhan, *mucking* dan *scaling*. Sisa hasil letupan akan diangkut keluar dengan trak dan sisa hasil letupan yang sesuai akan digunapakai semula untuk aktiviti

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pembinaan lain. Selepas sisa hasil letupan diangkut keluar, *scaling* akan dijalankan untuk mengeluarkan batuan yang kurang stabil disekeliling terowong dan menyediakan permukaan batuan dinding terowong untuk *shotcreting* dan *tunnel lining*.

Pembinaan Stesen

58. Pembinaan stesen akan melibatkan perobohan struktur-struktur sedia ada, kerja-kerja tanah, kerja-kerja sub-struktur dan asas, kerja-kerja super-struktur dan kerja-kerja infrastruktur dan utiliti. Kerja-kerja perobohan akan dilaksanakan menggunakan pengorek dan jentera lain. Kerja-kerja tanah akan dilaksanakan adalah pemotongan atau penambahan ('cut and fill') bagi mencapai paras platform yang dikehendaki. Di kawasan di mana *import earth* diperlukan, lori akan membawa bahan tersebut dan jentolak digunakan untuk meratakan tanah. *Rollers* akan digunakan untuk memampatkan tanah ke paras kepadatan yang dikehendaki.
59. Kerja-kerja *ground treatment* akan dilaksanakan di kawasan yang telah dikenalpasti dan kerja-kerja *foundation* akan melibatkan kerja-kerja pencerucukan (*piling*). Struktur utama akan dibina menggunakan rasuk keluli dan kerangka bangunan. Rasuk keluli dan tiang akan dihantar ke tapak dari kilang pembuatan dan dipasang di tapak. Lantai adalah slab konkrit yang akan dibina di tapak dari konkrit yang dibawa ke tapak pembinaan.

Pemasangan Trek dan Sistem

60. Selepas kerja-kerja tanah dan struktur untuk jajaran telah disiapkan, landasan kereta api dan sistem-sistem kawalan dan isyarat akan dipasang. Sistem landasan kereta api merangkumi jaringan trek yang menyediakan sokongan dan bimbingan untuk gerabak, termasuk unsur-unsur seperti rel, pengancing rel (*rail fastening*), *sleepers* dan *ballast*. Sistem akan memastikan fungsi pengasingan kereta api yang selamat dan membolehkan kereta api untuk bergerak pada kelajuan maksima yang konsisten dengan selamat. Selepas pemasangan komponen-komponen tersebut, pengujian dan pentauliahan akan dijalankan.

Operasi ECRL

61. Semasa peringkat operasi ECRL, kereta api akan beroperasi pada jangka masa yang tetap. Kereta api penumpang akan bergerak pada kelajuan 160 km/jam dan kereta api pengangkut pada kelajuan 80 km/jam. Di stesen penumpang, aktiviti-aktiviti yang dijangkakan adalah seperti perniagaan runcit, mengambil dan menurunkan penumpang serta aktiviti trafik yang

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berkaitan dengan stesen. Di stesen kereta api pengangkut pula, pemunggahan dan perpindahan pelbagai bentuk kargo dijangkakan.

Bilangan Penumpang

62. Bilangan penumpang (**Jadual RE-7**) telah dianggarkan berdasarkan bilangan penduduk, pekerjaan, KDNK, tempoh transit – kereta api/lebuhraya, tarif, kos pengangkutan, nilai tempoh perjalanan dan pelan menaik taraf lebuhraya. Pada 2024, apabila ECRL mula beroperasi, perkhidmatan keretapi adalah tujuh kali sehari untuk kereta api penumpang harian dari ITT Gombak - satu kali sehari ke KotaSAS, dua kali sehari ke Kuala Terengganu, dan empat kali sehari ke Wakaf Baru. Perkhidmatan kereta api penumpang akan beroperasi dari jam 5 pagi hingga 1 pagi.

Jadual RE-7 : Ramalan Perjalanan Penumpang ECRL

Tahun	Perjalanan Penumpang (Juta)	Tahun	Perjalanan Penumpang (Juta)
2025	4.49	2033	6.10
2026	4.66	2034	6.35
2027	4.83	2035	6.62
2028	5.01	2036	6.90
2029	5.19	2037	7.19
2030	5.39	2038	7.49
2031	5.61	2039	7.80
2032	5.85	2040	8.13

Sumber: Skim Keretapi MRL

Operasi Kereta Api Pengangkut

63. Kereta api pengangkut, yang akan dilengkapi sehingga 45 gerabak, dan beroperasi selama 22.5 jam sehari, tujuh hari seminggu. Pada tahun 2024, permintaan trafik yang paling sibuk dijangka di segmen antara Maran-Kuantan Port City (**Jadual RE-8**). Sebanyak 25 kereta api akan beroperasi setiap hari.

Jadual RE-8 : Operasi Pasangan Kereta Api Pengangkut (Kereta Api Setiap Hari)

Segmen	2024	2030	2035	2040
Gombak North - Mentakab	0	0	0	3.5
Mentakab - Maran	9.5	10.0	11.0	12.0
Maran - Kuantan Port City	12.5	17.5	19.5	23.0
Kuantan Port City - Chukai	2.0	2.5	5.0	6.0
Chukai - Kemasik	6.5	6.5	6.5	7.0
Kemasik - Dungun	6.0	6.5	6.5	6.5
Dungun - Wakaf Baru	1.0	1.0	1.5	1.5

Nota: "Pasangan kereta api" ialah satu servis pada laluan yang dinyatakan mengikut arah yang dinyatakan dan satu servis pergi-balik (*return*).

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64. Jenis barangan angkut yang akan dibawa dengan kereta api pengangkut termasuk arang batu, simen, keluli, getah, *polyethylene* dan biojisim kelapa sawit (**Jadual RE-9**), yang akan diangkut di dalam pelbagai rupa-bentuk seperti kontena, pakej, pukal kering dan pukal cecair.

Jadual RE-9 : Ringkasan Trafik Kereta Api Pengangkut Tahunan

Komoditi	Trafik Kereta Api Pengangkut	
	2030 (Juta Tan)	2040 (Juta Tan)
Kontena Eksport/Import	18.94	21.46
Bijih Besi	8.38	7.97
Arang Batu	2.00	3.50
Simen	0.33	3.33
Industri Keluli	0.50	0.50
Getah (Kontena)	0.47	0.63
Polyethylene	0.66	0.69
Biojisim Kelapa Sawit	6.00	6.00
Jumlah	37.28	44.08

Sumber : Skim Keretapi MRL

Jadual Pelaksanaan Projek

65. Pembinaan ECRL dijangka bermula pada Julai 2017. Pembinaan segment dari Bentong ke Terowong Genting akan dimulakan dahulu. Kerja-kerja pembinaan dijangka akan mengambil masa 7 tahun. ECRL dijangka akan mula beroperasi pada bulan Jun 2024.

PERSEKITARAN SEDIA ADA

Topografi

66. ECRL merentasi rupa bumi yang pelbagai – dari kawasan rendah dan rata di Kelantan ke kawasan berbukit dan bercerun di Pahang dan Selangor (**Rajah RE-8a** dan **Rajah RE-8b**). Di Kelantan dan utara Terengganu, jajaran merentasi kawasan rata dan rendah yang mempunyai aras ketinggian kurang dari 10m. Di kawasan yang berhampiran dengan Kuala Terengganu, jajaran melalui berhampiran kawasan berbukit rendah yang terletak jauh antara satu sama lain. Kebanyakan cerun di kawasan ini adalah Kelas I (0° - 15°).
67. Apabila jajaran memasuki daerah Dungun, kebanyakan keadaan rupa bumi adalah rata melainkan di dua lokasi iaitu di Bukit Bauk dan Paka di mana terowong akan dibina. Kebanyakan cerun di sepanjang jajaran di sini

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adalah Kelas I dan hanya sebahagian kecil kawasan mempunyai cerun Kelas II dan Kelas III.

68. Apabila jajaran memasuki Negeri Pahang, ia melalui kawasan yang agak rata di Cherating sehinggalah ke Kawasan Perindustrian Gebeng. Apabila jajaran melalui Kuantan dan daerah Maran, topografi adalah beralun. Beberapa terowong yang akan dibina di kawasan ini untuk mengelakkan pemotongan bukit. Kawasan yang dilalui oleh jajaran ini kebanyakannya dari cerun Kelas I. Beberapa kawasan antara Gambang dan Stesen Maran mempunyai cerun dari Kelas II dan Kelas III.
69. Jajaran melalui rupa bumi yang beralun dan berbukit di daerah Temerloh. Jajaran akan merentasi beberapa bukit melalui terowong sebelum tiba di Stesen Bentong. Selepas Stesen Bentong, jajaran akan mengikuti lembah Sg. Benus, sebelum melalui terowong merentasi Banjaran Titiwangsa yang berhampiran Bukit Tinggi. Kebanyakan cerun di antara kawasan Mentakab ke Stesen Bentong adalah Kelas I manakala selepas Bentong, kebanyakan cerun adalah Kelas II dengan Kelas III di beberapa kawasan.
70. Jajaran di Selangor melalui kawasan yang beralun dan berbukit. Selepas Terowong Genting, jajaran melalui satu terowong pendek (2 km) untuk merentasi kawasan berbukit berhampiran Kg. Sungai Salak. Selepas keluar dari terowong kedua ini, jajaran akan mengikuti topografi beralun di lembah Sg. Gombak. Cerun di sepanjang jajaran merupakan kombinasi cerun Kelas I, II dan III.

Geologi dan Tanah

71. Keseluruhan jajaran di Kelantan terletak di atas deposit Kuarternari (**Rajah RE-9**). Kebanyakan jajaran terletak di atas *undifferentiated alluvium* yang terdiri daripada tanah liat, kelodak, pasir dan lapisan batu terutamanya berhampiran dengan Kota Bharu. Kawasan gambut terletak di utara Tok Bali di mana jenis tanah ini *soil treatment* semasa peringkat pembinaan.
72. Sebahagian besar jajaran di utara Terengganu sehingga ke Kuala Terengganu terletak di atas deposit Kuarternari aluvium yang terdiri daripada tanah jenis pasir dan tanah liat marin. Di beberapa lokasi yang terletak di utara kawasan Kuala Terengganu, landasan kereta api terletak di atas granit. Jenis tanah untuk jajaran sisihan daripada Bukit Besi ke Dungun adalah terdiri daripada *sandstone*, *phyllite*, *slate* dan *shale*.
73. Jenis tanah untuk jajaran di selatan Terengganu terdiri daripada pelbagai batuan sedimen daripada *sandstone*, *phyllite*, *slate* dan *shale* yang mempunyai usia yang berbeza-beza. Di beberapa lokasi terutamanya di selatan Kerteh, jajaran terletak di atas kawasan granit. Jenis tanah untuk jajaran sisihan dari Dungun ke Bukit Besi juga terdiri daripada *sandstone*, *phyllite*, *slate* dan *shale*.

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74. Beberapa terowong berhampiran dengan Pengkalan Berangan dan selatan Kuala Terengganu akan dibina di atas kawasan granit. Terowong yang terletak ke utara Dungun akan dibina di kawasan *sandstone* dan *phyllite* manakala terowong di selatan Dungun pula dibina di kawasan granit.
75. Jajaran antara Cherating dan Kuantan terletak di kawasan aluvium manakala dari Kuantan ke Maran pula, ia terletak di kawasan pelbagai jenis batuan sedimen. Di Kuantan, terdapat juga kawasan di mana jajaran terletak di atas basalt Kuarternari. Jenis tanah untuk terowong yang dicadangkan berhampiran Gambang dan Maran adalah terdiri daripada batuan sedimen. Selepas Gambang, jajaran akan melalui *Lebir Fault* dan *Lepar Fault*.
76. Di kawasan barat Pahang, jajaran akan terletak di atas formasi geologi *Central Belt* yang terdiri daripada pelbagai jenis batu iaitu *sandstone*, *siltstone*, *shale* dan batuan volkano terutamanya *tuff*. Di kawasan barat Bentong, granit merupakan jenis batuan utama. Terowong yang dicadangkan berhampiran timur dan barat kawasan Bentong dijangka adalah jenis *phyllite* manakala granit di bahagian barat Bentong.
77. *Geological lineaments* utama adalah *Bentong Raub Suture Zone* yang terletak di kawasan Bentong. Jajaran dijangka merentasi *Bukit Tinggi Fault* di kawasan granit. Granit dari zaman Mesozoik dominan di sepanjang jajaran di Selangor (sebahagian besar adalah terowong) dan di bahagian barat Pahang. Hasil *boreholes* yang dijalankan di negeri Selangor menunjukkan bahawa jajaran terowong akan dibina di kawasan dasar batuan granit.

Iklim

78. Secara umumnya, iklim di tapak projek adalah serupa dengan seluruh Semenanjung Malaysia yang terletak di garisan khatulistiwa dengan kadar hujan tahunan yang tinggi (2500 mm - 3000 mm) dan mempunyai kelembapan yang tinggi dan suhu yang seragam. Musim tengkujuh yang berikut dialami sepanjang tahun:
 - (a) Musim tengkujuh timur laut (November/awal Disember hingga Mac)
 - (b) Antara-musim atau musim peralihan (April hingga Mei)
 - (c) Musim tengkujuh barat daya (Jun hingga September/ awal Oktober)
 - (d) Antara-musim atau musim peralihan (Oktober sehingga awal November)

Negeri Kelantan dan Terengganu lebih dipengaruhi oleh musim tengkujuh timur laut dan mengalami hujan lebat pada bulan November hingga Januari.

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Guna Tanah

79. Sebahagian besar jajaran ECRL merentasi kawasan pertanian dan hutan. Jajaran ECRL juga melalui 20 kawasan pihak berkuasa tempatan. Komposisi guna tanah untuk koridor jajaran ECRL (500 m di setiap sisi jajaran) adalah 42% pertanian, 36% hutan, 10% kawasan tepu bina dan 12% kegunaan lain (**Jadual RE -10**) (**Rajah RE-11**).

Jadual RE-10 : Guna Tanah dalam Lingkungan Koridor 500 m

Segmen	Pertanian	Hutan	Kawasan Tepu Bina	Lain-lain
Kelantan	55%	0.4%	11%	33%
Utara Terengganu	45%	27%	6%	22%
Selatan Terengganu	34%	53%	7%	7%
Timur Pahang	33%	46%	13%	9%
Barat Pahang	61%	21%	11%	7%
Selangor	28%	47%	21%	4%
Jumlah	42%	36%	10%	12%

Sistem Sungai, Kualiti Air dan Penggunaan Air

80. Jajaran ECRL akan merentasi 27 lembangan sungai (**Jadual RE-11**) (**Rajah RE-10** hingga **Rajah RE-10f**). Selain itu, jajaran juga akan melintasi pelbagai anak sungai, terusan pengairan, perparitan tanah, alur air dan kolam.

Jadual RE-11 : Lembangan Sungai Dientasi ECRL

Negeri	Lembangan Sungai	Keluasan (ha)
Kelantan	Sg. Kelantan	1,317,768
	Sg. Pengkalan Datu	3,903
	Sg. Kemasin	35,376
	Sg. Tekoh Dua	4,906
	Sg. Semerak	50,898
Terengganu	Sg. Besut	96,856
	Sg. Keluang Besar	29,242
	Sg. Setiu	88,996
	Sg. Merabang Banghung	1,632
	Sg. Merabang Besar	990
	Sg. Terengganu	46,6315
	Sg. Ibai	12,610
	Sg. Marang	41,779

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Negeri	Lembangan Sungai	Keluasan (ha)
	Sg. Mercang	26,306
	Sg. Dungun	185,261
	Sg. Sura	3,590
	Sg. Kemaman	221,779
	Sg. Paka	84,316
	Sg. Kertih	25,209
	Sg. Kemasik	4,854
	Sg. Cendur	4,475
Pahang	Sg. Cherating	8,959
	Sg. Balok	9,895
	Sg. Ular	1,002
	Sg. Kuantan	170,378
	Sg. Pahang	2,901,506
Selangor	Sg. Klang	130,996

81. Sebahagian besar daripada jajaran di Kelantan, Terengganu dan Pahang terletak di kawasan mudah banjir. Kejadian banjir sering berlaku antara bulan November ke Mac di pantai timur Semenanjung Malaysia ketika musim tengkujuh timur laut. Jajaran ECRL telah direka bentuk supaya paras landasan terletak lebih tinggi daripada paras banjir dan sebahagian jajaran di Kelantan dan Terengganu adalah jajaran bertingkat (*elevated*).
82. Persampelan kualiti air yang dijalankan di 46 lokasi menunjukkan bahawa kualiti air sungai-sungai di sepanjang jajaran ECRL adalah antara Kelas II dan Kelas III. Oleh kerana kebanyakan sungai mengairi kawasan pertanian, sumber pencemaran utama adalah Pepejal Terampai (TSS). Paras untuk parameter kualiti air seperti kandungan organik, logam berat dan lain – lain adalah pada takat yang rendah.
83. Sungai-sungai di sepanjang jajaran digunakan untuk pelbagai kegunaan seperti bekalan air minuman, bekalan skim pengairan, kegiatan akuakultur dan aktiviti rekreasi. Terdapat 8 muka sauk dan loji rawatan air yang terletak di hilir jajaran (**Jadual RE-12**). Walaupun terdapat beberapa muka sauk dan loji rawatan air terletak berhampiran dengan jajaran tetapi kesemuanya terletak ke hulu jajaran. Ini termasuk telaga tiub di Wakaf Bahru dan Kota Bahru.

Jadual RE-12 : Muka Sauk Hilir Daripada Jajaran

Muka Sauk/ Loji Rawatan Air	Sumber	Kawasan Bekalan Air	Kapasiti Reka Bentuk (mld)	Jarak dari Jajaran (km)
Kepong I	Sg. Terengganu	Kuala Terengganu	90	1.2
Kepong II	Sg. Terengganu	Kuala Terengganu & Marang	180	1.2
Bukit Losong	Sg. Terengganu	Kuala Terengganu	43	4.8
Bukit Bauk	Sg. Paka	Dungun	64	0.5
Lepar Hilir	Sg. Lepar	Kuantan	20	11
Semambu	Sg. Kuantan	Kuantan	291	3
Bukit Ubi	Sg. Kuantan	Kuantan	36	3
Benus Bt 4	Sg. Benus	Kg. Gementi & Ketari	4	0.1

Sumber: Suruhanjaya Pengurusan Air Negara, 2016

84. Jajaran juga merentasi banyak skim pengairan di Kelantan dan Terengganu. Antaranya termasuk kawasan jelapang padi utama seperti Kemasin Semerak IADP dan Kemubu IADA di Kelantan dan KETARA IADA di Terengganu dan pelbagai skim pengairan kecil yang lain.
85. Aktiviti akuakultur dijalankan di beberapa sungai di sepanjang jajaran di Kelantan, Terengganu dan Pahang. Di Kelantan, kawasan penternakan ikan terletak berhampiran dengan Kemasin Semerak IADA. Di Terengganu, kegiatan akuakultur ikan dijalankan di beberapa kawasan (seperti Kg. Pak Kiang Besut, Kg. Fikri dan Kg. Gong Batu) yang terletak kira-kira 7 - 15km hilir daripada jajaran. Aktiviti penternakan sangkar ikan terapung juga dijalankan di Sg. Terengganu dan beberapa lokasi lain di Pahang.
86. Beberapa kawasan rekreasi di Pahang seperti Hutan Lipur Lentang berhampiran Sg. Benus, terletak berdekatan dengan jajaran. Di Selangor pula, Kem Alang Sedayu yang merupakan sebuah pusat latihan, terletak kira-kira 130 m daripada jajaran. Di samping itu, komuniti Orang Asli di Gombak juga menggunakan Sg. Gombak sebagai sumber air mereka.

Kualiti Udara, Bunyi Bising dan Getaran

87. Persampelan kualiti udara yang telah dijalankan di 28 lokasi menunjukkan bahawa kualiti udara adalah mematuhi Interim Limit I Piawaian Kualiti Udara Ambien Malaysia 2013. Takat PM_{10} adalah antara 17 -73 $\mu g/m^3$ manakala $PM_{2.5}$ antara 2 - 35 $\mu g/m^3$. Takat NO_2 dan SO_2 adalah di bawah paras 5 $\mu g/m^3$ di semua lokasi persampelan manakala takat CO adalah antara tidak dapat dikesan hingga 5.7 $\mu g/m^3$. Takat ozon juga didapati di bawah 20 $\mu g/m^3$.

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88. Pengukuran tahap bunyi bising 24-jam yang dijalankan di 38 lokasi menunjukkan bahawa takat L_{eq} adalah berkait rapat dengan kegiatan guna tanah di kawasan sekelilingnya di mana tahap bunyi bising adalah antara 50.7 – 71.1 dBA (waktu siang) dan 44.3 – 65.9 dBA (waktu malam). Tahap bunyi bising di beberapa lokasi di dapati melebihi had dicadangkan untuk kawasan kediaman pinggir bandar (55 dBA untuk waktu siang dan 45 dBA untuk waktu malam) dan kawasan kediaman bandar (60 dBA untuk waktu siang dan 50 dBA untuk waktu malam).
89. Pengukuran tahap getaran dijalankan di 38 lokasi yang sama untuk bunyi bising dan paras getaran adalah antara 0.01 mm/s hingga 0.96 mm/s dan '*vibration response curves*' adalah antara *Curve* 4 hingga 8. Hasil pengukuran menunjukkan bahawa takat getaran adalah dibawah had yang boleh mengakibatkan kerosakan struktur dan mengganggu keselesaan awam seperti yang ditetapkan di dalam garis panduan oleh pihak JAS.

Ekologi

90. Jajaran ECRL akan merentasi 11 Hutan Simpanan Kekal (HSK) di Terengganu, Pahang dan Selangor (**Rajah RE-11**) (**Jadual RE-13**). Kesemua HSK ini adalah terdiri daripada pelbagai habitat semula jadi seperti Hutan Tanah Rendah dan Bukit Dipterokarp, Hutan Pantai Bukit, Hutan Bakau, dan Hutan Gelam. Jajaran tidak melalui sebarang HSK di Kelantan tetapi melalui beberapa kelompok kecil hutan tanah kerajaan di kawasan Pasir Puteh dan Bachok.
91. Jajaran ini tidak merentasi sebarang HSK di Terengganu Utara, tetapi lalu berhampiran dengan HS Pak Kancil, HS Bukit Terendak dan HS Jambu Bongkok yang terdiri daripada pelbagai jenis habitat yang kebanyakannya adalah gelam putih (*Melaleuca cajuputi*). Kesemua HSK ini adalah penting untuk memulihara hutan gelam yang masih ada di Pantai Timur. HS Pak Kancil juga merupakan sebahagian daripada rangkaian sekunder CFS1-SL5, yang berfungsi untuk menghubungkan Hutan Taman Negara ke hutan di sepanjang pantai timur, khususnya di daerah Setiu.
92. Di Terengganu Selatan, jajaran ini akan merentasi HS Bukit Bauk, HS Kuala Paka dan HS Kuala Kemaman. Jajaran laluan utama akan merentasi HS Bukit Bauk (melalui terowong sepanjang 900m) dan HS Kuala Paka, manakala jajaran sisihan ke Kemaman akan merentasi bahagian timur HS Kuala Kemaman. Selain itu, jajaran sisihan ke Bukit Besi akan merentasi bahagian barat HS Bukit Bauk. HS Bukit Bauk adalah sebahagian daripada rangkaian sekunder CFS1-SL4 dan '*hotspot*' untuk kepelbagaian biologi.
93. Di Pahang Timur, jajaran akan merentasi HS Balok (A), HS Bukit Galing, HS Berkelah dan HS Lepar. Jajaran akan merentasi kawasan hutan simpan ini

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melalui terowong kecuali di HS Balok (A). Walaupun kebanyakan kawasan HSK ini telah dibalak, ianya masih mempunyai pelbagai hidupan liar seperti gajah Asia dan tapir Malaya. HS Lepar adalah satu komponen penting CFS2-SL1 di mana ianya berfungsi untuk menghubungkan HS Chini dengan hutan-hutan simpan lain di selatan Pahang.

94. Di Pahang Barat, jajaran akan merentasi HS Kemasul, HS Klau (Tambahan) dan HS Bukit Tinggi. HS Kemasul dianggap sebagai 'hotspot' kerana mempunyai pelbagai hidupan liar serta isu konflik manusia-hidupan liar. Di Selangor, jajaran akan merentasi (melalui terowong) HS Hulu Gombak yang merupakan sebahagian daripada Taman Warisan Selangor.

Jadual RE-13 : Hutan Simpan Kekal yang direntasi oleh ECRL

HSK	Kawasan (ha)	Jenis	Nota
Bukit Bauk	7,616	Hutan Perlindungan Hutan Lipur	Jajaran laluan utama merentasi sebahagian daripada Hutan Lipur melalui terowong dengan jarak lebih kurang 900m. Jajaran sisihan pula akan merentasi bahagian barat HSK.
Kuala Paka	356	Hutan Perlindungan	Jajaran merentasi kawasan <i>shrub</i> sejauh 800m
Kuala Kemaman	2,741	Hutan Perlindungan	Jajaran sisihan akan melalui kawasan bakau muara sungai sejauh 3.5km
Balok (A)	6,369	Hutan Pengeluaran	Jajaran dan stesen Pelabuhan Kota Kuantan akan melalui sebahagian kecil HSK sejauh 1.5 km
Bukit Galing	383	Hutan Pengeluaran	Jajaran akan melalui terowong sejauh 1.55 km dan ' <i>at-gred</i> ' pada jarak 370 m.
Berkelah	30,825	Hutan Pengeluaran	Jajaran akan merentasi kawasan selatan sejauh 900 m diikuti dengan terowong untuk 1.2km.
Lepar	24,923	Hutan Pengeluaran	Jajaran akan melalui terowong sejauh 2.2km dan memotong di tepi bahagian barat sejauh 1.5km
Kemasul (Temerloh)	22,006	Hutan Pengeluaran	Jajaran melalui bahagian utara HSK sejauh 7.3km
Kemasul (Bentong)	21,477	Hutan Pengeluaran	Jajaran melalui bahagian hujung utara sejauh 500m
Klau (Tambahan)	214	Hutan Pengeluaran	Jajaran akan melalui terowong sejauh 400m
Bukit Tinggi	3,352	Hutan Pengeluaran	Jajaran sejauh 400km akan merentasi pinggir utara sebelum memasuki terowong Bentong-Gombak
Hulu Gombak	16,838	Hutan Perlindungan	Jajaran akan melalui terowong sejauh 8 km

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Sosio-ekonomi

95. Penduduk di dalam lingkungan koridor 1 km di kedua dua belah jajaran dianggarkan seramai 412,000 orang pada tahun 2016. Kajian persepsi melibatakan 2600 responden dan 27 perbincangan kumpulan telah di laksanakan di sepanjang jajaran untuk mendapatkan maklumbalas dari penduduk setempat.

Jadual RE-14 : Taburan Penduduk di dalam Koridor 2-km

State	Penduduk 2010 ('000)	%	Penduduk 2016 ^e ('000)	%
Kelantan	89.9	24.1	101.8	24.6
Terengganu	140.2	37.6	156.1	37.8
Pahang	97.5	26.1	103.5	25.0
Pantai Timur	327.6	87.7	361.3	87.5
Selangor	45.8	12.3	51.8	12.5

POTENSI IMPAK KETARA DAN LANGKAH TEBATAN SEMASA PERINGKAT PRA-PEMBINAAN DAN PEMBINAAN

96. Pelbagai impak dijangka semasa fasa pra-pembinaan dan pembinaan Projek (**Jadual RE-15**). Penerima impak terdiri daripada pelbagai komuniti dan guna tanah yang terletak berhampiran dengan jajaran, stesen, depoh dan *yards*.

Jadual RE-15 : Impak Semasa Fasa Pra-Pembinaan dan Pembinaan

Potensi Impak	Aktiviti-aktiviti
Penempatan Semula	• Pengambilan tanah
Pemindahan	• Pemindahan utiliti
Hakisan tanah dan pemendapan	• Pembersihan tapak dan kerja tanah • Kerja pengorekan dan <i>spoil</i> • Kerja penerowongan (<i>tunneling works</i>) • Kerja konkrit dan cerucuk
Banjir	• Pembinaan benteng (<i>embankment</i>) • Lintasan sungai
Penjanaan Sisa Buangan	• Pejabat tapak dan kem pekerja • Pembersihan tapak (<i>biojirim</i>) • Perobohan struktur binaan • Pelupusan <i>spoil/unsuitable material</i>
Peningkatan paras bunyi bising bagi penerima yang berhampiran dengan zon pembinaan	• Kerja konkrit dan cerucuk • Penggunaan jentera yang bising seperti set penjana elektrik, peralatan elektrik berkuasa tinggi, pemecah hidraulik, peralatan pengisar dan pemotongan
Peningkatan paras getaran bagi	• Pergerakan kenderaan pembinaan

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Potensi Impak	Aktiviti-aktiviti
penerima yang berhampiran dengan zon pembinaan	• Operasi jentera pembinaan • <i>Blasting</i>
Pencemaran udara / debu	• Kerja tanah • Pergerakan kenderaan pembinaan dan jentera
Kehilangan habitat, fragmentasi dan gangguan kepada hidupan liar	• Pembersihan tapak dan kerja tanah
Gangguan aliran lalu lintas jalan raya	• Trafik kenderaan pembinaan di jajaran, stesen, <i>yard</i>, dan depoh • Lencongan jalan
Keselamatan awam	• Risiko terhadap keselamatan orang awam akibat daripada aktiviti pembinaan

Fasa Pra-Pembinaan

97. Impak ketara yang dijangka ketika fasa pra-pembinaan adalah berkaitan dengan aktiviti berikut:
- Pengambilan tanah dan hartanah
 - Pemindahan utiliti
98. Pengambilan tanah dan hartanah merupakan kesan utama semasa fasa pra-pembinaan. Pada peringkat ini, 8,699 lot (atau sebahagian daripadanya) mungkin terjejas. Kerajaan dijangka untuk membayar pampasan yang sewajarnya kepada pihak yang terlibat. Walau bagaimanapun, pihak yang terjejas daripada pengambilan tersebut mungkin akan menghadapi masalah seperti gangguan kepada kehidupan mereka dan kehilangan perpaduan sosial (*social cohesion*).
99. Hasil daripada sesi perbincangan dengan pihak berkepentingan menunjukkan bahawa pengambilan tanah adalah isu yang penting. Persoalan utama bagi mereka adalah sama ada mereka akan terjejas oleh pengambilan tersebut. Antara kebimbangan mereka termasuk:
- Tidak dapat berpindah ke kediaman yang setaraf dengan kediaman sedia ada disebabkan kurang daya kemampuan (*affordability*) atau kurang ketersediaan kediaman sedemikian
 - Kehilangan perpaduan sosial, hidup berkomuniti dan gaya hidup semasa bagi komuniti yang terlibat
 - Dalam kes perniagaan, ada kemungkinan kehilangan pelanggan - terutamanya untuk perniagaan tempatan.
100. Untuk pengambilan tanah yang melibatkan kawasan pertanian yang masih aktif, kehidupan pemilik tanah pertanian mungkin akan terjejas disebabkan kehilangan punca pendapatan. Selain daripada itu, ada kemungkinan pengambilan tanah pertanian boleh mengakibatkan pengurangan saiz tanah

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pertanian dan menjejaskan hasil tanaman di mana ianya menjadi tidak produktif dan ekonomikal untuk meneruskan aktiviti pertanian.

101. Untuk mengurangkan kesan daripada aktiviti pengambilan tanah, pihak MRL akan menyediakan maklumat awal yang mencukupi mengenai mengenai proses pengambilan tanah kepada pihak yang terlibat. Antara langkah-langkah yang dicadangkan termasuk:
 - Memastikan penilaian tanah atau hartanah yang adil
 - Menyediakan notis, maklumat dan bantuan kepada pihak yang terjejas, memberi masa yang cukup kepada mereka untuk membuat perancangan alternatif dan mengurangkan sebarang kesulitan
 - Memastikan komunikasi yang berterusan dengan pihak-pihak yang terlibat dan membantu mereka di dalam proses pengambilan tanah.
102. Sebelum pembinaan bermula, utiliti yang terjejas di sepanjang koridor Projek akan dipindahkan atau dilindungi. Sebahagian daripada kerja-kerja pemindahan ini boleh menyebabkan kesesakan lalu lintas, hakisan tanah dan menimbulkan risiko kepada keselamatan awam. Langkah-langkah tebatan termasuklah menyedia dan melaksanakan Pelan Pengurusan Keselamatan yang efektif semasa kerja-kerja pemindahan utiliti. Ini termasuk penggunaan kaedah pemindahan utiliti yang sesuai untuk mengurangkan ancaman atau risiko keselamatan.

Fasa Pembinaan

103. Impak terhadap alam sekitar yang mungkin berlaku semasa fasa pembinaan termasuk hakisan tanah dan pemendapan dari pembersihan tapak dan kerja tanah, banjir disebabkan sekatan terhadap sistem saliran, penjana sisa pembinaan, risiko geologi, peningkatan paras bunyi bising, pencemaran udara, impak terhadap ekologi, gangguan lalu lintas, impak sosial dan isu-isu yang berkaitan dengan keselamatan awam.

Hakisan Tanah dan Pemendapan

104. Jajaran ECRL akan merentasi pelbagai bentuk rupa bumi. Di kawasan tanah rendah yang rata, terutama di Kelantan dan Terengganu, benteng tanah (*embankment*) akan dibina dan ini memerlukan jumlah tanah yang besar. Di kawasan yang beralun dan berbukit, pemotongan bukit akan menjadi aktiviti pembinaan utama. Walaupun 19 buah terowong akan dibina, pemotongan cerun bukit masih akan dilakukan di sepanjang jajaran. Berdasarkan peta risiko hakisan tanah bagi Semenanjung Malaysia, risiko hakisan di sepanjang jajaran yang telah dikenalpasti adalah seperti berikut:
 - Kelantan : Risiko hakisan rendah (Jelawat ke Tok Bali) – Sederhana (Wakaf Bahru ke Jelawat)

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- Terengganu Utara : risiko hakisan rendah (Kg. Raja ke Kuala Terengganu), risiko sederhana (Kuala Terengganu ke Pengkalan Berangan)
 - Terengganu Selatan : risiko hakisan rendah (Kerteh dan Cherating) dengan beberapa kawasan risiko sederhana (Dungun dan Chukai) dan risiko hakisan sangat tinggi (Kemasik)
 - Pahang Timur : Risiko hakisan sederhana dan tinggi (KotaSAS dan Gambang ke Maran)
 - Pahang Barat : Risiko hakisan tinggi dan sangat tinggi (Maran dan Bentong) dengan beberapa kawasan risiko rendah ke sederhana (Mentakab).
 - Selangor : Risiko hakisan sangat tinggi (di utara Gombak) dan risiko hakisan sederhana – tinggi (ITT Gombak)
105. Berdasarkan pengiraan, kadar hakisan adalah sangat tinggi sekiranya langkah – langkah tebatan (P2M2) tidak dilaksanakan. Impak daripada hakisan tanah dan pemendapan termasuk penurunan kualiti air, kapasiti sungai berkurangan, peningkatan risiko banjir, kecekapan loji rawatan air mungkin terjejas, nilai kawasan rekreasi dan produktiviti mungkin berkurangan.
106. Bagi mengurangkan hakisan tanah dan pemendapan, '*Land Disturbance Pollution Prevention and Mitigation Measures*' (LD-P2M2) telah disediakan untuk kawasan-kawasan *hotspots* di sepanjang jajaran. LD-P2M2 telah menggariskan kerja-kerja perancangan dan berperingkat, kawalan air larian (*run-off*) permukaan, peruntukan sistem perparitan sementara, pagar mendapan (*silt fence*), parit pemintas, parit *berm*, longkang melata (*cascading drain*) dan *toe drain* yang perlu disediakan. Langkah-langkah kawalan hakisan yang lain termasuklah perlindungan cerun sementara, '*turfing*', pemadatan dan perangkap mendap. Sistem Rawatan Aktif (ATS) - boleh dipertimbangkan sekiranya pelepasan mendapan didapati sangat tinggi dan perangkap mendap tidak mampu merawat TSS ke tahap 50mg/l atau keputusan analisis tanah menunjukkan bahawa *dispersible fine grained clay* mengandungi lebih daripada 10% *dispersible material*.
107. Sumber-sumber pencemaran air yang lain adalah sisa kumbahan dan *sullage* dari kem pekerja, sisa dari kerja penerowongan, air larian dari '*batching plants*', penyenggaraan loji dan kenderaan, dan sebarang pelepasan buangan atau tumpahan yang tidak dikawal. Ini boleh menjejaskan kualiti air sungai, sistem saliran dan pengairan yang di lintasi oleh jajaran. Impak ke atas sistem saliran ini juga boleh memberi kesan kepada penerima sensitif yang terletak di hilir jajaran Projek.
108. Langkah-langkah untuk mengawal pencemaran kualiti air daripada air kumbahan dan *sullage* – menyediakan kemudahan sanitasi sementara (tandas) mengikut keperluan DOSH untuk menangani ancaman kesihatan

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berkaitan dengan kumbahan. Sisa air daripada kerja-kerja penerowongan dan 'batching plant' akan dirawat menggunakan kolam mendapan (*settling pond*) dan/atau sistem rawatan sisa air untuk mengurangkan kandungan TSS di bawah aras 50 mg/l. Semua kerja-kerja penyelenggaraan jentera akan dijalankan di kawasan yang telah disediakan untuk memastikan sebarang pertumpahan atau masalah kebocoran boleh dikawal. Langkah kawalan lain termasuklah penyimpanan dan pengurusan minyak, minyak terpakai, minyak pelincir dan bahan-bahan lain di tapak. Penyimpanan dan pengendalian buangan terjadual akan dijalankan mengikut Peraturan-Peraturan Kualiti Alam Sekeliling (Buangan Terjadual), 2005.

109. Pembersihan tapak, kerja-kerja penerowongan, pemotongan cerun dan perobohan akan menghasilkan jumlah *spoil* dan *excess material* yang besar. Pelupusan *excess material* berpotensi untuk menyebabkan pemendapan, perubahan terhadap badan-badan air dan banjir setempat. Sejumlah 4.5 juta m³ batuan dan *unsuitable materials* lain dianggarkan dari kerja-kerja penerowongan dan perobohan. Sejumlah 600,000 tan biojisim dianggarkan daripada pembersihan tapak di sepanjang jajaran dan ini termasuk pokok hutan, pokok kelapa sawit, pokok renek, belukar dan dari sawah padi.

Jadual RE-16 : Anggaran Kuantiti Sisa Buangan

Kategori Sisa buangan	Kelantan	Terengganu Utara	Terengganu Selatan
Biojisim	12,000 tan	30,000 tan	150,000 tan
Bahan buangan dari kerja penerowongan	-	-	1.3 juta m ³
Sisa buangan perobohan	280,000 tan	170,000 tan	150,000 tan

Kategori Sisa Buangan	Pahang Timur	Pahang Barat	Selangor
Biojisim	160,000 tan	230,000 tan	13,000 tan
Bahan buangan dari penerowongan	1 juta m ³	1.5 juta m ³	750,000 m ³
Sisa buangan perobohan	21,000 tan	50,000 tan	68,000 tan

110. Jika bersesuaian, bahan terowong akan digunakan semula dalam kerja-kerja pembinaan manakala bahagian yang tidak boleh digunasemula akan dilupuskan di tapak pelupusan yang diluluskan atau digunakan untuk landskap. Proses pengorekan, pengangkutan dan pelupusan akan dilakukan secara sistematik dan teliti untuk mengurangkan impak. Biojisim yang terhasil akan digunakan sebagai perlindungan cerun sementara dan kemudiannya dibiarkan terurai di tapak. Pembakaran terbuka tidak dibenarkan sama sekali.

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111. Risiko banjir telah dikenalpasti daripada aktiviti pembinaan ECRL, terutama di kawasan-kawasan rendah di Kelantan, Terengganu dan Pahang disebabkan oleh:
- Halangan air banjir disebabkan oleh pembinaan benteng.
 - Kewujudan bangunan dan struktur yang terletak di laluan banjir.
 - Kekurangan pementang dan jambatan untuk aliran air banjir.
 - Konflik antara kerja-kerja pembinaan ECRL dengan kerja-kerja tebatan banjir sedia ada atau sedang dijalankan.
 - Sekatan atau lencongan longkang dan sungai semasa pembinaan.
 - Peningkatan air larian permukaan disebabkan oleh kawasan tidak telap air (*impervious area*).
112. Sebahagian besar dari jajaran di Kelantan dan Terengganu adalah lebih tinggi dari paras banjir semasa. Walau bagaimanapun, pembinaan benteng dan stesen berpotensi menyekat aliran air dan menyebabkan banjir. Walaupun 80 jambatan telah disediakan dan '*balancing culverts*' akan dibina untuk memastikan air banjir boleh mengalir melalui benteng yang telah dibina, risiko banjir perlu diberi perhatian yang serius sewajarnya.
113. Kawasan *hotspots* banjir telah dikenalpasti dan pihak MRL sedang kini menjalankan kajian untuk menyediakan rekabentuk kejuruteraan terperinci dan langkah tebatan banjir yang sesuai. Falsafah reka bentuk tebatan banjir asas yang akan diguna pakai adalah "ECRL tidak akan meningkatkan paras banjir selepas pembinaan siap". Pihak ECRL akan bekerjasama dengan pihak JPS dan agensi-agensi yang berkaitan untuk memastikan bahawa rekabentuk untuk saluran dan langkah tebatan banjir memenuhi keperluan semua pihak. Antara langkah-langkah awal yang dicadangkan termasuk:
- '*Elevated viaducts*' - akan dibina untuk merentasi dataran banjir bagi membolehkan air banjir mengalir tanpa sebarang halangan. Sepanjang 71.84 km jajaran yang akan dibina secara bertingkat (*elevated alignment*). Di mana mungkin, jajaran bertingkat akan dibina untuk mengelakkan gangguan kepada sistem saluran pengairan sedia ada.
 - '*Cross-culverts*' dan '*balancing culvert*' - akan dibina di banyak lokasi di sepanjang benteng untuk membolehkan air banjir mengalir tanpa gangguan. Kajian hidraulik yang terperinci akan dilaksanakan setelah kerja ukur tanah diselesaikan, untuk menentukan lokasi yang tepat dan reka bentuk pementang (*culverts*).
 - Jambatan – tiang (*piers*) akan dibina sejauh mungkin dari saluran aliran bagi mengurangkan kejadian *backwater*. Analisis *backwater* akan dijalankan dengan data keratan rentas untuk tujuan reka bentuk.
 - '*On-site Detention*' (OSD) - akan disediakan di depoh, *base* penyelenggaraan stesen, stesen dan *yards*. Reka bentuk OSD di setiap lokasi akan ditentukan semasa peringkat reka bentuk terperinci.
 - Parit sementara - sistem perparitan sementara akan dibina untuk menampung perubahan air larian permukaan.

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- Lintasan sungai - pembedung (*culverts*) akan pasang untuk memastikan aliran sungai yang berkesan. Pembedung ini akan direka bentuk untuk air larian pada waktu puncak.
 - *Good housekeeping* - amalan baik untuk memastikan bahawa BMPs dilaksanakan dan sistem perparitan berfungsi dengan baik.
114. Jajaran akan merentasi skim-skim pengairan dan berpotensi memberi kesan kepada infrastruktur pengairan (terusan, saluran paip, rumah pam, kunci pasang surut (*tidal gate*)) yang menyalurkan air ke kawasan sawah di jelapang Kelantan dan Terengganu iaitu Lembaga Kemajuan Pertanian Kemubu, Lembaga Kemajuan Pertanian Bersepadu Kemasin-Semarak dan Kawasan Pembangunan Pertanian Bersepadu Terengganu Utara dan skim-skim pengairan lain. Jajaran Projek yang merentasi sawah padi di selatan daerah Pasir Puteh berpotensi menjejaskan kawasan pengairan di sini. Terdapat juga skim-skim pengairan baru, seperti skim pengairan Semarak Selatan, di mana rumah pam, tali air dan saluran paip, sedang dirancang dan/atau dalam pembinaan. Langkah tebatan utama adalah untuk mengelakkan pembinaan di atas infrastruktur pengairan seperti terusan pengairan, paip pengairan dan rumah pam.
115. Jajaran akan merentasi pelbagai formasi geologi dan jenis tanah termasuk kawasan tanah gambut, kawasan bercerun dan kawasan yang penting untuk air bawah tanah. Terdapat beberapa risiko yang berkaitan dengan pembinaan terowong, terutamanya di kawasan Bukit Tinggi dan Terowong Genting sepanjang 17.8km. Risiko-risiko ini akan diambilkira dalam pemilihan kaedah pembinaan untuk terowong, pengorekan dan struktur. Sebarang pergerakan tanah disebabkan oleh kerja-kerja pembinaan perlu dikawal. Kawasan tanah gambut akan dirawat sebelum pembinaan. Resapan air bawah tanah perlu dikawal supaya tidak mengganggu kerja-kerja pengorekan. Penyiasatan tanah yang menyeluruh akan dijalankan untuk memahami profil geologi dan isu geoteknikal di sepanjang jajaran.
116. Kesan bunyi bising dijangka daripada aktiviti pembinaan stesen, landasan kereta api, pembinaan terowong, depoh dan *yards*. Bunyi bising semasa peringkat pembinaan dijangka berpunca daripada jentera berat (dozer, traktor), kenderaan berat (lori), set penjana electric dan kerja-kerja cerucuk. Untuk pembinaan terowong, terdapat juga kerja-kerja letupan.
117. Kerja-kerja cerucuk diperlukan untuk pembinaan tiang (*pier*) bagi jajaran bertingkat. Kesan getaran dan bunyi bising dari aktiviti cerucuk merupakan isu utama semasa pembinaan berdasarkan pengalaman dari projek rel yang lain. Ini adalah kerana aktiviti dijalankan progresif mengikut segmen jajaran yang *linear*. Oleh itu, isu-isu bunyi bising dan getaran boleh mengganggu kawasan kediaman berhampiran jajaran.

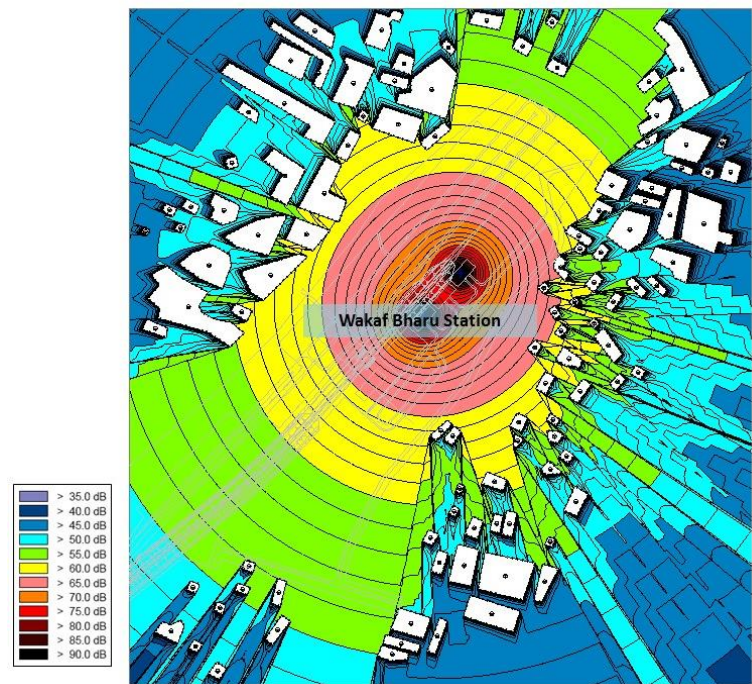
RINGKASAN EKSEKUTIF

118. Langkah-langkah untuk mengurangkan bunyi dan getaran termasuk:
- Pelan lencongan jalan untuk mengelakkan penggunaan jalan tempatan dan pergerakan kenderaan pembinaan semasa waktu bukan-puncak
 - Penghadang bunyi sementara
 - *Equipment shielding and enclosures*
 - Penggunaan kaedah cerucuk yang rendah bunyi seperti *bored piling*
 - *Flexible noise shroud* untuk mesin cerucuk
 - Parit (*Trenches*) dan tuang jenis berayun (*oscillating type casting*)
 - Menghadkan aktiviti cerucuk di waktu siang sahaja
 - Program pemantauan yang berterusan

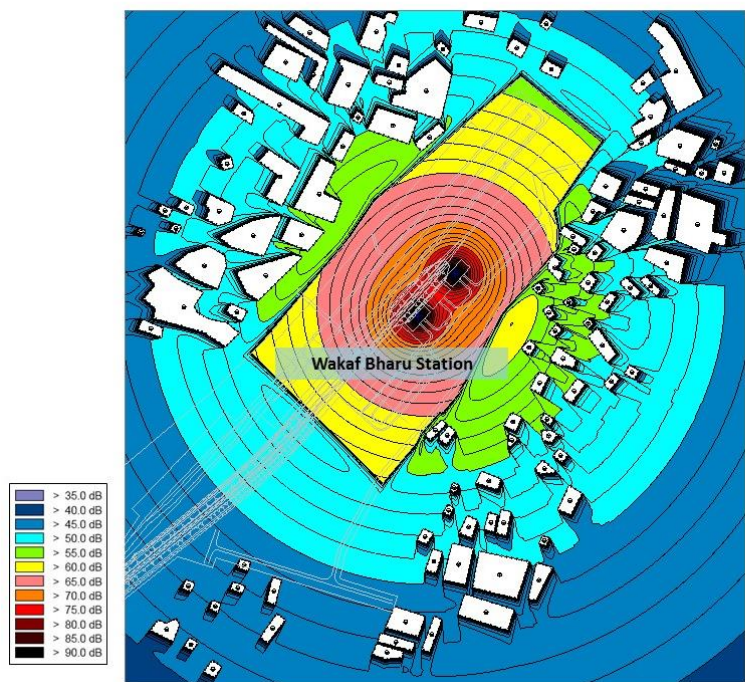
Pencemaran Udara

119. Aktiviti pembinaan boleh memberi kesan kepada kualiti udara terutama sekali depoh, yard dan stesen kerana pembinaan di sini melibatkan pembukaan tanah yang lebih besar. Kerja-kerja tanah untuk stesen Wakaf Baru, yard Wakaf Baru dan stesen Kota Bharu boleh menyebabkan kesan habuk (*fugitive dust*) untuk penerima sensitive berhampiran.
120. Kepekatan debu dijangka berada dalam keadaan terkawal dan mematuhi Garis Panduan Kualiti Udara Ambien Malaysia dengan pelaksanaan langkah kawalan seperti pembangunan secara berperingkat berbanding secara keseluruhan, pembasahan jalan masuk, '*wash trough*', '*hoarding*' di sekeliling kawasan kerja dan kawalan pergerakan jentera pembinaan.

Carta RE-1 : Kawalan bunyi bising semasa pembinaan



Noise Propagation from Piling at Wakaf Bharu Station without Mitigation



Noise Propagation from Piling at Wakaf Bharu Station with 4m hoarding

RINGKASAN EKSEKUTIF

Ekologi

121. Jajaran telah diperhalusi beberapa kali semasa peringkat perancangan dan reka bentuk awal. Pada asalnya, jajaran dicadangkan merentasi sebanyak 25 Hutan Simpan Kekal (HSK) dan melalui hanya satu terowong. Ini akan melibatkan pembersihan HSK lebih daripada 2,000 hektar dan menyebabkan fragementasi habitat yang serius. Selepas kajian lapangan dan penambahbaikan reka bentuk serta perbincangan bersama pihak berkepentingan, reka bentuk jajaran telah diubah di mana hanya 12 HSK akan direntasi. Daripada 12 HSK, 7 akan direntasi melalui terowong. Ini telah dapat mengurangkan keluasan kawasan hutan yang terjejas kepada kurang daripada 357 hektar berbanding dengan 2,000 hektar sebelum ini. Ini juga membantu mengurangkan isu fragmentasi habitat.
122. Impak ekologi yang dijangka termasuklah (i) fragmentasi habitat; (ii) kehilangan dan gangguan habitat; dan (iii) konflik manusia-hidupan liar. Jajaran landasan juga akan memisahkan beberapa kawasan hutan yang penting seperti HSK Bukit Bauk, Kuala Kemaman, Kemasul dan Lepar

Jadual RE-17 : Hutan Simpan Kekal yang direntasi ECRL

HSK	Jenis	Impak Terhadap Jajaran	Kehilangan hutan
Bukit Bauk	Hutan Perlindungan	▪ Terowong sepanjang kira-kira 900 m	2.2 hektar
	Hutan Lipur	▪ Jajaran sisihan <i>at-grade</i> kira-kira 16 km	150 hektar
Kuala Paka	Hutan Perlindungan	▪ <i>At-grade</i> kira-kira 800 m	3.8 hektar
Kuala Kemaman	Hutan Perlindungan	▪ Jajaran sisihan <i>at-grade</i> 3.5 km	41 hektar
Balok (A)	Hutan Pengeluaran	▪ Jajaran dan cadangan Stesen Kuantan Port City melintasi sebahagian kecil HSK <i>at-grade</i> sepanjang 1.5 km	29.2 hektar
Bukit Galing	Hutan Pengeluaran	▪ Terowong sepanjang sepanjang 1.1 km	<0.5 hektar
		▪ <i>At-grade</i> kira-kira 370m	7 hektar
Berkelah	Hutan Pengeluaran	▪ <i>At-grade</i> sepanjang 900m	6.2 hektar
		▪ Terowong sepanjang 1.2km	<0.5 ha
Lepar	Hutan Pengeluaran	▪ Terowong sepanjang sepanjang kira-kira 2.2km	<0.5 ha
		▪ Merentasi bahagian barat HSK, <i>at-grade</i> sepanjang 1.5km	13.2 ha
Kemasul (Temerloh)	Hutan Pengeluaran	• <i>at-grade</i> sepanjang 7.2 km	91 ha

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Kemasul (Bentong)	Hutan Pengeluaran	• <i>at-grade</i> sepanjang kira-kira 500m	2.4 ha
Klau (Tambahan)	Hutan Pengeluaran	• terowong sepanjang 400m	1.5 ha
Bukit Tinggi	Hutan Pengeluaran	• <i>at-grade</i> sepanjang kira-kira 400m	2.9 ha
Hulu Gombak	Hutan Perlindungan	• terowong	-

123. Fragmentasi berpotensi menyebabkan konflik manusia-hidupan liar. Mamalia besar seperti gajah dan tapir boleh didapati di beberapa kawasan yang direntasi ECRL. Oleh itu, pihak MRL akan menyediakan lintasan kehidupan liar (*wildlife crossing*) di mana *overpasses* dan *underpasses* boleh membantu kehidupan liar untuk melintasi ECRL dengan selamat.
124. Langkah tebatan yang akan dibina adalah struktur *wildlife crossing* bagi memudahkan pergerakan kehidupan liar dalam kawasan habitat hutan. Inisiatif termasuklah '*viaducts*', '*culverts*' dan *overpasses* kehidupan liar. 19 terowong telah dicadangkan di sepanjang jajaran ECRL. Terowong-terowong ini merentasi kawasan tanah tinggi dan kebanyakannya adalah kawasan hutan. Dengan adanya terowong ini, ia akan mengurangkan fragmentasi habitat sepanjang landskap koridor jajaran serta mengekalkan kesinambungan ekologi terutama di kawasan yang kritikal. Satu Pelan Pengurusan Hidupan Liar akan disediakan untuk menangani isu berkaitan pengurusan kehidupan liar di sepanjang jajaran.

Trafik

125. Masalah kesesakan lalu lintas di jalan-jalan sedia ada disebabkan aktiviti pembinaan dijangka berlaku di kesemua negeri. Kerja-kerja pembinaan akan menyebabkan lencongan jalan, penutupan dan pengurangan saiz jalan raya yang akan mengurangkan kapasiti jalan raya sedia ada. Oleh kerana sebahagian daripada jajaran melalui jalan raya sedia ada yang sibuk, kesesakan lalu lintas dijangka bertambah buruk. Pelan Terperinci Pengurusan Trafik akan disediakan bagi setiap tapak pembinaan bagi memastikan kelancaran trafik.
126. Langkah-langkah bagi mengurangkan kesesakan lalu lintas termasuk:
- Pengurusan trafik yang teratur dengan papan tanda amaran dan '*flagmen*' yang mencukupi
 - Mengekalkan bilangan lorong di jalan raya utama
 - Mengekalkan kelebaran lorong jalan raya pada lebar minimum, iaitu 2.75m – 3.0m, untuk semua jalan raya yang terlibat
 - Lori pengangkut hanya boleh beroperasi semasa waktu luar puncak
 - Pelan Terperinci Pengurusan Trafik akan disediakan

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Keselamatan Awam

127. Aktiviti peletupan (*blasting*) semasa kerja pembinaan memberi risiko pekerjaan dan keselamatan yang tinggi dan boleh menyebabkan kematian. Senario bahaya lain seperti pemindahan utiliti, banjir kilat dan kemalangan jalan raya pula mempunyai risiko sederhana. Bagi kerja bawah tanah, ia mempunyai risiko keselamatan sekiranya berlaku kejadian tanah runtuh atau wujudnya kaviti bawah tanah, kesan akibat aktiviti peletupan dan banjir di dalam terowong. Kesemua kejadian ini boleh memberi ancaman keselamatan kepada orang awam dan pekerja yang terlibat dalam kerja pembinaan.
128. Langkah kawalan termasuk termasuk penggunaan bahan letupan yang betul untuk mengelakkan kerosakan, jadual masa letupan akan diberitahu kepada orang yang terdekat serta pengudaraan yang bersesuaian dalam kawasan pembinaan terowong.

Impak sosial

129. Dari segi kesan sosial, kajian persepsi awam dan perbincangan dengan pihak berkepentingan telah menunjukkan bahawa kebimbangan utama orang awam adalah aspek keselamatan dan pengambilan tanah. Potensi risiko kemalangan dari pergerakan kenderaan berat semasa pembinaan yang boleh membahayakan orang awam, pelajar sekolah dan binatang ternakan juga telah dibangkitkan. Kaedah kerja-kerja pembinaan di kawasan kejiranan semasa pembinaan juga membimbangkan mereka. Selain itu, orang ramai juga bimbang akan berlakunya perubahan terhadap landskap luar bandar, ciri-ciri seni bina dan nilai-nilai kampung tradisional. Semua aspek ini hendaklah diambilkira semasa penyediaan reka bentuk stesen dan struktur kereta api yang melalui kawasan pantai timur.

Jadual RE-18 : Lima Kebimbangan Utama semasa Pembinaan

Kedudukan	Kelantan	Terengganu	Pahang	Selangor	Keseluruhan
1	Keselamatan	Keselamatan	Keselamatan	Pemindahan	Keselamatan
2	Penempatan semula	Pengambilan hartanah	Penempatan semula	Keselamatan	Penempatan semula
3	Pengambilan hartanah	Penempatan semula	Pengambilan hartanah	Terlalu dekat dengan tapak pembinaan	Pengambilan hartanah
4	Pencemaran debu dan udara	Pencemaran debu dan udara	Bunyi bising	Pengambilan hartanah	Pencemaran debu dan udara
5	Bunyi bising	Bunyi bising	Pencemaran debu dan udara	Pencemaran debu dan udara	Bunyi bising

Sumber: EIA East Coast Rail: Perception Survey (Februari 2017)

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130. Peningkatan kegiatan ekonomi dan peluang pekerjaan merupakan kesan positif yang utama semasa pembinaan. Sektor pembinaan dijangka mendapat manfaat daripada Projek disebabkan saiz dan magnitud Projek. Penerima utama dalam sektor ini termasuk:
 - Sektor pembinaan
 - Pembekal bahan pembinaan (permintaan bahan pembinaan seperti simen dan keluli dijangka meningkat)
 - Khidmat kejuruteraan dan sokongan yang menyediakan kerja-kerja awam dan struktur, kerja ukur tanah, perancangan pengangkutan dan khidmat lain yang berkaitan.
131. Pelbagai peluang pekerjaan akan dijana untuk memenuhi keperluan pembinaan Projek. Faedah sampingan dan peluang perniagaan juga dijangkakan di peringkat tempatan dari segi peluang pekerjaan dan permintaan hartanah, makanan dan lain-lain perkhidmatan.
132. Rundingan dan perbincangan dengan komuniti yang terlibat adalah amat penting untuk mengurangkan kesan dari Projek. Pihak awam akan dimaklumkan tentang Projek secara berkala.
133. Keutamaan peluang pekerjaan hendaklah diberikan kepada penduduk tempatan. Berdasarkan perbincangan yang telah diadakan dengan penduduk tempatan, mereka memohon supaya peluang pekerjaan diberikan kepada golongan belia tempatan. Walaupun diakui bahawa penduduk tempatan tidak mempunyai kemahiran yang diperlukan namun dengan latihan yang mencukupi, mereka boleh untuk menyumbang kepada Projek secara positif.
134. Beribu-ribu pekerja pembinaan untuk Projek ini dijangkakan semasa peringkat pembinaan puncak - iaitu di beberapa lokasi di sepanjang jajaran, depoh dan stesen. Kebanyakan depoh dan stesen terletak berhampiran dengan kawasan sub-bandar. Sebagai contoh, jajaran yang terletak berhampiran dengan kawasan perumahan dan pusat komersial adalah di Wakaf Bahru, Kota Bahru, Kuala Terengganu dan Kuantan. Kehadiran pekerja pembinaan yang ramai di kawasan luar bandar boleh menyebabkan konflik sosial di sebabkan perbezaan cara hidup antara pekerja dan penduduk tempatan.
135. Untuk mengurangkan konflik sosial dan kekurangan tempat kediaman, tempat penginapan berpusat untuk pekerja dicadangkan. Ini boleh membantu MRL dan kontraktor memantau aktiviti pekerja mereka dan seterusnya mengurangkan potensi konflik sosial dengan penduduk tempatan. Tempat penginapan pekerja hendaklah dipastikan sentiasa dalam keadaan bersih untuk mengelakkan penyebaran wabak penyakit.

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136. Aspek lain yang perlu dititikberatkan adalah aspek estetik. Jika dibandingkan dengan Pantai Barat Semenanjung Malaysia, negeri-negeri di Pantai Timur menerapkan nilai-nilai tradisional dan budaya yang berkait rapat dengan landskap semula jadi dan penduduk tempatan. Ciri-ciri ini adalah penting untuk penduduk dan hendaklah diterapkan dalam reka bentuk terperinci landasan kereta api dan juga stesen.

IMPAK KETARA & LANGKAH TEBATAN SEMASA PERINGKAT OPERASI

137. Pelbagai potensi impak semasa fasa operasi Projek (Jadual RE-xx) telah dikenalpasti. Penerima impak dari Projek ini terdiri daripada pelbagai komuniti dan guna tanah yang terletak berhampiran dengan jajaran, stesen, depoh dan lapangan (*yards*).

Jadual RE-19 : Potensi Impak Semasa Peringkat Operasi

Potensi Impak	Aktiviti
Pemangkin pembangunan di Pantai Timur	• Meningkatkan sesalinghubungan dan kebolehsampaian untuk komuniti dan kegiatan perniagaan di Pantai Timur
Peningkatan kegiatan ekonomi dan peluang di Pantai Timur; Pengganda ekonomi dan kesan sampingan positif disebabkan sistem pengangkutan yang bertambah baik	• Meningkatkan kapasiti penumpang dan pengangkutan barangan angkut di antara Pantai Timur dan Barat, dan di dalam kawasan Pantai Timur • Mengurangkan tempoh masa perjalanan
Peningkatan bunyi bising bagi penerima yang terletak berdekatan dengan landasan kereta api dan stesen	• Pergerakan kereta api
Potensi impak getaran terutama sekali bagi penerima yang terletak berdekatan dengan landasan kereta api dan stesen	• Pergerakan kereta api
Fragmentasi hutan dan ancaman kepada biodiversiti Halangan pergerakan hidupan liar; Koridor hidupan liar terputus	• Landasan kereta api yang merentasi hutan • Pergerakan kereta api
Fragmentasi guna tanah dan kawasan petempatan; Halangan fizikal yang memisahkan komuniti sedia ada	• Landasan kereta api yang merentasi komuniti sedia ada dan penempatan • Trek landasan kereta api menghadkan kesalinghubungan antara penempatan
Pengurangan perlepasan gas rumah hijau	• Meningkatkan kecekapan sistem pengangkutan • Pengurangan trafik jalan raya
Keselamatan Awam	• Risiko bahaya terhadap orang awam semasa peringkat operasi

Bunyi Bising

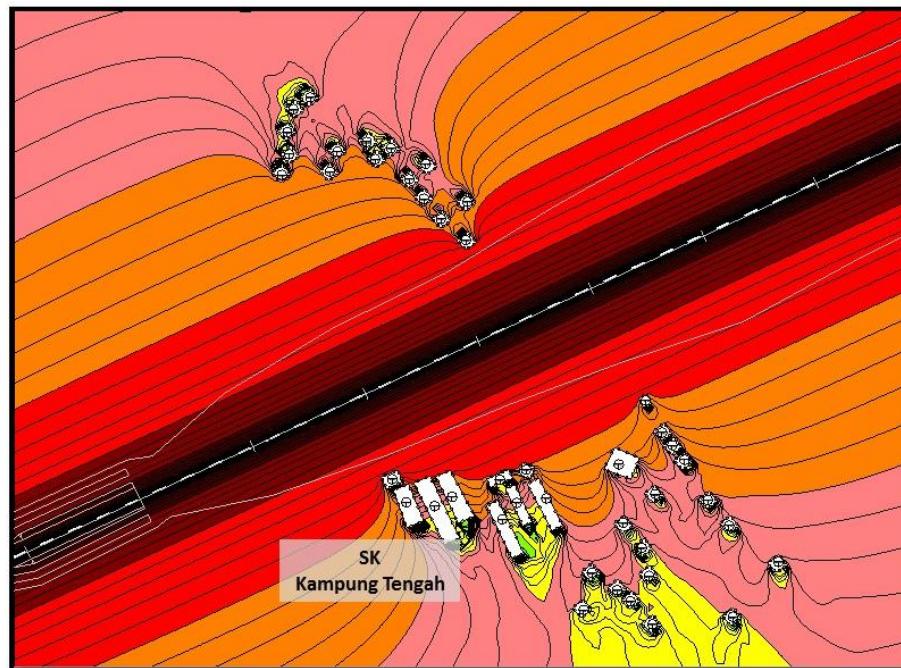
138. Analisa bunyi bising menunjukkan peningkatan L_{eq} secara amnya adalah tidak ketara disebabkan pergerakan kereta api yang bersifat sekejap kecuali di beberapa lokasi. Paras kumulatif bunyi bising L_{eq} di mana paras bunyi bising kereta api digabungkan dengan paras bunyi bising ambien secara keseluruhannya tidak akan meningkat lebih daripada 5 dB pada waktu siang di kebanyakan lokasi. Walau bagaimanapun, peningkatan bunyi bising sebanyak 10 – 16 dBA dijangkakan di beberapa lokasi, terutama sekali di kawasan pendalaman di Kelantan dan Terengganu.
139. Pemasangan penghadang bunyi adalah penting untuk mengurangkan paras bunyi bising di penerima sensitif bunyi bising. Gangguan bunyi bising dijangkakan bagi kediaman yang terletak di dalam jarak 50m dari jajaran di mana penerima dapat melihat jajaran (cth jarak adalah 15 m).
140. Langkah tebatan bunyi bising bagi jajaran ECRL termasuk penggunaan landasan terkimpal berterusan atau '*continuous welded tracks*', penghadang bunyi dan penyerapan akustik. Langkah tebatan yang lazim dan praktikal bagi transmisi bunyi melalui udara adalah penggunaan penghadang bunyi – sama ada di '*ROW*' landasan kereta api atau di sempadan penerima. Reka bentuk dan jenis bahan penghadang bunyi adalah dari jenis penyerap yang mempunyai panel serapan atau pantulan.

Getaran

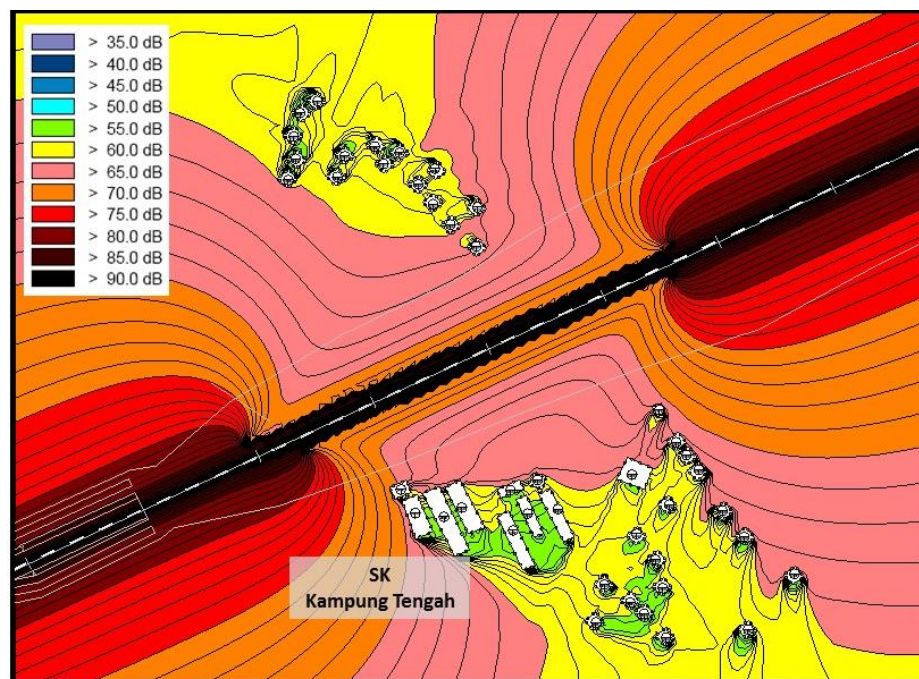
141. Getaran terhadap bangunan yang berpunca dari pergerakan kereta api bergantung kepada paras getaran di punca getaran iaitu samada atransmisi melalui tanah (getaran melalui tanah atau *ground borne vibrations*) dan interaksi dengan bangunan (*vibration response*).
142. Analisis getaran melalui tanah menunjukkan bahawa penerima yang berada di dalam rumah (1 – 2 tingkat) yang terletak 25m daripada landasan, paras getaran di bawah Curve 1, sekiranya roda/ trek adalah dalam keadaan baik. Bagaimanapun, kesan getaran melebihi Curve 2 sekiranya keadaan roda/trek adalah tidak baik tanpa sebarang langkah mitigasi. Bagi penerima yang berada di dalam bangunan tinggi (sat tingkat) dan terletak pada jarak 25m, paras getaran dianggarkan berada di bawah Curve 1 sekiranya keadaan roda/ trek adalah baik. Paras getaran akan melebihi Curve 2 bagi keadaan roda/ trek yang tidak baik dan tanpa sebarang langkah tebatan.

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Carta RE-2 : Kawalan bunyi bising menggunakan penghadang bunyi (contoh (di Kg Tengah off Temerloh)



Noise map at Kg Tengah off Temerloh without mitigation, passenger train at 160 km/hr



Noise map at Kg Tengah off Temerloh with noise barrier 4m height, passenger train at 160 km/hr

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143. Pengurangan paras getaran melalui tanah memerlukan kawalan transmisi getaran dari landasan ke tanah. Ini melibatkan penggunaan medium pengasingan getaran di antara landasan dan struktur sokongan. Pengurangan paras getaran dengan penggunaa '*standard rail strips*' dan '*rail pads*' adalah hampir sama, iaitu lebih kurang 3 – 6 dBV bergantung kepada ketegangan '*rail pad*'. Pemasangan '*resilient fixation devices*' atau '*base plate*' di bahagian bawah tanah landasan mungkin diperlukan di beberapa lokasi di sepanjang jajaran.

Pencemaran Air

144. Di peringkat operasi, Projek boleh menyebabkan pencemaran air yang berpunca daripada pelbagai aktiviti di stesen, depoh, *yard* dan *base* penyenggaraan. Pencemaran air di sepanjang jajaran pula terhad kepada insiden tumpahan dan kebocoran barangan angkut yang tidak disengajakan. Walau bagaimanapun, tumpahan dan kebocoran minyak daripada kereta api dapat dikurangkan memandangkan ECRL akan dijana sepenuhnya menggunakan kuasa elektrik. Kemudahan tandas di dalam kereta api akan dilengkapi dengan tangki simpanan kumbahan (*wastewater holding tanks*) yang akan dikosongkan di kawasan depoh, *yard* atau *base* penyenggaraan semasa penyenggaraan harian/berkala.
145. Kemudahan rawatan kumbahan akan direkabentuk untuk mematuhi semua keperluan di samping mempunyai kapasiti yang mencukupi untuk dinaiktaraf pada masa hadapan. Terdapat tiga jenis kemudahan rawatan kumbahan yang akan dibina iaitu untuk 1400 PE, 250 PE dan 150 PE. Perangkap minyak dan gris yang mencukupi akan dipasang di semua *base* penyenggaraan, *yard* dan depoh.

Kualiti Udara

146. ECRL dijangka menyumbang kepada peningkatan kualiti udara. Dengan pengurangan jumlah kenderaan di jalan raya, ECRL dijangka boleh membantu mengurangkan jumlah bahan pencemar yang dilepaskan ke udara Pelepasan bersih kumulatif emisi CO_{2e} yang dijangka dapat dielakkan dengan pelaksanaan ECRL adalah sebanyak 255,671 CO_{2e} tan metrik setahun pada 2024 dan 912,738 CO_{2e} tan metric setahun pada 2040. Melalui peralihan daripada kenderaan persendirian kepada perkhidmatan kereta api, pencemaran udara daripada pelepasan kenderaan seperti jisim zarah (*particulate matters*) (PM₁₀ dan PM_{2.5}) dan bahan pencemar gas (NO_x, SO₂, CO_x) juga akan dapat dikurangkan.

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Sisa Buangan

147. Sisa buangan akan dijana daripada operasi stesen, *yard* dan depoh serta aktiviti penyenggaraan. Pelbagai jenis sisa buangan akan dihasilkan termasuk sisa buangan domestik dan sisa buangan terjadual (**Jadual RE-20**). Sekiranya sisa buangan tidak dilupuskan dan diuruskan dengan sempurna, kesan kepada kawasan sekitar termasuklah masalah kesihatan dan kebersihan, saliran dan laluan air sedia ada tersumbat, pencemaran air dan tanah. Semua sisa buangan akan dilupuskan di tapak pelupusan yang diluluskan.

Jadual RE-21 : Penghasilan Sisa Buangan daripada Stesen

No.	Stesen	Purata Aliran Penumpang pada tahun 2040 (Orang/Tahun)	Anggaran Kuantiti setiap penumpang bagi setiap tahun (kg/tahun)
1	Wakaf Baru	279,955	18,700
2	Kota Bharu	1,742,875	117,000
3	Jelawat	202,575	13,500
4	Tok Bali	208,050	14,000
5	Kg.Raja	186,880	12,500
6	Penarik	79,935	5,300
7	Kuala Terengganu	1,164,350	78,000
8	Kuala Telemong	186,515	12,000
9	Pengkalan Berangan	158,775	10,000
10	Dungun	33,215	2,200
11	Kemasik	108,405	7,000
12	Chukai	229,220	15,000
13	Cherating	56,210	3,600
14	Kuantan Port City	109,500	7,000
15	Kota SAS	1,215,085	78,000
16	Gambang	129,940	8,400
17	Maran	314,995	22,000
18	Mentakab	143,080	9,200
19	Bentong	85,045	5,400
20	ITT Gombak	1,532,635	98,000

Ekologi

148. Antara isu berkaitan ekologi yang mungkin berlaku di peringkat operasi termasuklah halangan kepada pergerakan hidupan liar, kecederaan dan kematian haiwan, dan konflik manusia-hidupan liar. Kewujudan landasan kereta api akan memberi kesan kepada pergerakan hidupan liar, kawasan rayau (*habitat roaming*) dan laluan migrasi terutamanya bagi mamalia yang lebih besar (harimau, gajah dan tapir) dan primat (*primate*) (ungka, monyet). Kemungkinan berlakunya kejadian hidupan liar dilanggar kereta api dijangka kecil kerana landasan kereta api akan dipagar dengan asas konkrit pratuang (*precast concrete base*). Laluan kereta api boleh menyebabkan konflik manusia-hidupan liar apabila hidupan liar terpaksa merayau ke

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kawasan lain untuk mencari sumber makanan, seperti kawasan petempatan penduduk dan kawasan pertanian yang berhampiran. Kawasan tertentu seperti Kemasul di Pahang yang dikenali sebagai habitat (*hotspot*) bagi gajah dan tapir dijangka mengalami lebih banyak konflik manusia-hidupan liar.

149. Langkah tebatan untuk mengurangkan kesan ekologi semasa fasa operasi merangkumi aktiviti pemantauan untuk menilai samada ECRL telah mengakibatkan kesan ketara terhadap ekologi, khususnya untuk keadaan habitat dan populasi kehidupan liar. Penghadang (dinding konkrit dengan pagar) akan dibina di sepanjang jajaran untuk mengelakkan pencerobohan manusia dan kehidupan liar ke kawasan landasan kereta api. Penghadang di kawasan-kawasan di mana terdapat gajah (contohnya HSK Kemasul) akan diperkuatkan. Penghadang juga akan dibina di sekitar laluan masuk terowong untuk menghalang kehidupan liar daripada menceroboh masuk ke dalam terowong. Pemulihan habitat akan dilaksanakan bagi kawasan hutan yang telah diganggu atau dibersihkan semasa pembinaan. Pemantauan kehidupan liar juga akan dijalankan khususnya bagi kawasan yang dikenali menjadi tumpuan pergerakan kehidupan liar.

Trafik

150. Secara keseluruhannya, ECRL akan mempertingkatkan keadaan lalu lintas di jalan-jalan utama di wilayah ini, terutamanya di Pantai Timur. Ia menyediakan kesalinghubungan yang lebih baik di antara pusat-pusat bandar. Manfaat utama daripada ECRL adalah penambahbaikan dari segi pengangkutan awam di mana ianya akan meningkatkan kesalinghubungan melalui perkhidmatan kereta api di Pantai Timur dan di antara Pantai Timur dan Pantai Barat. Ini dijangka akan menggalakkan peralihan mod pengangkutan daripada menggunakan kenderaan persendirian kepada pengangkutan awam sekaligus mengurangkan jumlah perjalanan di antara pusat-pusat bandar.
151. Semasa fasa operasi, kesesakan lalu lintas setempat mungkin berlaku di beberapa stesen disebabkan lokasi stesen-stesen tersebut. Oleh itu, pelan akses ke kawasan stesen perlu disediakan. Pelan akses ini penting untuk memastikan kelancaran trafik dan mengurangkan kesesakan lalu lintas di sekitar kawasan stesen. Ia juga akan memastikan integrasi perkhidmatan ECRL yang cekap dalam konteks pengangkutan serbaguna (*multi-modal transportation*). Di samping itu, kemudahan akses ke stesen bagi pejalan kaki dan pengguna jalan raya yang lain juga penting.

Keselamatan Awam

152. Keselamatan awam semasa fasa operasi ECRL adalah sangat penting. ECRL akan mengangkut bijih besi, arang batu, simen, keluli, getah, *polythylene* dan biojisim sawit - secara amnya adalah tidak berbahaya.

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Pengiraan yang dibuat untuk menganggarkan risiko sekiranya kereta api pengangkut membawa kargo mudah terbakar. Penilaian awal menunjukkan bahawa kawasan di dalam lingkungan 164 m mungkin mengalami risiko bahaya sekiranya P2M2 tidak dilaksanakan. Langkah kawalan keselamatan yang sewajarnya telah diambil kira untuk mengurangkan sebarang risiko kepada orang awam dan harta benda.

153. ECRL akan direka bentuk dan dikendalikan selaras dengan peraturan Kesihatan dan Keselamatan yang berkaitan seperti Akta Keselamatan dan Kesihatan Pekerjaan 1994, Akta Kilang dan Jentera 1967 dan undang-undang kecil pihak berkuasa tempatan. Pengurusan keselamatan dan kawalan ancaman atau bahaya semasa peringkat operasi turut melibatkan pengurusan keselamatan di stesen-stesen dan di dalam kereta api. Langkah keselamatan untuk kebakaran, terutamanya di dalam terowong akan disediakan. Terowong Genting sepanjang 17.8 km akan menjadi terowong kereta api terpanjang di Malaysia dan ianya memerlukan langkah kawalan keselamatan tambahan. Berdasarkan kepada tahap risiko dan pematuhan kepada prosedur antarabangsa, Stesen Penyelamat Kecemasan akan dibina di tengah-tengah Terowong Genting. Terowong ini juga akan dilengkapi dengan lampu kecemasan, pemadam kebakaran, sistem isyarat dan komunikasi. Semasa peringkat rekabentuk terperinci, simulasi pemindahan (*evacuation simulation*) akan dijalankan untuk menentukan saiz kelebaran *platform* untuk stesen penyelamat kecemasan.
154. Pelan Tindakan Kecemasan akan disediakan untuk mengendalikan situasi kemalangan atau kecemasan seperti kebakaran di stesen, di dalam terowong atau di atas kereta api, kegelinciran kereta api, tumpahan kargo, kerosakkan peralatan dan kegagalan sistem ATP. Pelan tindakan kecemasan hendaklah merangkumi perkara berikut:
 - ‘*Fire Fighting and Evacuation Strategy*’ bagi penumpang dalam kereta api, stesen dan terowong
 - ‘*Fire Fighting and Spill Response*’ bagi kereta api barangan angkut (*freight*)
 - Langkah-langkah dan tindakan yang diambil sebelum pemindahan (*evacuation*)
 - Program latihan kecemasan dan keselamatan
 - Peranan dan tanggungjawab bagi semua peringkat kakitangan hendaklah diperjelaskan untuk pengurusan keselamatan dan kecemasan
 - Struktur komunikasi dan pelaporan ketika kejadian kecemasan
 - Program kesedaran keselamatan dan kecemasan untuk orang awam
 - Penubuhan pasukan pertolongan cemas semasa kecemasan
 - Menjalankan latihan *functional drill* untuk
 - situasi kecemasan yang mungkin berlaku semasa operasi

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- Proses pelaporan bagi sebarang aktiviti yang mencurigakan dalam membantu siasatan
- Pemeriksaan keselamatan fizikal
- Audit program keselamatan

Sosio-ekonomi

155. Perkara yang dikhuatiri ialah komuniti dan kampung-kampung mungkin akan terpisah dan terputus disebabkan laluan ECRL. Semasa peringkat operasi, landasan kereta api ECRL akan dipagar dan ini bertindak sebagai halangan fizikal yang boleh menghalang akses ke kawasan pertanian, sekolah, kedai dan kemudahan awam masyarakat. Ini boleh menjejaskan menjejaskan perpaduan masyarakat, meningkatkan kos perjalanan tempatan dan lebih ketara sekali adah perubahan cara hidup.
156. Untuk mengurangkan impak ini, Projek telah mencadangkan pembinaan hampir 200 *vehicular box culvert* untuk memudahkan pergerakan orang awam supaya dapat melintasi di bawah landasan kereta api. Ini dapat mengurangkan impak halangan (*barrier*) disebabkan oleh kehadiran landasan kereta api. *Overpasses* juga akan disediakan di beberapa lokasi termasuk di stesen-stesen. Reka bentuk dan lokasi *underpasses* dan *overpasses* akan ditentukan semasa perbincangan dengan pihak komuniti yang terlibat.
157. Semasa peringkat operasi, ECRL dijangka memberi pelbagai manfaat termasuk di peringkat wilayah dan tempatan. ECRL akan memberi manfaat kepada beribu penduduk di Pantai Timur. Selain mempertingkatkan pengangkutan awam, ECRL juga dapat meningkatkan kapasiti pengangkutan barangan angkut, menggalakkan pertumbuhan ekonomi dan merangsang daya saing perniagaan di Pantai Timur. ECRL akan menyediakan mod pengangkutan yang selamat dan boleh membantu meningkatkan produktiviti disebabkan penjimatan masa perjalanan. Manfaat utama dari segi sosial pula adalah pengurangan kesesakan lalu lintas di antara Lembah Klang dan wilayah Pantai Timur pada musim perayaan dan cuti sekolah.
158. ECRL dibina untuk memandu pengangkutan barangan angkut (*freight*) yang merupakan satu komponen penting untuk aktiviti perindustrian. ECRL akan memudahkan akses ke pelabuhan utama di kawasan Pantai Timur, iaitu pelabuhan perikanan Tok Bali, Pelabuhan Kertih, Pelabuhan Kemaman dan Pelabuhan Kuantan. Ini akan menarik lebih ramai pelabur untuk melabur di wilayah Pantai Timur di mana nilai tanah perindustrian adalah lebih murah daripada Pantai Barat dan akses ke pelabuhan utama di Semenanjung Malaysia adalah mudah. Produktiviti dijangka meningkat kerana tempoh masa perjalanan dapat dikurangkan, menggalakkan interaksi ekonomi yang lebih pesat di antara aktiviti perniagaan di Pantai Timur dan di Lembah Klang. Ia juga akan memberikan kesan positif kepada

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pertumbuhan produktiviti kerana urusan perniagaan, pengangkutan barangan dan perkhidmatan adalah lebih pantas dengan adanya ECRL.

159. ECRL juga akan menjana peluang pekerjaan baru. Selain daripada peluang pekerjaan secara langsung, ECRL juga bakal menjana peluang pekerjaan secara tidak langsung. Perniagaan seperti syarikat bekalan barangan dan perkhidmatan juga diperlukan untuk memenuhi keperluan operasi ECRL. Di samping itu, perniagaan ini juga mewujudkan peluang pekerjaan baru. Pertumbuhan ekonomi dan peluang pekerjaan yang dijangka daripada operasi ECRL dijangka akan memberi kesan positif kepada pertumbuhan pendapatan.
160. Di Mentakab, ECRL akan dihubungkan dengan laluan KTMB yang mempunyai hentian di Jerantut bagi membolehkan penumpang melawat Taman Negara dengan menggunakan ECRL. Oleh yang demikian, ECRL dapat membantu zon pelancungan pantai di wilayah pantai timur.
161. Program penglibatan pihak-pihak berkepentingan yang telah diadakan semasa fasa pembinaan akan diteruskan semasa fasa operasi, sekurang-kurangnya untuk tahun pertama operasi. Ini adalah untuk membolehkan penduduk yang tinggal di dalam koridor dan berhampiran dengan jajaran atau stesen memberi maklum balas. Ia juga berfungsi sebagai satu saluran maklum balas untuk MRL memantau impak kepada penduduk.
162. Aspek keselamatan merupakan kebimbangan utama pihak berkepentingan apabila semasa peringkat operasi. Semasa operasi, prosedur keselamatan akan disediakan dan dipatuhi untuk mengelakkan sebarang kemalangan dan insiden yang tidak diingini. Pondok polis yang dikendalikan oleh polis bantuan boleh ditubuhkan di stesen dan kawasan yang berkenaan. Dengan bantuan daripada pihak berkuasa tempatan, persatuan penduduk dan komuniti, langkah kawalan keselamatan dapat diatasi.
163. Pihak berkepentingan awam juga bimbang mengenai jarak antara landasan kereta api yang hampir dengan rumah mereka kerana orang dewasa, pelajar sekolah dan binatang ternakan mungkin merayau di atas landasan. Pagar akan dipasang untuk mengelakkan perkara ini daripada berlaku. Mereka juga bimbang pagar tersebut mungkin akan dirosakkan sekiranya ia menjadi penghalang untuk mereka melintas ke kawasan di seberang landasan. Oleh itu, lintasan (*crossings*) perlu disediakan di kawasan yang sesuai tetapi bagi kawasan berisiko, papan tanda amaran termasuk hukuman kesalahan perlu disediakan. Nasihat dan kerjasama daripada pihak polis dan pihak berkuasa tempatan perlu dirujuk untuk perkara ini.
164. Bagi komuniti yang tinggal berhampiran dengan jajaran dan stesen, kebimbangan utama mereka adalah impak bunyi dan getaran daripada kereta api. Oleh itu, langkah tebatan yang mencukupi perlu diambil.

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semasa peringkat reka bentuk terperinci untuk mengurangkan kesan bunyi dan getaran. Penghadang bunyi yang mencukupi dijangka dapat mengatasi kebimbangan terhadap bunyi bising dan tahap bunyi semasa operasi dapat dikawal di bawah had yang ditetapkan. Penduduk tempatan dan pihak lain seperti peniaga dan pemilik industri bimbang mengenai masalah kesesakan lalu lintas serta kekurangan tempat letak kereta di kawasan berhampiran dengan stesen.

165. Terdapat banyak peluang pekerjaan dan perniagaan, terutamanya di stesen, depoh dan *yards* yang akan dijana semasa operasi ECRL. Terdapat peluang untuk kedai-kedai runcit dan penyediaan pelbagai jenis perkhidmatan. Penduduk tempatan akan diberi peluang untuk mengambil bahagian dalam mana-mana aktiviti yang sesuai. Pada masa sama, MRL, bersama-sama dengan kerajaan negeri yang berkenaan, akan mengenal pasti peluang-peluang pekerjaan untuk penduduk tempatan.

PELAN PENGURUSAN ALAM SEKITAR

Struktur Organisasi

166. MRL akan bertanggungjawab untuk memastikan prestasi alam sekitar dan pematuhan kepada terhadap keperluan alam sekitar untuk Projek ECRL. Pihak-pihak lain yang perlu bertanggungjawab untuk pengurusan dan pematuhan alam sekitar termasuklah kontraktor EPCC, kontraktor untuk pakej-pakej pembinaan, perunding alam sekitar dan pegawai alam sekitar (**Carta RE-3, Jadual RE-21**).
167. MRL akan menubuhkan Jabatan Kesihatan, Keselamatan dan Alam Sekitar untuk memastikan pematuhan kepada semua keperluan alam sekitar yang berkaitan. Antara tanggungjawab Jabatan tersebut termasuklah menyediakan dasar alam sekitar, memantau kontraktor terhadap pematuhan kepada semua keperluan alam sekitar, mempengerusikan Jawatankuasa Pemantauan Prestasi Alam Sekitar (EPMC) dan bekerjasama dengan pihak berkuasa yang berkaitan untuk aspek alam sekitar.
168. Kontraktor EPCC juga akan menubuhkan Pasukan Pengurusan Alam Sekitar untuk memastikan pematuhan alam sekitar semasa peringkat pembinaan. Perunding alam sekitar dan pegawai alam sekitar juga akan dilantik bagi setiap pakej pembinaan untuk memastikan aspek alam sekitar diberi perhatian dan pelaksanaan P2M2 yang efektif.

Carta RE-3 : Cadangan Struktur Organisasi Pengurusan Alam Sekitar



Jadual RE-21: Peranan dan Tanggungjawab semasa Fasa Pembinaan

Peranan	Tanggungjawab
Pemaju Projek	- Mematuhi syarat-syarat kelulusan EIA dan keperluan alam sekitar yang lain - Memantau pematuhan alam sekitar oleh pihak kontraktor - Memastikan tindakan yang bersesuaian untuk menangani sebarang aduan - Mengemukakan laporan alam sekitar yang diperlukan kepada JAS
Kontraktor EPCC:	- Mematuhi syarat-syarat kelulusan EIA dan keperluan alam sekitar yang lain - Memaklumkan subkontraktor/ jururunding mengenai keperluan alam sekitar - Memastikan pelaksanaan P2M2 - Menyediakan dan mengemukakan laporan alam sekitar kepada MRL - Memastikan tindakan yang bersesuaian untuk menangani sebarang aduan
Kontraktor Pakej Pembinaan	- Melaksanakan P2M2 - Memastikan pematuhan kepada semua keperluan alam sekitar
Perunding Alam Sekitar	- Menyediakan kepakaran teknikal dalam penyediaan EMP, P2M2 dan Dokumen Pemantauan Prestasi Alam Sekitar (EPMD) - Memberi nasihat kepada MRL dan CCCC mengenai P2M2 dan pematuhan terhadap keperluan alam sekitar
Pegawai Alam Sekitar	- Melaksanakan EMP dan memantau pelaksanaan P2M2 - Menyediakan Dokumen Pemantauan Prestasi Alam Sekitar (EPMD) yang menjelaskan pematuhan dan prestasi P2M2 - Menyelia program Pemantauan Prestasi alam sekitar - Menyediakan Laporan Pemantauan Prestasi alam sekitar yang akan menilai prestasi keseluruhan P2M2 - Memaklumkan status pematuhan kepada MRL dan CCCC. - Menyelenggara rekod insiden dan dokumen lain yang berkaitan

169. Pengurusan alam sekitar akan dijalankan mengikut pakej di mana Pelan Pengurusan Alam Sekitar (EMP) akan disediakan dan dikemukakan kepada pejabat JAS Negeri masing-masing untuk kelulusan. Pembinaan untuk setiap pakej hanya akan bermula selepas kelulusan EMP diperolehi

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daripada JAS. Setiap pakej akan menyediakan dokumen LD-P2M2 terperinci yang merupakan sebahagian daripada EMP. Enam pakej untuk Pelan Pengurusan Alam Sekitar dicadangkan berdasarkan segmen jajaran seperti berikut (**Jadual RE-22**).

Jadual RE-22: Pakej-pakej EMP

Pakej EMP	Panjang (km)	Jumlah terowong	Jumlah jajaran sisihan
EMP 1 Kelantan	55.0	-	-
EMP 2 Terengganu Utara	85.3	-	-
EMP 3 Terengganu Selatan	142.6	7	3
EMP 4 Pahang Timur	141.0	6	2
EMP 5 Pahang Barat	91.8	5*	1
EMP 6 Selangor	16.4	2*	-

*Terowong Genting terletak di dalam negeri Pahang dan Selangor.

Pelaporan

170. Pelbagai jenis laporan alam sekitar akan disediakan semasa pelaksanaan Projek. Objektif penyediaan laporan adalah untuk merekodkan status/kemajuan alam sekitar, pematuhan kepada keperluan alam sekitar seperti syarat-syarat kelulusan EIA dan keberkesanan P2M2 (**Jadual RE-23**).

Jadual RE-23: Laporan yang akan dikemukakan kepada JAS

Jenis-jenis Laporan
Pelan Pengurusan Alam Sekitar (EMP) - disediakan untuk setiap pakej pembinaan - dikemukakan kepada JAS untuk kelulusan sebelum memulakan pembinaan
Laporan Pematuhan dan Pemantauan - disediakan dan dikemukakan kepada JAS setiap tiga bulan semasa peringkat pembinaan - termasuk borang EIA 1-08 dan EIA 2-08
Laporan Hakisan Online dan Pemeriksaan Kawalan Mendapan - dikemukakan kepada JAS semasa peringkat pembinaan
Laporan Audit Alam Sekitar (Pihak Ketiga) - dikemukakan kepada JAS semasa peringkat pembinaan

171. Laporan untuk keperluan dalaman (*internal reports*) akan disediakan semasa peringkat pembinaan. Antara laporan yang akan disediakan termasuk Dokumen Pemantauan Prestasi Alam Sekitar (EPMD) dan Laporan Pemantauan Prestasi (PMR). Selain daripada itu, dokumen lain yang akan disediakan termasuklah Senarai Semak P2M2s, Senarai Pemasangan, Senarai Penyelenggaraan, Senarai Pemeriksaan Tapak dan P2M2, Senarai Fail Gambar, Senarai Tindakan Pembetulan dan Senarai Prestasi Pemantauan.

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Komunikasi

172. Komunikasi yang efektif dengan pihak yang berkepentingan adalah amat penting. Oleh itu, amat penting untuk memastikan tindakan segera diambil secara sistematik terhadap sebarang pertanyaan, maklum balas dan aduan. Pelbagai saluran komunikasi akan disediakan oleh projek ECRL untuk menerima sebarang maklumbalas daripada pihak yang berkepentingan. Perjumpaan dengan pihak berkepentingan juga akan dijalankan sebelum kerja-kerja pembinaan bermula. Perjumpaan dengan pihak berkepentingan akan terus dijalankan di pelbagai peringkat pelaksanaan Projek untuk menangani sebarang isu. Pihak MRL juga akan berkomunikasi dengan pihak media untuk memastikan maklumat yang betul dan bersesuaian diberikan kepada pihak berkepentingan dan orang awam.

Program Pemantauan

173. Satu program pemantauan alam sekitar yang komprehensif akan dilaksanakan oleh pihak MRL untuk memantau keberkesanan P2M2 dan pematuhan kepada keperluan alam sekitar semasa peringkat pembinaan. Komponen program pemantauan boleh dibahagikan kepada tiga kategori iaitu **Pemantauan Prestasi**, **Pemantauan Pematuhan**, dan **Pemantauan Impak**. Program pemantauan kualiti alam sekitar akan merangkumi pemantauan kualiti air, pemantauan pelepasan dari perangkap mendap, pemantauan kualiti udara, pemantauan bunyi bising dan getaran serta pemantauan hidupan liar. Program pemantauan akan diseliasah oleh kakitangan yang kompeten.

Audit Alam Sekitar

174. Audit alam sekitar akan dijalankan setiap tiga bulan oleh pihak ketiga semasa peringkat pembinaan. Objektif utama audit adalah untuk menentukan sekiranya ada sebarang ketidakpatuhan kepada keperluan alam sekitar serta memastikan bahawa semua P2M2 dilaksanakan dengan baik, berfungsi seperti yang telah direkabentuk dan diselenggara dengan secukupnya.

KESIMPULAN

175. Laluan Rel Pantai Timur (ECRL) adalah **infrastruktur nasional** yang penting untuk merangsang pertumbuhan serta **mengurangkan jurang ekonomi di antara Pantai Timur dan Pantai Barat** Semenanjung Malaysia. Projek ECRL ini akan **memperkukuhkan kesalinghubungan** antara ibu negeri, pusat bandar utama, kluster perindustrian, pelabuhan laut dan darat, lapangan terbang dan kawasan pelancongan dan meningkatkan kebolehcapaian pengangkutan untuk penduduk di Pantai Timur. ECRL juga akan **meningkatkan kapasiti pengangkutan barangan angkut** di antara Pantai Timur dan Pantai Barat. Ia juga akan mempermudah

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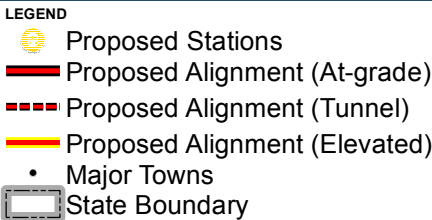
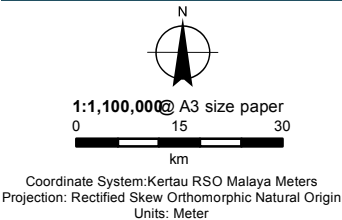
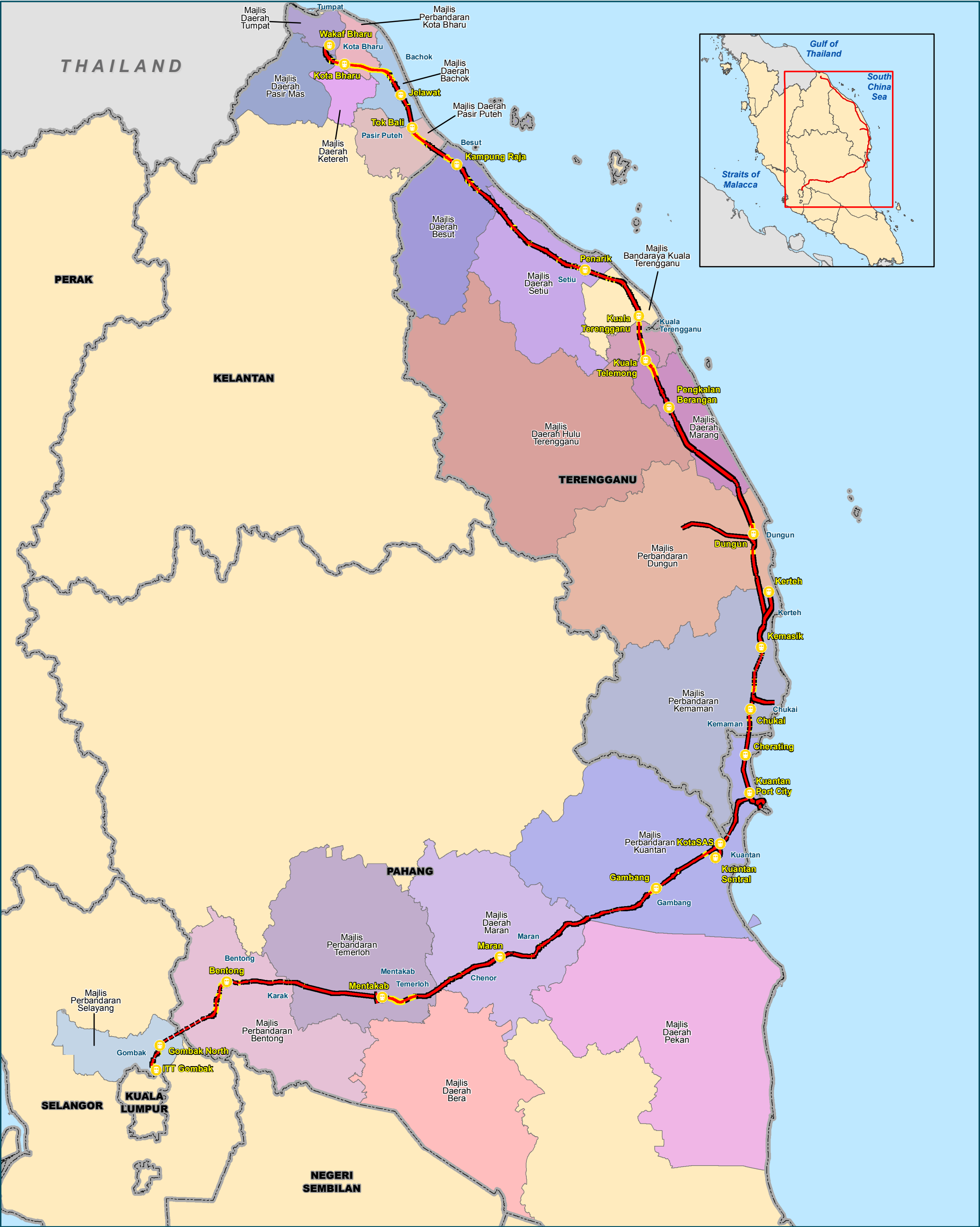
perdagangan yang dijangka akan meningkat serta memastikan logistik yang lebih efisien di kawasan Pantai Timur.

176. Isu utama semasa peringkat pra-pembinaan adalah pengambilan tanah dan hartanah. Pihak Kerajaan Malaysia akan memastikan pampasan yang sewajarnya diberikan kepada mereka yang terlibat. Untuk mengurangkan impak pengambilan tanah, pihak MRL akan memberi maklumat di peringkat awal dan maklumat yang secukupnya berkaitan proses pengambilan tanah kepada pihak yang terlibat. Pihak MRL akan memberi bantuan kepada pihak yang terlibat dengan isu pengambilan.
177. Impak utama semasa peringkat pembinaan adalah isu hakisan tanah dan pemendapan daripada kerja - kerja tanah, pemotongan cerun dan pembinaan terowong. Hasil penilaian menunjukkan bahawa impak dari hakisan dan pemendapan adalah signifikan sekiranya tiada sebarang langkah tebatan dan kawal (P2M2) dilaksanakan tapak pembinaan. Di samping itu, kerja-kerja pembersihan tapak, pemotongan cerun, pembinaan terowong dan perobohan struktur dan bangunan dijangka menghasilkan sisa buangan seperti tanah dan biojisim dalam kuantiti yang besar. Sisa buangan ini perlu diuruskan dengan baik iaitu samada digunasemula atau dilupuskan. Risiko kejadian banjir semasa pembinaan ECRL dijangka terutama sekali di kawasan rendah di negeri Kelantan, Terengganu dan Pahang. Walaupun 80 buah jambatan dan *balancing culverts* akan dibina, risiko banjir perlu diberi perhatian yang sewajarnya.
178. Projek ECRL akan mengakibatkan kehilangan dan fragmentasi habitat hidupan liar. Walaupun pelbagai usaha telah diambil untuk mengelakkan kawasan hutan simpan, sejumlah 357 hektar kawasan HSK akan terlibat, di mana sebahagian besarnya terletak di Terengganu dan Pahang. Landasan kereta api ECRL juga akan membahagi beberapa kawasan hutan simpan yang mempunyai populasi hidupan liar yang penting. Untuk mengurangkan impak akibat fragmentasi habitat, lintasan hidupan liar (*wildlife crossings*) dicadangkan di beberapa lokasi.
179. Semasa peringkat operasi, bunyi bising dan getaran merupakan isu utama. Walaupun kereta api berkuasa elektrik dan mempunyai paras bunyi yang rendah, hasil analisa menjangkakan bahawa paras bunyi akan melebihi limit di beberapa lokasi. Penghadang bunyi dicadangkan di kesemua lokasi tersebut. Selain penghadang bunyi, langkah mitigasi lain termasuklah menggunakan landasan berkimpal secara berterusan (*continuous welded tracks*) dan penyerap akustik (*acoustic absorption*) di tepi landasan.
180. Secara amnya, projek ECRL dijangka dapat membantu meningkatkan kualiti. Emisi kumulatif bersih CO_{2e} yang dijangka dapat dielakkan dengan pelaksanaan Projek ECRL dijangka adalah 255,671 CO_{2e} MT setahun pada 2024 dan 912,738 CO_{2e} tan MT setahun pada 2040. Bahan pencemar udara

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berkaitan dengan emisi kenderaan seperti jisim zarah (PM₁₀ dan PM_{2.5}) dan bahan pencemar gas (NO_x, SO₂, CO_x) juga dijangka akan berkurangan.

181. Bila beroperasi kelak, ECRL dijangka membawa pelbagai faedah di peringkat wilayah dan tempatan. Selain daripada membantu memudahkan perjalanan penumpang, ECRL juga dapat meningkatkan kapasiti barangan angkut, merangsang pertumbuhan ekonomi dan menggalakkan daya saing perniagaan di Pantai Timur. ECRL merupakan satu mod pengangkutan yang selamat dan berupaya meningkatkan produktiviti disebabkan penjimatan masa perjalanan. Salah satu faedah sosial yang penting adalah pengurangan kesesakan lalu lintas antara Lembah Klang dan kawasan Pantai Timur terutama sekali pada musim perayaan dan cuti sekolah.
182. ECRL dijangka menjana peluang pekerjaan baru. Selain daripada itu, ECRL juga akan mewujudkan peluang pekerjaan secara tidak langsung yang berkaitan dengan aspek operasi dan penyelenggaraan ECRL. Untuk memenuhi keperluan operasi ECRL, berbagai jenis perkhidmatan dan barangan akan diperolehi daripada sumber luar. Syarikat – syarikat yang membekalkan barangan dan perkhidmatan tersebut akan memerlukan tenaga pekerja dan ini akan menjana peluang pekerjaan baru. Pertumbuhan ekonomi dan peluang pekerjaan yang diramalkan daripada ECRL akan membawa impak positif kepada pertumbuhan pendapatan.
183. Untuk memastikan faedah yang maksima boleh diperolehi daripada projek ECRL dan kos ekonomi serta kesan alam sekitar dapat diminimakan, kesemua langkah tebatan (P2M2) yang digariskan di dalam laporan ini perlu dilaksanakan secara efektif. Di samping itu, aktiviti pembinaan mesti dipantau dengan teliti. Mekanisme pentadbiran yang merangkumi pemantauan, pelaporan, pengauditan dan lain-lain telah disediakan untuk pelaksanaan oleh pihak MRL.
184. MRL sangat komited dalam usaha mereka untuk mengarusperdanakan perlindungan alam sekitar di dalam pelaksanaan Projek ini dan akan memastikan bahawa kualiti alam sekitar dilindungi semasa peringkat pembinaan dan operasi ECRL. MRL akan memastikan komitmen daripada semua pihak termasuk jururunding, kontraktor, pembekal dan lain-lain patuh kepatuhan terhadap ketetapan alam sekitar semasa pelaksanaan Projek. MRL akan memastikan komunikasi dan perjumpaan dengan pihak-pihak berkepentingan dijalankan secara berterusan sepanjang hayat Projek.



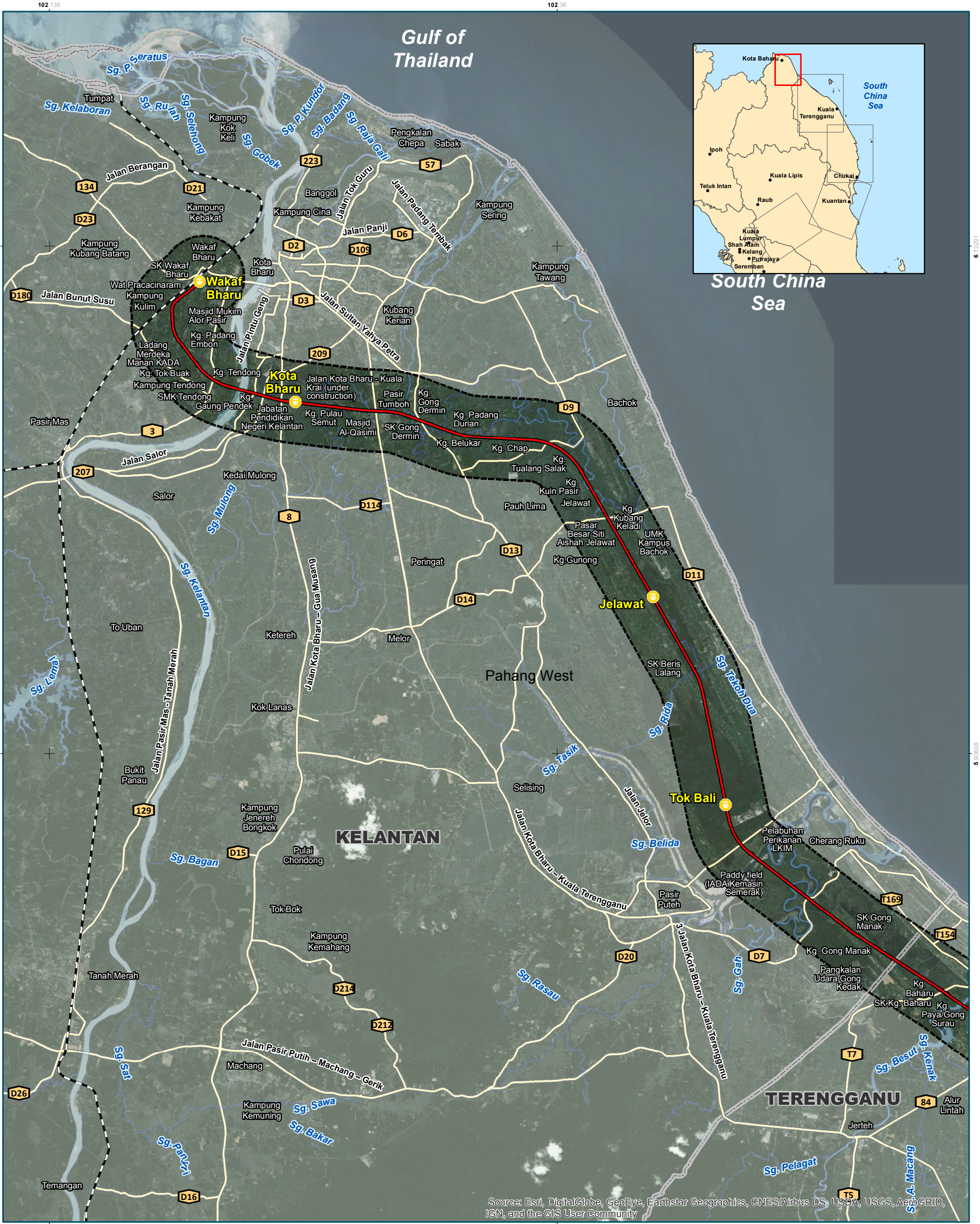
**Gambaran Keseluruhan
Jajaran ECRL**

Date
Project No
Produced by
Revision

27-03-2017
EJ 593
ZAB
A

RAJAH RE-1

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Source: Jabatan Perancangan Bandar dan Desa, Semenanjung Malaysia, Sistem Maklumat Gunatanah Perancangan Bersepadu (i-Plan) (2016). E:\Project\EJ 610 ECRL Tumpat-Gombak\Maps\WXD\EJ 610 Overview of ECRL Alignment 12b.mxd



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km

Coordinate System: GCS WGS 1984

Units: Degree

LEGEND

- Proposed Stations
- Proposed Alignment (At-grade)
- Proposed Alignment (Tunnel)
- Existing Railway Line
- Major Road
- State Boundary

Jajaran Projek ECRL (Kelantan)

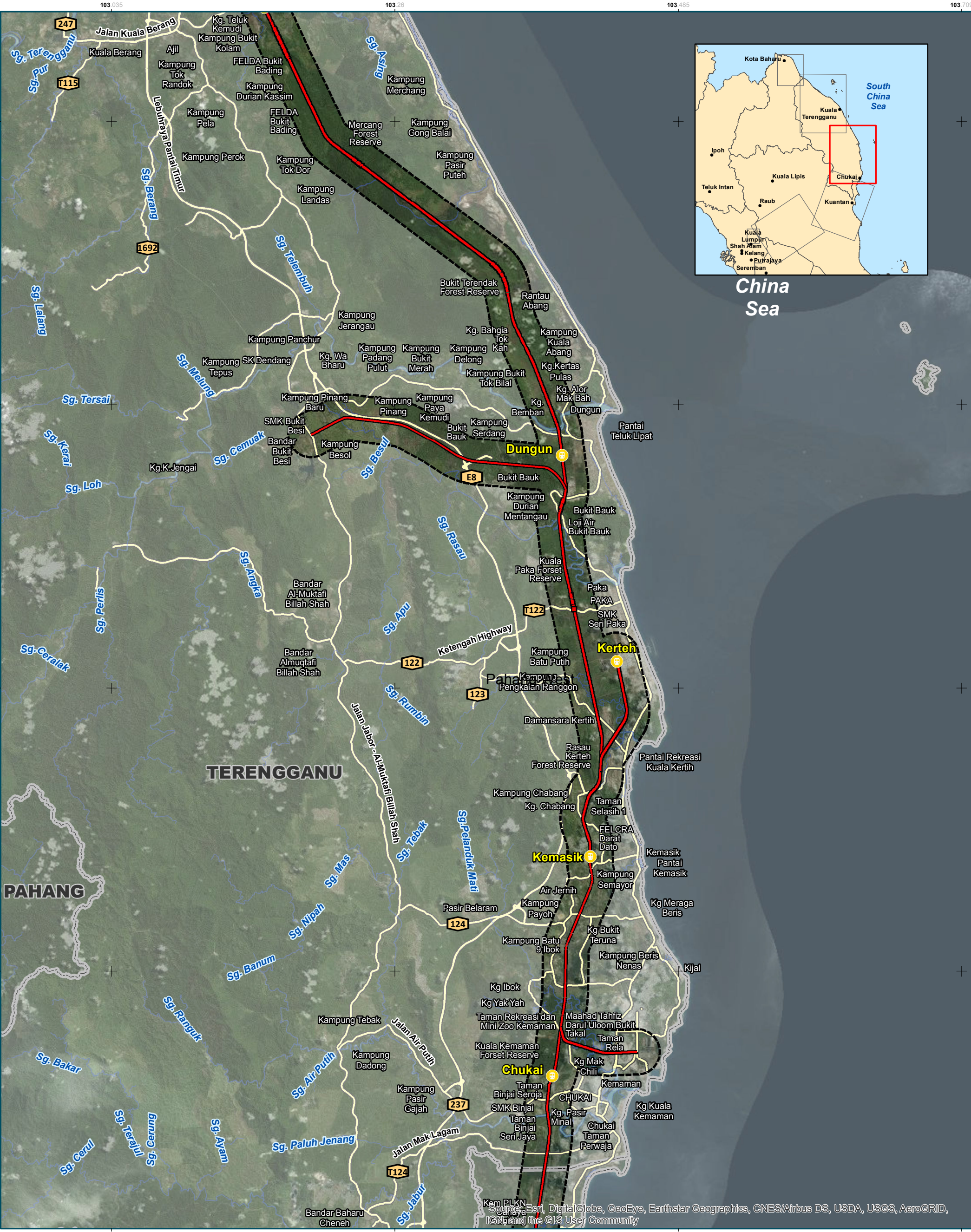
ere consulting group

Date	27-03-2017
Project No	EJ 593
Produced by	ZAB
Revision	A

RAJAH RE-2

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Source: ERE Consulting Group (2015). E:\Project\EJ 610 ECRL Tumput-Gombak\Maps\MXD\EJ 610 ECRL Project Description 12b ES.mxd



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Coordinate System: GCS WGS 1984

Units: Degree

LEGEND

Proposed Stations

Proposed Alignment (At-grade)

Proposed Alignment (Tunnel)

Existing Railway Line

Major Road

State Boundary

Jajaran Projek ECRL
(Terengganu Selatan)

Date: 27-03-2017

Project No: EJ 593

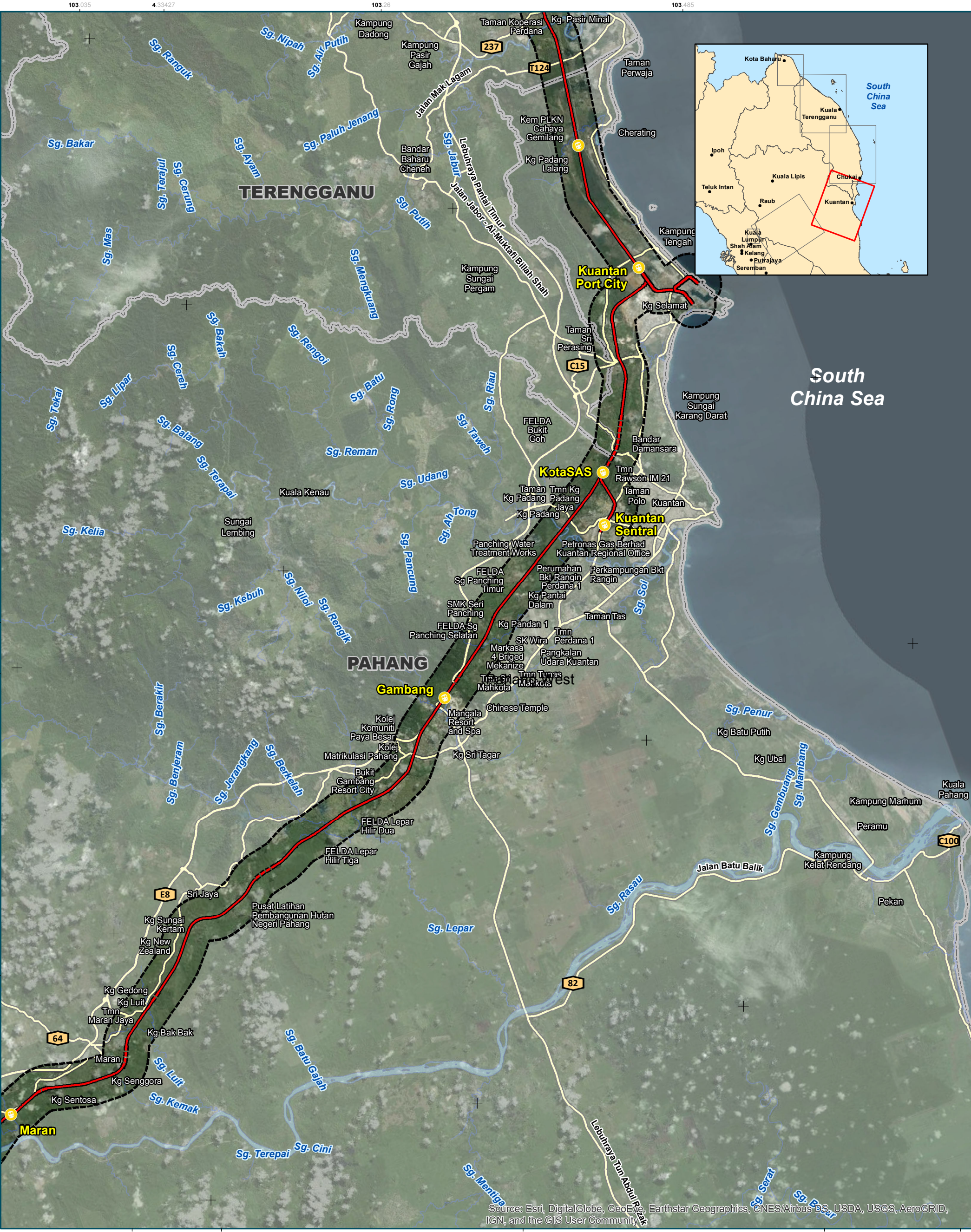
Produced by: ZAB

Revision: A

RAJAH RE-4

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Source: ERE Consulting Group (2015). E:\Project\EJ 610 ECRL Tumpat-Gombak\Maps\MXD\EJ 610 ECRL Project Description 12b ES.mxd



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Coordinate System: GCS WGS 1984

Units: Degree

LEGEND

	Proposed Stations		Existing Railway Line
	Proposed Alignment (At-grade)		Major Road
	Proposed Alignment (Tunnel)		State Boundary

JAJARAN PROJEK ECRL (PAHANG TIMUR)

ere consulting group
sensible environmental solutions

Date	27-03-2017
Project No	EJ 593
Produced by	ZAB
Revision	A

RAJAH RE-5

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Source: ERE Consulting Group (2015). E:\Project\EJ 610 ECRL Tumpat-Gombak\Maps\MXD\EJ 610 ECRL Project Description 12b ES.mxd



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km

Coordinate System: GCS WGS 1984

Units: Degree

LEGEND

Proposed Stations

Proposed Alignment (At-grade)

Proposed Alignment (Tunnel)

Existing Railway Line

Major Road

State Boundary

Jajaran Projek ECRL (Pahang Barat)

ere consulting group

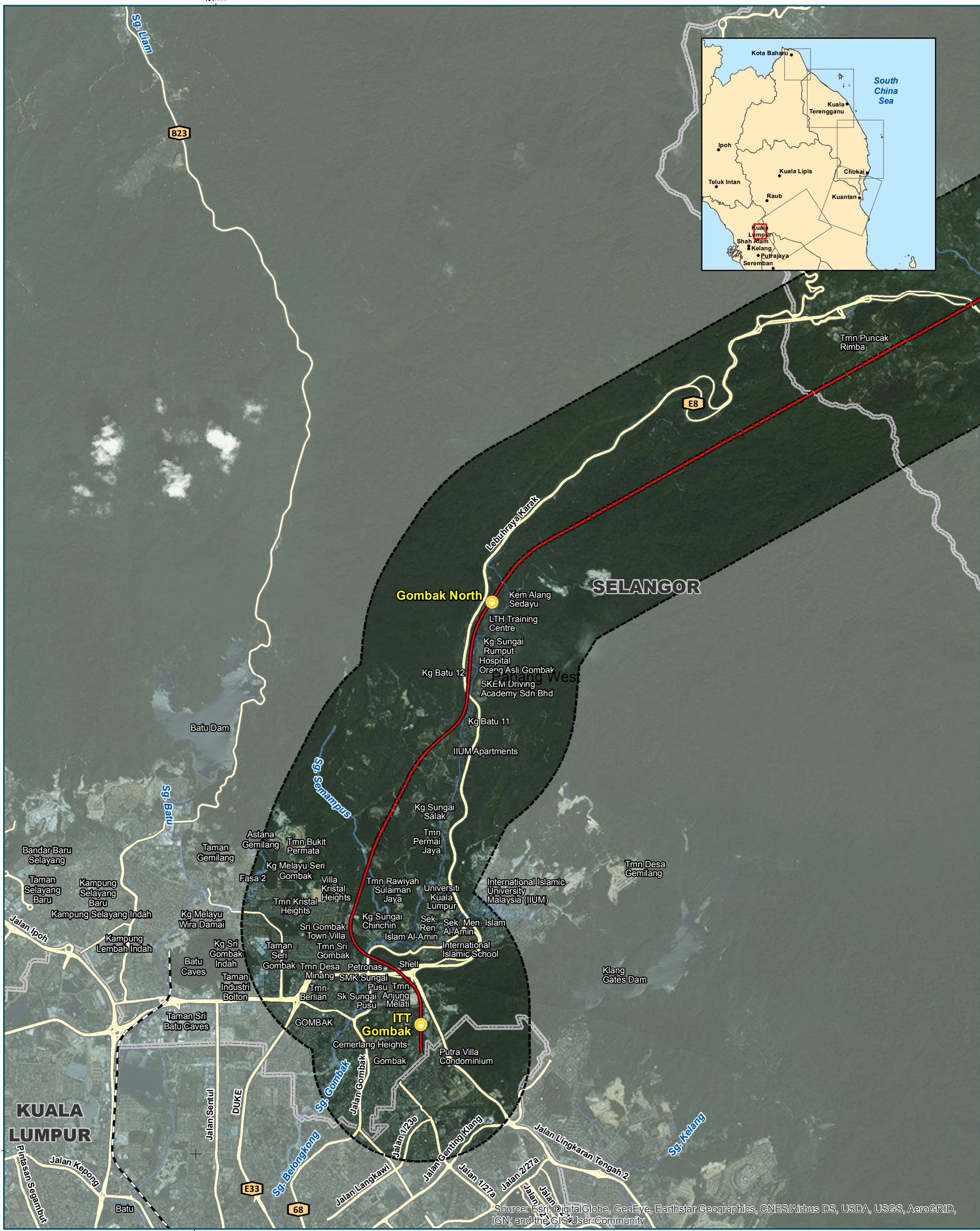
sensible environmental solutions

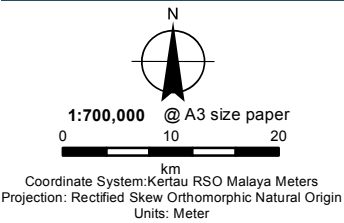
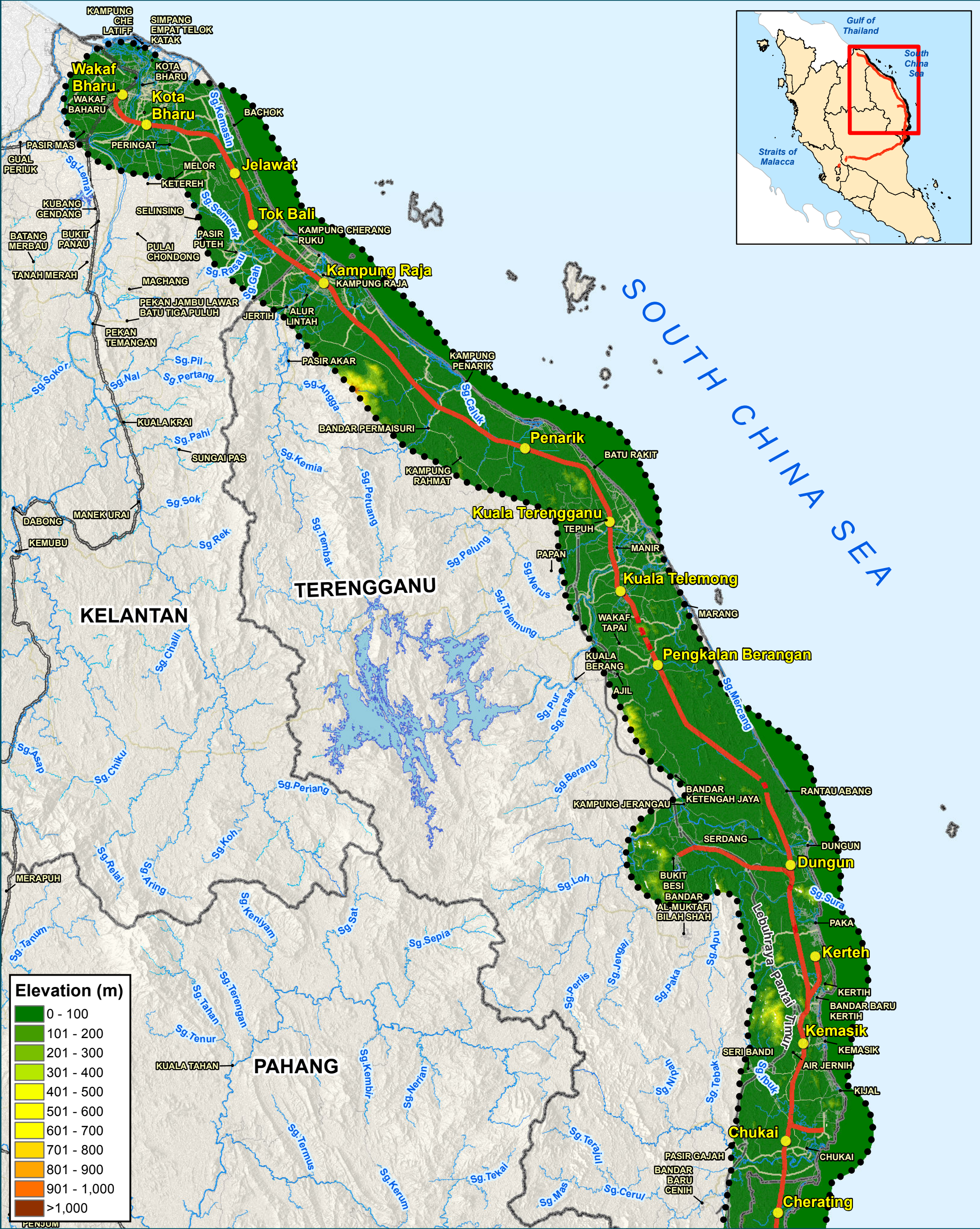
Date	27-03-2017
Project No	EJ 593
Produced by	ZAB
Revision	A

RAJAH RE-6

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Source: ERE Consulting Group (2015). E:\Project\EJ 610 ECRL Tumpat-Gombak\Maps\MXD\EJ 610 ECRL Project Description 12b ES.mxd





- LEGEND
- Proposed Stations
 - Proposed Alignment
 - Proposed Alignment (Tunnel Segment)
 - Waterbody/ Reservoir
 - River
 - Railway
 - Highway
 - Major Roads
 - Minor Roads
 - State Boundary
 - 10km Corridor
 - Settlements



Ketinggian Sepanjang
Jajaran ECRL
(Segmen 1 to 3)

Date
Project No
Produced by
Revision

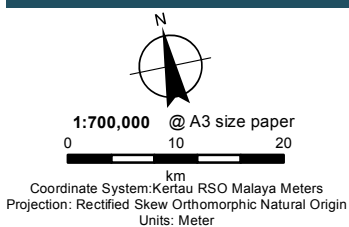
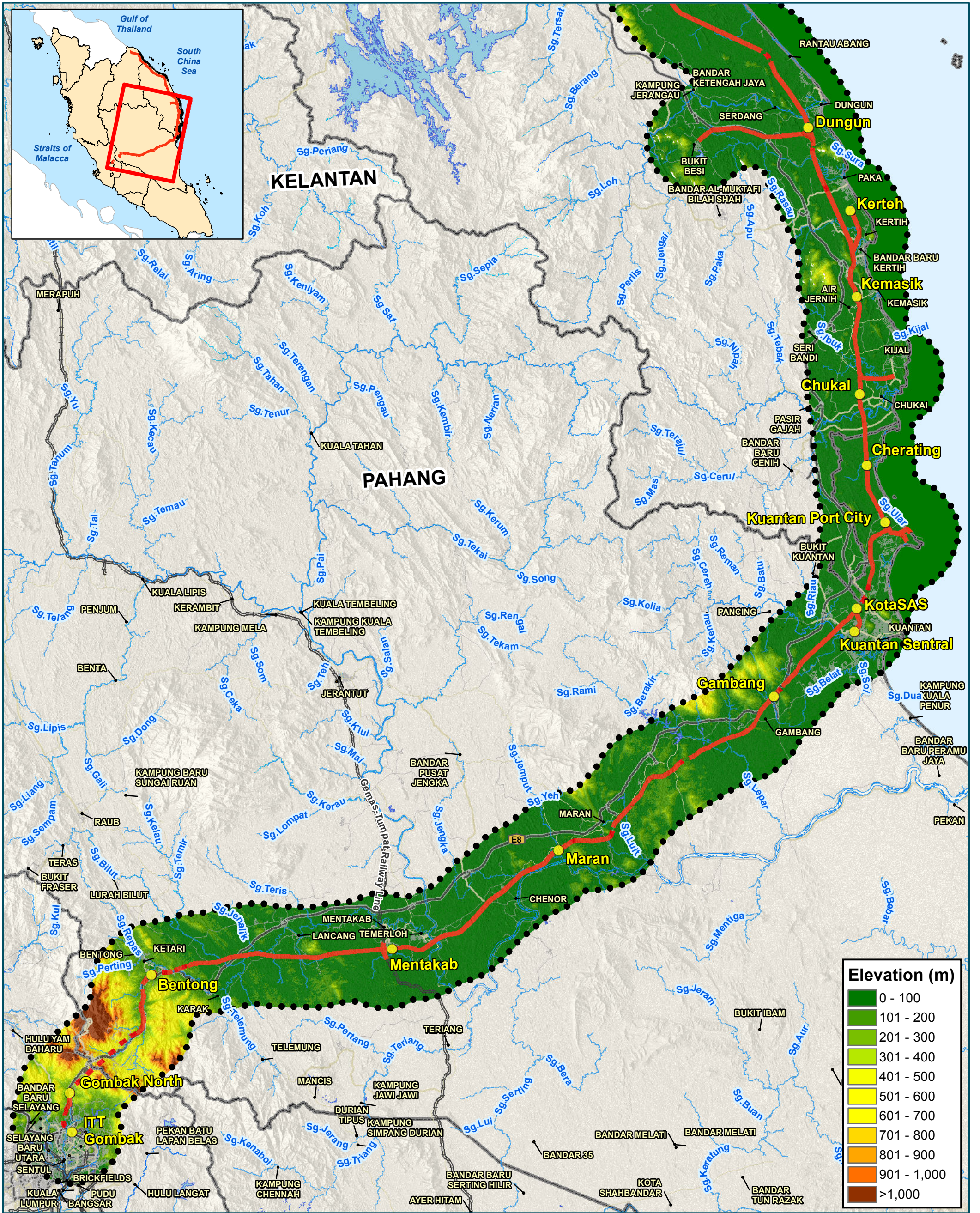
27-03-2017
EJ 610
AFZ
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RAJAH RE-8a

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Source: ERE Consulting (2017), JPBD (2016), OpenStreet Map (2017), Department of Irrigation and Drainage (2016), Elevation by SRTM (2000)

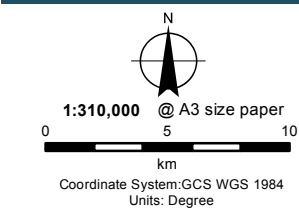
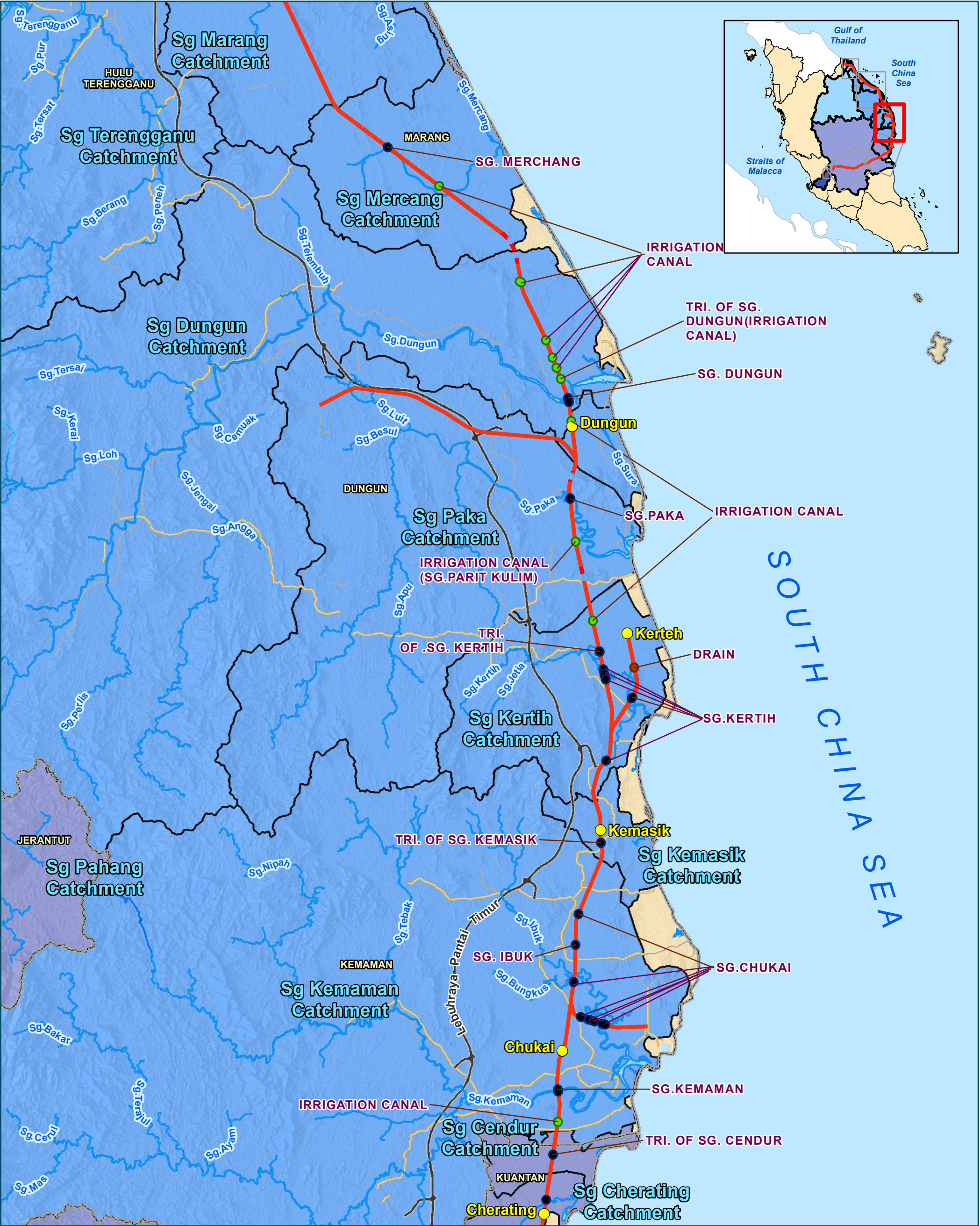
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Source: ERE Consulting (2017), JPBD (2016), OpenStreet Map (2017), Department of Irrigation and Drainage (2016), Elevation by SRTM (2000)

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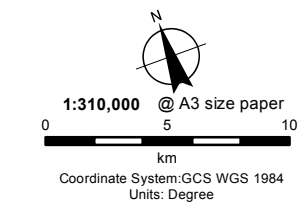
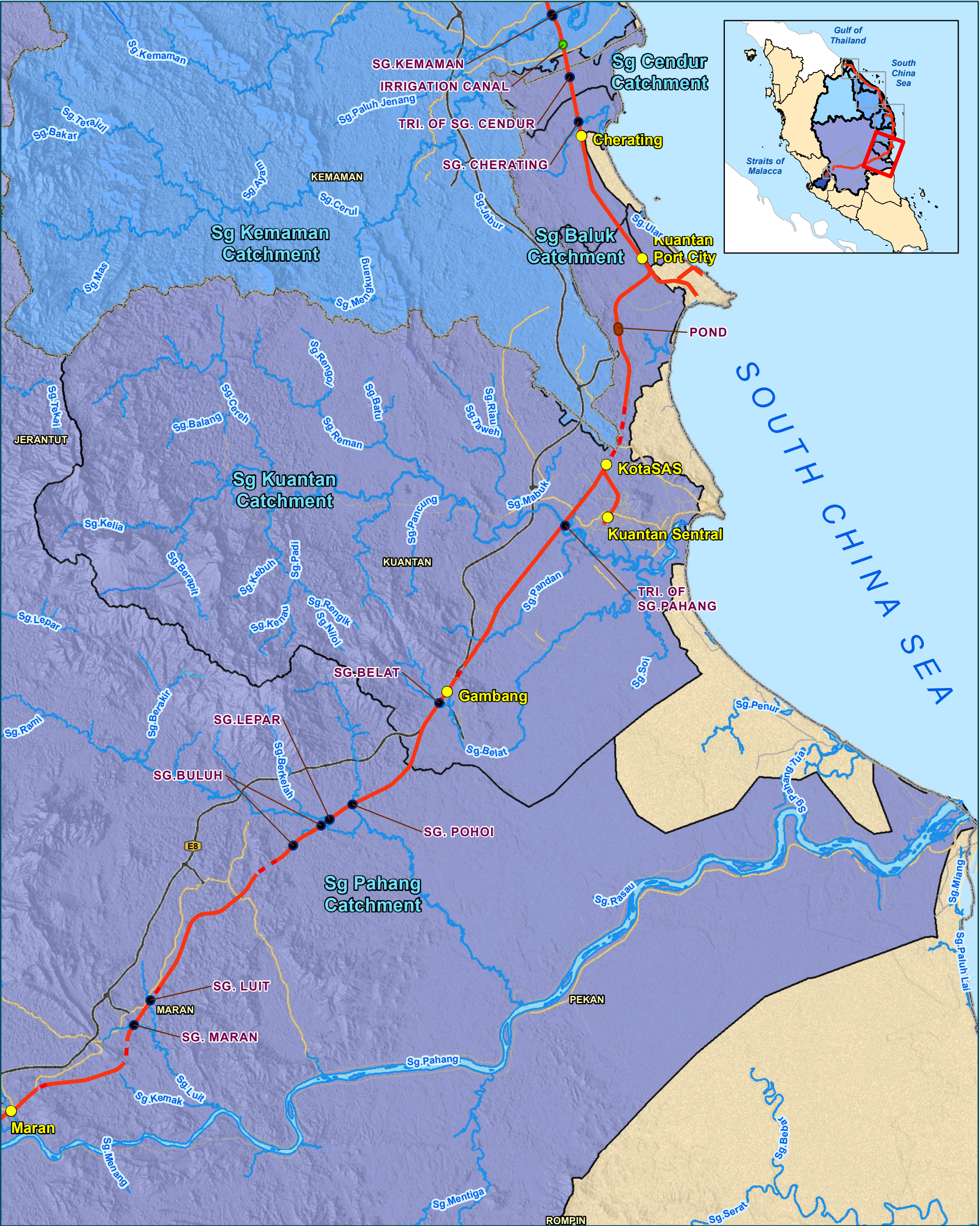
LEGEND		River Basin		River Crossing	
	Proposed Stations		River		Irrigation Canal
	Proposed Alignment		Railway		River Crossing
	Proposed Alignment (Tunnel Segment)		Highway		Drain/ Canal
	State Boundary		Major Roads		
			Minor Roads		



Lembangan Sungai
Direntasi ECRL
(Terengganu Selatan)

Date	27-03-2017
Project No	EJ 610
Produced by	AFZ
Revision	A

RAJAH RE-10c



LEGEND

- Proposed Stations
- Proposed Alignment
- Proposed Alignment (Tunnel Segment)
- State Boundary

- River
- Railway
- Highway
- Major Roads
- Minor Roads

River Basin

- Kelantan
- Pahang
- Selangor
- Terengganu

River Crossing

- Irrigation Canal
- River Crossing
- Drain/ Canal

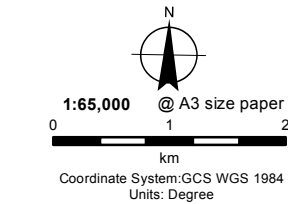
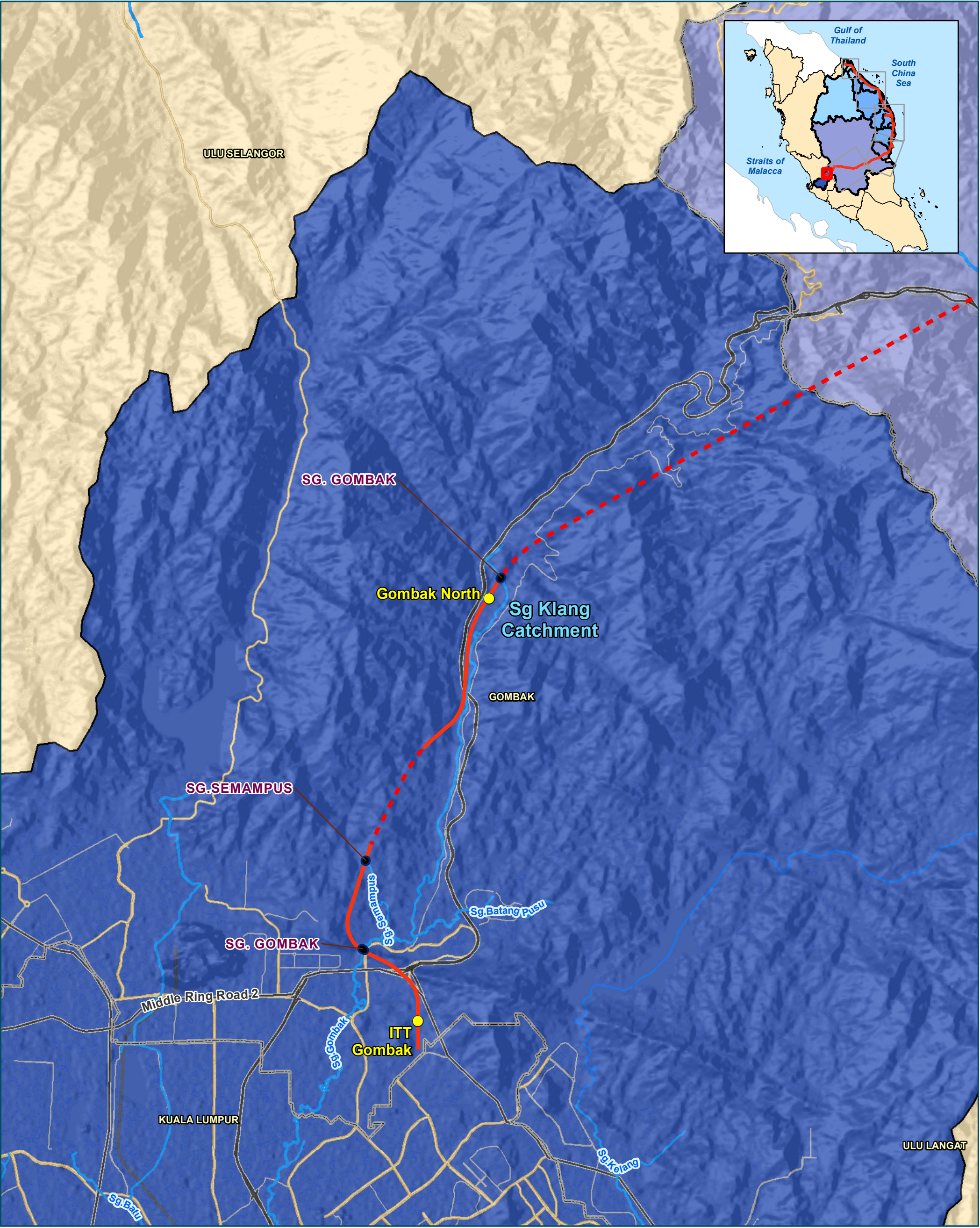


**Lembangan Sungai
Direntasi ECRL
(Pahang Timur)**

Date	27-03-2017
Project No	EJ 610
Produced by	AFZ
Revision	A

RAJAH RE-10 d

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Source: ERE Consulting (2017), JPBD (2016), OpenStreet Map (2017), Imagery courtesy of USGS (2017), Department of Irrigation and Drainage (2016) G:\Project\EJ 610 ECRL Tumpat-Gombak\Maps\MXD\EIA\EJ 610 ECRL River_Crossing_Catchments_LABEL_Pahang_ES_RE.mxd



LEGEND		River Basin		River Crossing	
	Proposed Stations		River		Irrigation Canal
	Proposed Alignment		Railway		River Crossing
	Proposed Alignment (Tunnel Segment)		Highway		Drain/ Canal
	State Boundary		Major Roads		
			Minor Roads		



Lembangan Sungai
Direntasi ECRL
(Selangor)

Date	27-03-2017
Project No	EJ 610
Produced by	AFZ
Revision	A

RAJAH RE-10 f

