

TOC

TABLE OF CONTENTS

TABLE OF CONTENTS

	Page
Table of Contents	i
List of Appendices	xii
List of Abbreviations	xii
List of Figures	xvii
List of Tables	xxi
List of Plates	xxx
List of Chart	xxxiii
SECTION 1 : INTRODUCTION	1-1
1.1 PROJECT BACKGROUND	1-1
1.1.1 Project Title	1-1
1.1.2 Project Concept	1-1
1.1.3 Project Location	1-2
1.1.4 Sensitive Receptors	1-2
1.2 PROJECT PROPONENT	1-3
1.3 EIA CONSULTANT	1-3
1.4 LEGAL REQUIREMENT	1-3
1.5 CONFORMANCE TO THE GOVERNMENT PLANS	1-4
1.5.1 State Government	1-4
1.5.2 National Physical Plan	1-4
1.5.2.1 National Physical Plan 1	1-4
1.5.2.2 National Physical Plan 2	1-4
1.5.2.3 National Physical Plan 3	1-5
1.5.3 State Structure Plans	1-5
1.5.3.1 Rancangan Struktur Negeri Kelantan 2003 – 2020	1-5
1.5.3.2 Rancangan Struktur Negeri Selangor 2035	1-5
1.5.3.3 Selangor Public Transport Master Plan	1-6
1.5.4 ECER Master Plan	1-6
1.5.5 National Land Public Transport Master Plan	1-6
SECTION 2 : TERMS OF REFERENCE OF EIA	2-1
2.1 INTRODUCTION	2-1
2.2 ENDORSEMENT OF TERMS OF REFERENCE	2-1
2.3 TERMS OF REFERENCE	2-15

2.3.1	Introduction	2-15
2.3.2	Statement of Need	2-16
2.3.3	Basic Project Information	2-17
2.3.4	Alternatives Consideration	2-19
2.3.5	Potential Impacts	2-20

SECTION 3 : STATEMENT OF NEED 3-1

3.1	NEED FOR THE PROJECT	3-1
3.1.1	Enhances Connectivity of ECRL Phase 1	3-1
3.1.2	Enhancing Freight Transport Capacity	3-1
3.1.3	Reduction in Greenhouse Gases	3-2
3.1.4	Transportation Development Plans in Selangor	3-2
3.1.5	National Physical Plan 3, Dasar Perbandaran Kedua (DPN2) and Dasar Perancangan Fizikal Desa Negara (DPFDN)	3-3
3.2	BENEFITS OF THE PROJECT	3-4

SECTION 4 : PROJECT OPTIONS 4-1

4.1	INTRODUCTION	4-1
4.2	PLANNING & DESIGN BASIS	4-1
4.2.1	Station Planning Criteria	4-3
4.3	NO PROJECT OPTION	4-3
4.4	ALIGNMENT OPTIONS	4-3
4.4.1	Kelantan Options	4-3
4.4.2	Selangor Options	4-5
4.5	RAILWAY GAUGE OPTIONS	4-7
4.6	Structural Options	4-8

SECTION 5 : PROJECT DESCRIPTION 5-1

5.1	INTRODUCTION	5-1
5.2	PROJECT ALIGNMENT	5-1
5.2.1	Segment 1: Kelantan – 26.7 km	5-3
5.2.2	Segment 2: Selangor – 79.5 km	5-4
5.2.3	Alignment Design	5-5
5.3	ALIGNMENT TYPE	5-7
5.3.1	At-Grade Sections	5-7
5.3.2	Elevated Sections	5-7
5.3.3	Tunnel Sections	5-9
5.4	STATIONS	5-15

5.4.1	Station Facilities & Layout	5-15
5.5	DEPOT AND MAINTENANCE BASES	5-21
5.5.1	General	5-21
5.5.2	Depot and Stabling Lines	5-21
5.5.3	Light and Medium Maintenance Bases	5-21
5.6	SYSTEMS	5-22
5.6.1	Trackwork	5-22
5.6.2	Ballasted Track	5-22
5.6.3	Electric Power Supply System for Railway Facilities	5-23
5.6.4	Traction Power Supply System	5-23
5.6.5	Signalling System	5-25
5.7	ROLLING STOCK	5-25
5.7.1	Electric Multiple Units	5-25
5.7.2	Locomotives	5-26
5.7.3	Wagon	5-27
5.8	PRINCIPAL PROJECT ACTIVITIES	5-28
5.8.1	Pre-Construction Stage	5-29
5.8.1.1	Land Acquisition	5-29
5.8.1.2	Utilities Relocation	5-30
5.8.2	Construction Stage	5-31
5.8.2.1	Site Clearing and Earthworks	5-31
5.8.2.2	Access Roads	5-32
5.8.2.3	Embankment Construction	5-32
5.8.2.4	Railway Bridge and Viaduct Construction	5-33
5.8.2.5	Tunnel Construction	5-34
5.8.2.6	Station Construction	5-36
5.8.2.7	Installation of Railway Tracks and Systems	5-37
5.8.3	Operation Stage	5-37
5.8.4	Passenger Train Operations	5-38
5.8.5	Freight Train Operations	5-39
5.9	LABOUR QUARTERS AND CONSTRUCTION WORKERS	5-41
5.10	PROJECT IMPLEMENTATION SCHEDULE	5-41
 SECTION 6 : EXISTING ENVIRONMENT		 6-1
6.1	INTRODUCTION	6-1
6.2	TOPOGRAPHY	6-1
6.2.1	Segment 1: Kelantan	6-1
6.2.2	Segment 2: Selangor	6-1
6.3	GEOLOGY	6-3
6.3.1	General Geology of Peninsular Malaysia	6-3
6.3.1.1	Kelantan	6-4

6.3.1.2	Selangor	6-6
6.3.2	Project Site Geology	6-9
6.3.2.1	Segment 1 : Kelantan	6-11
6.3.2.2	Selangor	6-15
6.3.3	Soil Investigation Works	6-27
6.3.3.1	Segment 1 : Kelantan	6-27
6.3.3.2	Selangor	6-28
6.3.4	Hydrogeology	6-31
6.3.4.1	Kelantan	6-31
6.3.4.2	Selangor	6-37
6.3.5	General Seismicity of Peninsular Malaysia	6-40
6.3.5.1	Kelantan	6-45
6.3.5.2	Selangor	6-45
6.4	CLIMATE	6-46
6.4.1	Kelantan	6-47
6.4.2	Selangor	6-47
6.5	LANDUSE	6-48
6.5.1	Segment 1: Kelantan	6-48
6.5.2	Segment 2 : Selangor	6-51
6.6	HYDROLOGY & DRAINAGE	6-63
6.6.1	River Catchments	6-63
6.6.1.1	Segment 1 : Kelantan	6-63
6.6.1.2	Segment 2 : Selangor	6-64
6.6.2	FLOOD RISK	6-67
6.6.3	Segment 1: Kelantan	6-68
6.6.4	Segment 2 : Selangor	6-68
6.7	WATER QUALITY	6-79
6.7.1	Approach & Methodology	6-79
6.7.2	Location of Water Quality Monitoring Stations	6-80
6.7.2.1	Segment 1 : Kelantan	6-80
6.7.2.2	Segment 2 : Selangor	6-81
6.7.3	Baseline Sampling Results	6-82
6.7.3.1	Segment 1: Kelantan	6-82
6.7.3.2	Segment 2 : Selangor	6-91
6.7.4	Water Supply	6-99
6.7.4.1	Segment 1 : Kelantan	6-99
6.7.4.2	Segment 2 : Selangor	6-99
6.7.5	Downstream Fisheries and Aquaculture Activities	6-100
6.7.5.1	Segment 1 : Kelantan	6-100
6.7.5.2	Segment 2 : Selangor	6-102
6.7.6	Irrigation Scheme	6-104
6.7.6.1	Segment 1: Kelantan	6-104

6.7.6.2	Segment 2 : Selangor	6-105
6.7.7	Recreation	6-105
6.7.7.1	Segment 1 : Kelantan	6-105
6.7.7.2	Segment 2 : Selangor	6-105
6.8	AIR QUALITY	6-106
6.8.1	Approach & Methodology	6-106
6.8.2	Monitoring Locations	6-107
6.8.3	Monitoring Results	6-108
6.8.3.1	Segment 1 : Kelantan	6-108
6.8.3.2	Segment 2 : Selangor	6-109
6.8.3.3	Summary	6-109
6.9	NOISE	6-109
6.9.1	Approach & Methodology	6-110
6.9.2	Monitoring Locations	6-112
6.9.2.1	Segment 1 : Kelantan	6-112
6.9.2.2	Segment 2 : Selangor	6-113
6.9.3	Monitoring Results	6-115
6.9.3.1	Segment 1 : Kelantan	6-115
6.9.3.2	Segment 2 : Selangor	6-116
6.9.3.3	Summary	6-118
6.10	VIBRATION	6-119
6.10.1	Approach & Methodology	6-119
6.10.2	Monitoring Locations	6-119
6.10.2.1	Segment 1 : Kelantan	6-119
6.10.2.2	Segment 2 : Selangor	6-120
6.10.3	Monitoring Results	6-122
6.10.3.1	Segment 1 : Kelantan	6-122
6.10.3.2	Segment 2 : Selangor	6-122
6.10.4	Summary	6-123
6.11	ECOLOGY	6-124
6.11.1	Flora	6-124
6.11.1.1	Approach & Methodology	6-124
6.11.1.2	Main vegetation types along the alignment	6-125
6.11.1.3	Segment 1 : Kelantan	6-126
6.11.1.4	Segment 2 : Selangor	6-126
6.11.2	Fauna	6-144
6.11.2.1	Approach & Methodology	6-145
6.11.2.2	Segment 1 : Kelantan	6-147
6.11.2.3	Segment 2: Selangor	6-149
6.11.3	Freshwater Ecology	6-158
6.11.3.1	Approach and Methodology	6-159
6.11.3.2	Overview of Freshwater Fauna	6-159

6.11.3.3	Kelantan	6-160
6.11.3.4	Selangor	6-160
6.12	SOCIO-ECONOMY	6-160
6.12.1	Introduction	6-160
6.12.2	Profile of 1 km corridor	6-162
6.12.2.1	Population And Household Growth	6-162
6.12.2.2	Gender Ratio and Ethnic Composition	6-164
6.12.2.3	Age Structure	6-166
6.13	TRAFFIC	6-169
6.13.1	Segment 1: Kelantan	6-169
6.13.2	Segment 2 : Selangor	6-171
6.14	WASTE	6-179
6.14.1	Segment 1: Kelantan	6-179
6.14.2	Segment 2 : Selangor	6-180
SECTION 7 : EVALUATION OF IMPACTS		7-1
7.1	INTRODUCTION	7-1
7.2	SENSITIVE RECEPTORS	7-2
7.3	IMPACTS DURING PRE-CONSTRUCTION STAGE	7-4
7.3.1	Potential Significant Impacts during Pre-Construction	7-4
7.3.2	Land Acquisition	7-5
7.3.2.1	Worries over Compensation and Payment	7-6
7.3.2.2	Loss of Homes and Shelter	7-7
7.3.2.3	Relocation and Resettlement	7-8
7.3.2.4	Losses of Livelihood and Income	7-8
7.3.2.5	Forced Out-Migration and Breakdown of Social Cohesion	7-9
7.3.2.6	Loss in Aesthetics, Cultural and Traditional Characteristics of Rural Landscape	7-9
7.3.3	Severances of Settlements	7-10
7.3.3.1	Disruptions of Social, Cultural and Religious Ties and Relationships	7-10
7.3.4	Utilities Relocation	7-11
7.4	IMPACTS DURING CONSTRUCTION STAGE	7-12
7.4.1	Soil Erosion and Sedimentation	7-12
7.4.1.1	Overview of Soil Erosion Risk along the Alignment	7-13
7.4.1.2	Overview of Soil Erosion and Sedimentation Impacts Along the Alignment	7-15
7.4.1.3	Soil erosion and sedimentation impacts assessment at hotspots	7-16
7.4.1.4	Segment 1: Kelantan	7-23
7.4.1.5	Segment 2: Selangor	7-28
7.4.1.6	Summary of soil erosion risk assessment at hotspots location	7-46
7.4.1.7	Prediction of TSS Concentration in the Rivers	7-48

7.4.2	Water Pollution	7-61
7.4.3	Air Pollution	7-67
7.4.3.1	Segment 1: Kelantan	7-79
7.4.3.2	Segment 2: Selangor	7-79
7.4.3.3	Summary	7-79
7.4.4	Noise	7-80
7.4.4.1	Segment 1 : Kelantan	7-82
7.4.4.2	Segment 2 : Selangor	7-86
7.4.5	Vibration	7-95
7.4.5.1	Segment 1 : Kelantan	7-98
7.4.5.2	Segment 2 : Selangor	7-99
7.4.6	Waste Management	7-100
7.4.6.1	Methodology	7-101
7.4.6.2	Results and Discussion	7-107
7.4.7	Flooding	7-110
7.4.7.1	Segment 1 : Kelantan	7-112
7.4.7.2	Segment 2 : Selangor	7-114
7.4.8	Impacts on Irrigation Systems	7-115
7.4.8.1	Segment 1 : Kelantan	7-115
7.4.8.2	Segment 2 : Selangor	7-116
7.4.9	Geotechnical and Geological Risks	7-116
7.4.9.1	Segment 1 : Kelantan	7-117
7.4.9.2	Segment 2 : Selangor	7-123
7.4.10	Ecology	7-132
7.4.10.1	Segment 1 : Kelantan	7-135
7.4.10.2	Segment 2 : Selangor	7-136
7.4.11	Socio-Economy	7-143
7.4.11.1	Potential Positive Impacts During Construction	7-143
7.4.11.2	Potential Negative Impacts During Construction	7-144
7.4.12	Traffic	7-148
7.4.12.1	Segment 1 : Kelantan	7-149
7.4.12.2	Segment 2 : Selangor	7-149
7.4.13	Hazards & Public Safety	7-154
7.4.13.1	Methodology	7-154
7.4.13.2	Segment 1: Kelantan	7-162
7.4.13.3	Segment 2 : Selangor	7-163
7.4.13.4	Summary	7-163
7.5	IMPACTS DURING OPERATION STAGE	7-165
7.5.1	Water Pollution	7-166
7.5.1.1	Effluent from Sewage Treatment Systems	7-166
7.5.1.1.1	Prediction of BOD, COD and AN concentration in the river	7-168
7.5.1.2	Wastewater from Maintenance Bases	7-181

7.5.1.3	Spillage	7-183
7.5.1.4	Track Drainage	7-183
7.5.1.5	Segment 1: Kelantan	7-185
7.5.1.6	Segment 2 : Selangor	7-186
7.5.2	Air Pollution & Greenhouse Gas Emission	7-189
7.5.2.1	Air Quality	7-189
7.5.2.2	Greenhouse Gas Avoidance	7-189
7.5.3	Noise	7-197
7.5.3.1	Approach and Methodology	7-197
7.5.3.2	Segment 1: Kelantan	7-221
7.5.3.3	Segment 2: Selangor	7-227
7.5.4	Vibration	7-240
7.5.4.1	Segment 1 : Kelantan	7-250
7.5.4.2	Segment 2 : Selangor	7-251
7.5.5	Waste Management	7-253
7.5.5.1	Methodology	7-253
7.5.5.2	Results and Discussion	7-257
7.5.6	Flooding	7-258
7.5.6.1	Segment 1 : Kelantan	7-258
7.5.6.2	Segment 2 : Selangor	7-259
7.5.7	Irrigation	7-259
7.5.8	Geotechnical & Geological Risks	7-259
7.5.8.1	Segment 1 : Kelantan	7-259
7.5.8.2	Segment 2 : Selangor	7-260
7.5.9	Ecology	7-263
7.5.9.1	Segment 1 : Kelantan	7-264
7.5.9.2	Segment 2 : Selangor	7-264
7.5.10	Socio-Economy	7-267
7.5.10.1	Potential Negative Impacts During Operational Stage	7-267
7.5.10.2	Potential Positive Impacts During Operational Stage	7-268
7.5.11	Traffic	7-274
7.5.11.1	Segment 1 : Kelantan	7-275
7.5.11.2	Segment 2 : Selangor	7-275
7.5.12	Hazards & Public Safety	7-279
7.5.12.1	Hazard and Risk Identification	7-279
7.5.12.2	Transportation of Goods	7-280

SECTION 8 : MITIGATION MEASURES

8-1

8.1	INTRODUCTION	8-1
8.2	MITIGATION MEASURES DURING PRE-CONSTRUCTION STAGE	8-1
8.2.1	Land Acquisition	8-1

8.2.1.1	Communications Strategy	8-3
8.2.1.2	Reviewing and Readjustment of Preferred Alignment	8-4
8.2.1.3	Appropriate Compensation and Timely Payment	8-5
8.2.1.4	Relocation and Resettlement Scheme	8-5
8.2.1.5	Land Arrangement Schemes and Arbitration	8-6
8.2.2	Utilities Relocation	8-7
8.3	MITIGATION MEASURES DURING CONSTRUCTION STAGE	8-8
8.3.1	Soil Erosion & Sedimentation	8-8
8.3.1.1	General LD-P2M2 Along the Alignment	8-8
8.3.1.2	LDP2M2 at Soil Erosion Hotspots	8-18
8.3.1.3	Segment 1: Kelantan	8-21
8.3.1.4	Segment 2: Selangor	8-24
	PLEDGE FOR LD-P2M2 ISSUES	8-41
8.3.2	Water Pollution	8-41
8.3.2.1	Sewage & Sullage Management	8-42
8.3.2.2	Wastewater from Tunnelling Works & Batching Plant	8-43
8.3.2.1	Storage & Handling of Petroleum Products & Wastes	8-46
8.3.2.2	Scheduled Waste	8-48
	PLEDGE FOR WATER POLLUTION ISSUES	8-48
8.3.3	Air Quality	8-49
8.3.4	Noise	8-51
8.3.4.1	Management Measures for Noise	8-51
8.3.5	Vibration	8-55
8.3.5.1	Management Measures for Vibration	8-55
8.3.6	Sustainable Waste Management	8-58
8.3.6.1	Management Measures for Waste	8-58
8.3.6.2	Waste Management & Disposal	8-64
	PLEDGE FOR WASTE ISSUES	8-68
8.3.7	Geotechnical & Geological Risks	8-68
8.3.7.1	Segment 1: Kelantan	8-69
8.3.7.2	Segment 2: Selangor	8-72
	PLEDGE FOR GEOTECHNICAL & GEOLOGICAL RISKS	8-80
8.3.8	Flooding	8-81
8.3.8.1	Elevated Viaducts	8-81
8.3.8.2	Cross Culverts and Balancing Culverts	8-82
8.3.8.3	River Crossing Structures	8-87
8.3.8.4	On Site Detention	8-87
8.3.8.5	Temporary Drains	8-87
8.3.8.6	Stream Crossings	8-87
8.3.8.7	Stream Diversion and Realignment	8-89
8.3.8.8	Housekeeping	8-89
8.3.9	Irrigation infrastructure	8-90

PLEDGE FOR FLOODING/DRAINAGE ISSUES	8-90
8.3.10 Ecology	8-91
8.3.10.1 Overview of Proposed Ecological Mitigation Measures	8-91
8.3.10.2 Segment 1 : Kelantan	8-95
8.3.10.3 Segment 2 : Selangor	8-95
8.3.11 Socio-Economy	8-101
8.3.11.1 Maintaining Communications Strategy	8-101
8.3.11.2 Dilapidation Survey	8-102
8.3.11.3 Construction Management Plan	8-102
8.3.11.4 Environmental Management Plan	8-103
8.3.11.5 Traffic Management Plan	8-103
8.3.11.6 Centralised Labour Camps	8-104
8.3.11.7 Public Health Management Plan	8-104
8.3.11.8 Local Youth Training Programme and Placement Scheme	8-104
8.3.12 Traffic	8-105
8.3.12.1 Mitigation Strategies to Minimize Traffic Congestion	8-106
8.3.12.2 Specific Mitigation Measures for Stations	8-107
8.3.13 Hazard Control & Public Safety	8-107
8.3.13.1 Safety Measures	8-107
8.3.13.2 Emergency Response Plan Framework	8-110
8.4 MITIGATION MEASURES DURING OPERATION STAGE	8-114
8.4.1 Water Pollution	8-114
8.4.1.1 Sewage Treatment	8-114
8.4.1.2 Sludge Management	8-115
8.4.1.3 Sullage Treatment	8-116
8.4.1.4 Oil Interceptor	8-119
8.4.1.5 Storage of Oil & Petroleum Products	8-119
8.4.1.6 Spillage	8-120
8.4.1.7 Track Drainage	8-120
PLEDGE FOR WATER POLLUTION ISSUES	8-121
8.4.2 Air Pollution & Greenhouse Gas Emission	8-121
8.4.3 Noise	8-122
8.4.3.1 Management Measures for Noise	8-122
8.4.3.2 Noise Barrier Design	8-127
8.4.3.3 Noise Barrier Locations	8-130
8.4.4 Vibration Mitigation Measures	8-132
8.4.4.1 Track	8-132
8.4.4.2 Vibration Mitigation Locations	8-135
8.4.5 Waste Management	8-136
8.4.5.1 Solid Waste Management	8-136
8.4.5.2 Scheduled Waste Management	8-137
PLEDGE FOR WASTE ISSUES	8-138

8.4.6	Geotechnical & Geology	8-139
8.4.6.1	Segment 1: Kelantan	8-139
8.4.6.2	Segment 2: Selangor	8-139
8.4.7	Flooding & Irrigation	8-141
8.4.8	Ecology	8-142
8.4.8.1	Overview of Ecological Mitigation Measures	8-142
8.4.9	Socio-Economy	8-145
8.4.9.1	Maintaining Communications Strategy	8-145
8.4.9.2	Safety and Security Measures	8-146
8.4.9.3	Monitoring Programme	8-146
8.4.9.4	Traffic Management Plan	8-147
8.4.10	Traffic	8-148
8.4.11	Hazard Control & Public Safety	8-149
8.4.11.1	Safety Measures	8-149
8.4.11.2	Emergency Response Plan Framework	8-153
8.4.12	Project Abandonment	8-154
	PLEDGE FOR RISK & PUBLIC SAFETY	8-157

SECTION 9 : ENVIRONMENTAL MANAGEMENT PLAN 9-1

9.1	INTRODUCTION	9-1
9.2	ORGANIZATION STRUCTURE	9-2
9.2.1	Key Parties	9-2
9.2.2	Health, Safety, Security and Environmental Department	9-4
9.3	P2M2 DURING CONSTRUCTION	9-5
9.4	REPORTING	9-6
9.4.1	Reporting to Department of Environment	9-6
9.5	EXTERNAL COMMUNICATIONS	9-6
9.6	MONITORING PROGRAMME	9-7
9.6.1	Performance Monitoring	9-8
9.6.2	Compliance Monitoring	9-8
9.6.2.1	Water Quality Monitoring	9-8
9.6.3	Impact Monitoring	9-8
9.6.3.1	Water Quality	9-8
9.6.3.2	Air Quality	9-9
9.6.3.3	Noise and Vibration	9-9
9.6.3.4	Wildlife	9-9
9.7	ENVIRONMENTAL AUDITING	9-9
9.8	ENVIRONMENTAL MAINSTREAMING AND GUIDED SELF-REGULATION	9-10
9.8.1	Environmental Policy (EP)	9-10
9.8.2	Environmental Budgeting (EB)	9-10

9.8.3	Environmental Monitoring Committee (EMC)	9-11
9.8.4	Environmental Facility (EF)	9-11
9.8.5	Environmental Competency (EC)	9-11
9.8.6	Environmental Reporting and Communication (ERC)	9-11
9.8.6.1	Internal Reporting	9-11
9.8.6.2	Environmental Performance Monitoring Document	9-12
9.8.6.3	Performance Monitoring Report	9-12
9.8.7	Environmental Transparency (ET)	9-12
9.8.8	Environmental Mainstreaming Tools Compliance Report	9-12

SECTION 10 : CONCLUSIONS **10-1**

10.1	ECRL – A VITAL NATIONAL INFRASTRUCTURE	10-1
10.2	PROJECT PLANNING	10-1
10.3	POTENTIAL SIGNIFICANT IMPACTS AND MITIGATION MEASURES	10-2
10.4	CONCLUSIONS	10-6

LIST OF APPENDICES

Appendix A	References
Appendix B	Soil Investigation Report
Appendix C	Laboratory Analysis Report
Appendix D	Flora and Wildlife Survey Data
Appendix E	Consultation with Government Agencies
Appendix F	Perception Survey and Stakeholder Engagement
Appendix G	Noise Plots
Appendix H	Soil Erosion Risk Assessment and LDP2M2
Appendix I	Sewage Treatment Facilities – Design and Drawings
Appendix J	QUAL2K

LIST OF ABBREVIATIONS

AKSB	Air Kelantan Sdn. Bhd
APG	Automatic Platform Gates
APHA	American Public Health Association
ASR	Air Sensitive Receptors
ATP	Automatic Train Protection
ATS	Active Treatment System
BAKU	Bekalan Air Kelantan Utara
BLS	Barat Laut Selangor
BMP	Best Management Practices
BOD	Biological Oxygen Demand
BRT	Bus Rapid Transit
CADNA	Computer Aided Noise Abatement
CFS	Central Forest Spine
CIQ	Customs, Immigration and Quarantine
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CM	Compliance Monitoring
CO	Carbon Monoxide
COC	Chain of Custody
COD	Chemical Oxygen Demand
CPESC	Certified Professional in Erosion and Sediment Control
CTC	Centralised Traffic Control
DOE	Department of Environment
DOF	Department of Fisheries
DOSH	Department of Occupational Safety and Health
DOSM	Department of Statistics, Malaysia
DWNP	Department of Wildlife and National Parks
EB	Environmental Budgeting
ECER	East Coast Economic Region
ECO	Electrical Control Operator
ECO	Environmental Competency
ECO	Environmental Competency
ECRL	East Coast Rail Link
EF	Environmental Facility
EIA	Environmental Impact Assessment
EMC	Electromagnetic Compatibility
EMC	Environmental Monitoring Committee
EMP	Environmental Management Plan
EMP	Environmental Management Plan
EMU	Electric Multiple Unit
EN	Endangered

EP	Environmental Policy
EPMC	Environmental Performance Monitoring Committee
EPMD	Environmental Performance Monitoring Document
EPU	Economic Planning Unit
ERC	Environmental Reporting and Communication
ERP	Emergency Response Plan
ESA	Environmentally Sensitive Areas
ESC	Erosion and Sediment Control
ESI	Environmental Scoping Information
ET	Environmental Transparency
ETS	Electric Train Services
FR	Federal Route
FRIM	Forest Research Institute Malaysia
FTA	Federal Transit Administration
GHG	Green House Gas
GPT	Gross Pollutant Traps
HCVF	High Conservation Value Forests
HIRARC	Hazard Identification, Risk Assessment and Risk Control
HORAS	Hybrid Off-River Augmentation System
HSSE	Health, Safety, Security and Environmental
HWC	Human Wildlife Conflict
IADA	Integrated Agriculture Development Area
IAQM	Institute of Air Quality Management
IM	Impact Monitoring
IUCN	International Union for Conservation of Nature
IWK	Indah Water Konsortium
JKKK	Jawatankuasa Kemajuan dan Keselamatan Kampung
JMG	Jabatan Mineral dan Geosains Malaysia
JPS	Jabatan Pengairan dan Saliran
KADA	Kemubu Agricultural Development Authority
KSAS	Kawasan Sensitif Alam Sekitar
KTMB	Keretapi Tanah Melayu Berhad
LD-P2M2	Land-disturbing pollution prevention and mitigation measures
LOS	Level of Service
LRA	Loji Rawatan Air
LRT	Light Rail Transit
LUAS	Lembaga Urus Air Selangor
MAAQS	Malaysian Ambient Air Quality Standards
MDF	Medium Density Fibre
MDHS	Majlis Daerah Hulu Selangor
MDK	Majlis Daerah Ketereh
MDKS	Majlis Daerah Kuala Selangor

MDPM	Majlis Daerah Pasir Mas
MDT	Majlis Daerah Tumpat
MENGO	Malaysian Environmental NGOs
MGB	Mobile Garbage Bin
MGR	Meter Gauge Railway
MLD	Millions of Liters Per Day
MNS	Malaysian Nature Society
MPK	Majlis Perbandaran Klang
MPS	Majlis Perbandaran Selayang
MRL	Malaysia Rail Link Sdn Bhd
MRT	Mass Rapid Transit
MSMA	Manual Saliran Mesra Alam
MTPA	Metric tonnes per annum
MUSLE	Modified Universal Soil Loss Equation
NATM	New Austrian Tunnelling Method
NFPA	National Fire Protection Agency
NH3-N	Ammoniacal Nitrogen
NLPTMP	National Land Public Transport Master Plan
NNKSB	New North Klang Straits Bypass
NO2	Nitrite
NO2	Nitrogen Dioxide
NO3	Nitrate
NPP	National Physical Plan
NSE	North South Expressway
NTCAP	National Tiger Conservation Action Plan
NWQS	National Water Quality Standards
O&G	Oil and grease
O3	Ozone
OCC	Operation Control Centre
OCS	Overhead Catenary System
OSD	On site detention
OSHA	Occupational Safety and Health Act
PE	Population Equivalent
PEKA	Pertubuhan Pelindung Khazanah Alam Malaysia
PGA	Peak Ground Acceleration
PIPANS	Pelan Induk Pengangkutan Awam Negeri Selangor
PM	Performance Monitoring
PM10	Particulate Matter less than 10 microns
PM2.5	Particulate Matter less than 2.5 microns
PMR	Performance Monitoring Report
PRF	Permanent Reserved Forests
PSCADA	Power Supervisory Control and Data Acquisition

RCD	Reversed Circulation Drilling
RORO	Roll-On Roll-Off
ROW	Right Of Way
RSN	Rancangan Struktur Negeri
RSNK	Rancangan Struktur Negeri Kelantan
RTB	Rancangan Tebatan Banjir
RUSLE	Revised Universal Soil Loss Equation
SGR	Standard Gauge Railway
SMA	Saliran Mesra Alam
SO ₂	Sulphur Dioxide
SPAD	Suruhanjaya Pengangkutan Awam Darat
SPAN	Suruhanjaya Perkhidmatan Air Negara
SPT	Standard Penetration Tests
SSP	Sg. Selangor Phase
SSTS	Small Sewage Treatment Systems
STP	Sewage Treatment Plant
STS	Sewage Treatment System
SW	Scheduled Waste
TMP	Traffic Management Plan
TNB	Tenaga Nasional Berhad
TOD	Transit Oriented Development
TOR	Terms of Reference
TPSS	Traction Power Substation
TrEES	Treat Every Environment Special
TSS	Total Suspended Solids
UPS	Uninterruptible Power Supply
USEPA	United States Environmental Protection Agency
VU	Vulnerable
WCE	West Coast Expressway
WGR	Waste Generation Rate
WMP	Wildlife Management Plan
WQI	Water Quality Index
WWF	World Wildlife Fund
WWTS	Waste Water Treatment System
ZOI	Zone Of Impact

LIST OF FIGURES

Figure 1.1-1	Overview of ECRL Phase 2 Alignment	1-9
Figure 1.5-1	East Coast Rail Corridor in Integrated National Transport Network in NPP1	1-10
Figure 1.5-2	East Coast Rail Corridor in Integrated National Transport Network in NPP2	1-11
Figure 1.5-3	East Coast Rail Corridor in Proposed Railway for Peninsular Malaysia in NPP3	1-12
Figure 1.5-4	Proposed Rail Networks in State Structure Plans	1-13
Figure 1.5-5	Proposed Public Transport Network in Selangor	1-14
Figure 1.5-6	Selangor Public Transport Master Plan	1-15
Figure 1.5-7	Potential Rail Network in ECER Master Plan	1-16
Figure 5.2-1a	Segment 1 : Kelantan	5-43
Figure 5.2-1b	Segment 1 : Kelantan	5-44
Figure 5.2-1c	Segment 1 : Kelantan	5-45
Figure 5.2-2a	Segment 2A : Gombak - Serendah	5-46
Figure 5.2-2b	Segment 2A : Gombak - Serendah	5-47
Figure 5.2-2c	Segment 2B : Serendah – Bandar Puncak Alam	5-48
Figure 5.2-2d	Segment 2B : Serendah – Bandar Puncak Alam	5-49
Figure 5.2-2e	Segment 2C : Bandar Puncak Alam – Port Klang	5-50
Figure 5.2-2f	Segment 2C : Bandar Puncak Alam – Port Klang	5-51
Figure 5.3-1	At-Grade Platform Station	5-52
Figure 6.2-1	Elevation Along the Alignment (Kelantan)	6-185
Figure 6.2-2	Slope Along the Alignment (Kelantan)	6-186
Figure 6.2-3a	Elevation Along the Alignment (Segment 2A) : Gombak North – Serendah	6-187
Figure 6.2-3b	Elevation Along the Alignment (Segment 2B) : Serendah – Bandar Puncak Alam	6-188
Figure 6.2-3c	Elevation Along the Alignment (Segment 2C) : Bandar Puncak Alam – Port Klang	6-189
Figure 6.2-4a	Slope Along the Alignment (Segment 2A) : Gombak North – Serendah	6-190
Figure 6.2-4b	Slope Along the Alignment (Segment 2B) : Serendah – Bandar Puncak Alam	6-191
Figure 6.2-4c	Slope Along the Alignment (Segment 2C) : Bandar Puncak Alam – Port Klang	6-192
Figure 6.4-1	Climate Condition in Project Areas	6-193
Figure 6.4-2	Kota Bharu and Petaling Jaya Wind Rose Profile	6-194
Figure 6.4-3	Kota Bharu Seasonal Wind Rose Profile (1985 – 2016)	6-195

Figure 6.4-4	Petaling Jaya Seasonal Wind Rose Profile (1969 – 2016)	6-196
Figure 6.5-1	Existing Land Use Along the Alignment (Kelantan)	6-197
Figure 6.5-2	Future Land Use Along the Alignment (Kelantan)	6-198
Figure 6.5-3a	Existing Land Use Along the Alignment (Selangor)	6-199
Figure 6.5-3b	Existing Land Use Along the Alignment (Selangor)	6-200
Figure 6.5-3c	Existing Land Use Along the Alignment (Selangor)	6-201
Figure 6.5-4a	Future Land Use Along the Alignment (Selangor)	6-202
Figure 6.5-4b	Future Land Use Along the Alignment (Selangor)	6-203
Figure 6.5-4c	Future Land Use Along the Alignment (Selangor)	6-204
Figure 6.6-1	River Crossings along Segment 1 : Kelantan	6-205
Figure 6.6-2a	River Crossings along Segment 2A: Gombak North-Serendah	6-206
Figure 6.6-2b	River Crossings along Segment 2A: Gombak North-Serendah	6-207
Figure 6.6-2c	River Crossings along Segment 2B: Serendah – Bandar Puncak Alam	6-208
Figure 6.6-2d	River Crossings along Segment 2B: Serendah – Bandar Puncak Alam	6-209
Figure 6.6-2e	River Crossings along Segment 2C: Bandar Puncak Alam – Port Klang	6-210
Figure 6.6-2f	River Crossings along Segment 2C: Bandar Puncak Alam – Port Klang	6-211
Figure 6.6-3	Flood Prone Areas Along the Allignment in Kelantan	6-212
Figure 6.6-4	Flood Prone Areas Along the Allignment in Selangor	6-213
Figure 6.7-1a	Baseline Sampling Stations in Kelantan	6-214
Figure 6.7-1b	Baseline Sampling Stations in Kelantan	6-215
Figure 6.7-1c	Baseline Sampling Stations in Kelantan	6-216
Figure 6.7-2a	Baseline Sampling Stations in Selangor	6-217
Figure 6.7-2b	Baseline Sampling Stations in Selangor	6-218
Figure 6.7-2c	Baseline Sampling Stations in Selangor	6-219
Figure 6.7-2d	Baseline Sampling Stations in Selangor	6-220
Figure 6.7-2e	Baseline Sampling Stations in Selangor	6-221
Figure 6.7-2f	Baseline Sampling Stations in Selangor	6-222
Figure 6.7-3	Water Supply Intakes in Kelantan	6-223
Figure 6.7-4a	Water Supply Intake at Sg. Batu	6-224
Figure 6.7-4b	Water Supply Intakes at Sg. Selangor	6-225
Figure 6.7-5	Location of Fisheries and Aquaculture Activities (Kelantan)	6-226
Figure 6.7-6	Location of Fisheries and Aquaculture Activities (Selangor)	6-227
Figure 6.7-7	Irrigation Schemes in Segment 1: Kelantan	6-228
Figure 6.7-8	Location of Recreational Areas (Selangor)	6-229
Figure 6.11-1	Ecological Areas Along the Allignment in Kelantan	6-230
Figure 6.11-2	Ecological Areas Along the Allignment in Selangor	6-231
Figure 6.11-2a	Ecological Areas Along the Allignment (Segment 2A) : Gombak North – Serendah	6-232

Figure 6.11-2b	Ecological Areas Along the Allignment (Segment 2B) : Serendah – Bandar Puncak Alam	6-233
Figure 6.11-2b	Ecological Areas Along the Allignment (Segment 2C) : Bandar Puncak Alam – Port Klang	6-234
Figure 6.11-3	CFS Corridor Near the Allignment in Selangor	6-235
Figure 6.11-4	Type of Forest in Permanent Reserved Forests in Selangor	6-236
Figure 6.11-5	Selangor Forest Resource Plan	6-237
Figure 6.14-1	Location of Existing Landfills (Kelantan)	6-238
Figure 6.14-2	Location of Existing Landfills (Selangor)	6-239
Figure 7.1-1	EIA Matrix for the Pre-Construction Stage	7-285
Figure 7.1-2	EIA Matrix for the Construction Stage	7-286
Figure 7.1-3	EIA Matrix for the Operational Stage	7-287
Figure 7.4.1-1	Existing Soil Erosion Risk and Hotspot Locations: Segment 1 (Kelantan)	7-288
Figure 7.4.1-2	Existing Soil Erosion Risk and Hotspot Locations : Segment 2 (Selangor)	7-289
Figure 7.4.1-3	Soil Erosion Risk Assessment at Hotspot S1	7-290
Figure 7.4.1-4	Soil Erosion Risk Assessment at Hotspot S2	7-291
Figure 7.4.1-5	Soil Erosion Risk Assessment at Hotspot S3	7-292
Figure 7.4.1-6	Soil Erosion Risk Assessment at Hotspot S4	7-293
Figure 7.4.1-7	Soil Erosion Risk Assessment at Hotspot S5	7-294
Figure 7.4.1-8a	Soil Erosion Risk Assessment at Hotspot S6	7-295
Figure 7.4.1-8b	Soil Erosion Risk Assessment at Hotspot S6	7-296
Figure 7.4.1-9a	Soil Erosion Risk Assessment at Hotspot S7	7-297
Figure 7.4.1-9b	Soil Erosion Risk Assessment at Hotspot S7	7-298
Figure 7.4.1-10a	Soil Erosion Risk Assessment at Hotspot S8	7-299
Figure 7.4.1-10b	Soil Erosion Risk Assessment at Hotspot S8	7-300
Figure 7.4.1-11a	Soil Erosion Risk Assessment at Hotspot S9	7-301
Figure 7.4.1-11b	Soil Erosion Risk Assessment at Hotspot S9	7-302
Figure 7.4.1-12	Soil Erosion Risk Assessment at Hotspot S10	7-303
Figure 7.4.1-13a	Soil Erosion Risk Assessment at Hotspot S11	7-304
Figure 7.4.1-13b	Soil Erosion Risk Assessment at Hotspot S11	7-305
Figure 7.4.1-14a	Soil Erosion Risk Assessment at Hotspot S12	7-306
Figure 7.4.1-14b	Soil Erosion Risk Assessment at Hotspot S12	7-307
Figure 7.4.1-15	Soil Erosion Risk Assessment at Hotspot S13	7-308
Figure 7.4.1-16a	Soil Erosion Risk Assessment at Hotspot S14	7-309
Figure 7.4.1-16b	Soil Erosion Risk Assessment at Hotspot S14	7-310
Figure 7.4.1-17	Soil Erosion Risk Assessment at Hotspot S15	7-311
Figure 7.4.1-18	Soil Erosion Risk Assessment at Hotspot S16	7-312
Figure 7.4.1-19	Soil Erosion Risk Assessment at Hotspot S17	7-313
Figure 7.4.1-20	Soil Erosion Risk Assessment at Hotspot S18	7-314

Figure 7.4.1-21	Soil Erosion Risk Assessment at Hotspot S19	7-315
Figure 7.4.1-22	Soil Erosion Risk Assessment at Hotspot S20	7-316
Figure 7.4.1-23	Soil Erosion Risk Assessment at Hotspot S21	7-317
Figure 7.4.2-1	Water Pollution Hotspots in Kelantan	7-318
Figure 7.4.2-2	Water Pollution Hotspots in Selangor	7-319
Figure 7.4.3-1	Potential Dust Emission Hotspots in Kelantan	7-320
Figure 7.4.3-2	Potential Dust Emission Hotspots in Selangor	7-321
Figure 7.4.3-3	Potential Dust Emission Hotspots in Selangor	7-322
Figure 7.4.3-4	Potential Dust Emission Hotspots in Selangor	7-323
Figure 7.4.7-1	Flood Hotspots in Kelantan	7-324
Figure 7.4.7-2	Flood Hotspots in Selangor	7-325
Figure 7.4.10-1	Potential Ecological Impacts in Selangor	7-326
Figure 8.3.1-1a	LDP2M2 of S1 (Station: Wakaf Bharu)	8-159
Figure 8.3.1-1b	LDP2M2 of S1 (Station: Wakaf Bharu)	8-160
Figure 8.3.1-2	LDP2M2 of S2 (Viaduct: Sg Peng Nangka)	8-161
Figure 8.3.1-3	LDP2M2 of S3 (Viaduct: Sg Mentua)	8-162
Figure 8.3.1-4a	LDP2M2 of S4 (Station: Pengkalan Kubor)	8-163
Figure 8.3.1-4b	LDP2M2 of S4 (Station: Pengkalan Kubor)	8-164
Figure 8.3.1-5	LDP2M2 of S5 (Viaduct: Kg Batu 12)	8-165
Figure 8.3.1-6	LDP2M2 of S6,S7,S8 (Tunnel Portal: Kg Batu 11, Desa Makmur, Kg Sg salak)	8-166
Figure 8.3.1-7	LDP2M2 of S9,S10 (Tunnel Portal: Taman Bukit, Viaduct: Taman Jasa Utama)	8-167
Figure 8.3.1-8	LDP2M2 of S11,S12 (Tunnel Portal: Templer Park Forest Reserve and Serendah Forest Reserve)	8-168
Figure 8.3.1-9	LDP2M2 of S13 (Station: Serendah)	8-169
Figure 8.3.1-10	LDP2M2 of S14,S15 (Tunnel Portal: Sg Buaya, Viaduct: Sg Garing)	8-170
Figure 8.3.1-11	LDP2M2 of S16 (Viaduct: Sg Kundang)	8-171
Figure 8.3.1-12	LDP2M2 of S17 (Cut Section: Rantau Panjang Forest Reserve)	8-172
Figure 8.3.1-13	LDP2M2 of S18 (Viaduct: Sg Puloh)	8-173
Figure 8.3.1-14	LDP2M2 of S19,S20 (At grade section: Kg Delek, Kg Sireh)	8-174
Figure 8.3.1-15	LDP2M2 of S21 (Station: Jalan Kastam)	8-175
Figure 8.3.1-16	Details of Sediment Basin	8-176
Figure 8.3.1-17	Sediment Basin Sizing and Dimension Table	8-177
Figure 8.3.1-18	Details of temporary earth drains, pipe culvert and silt fence	8-178
Figure 8.3.1-19	Details of typical cut section with turfing, berm drain, toe drain, interceptor drain and cascade drain	8-179
Figure 8.3.1-20	Details of wash trough	8-180
Figure 8.3.8-1a	RC Detention Storage Tank	8-181
Figure 8.3.8-1b	OSD (Section and Beam Details)	8-182

Figure 8.3.8-1c	OSD (Slab Key Plan)	8-183
Figure 8.3.10-1	Ecological Mitigation Measures in Selangor	8-184
Figure 8.4.1-1	Details of Oil Interceptor (Depot, Yard and Maintenance Yard)	8-185

LIST OF TABLES

Table 1 1 :	Length of Alignment	1-2
Table 1 2 :	Location of Stations	1-2
Table 2 1 :	Terms of Reference Compliance Checklist	2-2
Table 2-2:	Planning Guidelines for ECRL Phase 2	2-17
Table 2-3:	Approximate Alignment Structural Components	2-18
Table 2-4:	Summary of Proposed Stations and Station Configuration	2-18
Table 2-5:	Principal Project Activities	2-19
Table 2-6:	Potential Impacts and Anticipated Magnitude of Impacts	2-20
Table 2 7 :	Potential Impacts and Assessment Methodologies	2-25
Table 4-1 :	Planning Guidelines for ECRL Phase 2	4-1
Table 4-2 :	Alignment Criteria for ECRL Phase 2	4-2
Table 4-3:	Kelantan Alignment Options Evaluation	4-4
Table 4-4:	Selangor Alignment Options	4-6
Table 5-1(a):	Description of Project Alignment in Kelantan	5-2
Table 5-1(b):	Description of Project Alignment in Selangor	5-2
Table 5-2(a):	Alignment Lengths According to District in Kelantan	5-3
Table 5-2(b):	Alignment Lengths According to District in Selangor	5-3
Table 5-3 :	ECRL Design Parameters	5-6
Table 5 4 :	ECRL Stations and Configuration	5-15
Table 5 5 :	ECRL Stations and Configuration	5-25
Table 5-6 :	Principal Project Activities	5-29
Table 5-7 :	Land Acquisition in Kelantan And Selangor	5-30
Table 5-8 :	Major Utilities within ECRL Phase 2 Corridor	5-30
Table 5-9 :	Station Footprint	5-36
Table 5-10 :	Operation Schedule	5-38
Table 5-11 :	ECRL Phase 2 Kelantan Passenger Journey Forecast	5-39
Table 5-12 :	ECRL Phase 2 Selangor Passenger Journey Forecast	5-39
Table 5-13 :	Standard Gauge Railway Freight Train Operation Plan (Train/day/direction)	5-40
Table 5-14 :	Meter Gauge Railway Freight Train Operation Plan	

(Train/day/direction)	5-40
Table 5-15 : Freight Traffic Forecast	5-41
Table 5 16 : Project Implementation Schedule	5-41
Table 6-1 : General geology along the proposed alignment	6-10
Table 6-2 : Summary of the boreholes along Segment 1	6-28
Table 6-3 : Summary of the boreholes along Segment 2	6-29
Table 6-3 : Summary of the boreholes along Segment 2 (Cont'd)	6-30
Table 6-4 : Current groundwater abstraction for water supply in Kelantan (data from AKSB)	6-35
Table 6-5 : Damages by earthquake based on Richter Scale	6-42
Table 6-6 : Existing Land Use Breakdown Along the Alignment by Local Authority (1 km corridor)	6-59
Table 6-7: Future Land Use Breakdown Along the Alignment by Local Authority (1 km Corridor)	6-60
Table 6-8 : Major Land Uses along the Alignment in Kelantan	6-61
Table 6-9 : Major Land Uses along the Alignment in Selangor	6-62
Table 6-10 : Rivers Catchment Areas along the Proposed Alignment	6-63
Table 6-11 : River Crossings along the Proposed Alignment in Kelantan	6-63
Table 6-12 : River Crossings along the Proposed Alignment from Gombak North to Serendah	6-64
Table 6-13 : River Crossings along the Proposed Alignment from Serendah to Bandar Puncak Alam	6-65
Table 6-14 : River Crossings along the Proposed Alignment from Bandar Puncak Alam to Port Klang	6-66
Table 6-15: Annual Rainfall	6-67
Table 6-16 : Summary of Flood Occurrence in Kelantan	6-69
Table 6-17 : List of Flood Mitigation Plans / Studies in Kelantan	6-70
Table 6-18 : Summary of Flood Occurrence in Selangor	6-73
Table 6-19 : List of Flood Mitigation Plans / Studies in Selangor	6-76
Table 6-20 : Water Quality Parameters and Analysis Methods	6-79
Table 6-21 : Location of Water Quality Monitoring Stations in Kelantan	6-80
Table 6-22 : Location of Water Quality Monitoring Stations from Gombak North to Serendah	6-81
Table 6-23 : Location of Water Quality Monitoring Stations from Serendah to Bandar Puncak Alam	6-81
Table 6-23: Location of Water Quality Monitoring Stations from Serendah to Bandar Puncak Alam (cont'd)	6-82
Table 6-24 : Location of Water Quality Monitoring Stations from Bandar Puncak Alam to Port Klang	6-82
Table 6-25 : Water Quality Analysis Results for the Kelantan Segment	6-87
Table 6-26 : Water Quality Analysis Results for the Gombak North to	

Serendah Segment	6-92
Table 6-27 : Water Quality Analysis Results for the Serendah to Bandar Puncak Alam Segment	6-95
Table 6-28 : Water Quality Analysis Results for the Serendah to Bandar Puncak Alam Segment	6-98
Table 6-29 : Water Intake Point Downstream of Proposed Alignment Segment 2A	6-99
Table 6-30: Water Intake Point Downstream of Proposed Alignment Segment 2B	6-100
Table 6-31 : Caged Freshwater Fish Breeders in Sg. Pengkalan Nangka	6-101
Table 6-32 : Caged Brackish Water Fish Breeders in Sg. Mentua	6-101
Table 6-33 : Fish Breeders in Segment 2A	6-102
Table 6-34 : Fish Breeders in Segment 2B	6-103
Table 6-35: Sub-scheme of Kemubu Irrigation Scheme	6-104
Table 6-36 : Air Quality Parameters and Monitoring Methods	6-107
Table 6-37 : Locations of Ambient Air Quality Monitoring Points	6-107
Table 6-38 : Baseline Ambient Air Quality Results	6-108
Table 6-39 : Noise Monitoring Locations	6-113
Table 6-40 : Noise Monitoring Locations	6-113
Table 6-41 : Noise Monitoring Locations	6-114
Table 6-42 : Noise Monitoring Locations	6-114
Table 6-43 : Summary of Measured Baseline Noise Levels in Kelantan	6-115
Table 6-44 : Summary of Measured Baseline Noise Levels in Segment 2A	6-116
Table 6-45 : Summary of Measured Baseline Noise Levels in Segment 2B	6-117
Table 6-46: Summary of Measured Baseline Noise Levels in Segment 2C	6-118
Table 6-47: Vibration Monitoring in Kelantan	6-119
Table 6-48: Vibration Monitoring in Segemnt 2A	6-120
Table 6-49 : Vibration Monitoring in Segemnt 2B	6-121
Table 6-50 : Vibration Monitoring in Segment 2C	6-121
Table 6-51 : Summary of Measured Vibration Levels in Kelantan	6-122
Table 6-52 : Summary of Measured Vibration Levels in Segment 2A	6-122
Table 6-53 : Summary of Measured Vibration Levels in Segment 2B	6-123
Table 6-54: Summary of Measured Vibration Levels in Segment 2C	6-123
Table 6-55 : Permanent Reserved Forests Near the Alignment from Gombak North to Serendah	6-127
Table 6-56 : State Land Forests Adjacent to the Alignment from Gombak North to Serendah	6-128
Table 6-57 : Permanent Reserved Forests Near the Alignment from Serendah to Bandar Puncak Alam	6-133
Table 6-58 : State Land Forests Near the Alignment from Serendah to Bandar Puncak Alam	6-133
Table 6-59 : State Land Forests near The Alignment from	6-140

Bandar Puncak Alam to Port Klang	6-140
Table 6-60 : List of recorded species in Sg. Puloh	6-141
Table 6 61: Wildlife survey locations in Selangor	6-146
Table 6 62 : List of wildlife recorded during wildlife survey (Gombak North to Serendah)	6-152
Table 6 63 : List of wildlife recorded during wildlife survey (Serendah to Bandar Puncak Alam)	6-157
Table 6 64 : List of birds observed at Sg. Puloh mangroves	6-158
Table 6-65 : Regional Key Socio-Economic Parameters	6-161
Table 6-66 : Population and Household Changes in ECRL Phase 2 Corridor, 2010-2016	6-163
Table 6-67 : Kelantan Segment-Age Composition, Mean and Median Age, Dependency Ratio by District	6-167
Table 6-68 : Selangor Segment-Age Composition, Mean and Median Age, Dependency Ratio by Mukim	6-168
Table 6-69 : Roads Adjacent to Proposed Stations	6-169
Table 6-71 : Road Performance in the Vicinity of Stations	6-177
Table 6-72 : Solid Waste Generation in Kelantan (Current)	6-179
Table 6-73 : Solid Waste Generation in Selangor (Current)	6-181
Table 6-74 : List of Active Landfills near the Alignment in Kelantan and Selangor	6-183
Table 7 1 : Potentially Affected Land	7-5
Table 7-2 : Summary of Impacts during Construction Stage	7-12
Table 7-3 : Soil Erosion Risk along Kelantan Segment	7-13
Table 7-4 : Soil Erosion Risk Severity along Gombak North-Serendah Segment	7-14
Table 7-5 : Soil Erosion Risk Severity along Serendah – Bandar Puncak Alam Segment	7-14
Table 7-6 : Soil Erosion Risk Severity along Bandar Puncak Alam – Port Klang Segment	7-14
Table 7-7 : Soil Erosion Risk Hotspots along the Alignment	7-17
Table 7-8 : Criteria for Soil Erosion Hotspot Identification	7-19
Table 7-9 : Soil Loss Tolerance Rates from Erosion Risk Map of Peninsular Malaysia	7-23
Table 7-10 : Soil Erosion and Sedimentation for S1	7-24
Table 7-11 : Soil Erosion and Sedimentation for S2	7-25
Table 7-12 : Soil Erosion and Sedimentation for S3	7-26
Table 7-13 : Soil Erosion and Sedimentation for S4	7-27
Table 7-14 : Soil Erosion and Sedimentation for S5	7-28
Table 7-15 : Soil Erosion and Sedimentation for S6	7-29
Table 7-16 : Soil Erosion and Sedimentation for S7	7-30
Table 7-17 : Soil Erosion and Sedimentation for S8	7-31

Table 7-18 : Soil Erosion and Sedimentation for S9	7-32
Table 7-19 : Soil Erosion and Sedimentation for S10	7-33
Table 7-20 : Soil Erosion and Sedimentation for S11	7-34
Table 7-21 : Soil Erosion and Sedimentation for S12	7-35
Table 7-22 : Soil Erosion and Sedimentation for S13	7-37
Table 7-23 : Soil Erosion and Sedimentation for S14	7-38
Table 7 24 : Soil Erosion and Sedimentation for S15	7-39
Table 7-25 : Soil Erosion and Sedimentation for S16	7-40
Table 7-26 : Soil Erosion and Sedimentation for S17	7-41
Table 7-27 : Soil Erosion and Sedimentation for S18	7-42
Table 7-28 : Soil Erosion and Sedimentation for S19	7-43
Table 7-29 : Soil Erosion and Sedimentation for S20	7-44
Table 7-30 : Soil Erosion and Sedimentation for S21	7-45
Table 7 31 : Summary of Soil Erosion Risk Class at Segment 1 Hotspots	7-46
Table 7 32 : Summary of Soil Erosion Risk Class at Segment 2A Hotspots	7-47
Table 7 33 : Summary of Soil Erosion Risk Class at Segment 2B Hotspots	7-48
Table 7 34 : Summary of Soil Erosion Risk Class at Segment 2C Hotspots	7-48
Table 7-35 : Potential Hotspots, Receptors and Rivers in Kelantan	7-51
Table 7-36 : Predicted Changes of Suspended Solids for Scenario 1	7-52
Table 7-37 : Predicted Changes of Suspended Solids for Scenario 2	7-53
Table 7-38 : Concentration of Suspended Solids required preserve baseline water quality status	7-53
Table 7-39 : Potential Hotspots, Receptors and Rivers in Segment 2A	7-55
Table 7-40 : Predicted Changes of Suspended Solids for Scenario 1 at Segment 2A	7-55
Table 7-41 : Predicted Changes of Suspended Solids for Scenario 2 at Segment 2A	7-56
Table 7-42 : Potential Hotspots, Receptors and Rivers in Segment 2B	7-57
Table 7-43 : Potential Hotspots, Receptors and Rivers in Segment 2C	7-59
Table 7-44 : Predicted Changes of Suspended Solids for Scenario 1 at Segment 2C	7-60
Table 7-45 : Predicted Changes of Suspended Solids for Scenario 2 at Segment 2C	7-61
Table 7-46 : Potential Sources of Water Pollution, Receptors and Impacts	7-65
Table 7-47 : Summary of the Air Sensitive Receptors (ASRs) Screening for Stations	7-68
Table 7 48: Summary of the Air Sensitive Receptors (ASRs) Screening for Railway Construction	7-68
Table 7-49 : Air Sensitive Receptors (ASRs) within 350 m from the Project Site	7-69
Table 7-50 : Summary of the Potential Dust Emission Magnitude (Step 2A)	7-70
Table 7-51 : General Matric to Evaluate the Sensitivity of Certain Area to Human Health Impacts	7-72

Table 7-52 : Reclassified 24-Hour PM10 Concentrations Range ($\mu\text{g}/\text{m}^3$) for Kelantan and Selangor	7-72
Table 7-53 : Summary of the 24-Hour PM10 Concentrations ($\mu\text{g}/\text{m}^3$) from 2009 to 2015 for Kelantan and Selangor	7-72
Table 7-54 : Summary of the Sensitivity of the Areas to Human Health Impacts (Step 2B)	7-75
Table 7-55 : Risk of Fugitive Dust Impacts during Earthworks (Step 2C)	7-77
Table 7 56 : Maximum Permissible Sound Level of Construction, Maintenance and Demolition Works By Receiving Land Use	7-81
Table 7 57 : Typical Sound Power Levels for Typical Construction Equipment	7-81
Table 7 58 : Limit for Damage Risk in Buildings from Short Term Vibration	7-96
Table 7-59 : Receptors most affected by construction in Kelantan	7-98
Table 7-60 : Receptors most affected by construction in Selangor Gombak to Serendah	7-99
Table 7-61 : Receptors most affected by construction in Selangor Serendah to Bandar Puncak Alam	7-100
Table 7-62 : Receptors most affected by construction in Selangor Bandar Puncak Alam to Port Klang	7-100
Table 7 63 : Category of Wastes	7-103
Table 7-64 : Estimated Waste Generation by Alignment Segments	7-107
Table 7-65 : Potential Impacts from Waste Generation	7-109
Table 7-66 : Potential Flood Hotspots in Kelantan Adjacent to the ECRL Phase 2	7-113
Table 7 67 : Permanent Reserved Forests affected between Gombak North to Serendah	7-136
Table 7-68 : State Land Forests affected between Gombak North to Serendah	7-136
Table 7 69 : Permanent Reserved Forests affected between Serendah to Bandar Puncak Alam	7-138
Table 7 70 : State Land Forests affected between Serendah to Bandar Puncak Alam	7-138
Table 7 71 : State Land Forests affected between Bandar Puncak Alam to Port Klang	7-141
Table 7 72 : Summary of Potential Ecological Impacts during Construction	7-142
Table 7-73 : Potential Social Impacts during Construction Stage	7-146
Table 7-74 : Critical Issues and Impacts for Railway Segments	7-151
Table 7-75 : Road Performance during Construction Stage	7-153
Table 7-76 : Hazard Identification	7-157
Table 7-77 : Likelihood and Severity Categories	7-161
Table 7-78 : Likelihood and Severity Score of Potential Hazard	7-162
Table 7-79 : Risk Ranking	7-162
Table 7-80 : Summary of Impacts during Operation Stage	7-165
Table 7-81 : Proposed types of sewage treatment system and the receiving waterways	7-167

Table 7-82 : Sewage Treatment System Design Capacity	7-171
Table 7-83 : Potential Hotspots, Receptors and Rivers in Kelantan	7-171
Table 7-84 : Predicted Changes in Receiving Stream after Treated Sewage Effluent Discharge at Standard B Limits	7-172
Table 7-85 : Predicted Concentration of BOD and AN at Locations of Sensitive Receptors Downstream	7-173
Table 7-86 : Predicted Changes in Receiving Stream after Treated Sewage Effluent Discharge at Standard B Limits during 7Q10 low flow conditions	7-174
Table 7-87 : Predicted Concentration of BOD and AN at Locations of Sensitive Receptors Downstream	7-175
Table 7-88 : Concentration of Treated Sewage Effluent required preserve baseline water quality status during 7Q10 low flow conditions	7-176
Table 7-89 : Potential Hotspots, Receptors and Rivers in Segment 2B	7-177
Table 7-90 : Predicted Changes in Receiving Stream after Treated Sewage Effluent Discharge at Standard B Limits	7-180
Table 7-91 : Predicted Changes in Receiving Stream after STP Effluent Discharge at Standard B Limits during low flow conditions	7-181
Table 7-92 : Travel time for pollutants from Serendah Station to Water Supply Intakes in Sg. Selangor	7-183
Table 7-93 : Potential Water Pollution Sources & Receptors in Kelantan	7-185
Table 7-94 : Potential Water Pollution Sources & Receptors in Selangor	7-186
Table 7-95 : Summary of Net CO ₂ e Emission Avoided for Passenger Train	7-192
Table 7-96 : Summary of Net CO ₂ e Emission Avoided for Freight Train	7-193
Table 7-97 : Summary of Cumulative Net CO ₂ e Emission Avoided from the Project Operation	7-195
Table 7-98 : Comparison of ECRL Phase 2 with Other Railways in Malaysia	7-195
Table 7-99 : Summary of Measured Trains Noise Levels for Existing KTM Electrified Double Tracking Operations	7-202
Table 7-100 : Summary of Project Design Specifications for Trains Emission Noise Levels	7-202
Table 7-101 : Summary of Trains Noise Emission Levels used in DEIA Noise Modelling	7-202
Table 7-102 : DOE Guidelines, Schedule 5 - Limiting Noise Level from Railways including Transits (for new development and re-alignments).	7-205
Table 7-103 : Human Perception to Change in Sound Level	7-205
Table 7-104 : Annoyance to Noise	7-206
Table 7-105 : Summary of Predicted Train Pass-By L _{max} Noise Levels in Kelantan	7-207
Table 7-106 : Summary of Predicted Train Pass-By L _{max} Noise Levels in Selangor : Gombak North to Serendah	7-209

Table 7-107 : Summary of Predicted Train Pass-By Lmax Noise Levels in Selangor Serendah to Bandar Puncak Alam	7-210
Table 7-108 : Summary of Predicted Train Pass-By Lmax Noise Levels in Selangor Bandar Puncak Alam to Port Klang	7-211
Table 7-109 : Summary of Predicted Steady State Equivalent Noise Levels in Kelantan	7-212
Table 7-110 : Summary of Predicted Steady State Equivalent Noise Levels in Selangor : Gombak North to Serendah	7-214
Table 7-111 : Summary of Predicted Steady State Equivalent Noise Levels in Selangor Serendah to Bandar Puncak Alam	7-215
Table 7-112 : Summary of Predicted Steady State Equivalent Noise Levels in Selangor Bandar Puncak Alam to Port Klang	7-217
Table 7-113 : Trains pass by Lmax noise levels for different distances	7-219
Table 7-114 : Reduction in noise levels	7-220
Table 7-115 : Summary of Predicted Noise Levels from Train Operations and Impact in Kelantan	7-221
Table 7-116 : Summary of Predicted Noise Levels from Train Operations and Impact In Selangor : Gombak North to Serendah	7-227
Table 7-117 : Summary of Predicted Noise Levels from Train Operations and Impact In Selangor : Serendah to Bandar Puncak Alam	7-232
Table 7-118 : Summary of Predicted Noise Levels from Train Operations and Impact In Selangor : Bandar Puncak Alam to Port Klang	7-236
Table 7-119 : Summary of Measured Vibrations from Train Pass By	7-244
Table 7-120 : Distances for buildings to be screened for vibrations from trains	7-245
Table 7-121 : Recommended Limits for Human Response and Annoyance from Steady State Vibrations	7-247
Table 7-122 : Summary of Predicted Vibrations to Receptors from Passenger Train Operations	7-248
Table 7-123 : Summary of Predicted Vibrations to Receptors from Cargo Train Operations	7-249
Table 7-124 : Receptors that may be affected by groundborne vibrations from trains in Kelantan	7-250
Table 7-125 : Receptors that may be affected by groundborne vibrations from trains in Selangor Gombak North to Serendah	7-251
Table 7-126: Receptors that may be affected by groundborne vibrations from trains in Selangor Serendah to Bandar Puncak Alam	7-252
Table 7-127 : Receptors that may be affected by groundborne vibrations from trains in Selangor Bandar Puncak Alam to Port Klang	7-253
Table 7-128 : Category of Wastes	7-255
Table 7-129 : Number and Area of Facilities	7-257
Table 7-130 : Estimated Waste Generation Per Year By Segments	7-257
Table 7-131 : Potential Impacts from Waste Generation	7-258

Table 7-132 : Summary of Potential Ecological Impacts during Operation	7-266
Table 7-133 : Potential Social Impacts during Operational Stage	7-272
Table 7-134 : Predicted Traffic Condition During Operation	7-277
Table 7-135 : Traffic Issues at Stations During Operation	7-278
Table 7-136 : Safety Issues and Possible Consequences during ECRL Operation	7-280
Table 8-1 : Surface Runoff Control Components	8-10
Table 8-2 : Erosion Control Components	8-11
Table 8-3 : Sedimentation Control Components	8-12
Table 8-4 : Summary of LD-P2M2 Components for Each Hotspots	8-19
Table 8-5 : LD-P2M2 Components for S1	8-21
Table 8-6 : LD-P2M2 Components for S2	8-22
Table 8-7 : LD-P2M2 Components for S3	8-22
Table 8-8: LD-P2M2 Components for S4	8-23
Table 8-9: LD-P2M2 Components for S5	8-24
Table 8-10 : LD-P2M2 Components for S6	8-25
Table 8-11 : LD-P2M2 Components for S7	8-26
Table 8-12 : LD-P2M2 Components for S8	8-27
Table 8-13 : LD-P2M2 Components for S9	8-29
Table 8-14 : LD-P2M2 Components for S10	8-30
Table 8-15 : LD-P2M2 Components for S11	8-30
Table 8-16 : LD-P2M2 Components for S12	8-31
Table 8-17 : LD-P2M2 Components for S13	8-33
Table 8-18 : LD-P2M2 Components for S14	8-34
Table 8-19 : LD-P2M2 Components for S15	8-35
Table 8-20 : LD-P2M2 Components for S16	8-35
Table 8-21 : LD-P2M2 Components for S17	8-36
Table 8-22 : LD-P2M2 Components for S18	8-37
Table 8-23 : LD-P2M2 Components for S19	8-38
Table 8-24 : LD-P2M2 Components for S20	8-39
Table 8-25 : LD-P2M2 Components for S21	8-41
Table 8-26 : Design of Grease Trap at Workers' Camp	8-43
Table 8-27 : Potential Waste Reuse/Recycle Option	8-61
Table 8-28 : Value-Added Products from Biomass	8-62
Table 8-29 : Minimum Number of MGB bins required based on the number of employees	8-65
Table 8 30 : List of Active Landfills near the Alignment in Kelantan and Selangor	8-66
Table 8 31: Elevated Viaducts along the Alignment	8-81
Table 8 32 : Bridges / Viaducts	8-87
Table 8 33 : Mitigation Measures for Stations	8-107
Table 8 34 : Design of Grease Trap/ Interceptor	8-117

Table 8 35 : Criteria for Inspection of Grease Trap	8-118
Table 8 36 : Major influence parameters on railways track noise	8-123
Table 8 37 : Comparison of Noise Mitigation Measures and Effectiveness	8-126
Table 8 38 : Proposed locations to be installed with noise barriers	8-131
Table 8 39 : Recommended Distances for Receptors requiring Trackworks Vibration Mitigation	8-135
Table 9 1 : Roles and Responsibilities during Project Construction	9-3
Table 9-2 : EMP Packages	9-5
Table 9-3 : Focus of the P2M2	9-5
Table 9-4 : Reports to be Submitted to DOE	9-6
Table 9-5 : Proposed Monitoring Programme	9-19

LIST OF PLATES

Plate 5-1 : Visualization of at-grade Section at Kg. Sementa	5-7
Plate 5-2 : Visualization of elevated section at Kelantan	5-8
Plate 5-3 : Visualization of elevated section along Jalan Sg. Puloh, Klang	5-8
Plate 5-4 : Visualization of tunnel Portals at Templer Park	5-10
Plate 5-5 : Visualization of station at Jalan Kastam	5-16
Plate 5-6 : Electric Multiple Unit Passenger Train	5-26
Plate 5-7 : Electric Freight Locomotive	5-26
Plate 5-8 : KTMB Diesel Locomotive	5-27
Plate 5-9 : KTMB Electric Locomotive (under testing)	5-27
Plate 5-10 : Freight Wagons	5-28
Plate 5-11 : Example of Railway Bridge (Light Rail Transit)	5-33
Plate 5-12 : Example of Beam Launching Using Mobile Crane	5-34
Plate 5-13 : Example of Bridge Construction Machine	5-34
Plate 5-14 : New Austrian Tunnelling Method Cycle	5-35
Plate 5-15 : Example of Railway Station (Electrified Double Track)	5-37
Plate 6-1: Kg. Gaung Pendek	6-49
Plate 6-2: Kg. Alor Durian	6-49
Plate 6-3: Sg. Pengkalan Nangka	6-50
Plate 6-4: Kg. Cherang	6-50
Plate 6-5: Kg. Pauh Sebanjan	6-51
Plate 6-6: Hospital Orang Asli Gombak	6-53
Plate 6-7: Taman Jasa Utama	6-53
Plate 6-8: Batu Dam	6-54
Plate 6-9: Templer Park	6-54
Plate 6-10: Perodua Global Manufacturing	6-55

Plate 6-11: Saujana Rawang	6-55
Plate 6-12: Bandar Puncak Alam	6-56
Plate 6-13: Kg. Delek	6-56
Plate 6-14: Kg. Sireh Tambahan	6-57
Plate 6-15 : Cattle grazing along the irrigation canal near WK2	6-83
Plate 6-16 : Canal at Jalan Kebang Mas, sampling point WK9	6-84
Plate 6-17 : Sg. Kelantan from Jalan Tendong-Mulong, Pasir Mas.	6-84
Plate 6-18 : Jetty at Kg. Delek.	6-104
Plate 6-19 : Waterfall in Kanching Recreational Forest	6-106
Plate 6-20 : Alignment at Ulu Gombak FR, Templer FR and Serendah FR	6-128
Plate 6-21 : Ulu Gombak FR	6-130
Plate 6-22 : Aerial view of Ulu Gombak FR nearby the Batu Dam reservoir	6-131
Plate 6-23 : Templer FR	6-131
Plate 6-24 : State land forests near Templer FR and Setia Eco Templer	6-132
Plate 6-25 : Gateway of Selangor State Park at Hutan Lipur Sg. Tua	6-132
Plate 6-26 : Alignment at Rantau Panjang Forest Reserve	6-135
Plate 6-27 : Rantau Panjang Forest Reserve	6-136
Plate 6-28 : M Residence and palm oil plantation adjacent to Rantau Panjang FR	6-136
Plate 6-29 : Forest structure at Rantau Panjang FR	6-137
Plate 6-30 : Forest structure in Rantau Panjang FR	6-137
Plate 6-31 : Rubber plantation in the southeastern section of Rantau Panjang FR	6-138
Plate 6-32 : Fragmentation by transmission line at southeastern section of Rantau Panjang FR	6-138
Plate 6-33 : Hutan Sungai Buaya in Serendah (3°20'54.77"N 101°30'38.01"EZ)	6-139
Plate 6-34 : Alignment at Sungai Puloh	6-142
Plate 6-35 : Mangroves along Sungai Puloh	6-142
Plate 6-36 : Bakau minyak (<i>Rhizophora apiculata</i>)	6-143
Plate 6-37 : Dense growth of tengar (<i>Ceriops tagal</i>) in the interior sections of the mangrove	6-143
Plate 6-38 : Mangrove structure near Kg. Sementa	6-144
Plate 6-39 : Degraded mangroves in the southern section of Sg. Puloh	6-144
Plate 6-40 : Wildlife spotted in Selangor State Park	6-151
Plate 6-41 : Wildlife spotted in Rantau Panjang FR	6-154
Plate 6-42 : Wild boar foraging marks	6-155
Plate 6-43 : Shotgun casing found in Rantau Panjang FR	6-155
Plate 6-44 : Long-tailed macaques along Jalan Batu Arang in Rantau Panjang FR	6-156
Plate 7-1 : Degree of fragmentation in Rantau Panjang FR	7-138
Plate 7-2 : View of Test Measurement site for Trains Pass by noise at Sg Siput	7-197
Plate 7-3 : View of Test Measurement site for Trains Pass by Noise at Serendah	7-197
Plate 7-4 : Noise and vibration test location at Sg Siput amongst residential houses	7-236

Plate 7-5 : Vibration and measurements at residential receptors near the Electrified Double Track, Sg Siput.	7-237
Plate 8-1 : Example of silt fence installation along construction site perimeter	8-14
Plate 8-2 : Example of silt fence installation along river bank	8-15
Plate 8-3: Example of temporary slope protection	8-15
Plate 8-4: Example of turfing at slope area	8-16
Plate 8-5: Example of a sediment basin	8-16
Plate 8-6: Example of mobile silt traps	8-17
Plate 8-7: Example of an active treatment system	8-17
Plate 8-8: Example of Settling Pond at Batching Plant	8-45
Plate 8-9: Example of Compact WWTS	8-46
Plate 8-10: Turfing at completed slope	8-49
Plate 8-11: Water bowser spraying the access road	8-49
Plate 8-12: Wheel washing facility	8-50
Plate 8-13: Vehicle load covered with tarpaulin	8-50
Plate 8-14 : Temporary acoustic barrier for MRT construction site	8-52
Plate 8-15: Temporary acoustic barrier for MRT construction site	8-52
Plate 8-16: Temporary acoustic barrier for MRT construction site	8-53
Plate 8-17: Temporary acoustic barrier for MRT construction site	8-53
Plate 8-18: Partial closure for piling machine	8-54
Plate 8-19 : Partial movable light weight enclosure for movable equipment	8-54
Plate 8-20 : Oscillation method piling machine	8-57
Plate 8-21 : RCD (Reversed circulation drilling) piling machine used for DUKE2 highway project	8-57
Plate 8-22 : Selective Demolition (removal of electrical fittings)	8-59
Plate 8-23 : Segregation of Construction Waste Materials	8-59
Plate 8-24 : (a) Proper storage of construction material (b) Improper storage of material	8-60
Plate 8-25 : Concrete waste is being reused as crusher run	8-61
Plate 8-26 : Optimize the use of formwork	8-61
Plate 8-27 : Example of biomass temporarily stockpiled within the ROW	8-62
Plate 8-28 : Example of RORO bins for construction waste	8-64
Plate 8-29 : Mobile Garbage Bins (MGB)	8-65
Plate 8-30 : Example of Scheduled Waste Storage Area	8-68
Plate 8-31 : Culvert with Sandbagged Headwall	8-89
Plate 8-32 : Examples of wildlife warning signage to reduce motorists speed	8-99
Plate 8 33 : Example of monkey bridges in Kinabatangan River, Borneo	8-100
Plate 8-34 : Typical absorptive metal noise barriers	8-127
Plate 8-35 : Metal absorptive noise barriers for railway noise mitigation	8-128
Plate 8-36 : Masonry noise barriers for roads and railway noise mitigation	8-128
Plate 8-37 : Diffusive and reflective transparent noise barrier	8-129

Plate 8-38: Absorptive metal noise barrier (West Rail Hong Kong)	8-130
Plate 8-39: Acoustically reflective transparent (PMMA) noise barrier (Germany)	8-130
Plate 8-40 : Example of under-sleeper pads used on ballast tracks	8-134
Plate 8-41 : Under-sleeper pads as used on underside of concrete sleepers	8-134
Plate 8-42 : Schematic Illustration of Booted Block System	8-134
Plate 8-44 : Illustration of proposed barrier along the railway	8-143
Plate 8-45 : Illustration of proposed barrier at a tunnel entrance	8-143

LIST OF CHARTS

Chart 2-1 : Project Assessment (EIA) Timeline	2-33
Chart 3-1 : Freight Relief Provided for KL Sentral	3-2
Chart 4-1 : Kelantan Route Options	4-4
Chart 4-2 : Selangor Route Options	4-5
Chart 5-1a : Typical Cross Section for Single Track Embankment	5-11
Chart 5-1b : Typical Cross Section of Double Track Embankment	5-12
Chart 5-2 : Typical Cross Section of Bridges	5-13
Chart 5-3a: Cross Section of Single-Track Tunnel	5-14
Chart 5-3b: Cross Section of Double-Track Tunnel	5-14
Chart 5-4: Diagrammatic Layout of Stations	5-17
Chart 5-5: Typical Section Track Schematic (Serendah)	5-19
Chart 5-6 : Typical Overhead Catenary System (OCS)	5-24
Chart 5-7 : Typical Railway Formation	5-32
Chart 6-1 : Geological evolution of Peninsular Malaysia (JMG Malaysia)	6-4
Chart 6-2 : General Geology of North Kelantan (JMG Malaysia)	6-5
Chart 6-3 : Areas in Kelantan underlain by Quaternary deposits (JMG Malaysia)	6-6
Chart 6-4 : General geology of Selangor (JMG Malaysia)	6-8
Chart 6-5 : Quaternary deposits in Kelantan	6-13
Chart 6-6 : Geology of the alignment in Selangor	6-19
Chart 6-7 : Typical cross-section of granitic area	6-21
Chart 6-8 : Ex-mining areas in Serendah and Rawang	6-21
Chart 6-9: Alignment crossing ex-mining pond Serendah	6-22
Chart 6-10 : Bedrock exposures at the construction sites in Bandar Puncak Alam	6-23
Chart 6-11 : Typical alluvial soil near Kapar	6-26
Chart 6-12 : The occurrence of major peat areas in Selangor (Wetlands International – Malaysia, 2010)	6-26
Chart 6-13 : Bukit Tinggi Fault and Kuala Lumpur Fault Lines	6-27

Chart 6-14 : Hydrogeological map of north Kelantan	6-33
Chart 6-15 : Fence diagram of Kelantan aquifer	6-33
Chart 6-16 : Location of groundwater wellfields and treatment plants	6-34
Chart 6-17 : Water treatment plants near Segment 1	6-36
Chart 6-18: Groundwater level and chloride monitoring results at the Tg. Mas Wellfield	6-37
Chart 6-19 : Hydrogeological map of central Selangor	6-38
Chart 6-20 : Distribution of groundwater wells in Selangor (JMG Malaysia)	6-39
Chart 6-21 : Occurrence of earthquake in Peninsular Malaysia between 2007 to 2010 (Alexander Yan, 2011)	6-41
Chart 6-22 : Draft seismic hazard map of Malaysia (JMG Malaysia)	6-43
Chart 6-23 : Location of epicentres	6-46
Chart 6-24 : Human Wildlife Conflict Records along the Alignment from 2012-2016 (Kelantan)	6-148
Chart 6-25 : Human Wildlife Conflict Records along the Alignment from 2012-2016 (Selangor)	6-152
Chart 6-26 : Kelantan - Gender Ratio and Ethnic Composition	6-165
Chart 6-27 : Selangor - Gender Ratio and Ethnic Composition	6-166
Chart 6-28 : Kelantan Segment-Age Structure, Mean and Median Age and Dependency Ratio	6-167
Chart 6-29 : Selangor Segment-Age Structure, Mean and Median Age and Dependency Ratio	6-168
Chart 6-30 : Existing Road Network Surrounding Pengkalan Kubor Station	6-170
Chart 6-31 : Existing Road Network Surrounding Wakaf Bharu Station	6-171
Chart 6-32 : Existing Road Network Surrounding Serendah Station	6-172
Chart 6-33 : Existing Road Network Surrounding Puncak Alam Station	6-173
Chart 6-34 : Existing Road Network Surrounding Kapar Station	6-174
Chart 6-35 : Existing Road Network Surrounding Jalan Kastam Station	6-175
Chart 7-1 : Sediment Contribution into receiving waterway	7-49
Chart 7-2 : QUAL2K River Schematic (Construction Phase)	7-50
Chart 7-3 : Simulated Suspended Solids Concentration in Segment 2B	7-58
Chart 7-4 : Noise Model of Work Site at Wakaf Bharu Station without mitigation	7-83
Chart 7 5 : Noise Propagation from Piling at Wakaf Bharu Station without Mitigation	7-83
Chart 7-6 : Noise Model of Work Site at Wakaf Bharu Station with 4m hoarding	7-84
Chart 7-7 : Noise Propagation from Piling at Wakaf Bharu Station with 4m hoarding	7-84
Chart 7-8 : Noise Model of Work Site at Wakaf Bharu Station with 8m hoarding	7-85
Chart 7-9 : Noise Propagation from Piling at Wakaf Bharu Station with 8m hoarding	7-85

Chart 7-10 : Noise Model of Work Site at Taman Jasa Utama without mitigation	7-86
Chart 7-11 : Noise Propagation from Piling at Taman Jasa Utama without Mitigation	7-86
Chart 7-12 : Noise Model of Work Site at Taman Jasa Utama with 4m piling shroud	7-87
Chart 7-13 : Noise Propagation from Piling at Taman Jasa Utama with 4m piling shroud	7-87
Chart 7-14 : Noise Model of Work Site at Taman Jasa Utama with 8m piling shroud	7-88
Chart 7-15 : Noise Propagation from Piling at Taman Jasa Utama with 8m piling shroud	7-88
Chart 7-16 : Noise Model of Work Site at Serendah Station without mitigation	7-89
Chart 7-17 : Noise Propagation from Piling at Serendah Station without Mitigation	7-89
Chart 7-18 : Noise Model of Work Site at Serendah Station with 4m hoarding	7-90
Chart 7-19 : Noise Propagation from Piling at Serendah Station with 4m hoarding	7-90
Chart 7-20 : Noise Model of Work Site at Serendah Station with 8m hoarding	7-91
Chart 7-21 : Noise Propagation from Piling at Serendah Station with 8m hoarding	7-91
Chart 7-22 : Noise Model of Work Site at Port Klang Depot without mitigation	7-92
Chart 7-23 : Noise Propagation from Piling at Port Klang Depot without Mitigation	7-92
Chart 7-24 : Noise Model of Work Site at Port Klang Depot with 4m hoarding	7-93
Chart 7-25 : Noise Propagation from Piling at Port Klang Depot with 4m hoarding	7-93
Chart 7-26 : Noise Model of Work Site at Port Klang Depot with 8m hoarding	7-94
Chart 7-27 : Noise Propagation from Piling at Port Klang Depot Station with 8m hoarding	7-94
Chart 7-28 : Typical vibration from bored piling in Malaysian construction works (Penang Bridge widening works)	7-97
Chart 7-29 : Measured vibration from bored piling in KVMRT Project	7-97
Chart 7-30 : Aerial view of Batu Dam and the proposed ECRL alignment	7-99
Chart 7-31 : Piling work carried out piercing the multi-layered aquifer could lead to groundwater contamination	7-118
Chart 7-32 : Conceptual engineering geological model for an area where sediments overlie granite (Parry, 2014)	7-120
Chart 7-33 : Initial observational model for the project based on mapping and boreholes (Parry, 2014)	7-120
Chart 7-34 : The influence of project type on the engineering geological considerations (Parry, 2014)	7-122
Chart 7-35 : Location of Quartz Ridge and ECRL Phase 2 Alignment	7-123

Chart 7-36 : The alignment downstream of Batu Dam	7-125
Chart 7-37 : Some piling problems in limestone formation (Neoh, 1998)	7-128
Chart 7-38a : Alignment crossing limestone and mined out areas	7-128
Chart 7-38b : Ex-mining lake within alignment ROW	7-129
Chart 7-39 : Locations of coal mining relicts in Batu Arang	7-130
Chart 7-40 : Major peat areas in Selangor (Wetlands International – Malaysia, 2010)	7-131
Chart 7-41 : Risk Assessment Methodology	7-156
Chart 7-42 : Discharge of treated STP effluent into receiving waterway	7-169
Chart 7-43 : QUAL2K River Schematic (Operation Phase)	7-170
Chart 7-44 : Simulated BOD Concentration in Segment 2B	7-178
Chart 7-45 : Simulated Ammoniacal Nitrogen Concentration in Segment 2B	7-179
Chart 7-46 : Simulated Suspended Solids Concentration in Segment 2B	7-179
Chart 7-47 : Carbon Emissions by Transport Mode	7-190
Chart 7-48 : Relationship of main noise sources with train speed	7-197
Chart 7-49 : Measured L _{Amax} , fast Noise Levels at 15m	7-198
Chart 7-50 : Typical Passenger Train Pass by Noise measured at Sg Siput.	7-200
Chart 7-51 : Typical Passenger Train Pass by Noise measured at Serendah	7-200
Chart 7-52 : Typical Freight Train Pass by Noise measured at Sg Siput.	7-201
Chart 7-53 : View of Alignment at Kampung Kubang Panjang	7-222
Chart 7-54 : 3-D Noise Model at Kelantan Kampung Kubang Panjang with train at 100 km/hr without mitigation	7-224
Chart 7-55 : Noise map at Kelantan Kampung Kubang Panjang with train at 100 km/hr without mitigation.	7-224
Chart 7-56 : 3d Noise Model at Kelantan Kampung Kubang Panjang with train at 100 km/hr with mitigation (4m height noise barrier)	7-225
Chart 7-57 : Noise Map at Kelantan Kampung Kubang Panjang with train at 100 km/hr with mitigation (4m height noise barrier)	7-225
Chart 7-58 : Noise maps for existing road traffic in vicinity of proposed Wakaf Bahru Station.	7-226
Chart 7-59 : Noise maps for anticipated road traffic in vicinity of Wakaf Bahru Station during operations	7-226
Chart 7-60 : View of Alignment at Apartment Templer Impian	7-228
Chart 7-61 : 3-D Noise Model at Apartment Templer Impian with train at 100 km/hr without mitigation	7-229
Chart 7-62 : Noise map at Apartment Templer Impian with train at 100 km/hr without mitigation.	7-229
Chart 7-63 : 3d Noise Model at Apartment Templer Impian with train at 100 km/hr with mitigation (4m height noise barrier)	7-230
Chart 7-64 : Noise Map at Apartment Templer Impian with train at 100 km/hr with mitigation (4m height noise barrier)	7-230
Chart 7-65 : Noise maps for existing road traffic in vicinity of proposed	

Serendah Station.	7-231
Chart 7-66 : Noise maps for anticipated road traffic in vicinity of proposed Serendah Station.	7-231
Chart 7-67 : View of Alignment at M-Residence Rawang	7-233
Chart 7-68 : 3-D Noise Model at M-Residence Rawang with train at 100 km/hr without mitigation	7-234
Chart 7-69 : Noise map at M-Residence Rawang with train at 100 km/hr without mitigation.	7-234
Chart 7-70 : 3-D Noise Model at M-Residence Rawang with train at 100 km/hr with mitigation (4m height noise barrier)	7-235
Chart 7-71 : Noise Map at M-Residence Rawang with train at 100 km/hr with mitigation (4m height noise barrier)	7-235
Chart 7-72 : View of Alignment at Taman Jaya, Kapar	7-237
Chart 7-73 : 3-D Noise Model at Taman Jaya, Kapar with train at 100 km/hr without mitigation	7-238
Chart 7-74 : Noise map at Taman Jaya, Kapar with train at 100 km/hr without mitigation.	7-238
Chart 7-75 : 3d Noise Model at Taman Jaya, Kapar with train at 100 km/hr with mitigation (4m height noise barrier)	7-239
Chart 7-76 : Noise Map at Taman Jaya, Kapar with train at 100 km/hr with mitigation (4m height noise barrier)	7-239
Chart 7-77 : Typical passenger train ground vibrations at 26m from tracks, train speed 135 km/hr	7-242
Chart 7-78 : Typical freight train ground vibrations at 23m from tracks, train speed 80 km/hr	7-242
Chart 7-79 : Typical passenger train ground vibrations at receptors 50m from tracks train speed 140 km/hr	7-243
Chart 7-80 : Typical freight train ground vibrations at receptors 50m from tracks train speed 80 km/hr	7-243
Chart 7-81 : Ground-borne vibration propagation from railways	7-246
Chart 8-1 : Process Flow Chart for Active Treatment System	8-14
Chart 8-2 : Settling Ponds	8-44
Chart 8-3 : Bunded Skid Tank	8-48
Chart 8-4 : Sustainable Waste Management Priorities	8-58
Chart 8-5 : Spoil Management Hierarchy	8-63
Chart 8-6 : Flow Process of Waste Collection to Waste Disposal to the Authorised Landfill	8-67
Chart 8-7 : Principle sketch of commonly used tunnel support systems in weak rocks	8-73
Chart 8-8 : Pre-excavation grouting and tunnel excavation pattern	8-74
Chart 8-9 : Road cutting along hill slope in layered rocks.	8-78

Chart 8-10 : Design Process	8-85
Chart 8-11 : Typical Balancing Culvert / Crossing Culvert	8-86
Chart 8-12 : Culvert in Section	8-88
Chart 8-13 : Alignment at Rantau Panjang FR: Before and After Redesign	8-92
Chart 8-14 : Phasing direction of vegetation clearing in state land forests south of Ulu Gombak FR	8-96
Chart 8-15 : Phasing direction of vegetation clearing in state land forests west of Templer FR/north of Setia Eco Templer	8-96
Chart 8-16 : Phasing direction of vegetation clearing in state land forests adjacent to Serendah FR	8-97
Chart 8-17 : Phasing direction of vegetation clearing in Rantau Panjang FR	8-98
Chart 8-18 : Phasing direction of vegetation clearing in Sg. Puloh Mangrove Forest	8-100
Chart 8-19 : Schematic Diagram of Small Sewage Treatment System	8-115
Chart 8-20 : Nearby Sludge Disposal Sites	8-116
Chart 8-21 : Grease Interceptor	8-117
Chart 8-22 : Grease Trap	8-118
Chart 8-23 : Reduction Measures to address Trains Pass-By Noise	8-124
Chart 9-1: Proposed Environmental Management Organizational Structure	9-2
Chart 9-2 : Performance Monitoring Report Template	9-13
Chart 9-3 : Performance Monitoring – Environmental Control Measures Template	9-15
Chart 9-4 : Environmental Mainstreaming Tools Compliance Report	9-17