# HIGHWAYS DEPARTMENT MAJOR WORKS PROJECT MANAGEMENT OFFICE

AGREEMENT NO. CE 73/98
INVESTIGATION ASSIGNMENT FOR
WIDENING OF TOLO HIGHWAY/FANLING HIGHWAY
BETWEEN ISLAND HOUSE INTERCHANGE AND FANLING

# ENVIRONMENTAL IMPACT ASSESSMENT FINAL REPORT

**MARCH 2000** 

Volume 1 of 2



in association with

MVA Hong Kong Ltd Enviros Hong Kong Ltd ACL Asia Ltd ERM Hong Kong Ltd

# HIGHWAYS DEPARTMENT MAJOR WORKS PROJECT MANAGEMENT OFFICE

AGREEMENT NO. CE 73/98
INVESTIGATION ASSIGNMENT FOR
WIDENING OF TOLO HIGHWAY/FANLING HIGHWAY
BETWEEN ISLAND HOUSE INTERCHANGE AND FANLING

## ENVIRONMENTAL IMPACT ASSESSMENT FINAL REPORT

**MARCH 2000** 

#### **Issue and Revision Record**

Rev	Date	Originator	Checked By	Approved By	Description
A	July 99	MCL/Enviros/ACLA	H T Cheng	K W Lee	Draft
В	Oct 99	MCL/Enviros/ACLA	T Ishola	K W Lee	Advance Copy of Draft Final
C	Dec 99	MCL/Enviros/ACLA	T Ishola	K W Lee	Draft Final
D	Mar 00	MCL/Enviros/ACLA	H T Cheng	K W Lee	Final

# ENVIRONMENTAL IMPACT ASSESSMENT FINAL REPORT

#### **Contents**

#### Volume 1 of 2

			Page
1	INTI	RODUCTION	1-1
	1.1	Preamble	1 - 1
	1.2	The EIA Study Area	1 - 1
	1.3	Objectives of the Environmental Impact Assessment Study	1 - 2
	1.4	Structure of the Environmental Impact Assessment Study	1 - 3
2	PRO	DJECT DESCRIPTION	2 - 1
	2.1	Introduction	2 - 1
	2.2	Alignment	2 - 1
	2.3	Construction Activities	2 - 5
	2.4	Traffic Forecasts	2 - 5
3	REL	EVANT ENVIRONMENTAL LEGISLATION	3-1
	3.1	Introduction	3 - 1
	3.2	Environmental Impact Assessment Ordinance	3 - 1
	3.3	Air	3 - 1
	3.4	Noise	3 - 2
	3.5	Water	3 - 3
	3.6	Waste	3 - 8
	3.7	Ecology	3 - 9
	3.8	Landscape and Visual Impact Assessment	3 - 10
	3.9	Heritage Impact Assessment	3 - 10
4	AIR	QUALITY IMPACT ASSESSMENT	4 - 1
	4.1	Introduction	4 - 1
	4.2	Description of Surrounding Environment	4 - 1
	4.3	Air Sensitive Receivers (ASRs)	4 - 2
	4.4	Meteorology	4 - 4
	4.5	Construction Phase Air Quality Impacts	4 - 5
	4.6	Operational Phase Air Quality Impacts	4 - 6
	4.7	Conclusions and Recommendations	4 - 10
	4.8	References	4 - 10
5	NOIS	SE IMPACT ASSESSMENT	5 - 1
	5.1	Introduction	5 - 1
	5.2	Description of Surrounding Environment	5 - 1
	5.3	Noise Sensitive Receivers	5 - 2
	5.4	Construction Phase Noise Impacts	5 - 6
	5.5	Operational Phase Noise Impacts	5 - 28
	5.6	Conclusions and Recommendations	5 - 46
	5.7	References	5 - 46
	5.8	Acoustic Terminology	5 - 46

e:\eia\tocv1.doc (i)

			Page
6.	WAT	TER QUALITY	6 - 1
	6.1	Introduction	6 - 1
	6.2	Baseline Conditions	6 - 1
	6.3	Sensitive Receivers	6 - 3
	6.4	Construction Phase Impacts	6 - 3
	6.5	Operation Phase Impacts	6 - 7
	6.6	Proposed Mitigation Measures	6 - 7
	6.7	EM&A Requirements	6 - 9
	6.8	Conclusions	6 - 9
7	SOL	ID WASTE MANAGEMENT ASSESSMENT	7 - 1
	7.1	Introduction	7 - 1
	7.2	Objectives	7 - 1
	7.3	Nature And Type Of Waste Materials	7 - 2
	7.4	Potential Impacts & Mitigation Measures	7 - 6
	7.5	Summary Of Waste Management Plan (Wmp)	7 - 11
	7.6	Conclusions	7 - 13
8	ECO	LOGY	8 - 1
	8.1	Introduction	8 - 1
	8.2	Baseline Habitat Description	8 - 1
	8.3	Baseline Survey Findings	8 - 4
	8.4	Evaluation of Ecological Impacts	8 - 19
	8.5	Impact Mitigation	8 - 27
	8.6	Residual Impacts	8 - 29
	8.7	Conclusion	8 - 29
	8.8	References	8 - 32
9	LAN	DSCAPE AND VISUAL IMPACT ASSESSMENT	9 - 1
	9.1	Introduction	9 - 1
	9.2	Standards and Legislation	9 - 1
	9.3	Landscape Impact Assessment Methodology	9 - 1
	9.4	Tree Survey Methodology	9 - 3
	9.5	Visual Impact Assessment Methodology	9 - 3
	9.6	The Residual Impacts	9 - 5
	9.7	Mitigation Measures	9 - 6
	9.8	Existing Landscape Context and Landscape Impacts	9 - 6
	9.9	Review of Planning and Development Control Framework	9 - 11
	9.10	Existing Visual Context and Visual Impacts	9 - 18
	9.11	Opportunities for Mitigation Measures	9 - 25
	9.12	Residual Impacts Subsequent to Mitigation	9 - 31
	9.13	Programme for Landscape Works	9 - 73
	9.14	Implementation, Management and Maintenance of the Landscape Works	9 - 73
	9.15	Summary	9 - 74

e:\eia\tocv1.doc (ii)

			Page
10	CUL	TURAL HERITAGE IMPACT ASSESSMENT	10 - 1
	10.1	Background	10 - 1
	10.2	Findings	10 - 1
11	ENVI	RONMENTAL MONITORING AND AUDIT	11 - 1
	11.1	Introduction	11 - 1
	11.2	Objectives of Environmental Monitoring & Audit	11 - 1
	11.3	Construction Noise	11 - 1
	11.4	Operational Noise	11 - 3
	11.5	Construction Dust	11 - 4
	11.6	Waste Management	11 - 5
	11.7	Water Quality	11 - 5
	11.8	Ecology	11 - 5
	11.9	Cultural Heritage	11 - 5
12	CON	CLUSIONS	12 - 1
	12.1	Introduction	12 - 1
	12.2	Air Quality	12 - 1
	12.3	Noise	12 - 2
	12.4	Water	12 - 2
	12.5	Waste	12 - 2
	12.6	Ecology	12 - 3
	12.7	Landscape and Visual Impact	12 - 3
	12.8	Cultural Heritage	12 - 4
	12.9	Environmental Monitoring and Audit	12 - 4
13	SCHI	EDULE OF RECOMMENDED MITIGATION MEASURES	13 - 1
	13.1	Introduction	13 - 1
List of	Tables	5	
Table	2.1	Main Differences between the Alignments	
Table	2.2	Scoring Result for Environmental Category	
Table	3.1	Hong Kong Air Quality Objectives	
Table	3.2	Tunnel Air Quality Guidelines	
Table	3.3	Area Sensitivity Rating	
Table	3.4	Basic Noise Levels in $L_{eq(30 \text{ min})} dB(A)$	
Table	3.5	Acceptable Noise Levels for Percussive Piling	
Table		Acceptable Noise Levels (ANL) in $L_{eq(30min)} dB(A)$	
Table		Water Quality Objectives for the Tolo Harbour and Channel Water	Control Zone
Table	3.8	TM Standards for Discharges to Group D Water (all units in mg/l unless otherwise stated)	
Table	3.9	Standards for effluent discharged into foul sewers leading into Gov	vernment sewage
1 aoic	. 3.7	treatment plants	crimient sewage
		(All units in mg/L unless otherwise stated; all figures are upper lim	its unless
		otherwise indicated)	ito unicoo
Table	4.1	TSP, RSP and NO <sub>2</sub> Monitoring Data 1997 from Tai Po Air Quality	Monitoring
		Station	•
Table	4.2	List of Outline Zoning Plans and Outline Development Plans	

e:\eia\tocv1.doc (iii)

### List of Tables (Cont'd)

Table 4.3	Selected Air Sensitive Receivers (ASRs) between Pak Wo Road and Hong Lok Yuen Road
Table 4.4	Selected Air Sensitive Receivers (ASRs) between Hong Lok Yuen Road and Tai Po Tai Wo Road
Table 4.5	Selected Air Sensitive Receivers (ASRs) between Tai Po Tai Wo Road and Tat Wan Road
Table 4.6	Selected Air Sensitive Receivers (ASRs) between Tat Wan Road and Island House Interchange
Table 4.7	Meteorological Parameters
Table 4.8	Predicted Vehicular Air Quality Impacts at the Worst Case Elevations with Noise Barriers in Place
Table 5.1	Background Noise Measurement Results (Spot Measurements during Peak Hours)
Table 5.2	Background Noise Measurement Results (Spot Measurements during Non Peak Hours)
Table 5.3	Selected Representative Noise Sensitive Receivers (NSRs) between Pak Wo Road and Hong Lok Yuen Road
Table 5.4	Selected Representative Noise Sensitive Receivers (NSRs) between Hong Lok Yuen Road and Tai Po Tai Wo Road
Table 5.5	Selected Representative Noise Sensitive Receivers (NSRs) between Tai Po Tai Wo Road and Tat Wan Road
Table 5.6	Selected Representative Noise Sensitive Receivers (NSRs) between Tat Wan Road and Island House Interchange
Table 5.7	Summary of Current Selected NSR Locations which are the same as proposed in the NIA for 24 Hour Opening of Border Crossings
Table 5.8	Summary of Predicted Construction Noise Levels Without Mitigation Measures
Table 5.9	Adopted Sound Power Levels of Silenced Equipment
Table 5.10	Summary of Mitigated Construction Noise Levels for Week 21
Table 5.11	Summary of Mitigated Construction Noise Levels for Week 30
Table 5.12	Summary of Mitigated Construction Noise Levels for Week 38
Table 5.13	Summary of Mitigated Construction Noise Levels for Week 77
Table 5.14	Summary of Residually Impacted NSRs after provision of all practicable direct mitigation measures
Table 5.15	Summary of the Predicted Traffic Noise Levels (Year 2002) With No Mitigation Measures
Table 5.16	Summary of the Predicted Traffic Noise Levels (Year 2020) With No Mitigation Measures
Table 5.17	Summary of the Predicted Traffic Noise Levels (Year 2020) With Direct Mitigation Measures
Table 5.18	Predicted Traffic Noise Levels due to Border Crossing Traffic Only Incorporating Mitigation Measures Proposed for the Current Road Widening Study
Table 6.1	Marine Water Quality in the Tolo Harbour and Channel (Harbour Subzone)
Table 6.2	River Water Quality in the Tolo Harbour and Channel (Tai Po River and Lam Tsuen River)
Table 6.3	Summary of Water Quality Impacts and Mitigation Measures
Table 6.4	Trigger Levels and Upper Limits
Table 6.5	Action Plan for Exceedance of Trigger Level
Table 6.6	Action Plan for Exceedance of Upper Limit
Table 7.1	Activities Involving Generation of Demolition Materials
Table 7.2	Estimated Volumes of Material From Cut and Fill Activities
Table 7.3	Estimated Volumes of Material from "Cut" Activities which are Acceptable or Unacceptable for Re-use within the Project

e:\eia\tocv1.doc (iv)

#### List of Tables (Cont'd)

Table 7.4	Volumes of Material from Cut and Fill Activities to be imported to site/requiring off-site disposal
Table 7.5	Summary of waste to be Generated
Table 7.6	Waste Management Plan
1 abic 7.0	waste management i ian
Table 8.1	Habitat Types within 500m of the Study Area
Table 8.2	Species Identified in the Active Agricultural Land
Table 8.3	Summary of Dominant Tree Shrub species in the Study Area
Table 8.4	Species of Trees and Shrubs in Plantation Woodlands
Table 8.5	Birds Identified within the Study Area during the Initial Ecological Surveys
Table 8.6	Location and Habitat Composition of Point Counts
Table 8.7	Results of Point Count Data for Birds
Table 8.8	Species of Amphibians and Reptiles within the Study Area
Table 8.9	Summary of Aquatic Species Abundance and Diversity Data collected by Kick
1 4010 0.9	Sampling at Sites S1 – S5
Table 8.10	Species of Butterflies Identified within the Study Area
Table 8.11	Species of Damselfly and Dragonfly Identified in the Study Area
Table 8.12	Habitats areas to be Lost/Impacted by the Construction
Table 8.13	Ecological Evaluation of Plantation Woodland
Table 8.14	Ecological Evaluation of Natural Woodland
Table 8.15	Ecological Evaluation of Fung Shui Woodland
Table 8.16	Ecological Evaluation of Grassland
Table 8.17	Ecological Evaluation of Active Agricultural Land
Table 8.18	Ecological Evaluation of Inactive Agricultural Land
Table 8.19	Ecological Evaluation of Artificial Drainage Channels
Table 8.20	Ecological Evaluation of Natural Watercourses
Table 8.21	Ecological Evaluation of Orchards
Table 8.22	Ecological Evaluation of Intertidal Habitat
Table 8.23	Ecological Evaluation of Marine Habitat
Table 8.24	Summary of Impacts, Mitigatory Measures and Residual Impacts within the Study
14010 0.21	Area
Table 8.25	Key Areas for Ecological Compensation Planting
Table 9.1	Existing Landscape Context and Landscape Impact during the Opening Year
Table 9.2	Review of Existing Planning and Development Control Framework
Table 9.3	Visually Sensitive Receivers and Visual Impacts
Table 9.4	Sources of Landscape Impact and Mitigation Measures
Table 9.5	Sources of Visual Impacts and Mitigation Measures
Table 9.6	Summary of Impacts during Opening Year, Mitigation Measures and Residual
	Impacts during the design Year
Table 9.7	Summary of Mitigation Measures and Residual Impacts
Table 9.8	Provisional Programme for Landscape Works
Table 9.9	Implementation, Management and Maintenance of Landscape Works
Table 12.1	Summary of Environmental Assessment Findings
Table 13.1	Air Quality – Schedule of Recommended Mitigation Measures
Table 13.2	Noise Impact – Schedule of Recommended Mitigation Measures
Table 13.3	Water Quality – Schedule of Recommended Mitigation Measures
Table 13.4	Waste – Schedule of Recommended Mitigation Measures
Table 13.5	Ecology – Schedule of Recommended Mitigation Measures
Table 13.6	Landscape and Visual – Schedule of Recommended Mitigation Measures
- 4010 10.0	

e:\eia\tocv1.doc (v)

#### Volume 2 of 2

#### **FIGURES**

FIGURES	
Figure 1.1	Location Plan
Figure 3.1	Tolo Harbour Supplementary Water Control Zone
Figure 4.1.1 - 4.1.3	Air Sensitive Receiver Locations
Figure 4.2.1 - 4.2.5	Hourly NO <sub>2</sub> Concentration Isopleths at 6 mPD
Figure 4.3.1 - 4.3.5	Hourly NO <sub>2</sub> Concentration Isopleths at 35 mPD
Figure 4.4.1 - 4.4.5	Hourly NO <sub>2</sub> Concentration Isopleths at 64 mPD
Figure 4.5.1 - 4.5.5	Daily RSP Concentration Isopleths at 6 mPD
Figure 4.6.1 - 4.6.5	Daily RSP Concentration Isopleths at 35 mPD
Figure 4.7.1 - 4.7.5	Daily RSP Concentration Isopleths at 64 mPD
Figure 4.8	Plot Areas of Air Pollutant Concentration Isopleths
Figure 5.1.1 - 5.1.40	Noise Sensitive Receiver Locations
Figure 5.2	Phasing of Construction Work
Figure 5.3	Not Used
Figure 5.4.1 - 5.4.7	Background Noise Measurement Results
Figure 5.5.1 - 5.5.7	Spot Measurements of the $L_{eq(5 \text{ min})}$ Noise Levels
Figure 5.6.1 - 5.6.5	Proposed Locations of Purpose-Built Noise Barriers During Construction
Figure 5.7.1 - 5.7.4	Illustration of "New" and "Existing" Roads for Road Traffic Noise Modelling
Figure 5.8	Noise Barriers Proposed between Island House Interchange and Ma Liu Shui for Widening of Tolo Highway
Figure 6.1	Water Quality Sensitive Receivers
Figure 6.2	Proposed River Training Works
Figure 8.1.1 - 8.1.6	The Habitat Map Showing the Tolo Highway/Fanling Highway and the 100m and 500m Study Area
Figure 8.2	Location of Key Important Areas and Habitats Identified During the Baseline Ecological Surveys Utilised by Birds
Figure 8.3.1 - 8.3.4	Location of Point Courts and Numbers of Birds Identified at each site during
8	May to August 1999
Figure 8.4	Ecological Sensitive Receiver Locations
Figure 8.5.1 - 8.5.6	The Impacted Habitat
Figure 8.6	Water Course Sampling Locations
Figure 9.1	Landscape Character and Quality Assessment
Figure 9.2a - 9.2b	Landscape Character Photographs
Figure 9.3	Visual Envelope
Figure 9.4a - 9.4b	Visual Impact Assessment
Figure 9.5	Not Used
Figure 9.6a - 9.6c	Typical Details
Figure 9.7	Photomontage Location Plan
Figure 9.8a - 9.8j	Photomontages
Figure 10.1 - 10.2	Extent of Archaeological Monitoring Works
DRAWINGS	
551/I /5101 5100	Landsonna Proposal

551/L/5101 - 5109	Landscape Proposal
551/R/9001 - 9016	General Layout Plans for EIA Study
551/R/9017 - 9018	General Arrangement of Noise Barriers

(vi) e:\eia\tocv1.doc

#### **APPENDICES**

Appendix 1.1	Construction Program
Appendix 4.1	Emission Factors
Appendix 4.2	"CALINE4" Modelling Results Summary
Appendix 4.3	"CALINE4" Modelling Output Files
Appendix 5.1	Construction Plant Inventory
Appendix 5.2	Estimation of Maximum Construction Traffic Flows
Appendix 5.3	Traffic Flow Forecast
Appendix 5.4	Predicted Construction Noise Levels
Appendix 5.5	Correspondence from MVA Indicating the Worst Traffic Scenario is Year 2020
Appendix 5.6	Predicted Traffic Noise Levels
Appendix 5.7	"siteNoise" (Construction Noise) Input Files Sample
Appendix 5.8	"roadNoise" Input Files Sample
Appendix 5.9	Computer Plot of "roadNoise" Model
Appendix 5.10	Correspondences from Government Department
Appendix 5.11	Equipment Sound Power Levels Information from Local Suppliers
Appendix 5.12	2006 Cross Border Freight Traffic Flows Extracted from the NIA for 24 Hour
Appendix 5.13	Opening of Border Crossings Final Report August 1996 Predicted Year 2006 Cross Border Freight Traffic Noise with the Widened Highways and Proposed Mitigation Measures
Appendix 8.1	Summary of Freshwater Benthic & Fisheries Surveys
Appendix 8.2	Photos from Ecological Survey
Appendix 9.1	Compensatory Planting Proposals
Appendix 10	Archaeological Impact Assessment Report

e:\eia\tocv1.doc (vii)