

Agreement No. CE69/2001(HY)

Tsuen Wan Bypass, Widening of Tsuen Wan Road between Tsuen Tsing Interchange and Kwai Tsing Interchange and Associated Junction Improvement Works

Environmental Impact Assessment

Final Report

September 2008

Prepared by :

Checked by :

Approved by

Rodney Ip **Harold Insley** Geoffrey Phillips

Scott Wilson Ltd



# **Table of Contents**

<u>1.</u>	INTRODUCTION	1-1
1.1	Background	1-1
1.2	Purpose and Scope of the EIA	1-1
1.3	EIA Study Area	1-3
1.4	Structure of the Report	1-4
2.	DESCRIPTION OF THE PROJECT	2-1
2.1	Introduction	2-1
2.2	Scope of the Project	2-1
2.3	Need of the Project	2-1
2.4	Consideration of Different Alignment Options and Built-forms	2-2
2.5	Justifications and Consideration of Alternative Built-forms	2-5
2.6	Consideration of Alternative Construction Methods and Sequences of	
	Works	2-6
2.7	Description of the Selected Alignment and Proposed Engineering Works	2-7
2.8	Construction Programme	2-7
2.9	Concurrent Projects	2-9
3.	NOISE IMPACTS	3-1
3. 3.1	Introduction	3-1
3.2	Operational Noise	3-1
3.2.1	Environmental Legislations, Policies, Plans and Standards	3-1
3.2.2	Noise Sensitive Receivers	3-1
3.2.3	Assessment Methodology	3-11
3.2.4	Prediction and Evaluation of Noise Impacts	3-16
3.2.5	Proposed Noise Mitigation Measures	3-21
3.2.6	Assessment of Noise Impacts with the Application of Mitigation Measure	es3-23
3.2.7	Residual Impact	3-33
3.2.8	Environmental Monitoring and Audit	3-33
3.2.9	Conclusions	3-34
3.3	Construction Noise	3-34
3.3.1	Environmental Legislations, Policies, Plans and Standards	3-34
3.3.2	Assessment Methodology	3-35
3.3.3	Prediction and Evaluation of Noise Impacts	3-35
3.3.4	Proposed Noise Mitigation Measures	3-40
3.3.5	Assessment of Noise Impacts with the Application of Mitigation Measure	es3-43
3.3.6	Residual Impact	3-47
3.3.7	Environmental Monitoring and Audit	3-49
3.3.8	Conclusions	3-50
4	AIR QUALITY IMPACTS	4-1
4.1	Introduction	4-1
4.2	Environmental Legislation, Polices, Standards and Criteria	4-1
4.3	Identification Air Sensitive Receivers	4-2

律 Scot

8-1

8-2

Scott Wilson Ltd

4.4	Identification of Potential Air Quality Impacts	4-7
4.5	Assessment Methodologies	4-9
4.6	Evaluation of Air Quality Impacts	4-22
4.7	Recommendations for Monitoring and Audit	4-30
4.8	Conclusions	4-31
5.	WATER QUALITY IMPACT	5-1
5.1	Introduction	5-1
5.2	Environmental Legislation, Policies, Plans and Standards	5-1
5.3	Sensitive Receivers	5-8
5.4	Description of the Environment	5-8
5.5	Identification and Evaluation of Water Quality Impact	5-11
5.6	Identification and Evaluation of Cumulative Water Quality Impact	5-12
5.7	Mitigation Measures for Water Quality Impact	5-13
5.8	Residual Impacts on Water Quality	5-16
5.9	Environmental Monitoring and Audit	5-16
5.10	Conclusions	5-16
6.	WASTE MANAGEMENT IMPLICATIONS	6-1
6.1	Introduction	6-1
6.2	Environmental Legislation, Policies, Plans and Standards	6-1
6.3	Assessment Methodology	6-5
6.4	Identification of Potential Sources of Impacts	6-5
6.5	Prediction and Evaluation of Environmental Impacts	6-5
6.6	Mitigation Measures for Adverse Environmental Impacts	6-7
6.7	Evaluation of Residual Impacts	6-11
6.8	Environmental Monitoring and Audit	6-11
6.9	Land Contamination Assessment	6-11
6.10	Conclusions	6-13
7	LANDFILL GAS HAZARD	7-1
<mark>7.</mark> 7.1	Introduction	7-1
7.2	Assessment Scope	7-1

1.2	Assessment scope	/-1
7.3	Potential Hazards Associated with Landfill Gas	7-1
7.4	Assessment Methodology	7-2
7.5	Description and History of Gin Drinkers Bay Landfill	7-4
7.6	Landfill Gas Risk Assessment	7-5
7.7	Proposed Protection and Precautionary Measures	7-13
7.8	Environmental Monitoring & Audit	7-17
7.9	Conclusions	7-17
<u>8.</u>	LANDSCAPE & VISUAL IMPACT ASSESSMENT	8-1
8.1	Introduction	8-1
8.2	Legislations, Policies, Plans and Standards	8-1



Tsuen Wan Bypass, Widening of Tsuen Wan Road between Tsuen Tsing Interchange and Kwai Tsing Interchange and Associated Junction Improvement Works Environmental Impact Assessment

8.5	Impact Assessment	8-2
8.6	The Study Area	8-3
8.7	Consultation with Relevant Departments	8-3
8.8	Methodology for Landscape Impact Assessment	8-3
8.9	Landscape Sensitivity	8-3
8.10	Magnitude of Landscape Impacts	8-4
8.11	Significance of the Landscape Effects	8-5
8.12	Visual Assessment Methodology	8-7
8.13	Mitigation	8-8
8.14	Environmental Legislation and Guidelines	8-8
8.15	Planning & Development Review	8-9
8.16	Baseline Conditions Year 2011	8-13
8.17	Landscape Resources LR	8-16
8.18	Landscape Character Area	8-17
8.19	Landscape and visual Effect Assessment Methodology	8-18
8.20	Landscape Resources LR effects	8-19
8.21	Landscape Character Area LCA effects	8-19
8.22	Visual Effects	8-22
8.23	Visual Sensitive Receivers VSRs	8-23
8.24	Mitigations	8-26
8.25	Residual Impacts	8-29
8.26	Environmental Monitoring and Audit	8-29
8.27	Summary of Conclusions	8-29

9.	HAZARD TO LIFE	<u>9-1</u>
9.1	Introduction	9-1
9.2	Yau Kom Tau Water Treatment Works Location and Operations	9-3
9.3	Tsuen Wan Road Upgrading Project	9-6
9.4	Meteorological Conditions and Population Data	9-6
9.5	Hazard Identification	9-22
9.6	Consequence Analysis	9-34
9.7	Rationalisation of Chlorine Release scenarios And estimation	of Scenario
	Frequencies	9-45
9.8	Quantitative Risk Assessment	9-54
9.9	Conclusions and Recommendations	9-61
9.10	References	9-62

<u>10.</u>	ECOLOGICAL IMPACTS	<u>10-1</u>
10.1	Introduction	10-1
10.2	Environmental Legislation, Policies, Plans, Standards and Criteria	10-1
10.3	Assessment Methodology	10-1
10.4	Baseline Conditions	10-2
10.5	Evaluation of Habitats	10-3
10.6	Impact Identification	10-6
10.7	Impact Evaluation	10-6
10.8	Mitigation Measures	10-8

偉 Sco

信 Wilson

October 2008

10.9	Residual Impacts	10-8
10.10	Environmental Monitoring and Audit	10-8
	Conclusions	10-8
<u>11.</u>	CULTURAL HERITAGE IMPACTS	<u>11-1</u>
11.1	Introduction	11-1
11.2	Legislations and Applicable Standards	11-1
11.3	Study Methodology	11-2
11.4	History of the Tsuen Wan Area	11-2
11.5	Potential Impacts Upon the Cultural Heritage along the Alignment	11-8
11.6	Conclusions	11-10
10	ENVIRONMENTAL MONITORING AND AUDIT	12.1
<u>12.</u> 12.1	ENVIRONMENTAL MONITORING AND AUDIT Introduction	<u>12-1</u> 12-1
12.1	Noise	12-1
12.2		12-1
	Air Quality Water Quality	12-2
12.4	Water Quality Landfill Gas Hazards	
12.5		12-2 12-2
12.6	Waste Management Hazard to Life	12-2
12.7		12-2
12.8	Landscape and Visual	12-3
12.9	Ecological	
12.10	Cultural Heritage	12-3
<u>13.</u>	CONCLUSIONS	<b>13-1</b>
13.1	Introduction	13-1
13.2	Environmental Outcomes	13-1
13.3	Noise Impacts	13-6
13.4	Air Quality Impacts	13-7
13.5	Water Quality Impacts	13-7
13.6	Waste Management Implications	13-7
13.7	Landfill Gas Hazards	13-8
13.8	Landscape & Visual Impacts	13-8
13.9	Ecological Impacts	13-8
13.10	Cultural Heritage Impacts	13-9
13.11	Hazard to Life	13-9
13.12	Environmental Monitoring and Audit	13-11
13.13	Overall Conclusion	13-11
13.14	References	13-12
14.	IMPLEMENTATION SCHEDULE OF RECOMMENDED	

<u>14.</u>	<b>IMPLEMENTATION SCHEDULE OF RECOMMENDED</b>	
	MITIGATION MEASURES	14-1

#### List of Figures

### **SECTION 2**

Figure 2-1 <u>Key Plan, Sheet 1, 2, 3, 4</u> Figure 2-2 <u>Sheet 1, 2, 3</u> Figure 2-3 <u>Sheet 1, 2, 3</u>

### <u>Figure 2-4</u> <u>Figure 2-5</u> Figure 2-6 <u>Option 1 Sheet 1, 2, 3, 4,</u> <u>Option 2 Sheet 1, 2, 3, 4,</u> <u>Option 3,</u> <u>Option 4,</u> Option 5

# **SECTION 3**

Figure 3-1 <u>Sheet 1, 2, 3, 4</u> <u>Figure 3-2</u> Figure 3-3 <u>Key Plan, Sheet 1, 2, 3, 4, 5, 6</u> Figure 3-4 <u>Key Plan, Sheet 1, 2, 3, 4, 5, 6</u> Figure 3-5 <u>Sheet 1, 2, 3, 4, 5, 6, 7</u>

# **SECTION 4**

Figure 4-1 <u>Key Plan, Sheet 1, 2, 3, 4, 5, 6</u> <u>Figure 4-2</u>

Figure 4-3 Figure 4-4 Sheet 1, 2, 3 Figure 4-5 Key Plan, Sheet 1, 2, 3, 4, 5, 6 Figure 4-6 Key Plan, Sheet 1, 2, 3, 4, 5, 6 Figure 4-7 Key Plan, Sheet 1, 2, 3, 4, 5, 6 General Layout of the Project

Typical Sections of Tsuen Wan Road in the Project

Construction Programme for Tsuen Wan Bypass, Widening of Tsuen Wan Road between Tsuen Tsing Interchange and Kwai Tsing Interchange and Associated Junction Improvement Works Project Works Areas Typical Construction Sequence Alignment Options

# NOISE IMPACTS

DP Road Extents of the Project

Assessment Areas for Noise Impact Assessment Locations of Representative Noise Sensitive Receivers

Locations of Selected Noise Assessment Points at each NSR

Locations and Cross Sections of Proposed Direct Noise Mitigation Measures

#### AIR QUALITY IMPACTS

Representative Air Sensitive Receivers Under EIAO

Location of Tsuen Wan Air Quality Monitoring Station and Ching Pak House Automatic Weather Station Location of Concurrent Projects Location of Chimneys

Predicted Cumulative Hourly NO2 Concentration At Worst Hit Level 1.5m Above Ground Predicted Cumulative Daily NO2 Concentration At Worst Hit Level 1.5m Above Ground

Predicted Cumulative Daily RSP Concentration At Worst Hit Level 1.5m Above Ground

Scott Wilson Ltd

October 2008

韋	Scot+
	Wilson

SECTION 5	WATER QUALITY IMPACTS
Figure 5-1	Locations of Water Sensitive Receivers and EPD Routine
	Water Quality Monitoring Stations
SECTION 6	WASTE MANAGEMENT IMPLICATIONS
Figure 6-1	Locations and Associated Extent of Cut and Fill Areas
<u>Sheet 1, 2, 3, 4, 5</u>	
Figure 6-2	Location of Potential Contamination Land Uses
<u>Key Plan</u> , <u>Sheet 1</u> , <u>2</u> , <u>3</u> , <u>4</u> , <u>5</u> , <u>6</u>	
SECTION 7	
SECTION 7	LANDFILL GAS HAZARD
Figure 7-1	Location of Tsuen Wan Road Relative To Gin Drinkers
F: 7.2	Bay Landfill
Figure 7-2	Consultation Zone of Gin Drinkers Bay Landfill and
	Locations of Landfill Gas Monitoring Points
Figure 7-3	Diverted Utility Routes to be Designated as "Special
	Routes"
Figure 7-4	Details of Possible Cut-off Barriers for New Utilities
	Crossing Consultation Zone
SECTION 8	LANDSCAPE AND VISUAL IMPACTS
Figure 8-1	Tsuen Wan Outline Zoning Plan Plan No. S/TW/25
Figure 8-2	Kwai Chung Outline Zoning Plan Plan No. S/KC/21
Figure 8-3	Baseline Landscape Resources & Landscape Character
<u> </u>	Areas and Photographs
Figure 8-3a	Landscape Character Areas On Site Photos
Figure 8-4	Visual Envelope
Figure 8-4a	Zone of Visual Influence and Key Visual Sensitive
<u>iigaro o na</u>	Receptors VSRs
Figure 8-5	Conceptual Landscape Layout (Sheet 1 of 5)
Figure 8-6	Conceptual Landscape Layout (Sheet 2 of 5)
Figure 8-7	Conceptual Landscape Layout (Sheet 3 of 5)
Figure 8-8	Conceptual Landscape Layout (Sheet 4 of 5)
Figure 8-9	Conceptual Landscape Layout (Sheet 5 of 5)
Figure 8.10a	Conceptual Landscape Layout and Photomontages – 1
Figure 8.10b	Conceptual Landscape Layout and Photomontages – 2
Figure 8-10c	Conceptual Landscape Layout and Photomontages – 3
Figure 8.10d	Conceptual Landscape Layout and Photomontages – 4
Figure 8-10e	Conceptual Landscape Layout and Photomontages – 5
Figure 8-11	Schedule of Landscape Resources & Characters Effects
Figure 8-12	Schedule of Visual Effects
Figure 8-13	Road Cross Sections (Sheet 1 of 3)
Figure 8-14	Road Cross Sections (Sheet 2 of 3)
Figure 8-15	Road Cross Sections (Sheet 2 of 3)
Figure 8-16	Details of Bridge Deck Planter
Figure 8-17	Details of Planter at Bridge Pier
<u>115010 0 17</u>	Details of Flatter at Dilage Flot

Scott Wilson Ltd October 2008



on Route 9 in Front of Summit Terrace and on Tsuen King

Figure 8-18	Images of Propose Planter
Figure 8-19	Tree Survey Plan
<u>Sheet 1, 2, 3, 4, 5</u>	
SECTION 9	HAZARD TO LIFE
Figure 9-1	Site Layout of Yau Kom Tau Water Treatment Works
Figure 9-2	Site Location of Yau Kom Tau WTW
Figure 9-3	Tsuen Wan Road Upgrading Project and the Developments Planned in its Vicinity
Figure 9-4	Population Map
Figure 9-5	Scheme of Traffic Lanes included in the Traffic Impact Assessment for the Project
Figure 9-6	Frequency Number FN Curves for "Background" General Population
Figure 9-7	Frequency Number FN Curves for "Updated" General Population
Figure 9-8	Individual Risk Levels
SECTION 10	ECOLOGICAL IMPACTS
Figure 10-1	Habitat Map of Study Area for Ecological Impact
<u>Sheet 1</u> , <u>2</u>	Assessment
SECTION 11	CULTURAL HERITAGE IMPACTS
Figure 11-1	Historic Settlement Pattern in Tsuen Wan
List of Appendices	
Appendix 3	
Appendix 3-A	Photos of Representative Noise Sensitive Receivers
Appendix 3-B	Building Layout Plans of Planned NSRs – Residential Developments at TW5, TW6, TW7 and TWTL 394
Appendix 3-C	Photos of NSRs which are Government Aided Schools
Appendix 3-D	Source of Information Showing Government Aided Schools
	Under the "Noise Abatement Programme"
<u>Appendix 3-E</u>	Photos of NSRs with Window-type Air-conditioners Installed
Appendix 3-F	Source of Information Showing the Land Uses as Service
	Apartments with the Application of Central Air Conditioning
	for Chelsea Court TWTL 373, Indi Home TWTL 406 and H-
	Cube TWTL 407
<u>Appendix 3-G</u>	Correspondences for the Endorsement of the Final TIA
Annondia 2 II	Review Report Issued in January 2007
<u>Appendix 3-H</u>	Traffic Forecast at Year 2010 and Year 2030 in the Final TIA Review Report Issued in January 2007
Appendix 3-I	Locations and Photos of Existing Noise Mitigation Measures

Environmental Impact Assessment

Scott Wilson Ltd October 2008



	Circuit
<u>Appendix 3-J</u>	Locations of Planned Noise Mitigation Measures on Tuen Mun
	Road and on Yeung Uk Road
Appendix 3-K	Correspondence for Information of Planned Noise Mitigation
	Measures and Low Noise Surfacing Pavement
Appendix 3-L	Typical Computer Plot of the "RoadNoise® 2000" Model
Appendix 3-M	Detailed Calculations for Construction Noise Impact
<u> </u>	Assessment and Complete PME Inventory
Appendix 3-N	Detailed Predicted Road Traffic Noise Results at Each Noise
<u> </u>	Assessment Point under the Unmitigated Scenario
Appendix 3-O	Detailed Predicted Road Traffic Noise Results at Each Noise
	Assessment Point under the Mitigated Scenario
Appendix 3-P	Correspondence Showing the Anticipated Development
	Completion Dates of Residential Development at TW5 and
	TW7
	1 // /
Appendix 4	
Appendix 4-A	Photos of Air Sensitive Receivers
Appendix 4-B	Road Link Map
Appendix 4-C	Adjustments on Exhaust Technology Fractions
Appendix 4-D	Estimated population in year 2015, 2020, 2025, 2030
Appendix 4-E	Trips per VMT
Appendix 4-F	Details of Annual Traffic Census Core Station 5010, 5018,
<u>Appendix + 1</u>	5026, 5030 and 5035
Appendix 4-G	Meteorology Information
Appendix 4-H	Sensitivity Test of Emission Inventory and Calculation of
	Emission Factors
Appendix 4-I	Speed Fraction
Appendix 4-J	Sensitivity Test Speed Fraction
<u>Appendix 4-K</u>	Surface Roughness
Appendix 4-L	Supplementary Information for CALINE4 Model
Appendix 4-M	Calculation of Portal Emission
Appendix 4-N	Photographic Survey for Chimney Inventory
Appendix 4-O	Request Letter and Responses for Chimney Inventory
Appendix 4-P	Chimney Emission Inventory
Appendix 4-Q	Calculation of Air Quality Inside Full Noise Enclosure
Appendix 4-R	Sample Input Files of EMFAC-HK Model
Appendix 4-S	Sample Input Files of CALINE4 Model
Appendix 4-T	Sample Input Files of ISCST3 Model
Appendix 4-U	Predicted Worst Case Average Pollutant Concentrations at
Арренціх 4-0	ASRs
	ADIV)
Appondix 8	
Appendix 8	<b>— — — — — — — — — —</b>

Appendix 8-A Appendix 8-B Tree Schedule Conceptual Planting Plan



Appendix 9	
Appendix 9-A	DRIFT Flat Terrain Dispersion Modelling
<u>Appendix 9-B</u>	Wind Tunnel Test Results
<u>Appendix 9-C</u>	CFD Modelling Results for Sha Tin WTW and Tai Po Tau
	WTW
Appendix 9-D	Application of Dispersion Modelling Results in QRA
Appendix 9-E	Chlorine Cloud Height Predictions
Appendix 9-F	Modelling of Escape from Chlorine Cloud
Appendix 9-G	Seismic Hazard Assessment
Appendix 9-H	Aircraft Crash Frequency Assessment
Appendix 9-I	Frequency Estimation
Appendix 9-J	Traffic Projections from the Project Traffic Impact Assessment
Appendix 9-K	Probability of Fatality for the Indoor Population
Appendix 10	

Appendix 10-A

Flora Species Recorded at Different Habitats