

**Highways Department
Works Division**

Agreement No. WD 7/2007

Upgrading of Remaining Sections of Kam Tin Road & Lam Kam Road

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Volume 1 of 2

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**Mannings (Asia) Consultants Ltd
*in association with BMT Asia Pacific Ltd***

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**Construction Agreement No. WD 7/2007
Upgrading of Remaining Sections of Kam Tin Road and Lam Kam Road**

Environmental Impact Assessment Report

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**ENVIRONMENTAL IMPACT ASSESSMENT REPORT
VOLUME 1 OF 2**

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1.0 INTRODUCTION

Project Background

- 1.1 Kam Tin Road and Lam Kam Road together form a critical route serving the local areas in Yuen Long east and Tai Po south. Sections of Kam Tin Road and Lam Kam Road have been upgraded under the following projects:
- (a) Lam Kam Road Improvement Stage I and II, completed in 1986 and 1994 respectively, upgraded the section between Kadoorie Farm and Lam Kam Road Interchange;
 - (b) Improvement to Kam Tin Road Stage I, completed in 2002, widened the section of Kam Tin Road between Au Tau Roundabout and Ko Po Tsuen from single two-lane carriageway to dual two-lane carriageway; and
 - (c) Kam Tin Bypass, completed in 2004, constructed dual two-lane carriageway to bypass traffic from Kam Tin Road between Ko Po Tsuen and Kiu Tau Tsuen.
- 1.2 The remaining sections of Kam Tin Road and Lam Kam Road are located at Kam Tin Road between Kam Tin Bypass and Lam Kam Road, and Lam Kam Road between Kam Tin Road and Kadoorie Farm. These sections comprise a substandard single two-lane carriageway. Road safety problems are compounded by fast vehicular traffic, sharp bends, hidden accesses, sub-standard gradients, inadequate lateral clearance, frequent usage of heavy vehicles, insufficient pedestrian crossing facilities, significant jay-walking and lack of bus-bays. On road safety grounds, the project titled "Upgrading of Remaining Sections of Kam Tin Road and Lam Kam Road" (hereinafter known as the "Project") was initiated in 2007.
- 1.3 Kam Tin Road and Lam Kam Road are rural roads. The Project does not include 100 m long road bridge or 800 m long road tunnel. In addition, it does not have any additional traffic lane or long road extension. However, it encroaches upon existing conservation areas. Hence, the Project is a Designated Project (DP) under item Q.1 of Part 1, Schedule 2 of the EIAO: *"All projects including new access roads, railways, sewers, sewage treatment facilities, earthworks, dredging works and other building works partly or wholly in an existing or gazetted proposed country park or special area, a conservation area, an existing or gazetted proposed marine park or marine reserve, a site of cultural heritage, and a site of special scientific interest."*
- 1.4 The Highways Department (HyD) submitted an application for an Environmental Impact Assessment (EIA) study brief with a project profile in September 2007. Pursuant to Section 5(7)(a) of the Environmental Impact Assessment Ordinance (EIAO), the Environmental Protection Department issued the EIA study brief (ESB-170/2007) for the Project in October 2007.
- 1.5 In March 2008, Mannings (Asia) Consultants Limited in association with BMT Asia Pacific Limited was employed by the Government of Hong Kong Special Administrative Region, represented by HyD, to undertake the EIA for the Project.

- 1.6 This report presents the approach and findings of the EIA study which conducted in accordance with the requirements in the EIA Study Brief No. ESB-170/2007.

Objectives of the EIA Study

- 1.7 According to the EIA study brief, the objectives of the study are to:
- (a) Describe the Project and associated works together with the requirements for carrying out the Project;
 - (b) Identify and describe elements of community and environment likely to be affected by the Project and/or likely to cause adverse impacts to the Project, including natural and man-made environment and the associated environmental constraints;
 - (c) Provide information on the consideration of alternatives to avoid and minimize potential environmental impacts to environmentally sensitive areas and other sensitive uses; to compare the environmental benefits and dis-benefits of each of different options; to provide reasons for selecting the preferred option(s) and to describe the part environmental factors played in the selection of preferred option(s);
 - (d) Identify and quantify all environmental sensitive receivers, emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;
 - (e) Identify and quantify any potential losses or damage to flora, fauna and natural habitats;
 - (f) Identify and quantify any potential landscape and visual impacts and to propose measures to mitigate these impacts;
 - (g) Identify any negative impacts on sites of cultural heritage and propose measures to mitigate these impacts;
 - (h) Propose provision of mitigation measures so as to minimize pollution, environmental disturbance & nuisance during construction & operation of Project;
 - (i) Investigate the feasibility, practicability, effectiveness and implications of the proposed mitigation measures;
 - (j) Identify, within the study area, any individual project(s) that fall under Schedule 2 and/or Schedule 3 of the EIAO; to ascertain whether the findings of this EIA study have adequately addressed the environmental impacts of those projects; and where necessary, to identify the outstanding issues that need to be addressed in any further detailed EIA study;

- (k) Identify, predict and evaluate the residual environmental impacts (i.e. after practicable mitigation) and the cumulative effects expected to arise during the construction and operation phases of the Project in relation to the sensitive receivers and potential affected uses;
- (l) Identify, assess and specify methods, measures and standards, to be included in the detailed design, construction and operation of the Project which are necessary to mitigate these environmental impacts and cumulative effects and reduce them to acceptable levels;
- (m) Investigate the extent of the secondary environmental impacts that may arise from the proposed mitigation measures and to identify constraints associated with the mitigation measures recommended in the EIA study, as well as the provision of any necessary modification; and
- (n) Design and specify environmental monitoring and audit requirements to ensure the effective implementation of the recommended environmental protection and pollution control measures.

Structure of the Report

1.8 The structure of the EIA Report is as follows:

Section 2 – Project Background and Description

Section 3 – Air Quality

Section 4 – Noise

Section 5 – Water Quality

Section 6 – Waste Management

Section 7 – Ecology

Section 8 – Cultural Heritage

Section 9 – Landscape and Visual

Section 10 – Implementation Schedule of Recommended Mitigation Measures

Section 11 – Conclusions

2.0 PROJECT DESCRIPTION

Key Requirements of the Project

- 2.1 The Project is to upgrade the remaining sections of Kam Tin Road and Lam Kam Road from a substandard single two-lane carriageway into a standard 7.3 m wide carriageway, with the associated improvement of pedestrian facilities and public transport laybys.

Scope of the Project

- 2.2 The scope of the Project comprises:
- (a) Upgrading of about 5.2 km long road section into standard width single two-lane carriageway;
 - (b) Provision of laybys and crossing facilities; and
 - (c) Associated slope and drainage works, traffic aids and street lighting modification, landscaping works and environmental mitigation measures if required.

The Need for the Project

- 2.3 The need to upgrade the remaining sections of Kam Tin Road and Lam Kam Road is recognized in the Project Definition Statement (PDS) issued by the Environment, Transport and Works Bureau (ETWB) in January 2007. These remaining sections are single two-lane carriageway with sub-standard width. Road safety problems are compounded by fast vehicular traffic, sharp bends, hidden accesses, sub-standard gradients, inadequate lateral clearance, frequent usage of heavy vehicles, insufficient pedestrian crossing facilities and lack of bus-bays.

Encroachment of the Conservation Areas

- 2.4 The Project is a DP since part of its boundary encroaches upon the Conservation Area (CA) zoning as defined on relevant Outline Zoning Plans (OZPs), and as referred in Section 1.3 of the EIA Study Brief No. ESB-170/2007. There are four encroachment areas which are shown in Figure 2.2, and described below:

CA at north of section between Chainage CHB 28+70 and CHB 30+10 of Kam Tin Road

- The proposed works within CA are construction of an earth retaining wall and reconstruction of existing footway. The concerned works are not arising from change of road alignment. The earth retaining wall is to upgrade an existing road side slope which is assessed to be below the current safety standards. The footway reconstruction is required from maintenance viewpoint.

CA at south of section between Chainage CHB 44+30 to CHB 44+80 of Lam Kam Road

- The proposed works within CA are widening of existing carriageway, and reconstruction of existing footway and carriageway. Options of road alignment have been explored at this section and the current alignment is the preferred option. Although it slightly encroaches upon CA, it can overall preserve more mature trees and reduce environmental impacts. More detailed description of the subject option comparison is at Section 2.5. As for the reconstruction works, they are required from maintenance viewpoint.

CA at south of section between Chainage CHB 48+00 to CHB 52+30 of Lam Kam Road

- The proposed works within CA are soil nailing of existing slopes and construction of 2m high retaining wall. The concerned works are not arising from change of road alignment. The proposed soil nailing is to upgrade the existing road side slopes which are assessed to be below the current safety standards. The proposed retaining wall is a safety measure to protect road users against the identified potential natural terrain hazards.

CA at north of section between Chainage CHB 50+20 to CHB 52+40 of Lam Kam Road

- The proposed works within CA are widening of existing footway and carriageway, soil nailing of an existing slope, and re-compaction of an existing slope. Options of road layout have been explored at this section and the current scheme is the preferred option which can minimise CA encroachment and geotechnical works. The proposed soil nailing and slope re-compaction are to upgrade an existing slope which is assessed to be below current safety standards. As revealed on site, there is a layer of waste materials on the concerned slope surface and hence a rather large scale re-compaction is considered necessary from safety viewpoint.

Alternatives for the Proposed Project

2.5 The sections of Kam Tin Road and Lam Kam Road to be upgraded are rural roads serving many road side developments. Hence, the proposed road alignment follows closely with the existing alignment. In addition, the proposed road alignment is designed based on the principle of minimising land resumption and environmental impacts. The following measures have been taken to minimise the environmental impacts.

- In section between Chainage CHA17+10 and CHA 18+90 of Kam Tin Road, the existing single carriageway is proposed to be widened by converting it to dual carriageway. Although it involves resumption of larger area of private land, the adoption of this option can preserve 4 numbers of mature trees, 2 numbers of which are of 1m trunk diameter.
- In section between Chainage CHB41+90 and CHB49+30 of Lam Kam Road, two options have been considered. Option A is to widen the carriageway northwards to avoid encroachment of the CA thereat while Option B is to widen southwards. The sections forming the two alternative options are shown on Figures 9.15 M & N. Upon a detailed comparison, Option B is adopted as the preferred option. A brief summary of the assessment findings is described below:

- (i) The preferred option can overall preserve 65 more mature trees. In particular, three numbers of trees of over 1m trunk diameter can be preserved.
 - (ii) The preferred option can avoid affecting the existing slopes at the north of the concerned road section. The reduced geotechnical works give rise to less waste, noise, air quality, landscape and visual impacts.
 - (iii) The preferred option slightly encroaches upon CA. However, the concerned area is a paved footway with isolated trees, and hence the potential impact to habitat loss/vegetation clearance is considered to be low. Detailed ecological impact assessment is in Section 7.
 - (iv) Apart from CA encroachment, another disadvantage of the preferred option is the need to resume larger area of private land.
- In section between Chainage CHB48+00 and CHB48+80 of Lam Kam Road, the southern footway is proposed to be set back in order to preserve the existing road side trees thereat.
 - In section between Chainage CHB49+10 and CHB52+90 of Lam Kam Road, the preferred option upgrades the carriageway and the northern footway, but does not add footway at the southern sides of the carriageway. Such arrangement is to minimise the extent of CA encroachment. Besides, considering that extensive geotechnical works will be required for adding the concerned footway, such arrangement can reduce waste, noise, air quality, landscape and visual impacts.

Construction Program and Methodology

- 2.6 The construction programme is to commence works in the first quarter of 2011 for completion in the third quarter of 2015. The upgrading works are to be carried out by conventional open excavation method. The construction sequence is to upgrade in stages with two-way traffic maintained throughout the construction period.

Consideration of Alternatives Construction Methods and Sequences of Works

- 2.7 The upgrading of at-grade road sections is a straight forward construction process that will not involve complicated construction sequences and activities. For the purpose of the EIA Study, the construction sequences that have been reviewed are briefly described as follows:

(A) Upgrading both bounds of Kam Tin Road and Lam Kam Road simultaneously:

- The most distinct advantage of this construction method is that a shorter construction period can be achieved thus resulting construction impacts of shorter term. However, there are drawbacks as follows:
 - Higher impacts on noise and air quality during construction period;
 - Complicated diversion schemes for traffic and utilities; and
 - Higher risks to road users.

(B) Upgrading both bounds of Kam Tin Road and Lam Kam Road in stages:

- Under this option, the remaining sections of Kam Tin Road and Lam Kam Road will be upgraded in stages, i.e. bound by bound. Though the construction period will be longer, the following advantages can be achieved:
 - Less noise and air quality impacts during construction period thus more manageable;
 - Less complicated diversion schemes for traffic and utilities; and
 - Less disturbance to existing road side developments.

2.8 In conclusion, the impacts and risks under the latter option, i.e. to upgrade the remaining sections of Kam Tin Road and Lam Kam Road bound by bound, are more manageable and therefore this option is adopted.

Concurrent Project and Potential Cumulative Impacts

- 2.9 One Designated Project defined by the EIAO, namely, *Hong Kong Section of Guangzhou - Shenzhen - Hong Kong Express Rail Link* will be implemented and within 500m of the Project boundary. According to the Project Profile of this railway project (application no.: ESB-197/2008), the construction works is tentatively scheduled to commence in the 4th quarter of 2009 and complete by 2015 which would coincide with the construction period of the proposed Project. As the EIA study of this railway project is in progress, there is no detailed construction methods and programme can be reviewed. As such, the EIA study of this railway project should take into account the potential cumulative impacts arising from the proposed Project. In addition, the Project Contractor is required to ensure close liaison with relevant interfacing parties to avoid or minimise concurrent works activities and potential cumulative impacts.
- 2.10 Two other Designated Projects defined by the EIAO, namely, *Yuen Long, Kam Tin, Ngau Tam Mei & Tin Shui Wai Drainage Improvement Stage 1, Phase 2B - Kam Tin Secondary Drainage Channel KT13 (CE 67/98)* and *Drainage Improvement in Sha Tin and Tai Po Design and Construction (CE 50/2001)* will be implemented. However, no cumulative impacts are anticipated from these two projects as both are scheduled to be completed before the commencement of the Project, and both are located over 1 km from the proposed Project.
- 2.11 Table 2.1 summarises other non-designated projects in the vicinity of the proposed Project.
- 2.12 For item (i), minor works will be undertaken during or after 2010 along a 50m section of Kam Tin Road close to the junction of Fan Kam Road. As such, the cumulative environmental impacts of such minor activities shall be minimal.
- 2.13 For item (ii), mains laying works shall be at least 1 km away from the Project and hence cumulative impacts shall also be minimal.

Table 2.1 Concurrent Non-designated Projects

Item	Agreement No.	Project Title	Implementation
(i)	CE 1/2005	Replacement and Rehabilitation of Water mains Stage 2; Mains in New Territories West – Investigation, Design and Construction	2007 - 2011
(ii)	CE 6/2005	Replacement and Rehabilitation of Water mains Stage 2; Mains in New Territories East – Investigation, Design and Construction	2007 - 2011
(iii)	CE 10/2008	Replacement and Rehabilitation of Water mains Stage 4; Mains in New Territories – Investigation, Design and Construction	Mid 2010 - 2015
(iv)	PWP 337WF	Alternative Raw Water Supply to Yau Kom Tau Water Treatment Works from Au Tau Raw Water Pumping Station	End 2010 - 2014
(v)	PWP 4235DS	Yuen Long and Kam Tin Sewerage and Sewage Disposal	See text

- 2.14 For item (iii), minor works will be undertaken during or after 2010. Total six active site area in small local-scale within the Project boundary. There shall be only one active construction site within 300 m due to necessary traffic management arrangements. Therefore, there will not increase the total number of active construction site along am Tin Road and Lam Kam Road. As such, it is recommended that the Project Contractor ensures close liaison with relevant interfacing parties and that the works be scheduled to avoid or otherwise control cumulative environmental impacts to within acceptable limits.
- 2.15 For item (iv), no significant cumulative environmental impacts are anticipated as these water mains laying works are anticipated to be implemented at least 300 metres from the western end of the Project area.
- 2.16 For item (v), the laying of sewerage pipes along Kam Tin Road and Kam Sheung Road is anticipated from 2010 which would coincide with the construction period of the proposed Project. There shall be only one active construction site within 300 m due to necessary traffic management arrangements. Therefore, there will not increase the total number of active construction site along am Tin Road and Lam Kam Road. As such, the Project Contractor is required to ensure close liaison with relevant interfacing parties to avoid or minimise concurrent works activities and potential cumulative impacts.

Operational Traffic Forecast

- 2.17 Traffic flow predictions for the year 2030 (i.e. 15 year after Project commencement) have been adopted to support the operational air quality and noise impact assessment studies in Sections 3 and 4, respectively, as appropriate. Full details of the adopted traffic forecast data accepted by the Transport Department is presented in Appendix A1. The letter of acceptance by the Transport Department is provided in Appendix A2.

3.0 AIR QUALITY IMPACT ASSESSMENT

Introduction

- 3.1 The air quality impacts during the construction and operational phases of the Project have been assessed in accordance with the guidelines referred in Annex 12 of the Technical Memorandum of the Environmental Impact Assessment Process (EIA-TM).
- 3.2 Representative air sensitive receivers within the Project area have been identified, and following assessment by modelling techniques, mitigation measures shall be proposed as appropriate to control impacts to within acceptable levels.

Environmental Legislation, Standards and Guidelines

- 3.3 The criteria to evaluate the air quality impacts are set out in Annex 4 of the EIA-TM specify the compliance of the Air Quality Objectives (AQOs). Table 3.1 presents the applicable AQOs for the impact assessment.

Table 3.1 Hong Kong Air Quality Objectives

Pollutant	Concentration ($\mu\text{g}/\text{m}^3$) ⁽¹⁾ Averaging Time				
	1 Hour ⁽²⁾	8 Hours ⁽³⁾	24 Hours ⁽³⁾	3 Months ⁽⁴⁾	1 Year ⁽⁴⁾
Sulphur Dioxide (SO ₂)	800	–	350	–	80
Total Suspended Particulates (TSP)	–	–	260	–	80
Respirable Suspended Particulates (RSP) ⁽⁵⁾	–	–	180	–	55
Nitrogen Dioxide (NO ₂)	300	–	150	–	80
Carbon Monoxide (CO)	30000	10000	–	–	–
Photochemical Oxidants (as ozone ⁽⁶⁾)	240	–	–	–	–
Lead	–	–	–	1.5	–

Notes:

- (1) Measured at 298 K and 101.325 kPa (one atmosphere).
 (2) Not to be exceeded more than three times per year.
 (3) Not to be exceeded more than once per year.
 (4) Arithmetic means.
 (5) Respirable suspended particulates means suspended particles in air with a nominal aerodynamic diameter of 10 micrometers or less.
 (6) Photochemical oxidants are determined by measurement of ozone only.

- 3.4 The EIAO-TM stipulates that the hourly TSP level should not exceed $500 \mu\text{g}/\text{m}^3$ (measured at 25°C and one atmosphere) for construction dust impact assessment.

Baseline Conditions

- 3.5 The major pollution sources of the study area are the vehicle emissions of Kam Tin Road and Lam Kam Road. By considering the geographical constituency to which the site belongs, TSP, RSP and NO₂ concentrations were extracted from the EPD's Tai Po Air Quality Monitoring Station (AQMS), instead of the EPD's Yuen Long AQMS. According to the EPD's "Guideline on Assessing the 'Total' Air Quality Impact", the latest five years (i.e., 2003 – 2007) average monitoring data should be adopted as the background concentration. Table 3.2 summarizes the annual average concentrations of the pollutants (NO₂, RSP and TSP) in the latest five years.

Table 3.2 Annual Average Concentrations of Pollutants in the Latest Five Years (Year 2003 - 2007) at Tai Po Air Quality Monitoring Station

Pollutant	Annual Average Concentration in the Latest Five Years ($\mu\text{g}/\text{m}^3$)
Nitrogen Dioxide (NO ₂)	53
Respirable Suspended Particulates (RSP)	52
Total Suspended Particulates (TSP)	68

Air Sensitive Receivers (ASRs)

- 3.6 Representative existing ASRs, within the study area (i.e. 500 m from the proposed Project boundary), have been identified according to Annex 12 of the EIA-TM.
- 3.7 For future ASRs, all planned sensitive uses within the study area as referred on each relevant Outline Zoning Plan (OZP) have been identified. The relevant OZPs are referred to Shek Kong (Plan no.: S/YL-SK/9), Pat Heung (Plan no.: S/YL-PH/11), Lam Tsuen (Plan no.: S/NE-LT/11), Kam Tin North (Plan no.: S/YL-KTN/7) and Kam Tin South (Plan no.: S/YL-KTS/11). As there is no detailed layout of the planned ASRs during the preparation of the EIA report, the assessment points of the planned ASRs is located at the site boundary to simulate the worst-case scenario.
- 3.8 Table 3.3 and Figure 3.1 summarize the description and location of the ASRs for impact assessment.

Table 3.3 Identified ASRs for Construction and Operational AQIA

ASR	Description	Sensitive Use	Horizontal Distance from the Nearest Work Site Boundary (m)
A4	Village house near Petrol Station	Residential	24
A6	Kam Tin Clinic	Clinical	7
A8	Quarter of Shek Kong Barrack	Residential	13
A10	Village house of Shek Kong San Tsuen	Residential	11

ASR	Description	Sensitive Use	Horizontal Distance from the Nearest Work Site Boundary (m)
A11	Education Centre of Shek Kong Barrack	Educational	7
A13	Village house near Season Villas	Residential	3
A14	Church of Shek Kong Barrack	Place of worship	13
A18	Village house, Chung Ying Yuen	Residential	19
A19	Village house, Ching Yuen	Residential	7
A24	Village house, Lee Ka Yuen	Residential	13
A27	Village house near Petrol Station (under construction)	Residential	6
A31	Village house, 30, Wang Toi Shan Lo Uk Tsuen	Residential	15
A32	Block 9, Evergreen Intl Hong Kong Association	Home for Aged	25
A33	Village house	Residential	19
A34	Village house, Fau Wan Court	Residential	26
A35	Village house near Pine Hill Villa	Residential	29
A38	Village house	Residential	24
A39	Village house near Pat Heung Old Temple	Residential	3
A40	Pat Heung Rural Committee	Office	18
A43	Village house	Residential	22
A45	Village house	Residential	27
A49	Village house	Residential	12
A50	Village house	Residential	27
A51	Village house (No. 151 Lam Kam Road)	Residential	22
A53	Village house (No. 70 Lam Kam Road)	Residential	7
A54	Village house (opposite Kadoorie Experimental Farm)	Residential	11
P01	Planned village development (V Zone)	Residential	34
P02	Planned residential development (R(D) Zone)	Residential	At Project Boundary
P03	Planned village house	Residential	36
P04	Planned residential development (R(D) Zone)	Residential	At Project Boundary
P05	Planned village development (V Zone)	Residential	75
P06	Planned village development (V Zone)	Residential	At Project Boundary
P07	Planned residential development (R(D) Zone)	Residential	At Project Boundary
P08	Planned residential development (R(C)2 Zone)	Residential	At Project Boundary

ASR	Description	Sensitive Use	Horizontal Distance from the Nearest Work Site Boundary (m)
P09	Planned village development (V Zone)	Residential	At Project Boundary
P10	Planned village development (V Zone)	Residential	At Project Boundary
P11	Planned residential development (R(D) Zone)	Residential	At Project Boundary
P12	Planned village development (V Zone)	Residential	At Project Boundary
P13	Planned village development (V Zone)	Residential	At Project Boundary

- 3.9 Three elevations of 1.5 m above local ground level (which is the average height of the human breathing zone), 4.5 m and 7.5 m above local ground level have been chosen for the assessment.

Construction Air Quality Impact Assessment

Impacts Identification and Evaluation

- 3.10 Fugitive dust may be generated from works activities including site clearance, excavation, handling of construction materials, concrete breaking and from minor wind erosion. Due to site constraints and road traffic management arrangements for Kam Tin Road section between CH0+00 and CH19+00, each active construction activity location shall occupy about 50 m in length of the Project alignment at any one time, and with a distance separation more than 300m between each location. The area of the work front would be about 175 m² (50 m x 3.5 m). The total volume of generated C&D materials is estimated to be 45,000 m³. The construction programme is about 54 working months and 26 working days for each working month are assumed for this Project. Therefore, the amount of excavated/handled materials for all work fronts per day is about 32 m³, which is small amount of excavated materials. Given that each works area and the amount of excavated/handled materials for all work fronts is small, dust impacts during the construction phases are anticipated to be insignificant with the adoption of mitigation measures stipulated in the Air Pollution Control (Construction Dust) Regulation. As such, a quantitative dust impact assessment is not necessary.
- 3.11 In addition, activities that may induce significant dust emissions such as extensive site formation and blasting are not required for Project development.
- 3.12 Small amount of sulphur dioxide (SO₂), nitrogen dioxide (NO₂) and smoke shall be emitted from the diesel-powered construction equipment, Under normal operation, however, such properly maintained equipment shall not contribute any significant smoke or gaseous emissions. As such, it is not anticipated that Air Quality Objectives (AQOs) for these pollutants would be exceeded during the construction phase.

Potential Cumulative Impacts

- 3.13 As stated in Section 2, there is only one designated project within 500m of the Project boundary (i.e., *Hong Kong Section of Guangzhou - Shenzhen - Hong*

Kong Express Rail Link) and will potentially be constructing concurrently with this project. As the EIA study of this railway project is in progress, there is no detailed construction methods and programme can be reviewed. As such, the EIA study of this railway project should take into account the potential cumulative impacts arising from the proposed Project. According to the Project Profile of this railway project (application no.: ESB-197/2008), most of the construction works would be carried out in underground condition. Therefore, no significant cumulative impacts are anticipated. Concurrent non-designated projects have been summarized in Section 2, and specifically Table 2.1. Only minor local-scale dust impacts arising from the construction activities of these projects are anticipated. For the concurrent water mains and sewerage projects undertaken along the Kam Tin Road and Lam Kam Road, there shall be only one active construction site within 300 m due to necessary traffic management arrangements. Regarding the water mains laying works near Au Tau (PWP 337WF), these shall be at 300 m from the proposed Project. In general, the construction works of water and sewerage project will likely be constructed section by section in small work front areas within a short period. Therefore, the quantity of the spoil materials from the concurrent water mains and sewerage projects unlikely to be large enough to cause a significant dust nuisance. As such, the cumulative dust impacts as a result of concurrent works within the study area are not expected given the large distance separation and provided that the recommended dust suppression measures are implemented.

Mitigation Measures

3.14 Although no adverse construction phase air quality impacts are anticipated, as a best practice measure to ensure compliance with the Air Pollution Control (Construction Dust) Regulation it is suggested that the following control measures be incorporated into contract documentation:

- Works area for site clearance shall be sprayed with water before, during and after the operation so as to maintain the entire surface wet;
- All dusty materials shall be sprayed with water immediately prior to any loading, unloading or transfer operation so as to maintain the dusty materials wet;
- Hoarding of not less than 2.4 m above ground shall be provided, as far as practicable, along the site boundary which is next to the public areas;
- Restricting heights not higher than 1.5m above ground from which materials are to be dropped, as far as practicable to minimise the fugitive dust arising from unloading/ loading;
- Any stockpile of dusty materials shall be covered entirely by impervious sheeting; and/ or placed in an area sheltered on the top and 4 sides;
- Immediately before leaving a construction site, all vehicles shall be washed to remove any dusty materials from its body and wheels; and
- Where a vehicle leaving a construction site is carrying a load of dusty materials, the load shall be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle.

Residual impacts

3.15 No adverse residual impacts are anticipated during the construction phase.

Operational Air Quality Impact Assessment

Impact Identification

- 3.16 Vehicular emissions from open road sections of the existing and widened Kam Tin Road and Lam Kam Road are the potential air impact to the surrounding ASRs during Project operation.

Methodology

- 3.17 Fuel combustion of road vehicles generate air pollutants such as Carbon Monoxide (CO), Nitrogen Dioxide (NO₂) and Respirable Suspended Particulates (RSP). Owing to much higher AQO limit comparing with other major parameters of air quality impact, non-compliance of CO is not envisaged in general given that the NO₂ concentrations are below the AQO standards. Therefore, NO₂ and RSP are considered as the key air pollutant parameters and the averaging time of the 1-hour concentration of NO₂ and 24-hour concentrations of NO₂ and RSP were selected for the assessment of air quality impact associated with vehicular emission and compared against the AQO limits.
- 3.18 The EPD recommended air dispersion model, CALINE4, was adopted to predict the pollution of vehicle exhaust from the Project and surrounding roads. All major roads within the study area were included in the model.
- 3.19 The completion of the Project would be in Year 2015. The predicted peak traffic flows in year 2030 is the highest compared to those within the next 15 years after the operation of the Project. As such, the morning and afternoon peak traffic flows in year 2030 is adopted to represent the worst-case scenario and is given in Appendix A1.
- 3.20 The hourly profile in year 2008 was adopted and assumed as the hourly profile of all roads within the Study Area. The same traffic breakdown was applied for all hours.
- 3.21 The methodology and assumptions of producing the hourly profile in 2008, traffic flow and traffic breakdown in 2030 were accepted by Transport Department (see Appendix A2).

Fleet Average Emission Factors

- 3.22 The emission model EMFAC-HK was adopted to calculate the vehicle emission factors of NO_x and RSP. The following details the input assumptions of the model.

Vehicle Classes

- 3.23 The vehicle composition of the roads was broken down into 16 vehicle classes according to the EMFAC-HK model. The vehicle classifications as detailed in Appendix I – EMFAC-HK Vehicle Classification (July 2005) have been provided by EPD.
- 3.24 Table 3.4 summarizes the 16 vehicle classes to be modelled using EMFAC-HK.

Table 3.4 Vehicle Classes in EMFAC-HK Model

Vehicle Class*	Description	Fuel	Gross Weight
MC1	Petrol Private Cars (PC) & Light Goods Vehicles (LGV)	Petrol	all
MC3	Diesel PC & LGV	Diesel	<=2.5t
MC4	Diesel PC & LGV	Diesel	>2.5-3.5t
MC5	Public Light Buses (PLB)	LPG, Diesel	all
MC6	LGV	Diesel	>3.5-5.5t
MC7	Medium & Heavy Goods Vehicles (MGV & HGV)	Diesel	>5.5-15t
MC8	MGV & HGV	Diesel	>15t
MC10	Double Deck Franchised Buses (DDFB)	Diesel	all
MC11	Motor Cycles (MC)	Petrol	all
Taxi3	Taxi	LPG	all
Taxi4	Private Light Buses (PrLB)	LPG, Diesel	<=3.5t
Taxi5	PrLB	LPG, Diesel	>3.5t
Taxi6	Non-franchised Buses (NFB)	Diesel	<=6.4t
Taxi7	NFB	Diesel	>6.4-15t
Taxi8	NFB	Diesel	>15t
Taxi10	Single Deck Franchised Buses (SDFB)	Diesel	all

* MC/Taxi – Sub-model of EMFAC – HK: EMFAC – HK MC v1.2/ EMFAC – HK Taxi v1.2; e.g. MC1 – Vehicle Class 1 defined in the sub-model EMFAC – HK MC v1.2

Road Grouping

- 3.25 As the road characteristics within the study area is similar and the speed limit of the road was 50kph except a portion of Kam Tin Bypass (as shown in Appendix A1) was 70kph. Only single road type was assumed and a single set of emission factors were calculated.

Modelling Modes

- 3.26 As suggested in EPD guideline, “Burden mode” was selected. Vehicular emissions for each hour and for daily totals were output.

Technology Fractions

- 3.27 In different years each vehicle class has a different exhaust technology group index and technology fraction. Each technology group represents a distinct emission control technology. The technology fractions input to the model are based on the “Up to Date Vehicle Licensed Number by Age and Technology Group Fractions” provided by EPD. Since the exhaust technology fractions are only presented up to the year 2003, those after this time have been projected in accordance with the EPD Guideline on Modelling Vehicle Emissions Appendix II - “The Implementation Schedule of Vehicle Emission Standards in Hong Kong (Updated as at 17 August 2005)” and Appendix III - “The Technology Group Indexes”.
- 3.28 Since sufficient information is not available for the projected breakdown in percentage of the exhaust technology fractions for petrol PC & LGV, diesel PC & LGV and PrLB (> 3.5t, diesel & LPG) from Year 2004 to 2030, the projected

breakdowns have been made reference to the default values of the EMFAC-HK model. It is justified that the existing vehicle emission control programs were included in the model according to the EPD's "Guideline on Modeling Vehicle Emissions".

- 3.29 For SDFB, the Euro II emission standards were assumed in Year 2001 – 2005. The emission standards after Year 2005 have been followed the "Implementation Schedule of Vehicle Emission Standards in Hong Kong".
- 3.30 The technology fractions adopted have been presented in Appendix B1. The fractions for the period 2025 – 2030 were assumed to be the same as those for the year 2024.
- 3.31 Default values were used for the evaporative technology fraction.

Vehicle Population

- 3.32 As recommended in EPD's "Guideline on Modelling Vehicle Emissions", the latest vehicle age distribution data provided in the EPD's website (i.e. the Vehicle Population in 2003) was adopted, except the population of private car and taxi. Corresponding population has been calculated and shown in Appendix B2. Details on the rationales adopted for the abovementioned vehicle population are presented below.

Private Car

- 3.33 As the implementation of Vehicle Emission Standards, there was no new registration of diesel private car in Hong Kong after 1998. Hence, population of private car is considered 100% using petrol fuel in this Study, and number of diesel private car subsequent to year 1998 is regrouped into petrol type.

Taxi

- 3.34 As the implementation of Vehicle Emission Standards, new registration of diesel taxi was banned in Hong Kong on from 2001. 100% of LPG taxi was therefore assumed in this study and diesel taxi subsequent to year 2001 was regrouped into LPG fuel type.

Light Bus

- 3.35 Environment, Transport and Works Bureau (ETWB) implemented an incentive scheme to encourage the early replacement of diesel light buses with LPG or electric ones since 2002. As a conservative approach, the incentive scheme for light buses would not be considered in this assessment as a conservative approach.

Accrual Rate

- 3.36 The "Default values and compositions" were adopted referred to EMFAC-HK Guideline.

Diurnal Variation of Daily Trips

- 3.37 The daily trips were used to estimate the cold start emissions of the petrol vehicles only. Hence, trips for vehicle other than petrol type vehicle would be

assumed zero. The number of vehicle trips in the study area was calculated by the following equation:

$$\text{Vehicle Trip of Class 1 in the Study Area at hour 1} = \text{VMT for vehicle Class 1 in the Study Area at hour 1} \times \text{Vehicle trip of Class 1 in the territory} / \text{VMT for vehicle Class 1 in the territory.}^*$$

* Default data of EMFAC-HK model

Diurnal Variation of Daily Vehicle Mile-Travelled (VMT)

- 3.38 The VMT was calculated by multiplying the number of vehicles from the forecast hourly traffic flow in Year 2030 by the length of road travelled. The adopted daily trips and VMT are summarized in Appendix B3.

Hourly Temperature and Relative Humidity Profile

- 3.39 According to the information provided by Hong Kong Observatory (HKO), Shek Kong meteorological station was the nearest station of the Project and was adopted for the model input. As Year 2007 meteorological data from the Shek Kong meteorological station more than 10% data are invalid, Year 2006 meteorological data for hourly temperature and relative humidity profiles were adopted.

Speed Fraction

- 3.40 The speed limits of all roads within the Study Area (except a portion of Kam Tin Bypass) would be 50kph, whereas the speed limit of the portion of Kam Tin Bypass would be 70kph. It was assumed that all vehicle classes had the same speed profile in the model.
- 3.41 To simulate the effect of different road speed during the rush and non-rush hour, sensitivity test had been carried out. The design road speed limits were assumed for representing the situation during non-rush hour; while the vehicle speed of peak hour flow in Year 2030 was adopted representing the situation during the rush hour. The estimated speed fractions provided by the traffic consultant were shown in Appendix B4 and the acceptance by the Transport Department is provided in Appendix A2.
- 3.42 In the model, same road speeds were applied to all hours to demonstrate the effect of using peak flow speed and design speed. A sensitivity test based on 2015 model year has been conducted to compare the total emission for all vehicle classes using design road speed limits and peak hour speed profile at morning peak and afternoon peak traffic flow respectively.
- 3.43 From the results of the sensitivity test shown in Appendix B5, it indicated that higher total daily NO_x and RSP emissions would be obtained at morning peak hour traffic flow. Therefore, the emission factor at morning peak traffic flow was considered worse than that of afternoon peak traffic flow.
- 3.44 In addition, the results of the sensitivity test indicated a higher total daily NO_x and RSP emissions would be obtained at a lower road speed. Therefore, the

peak hour flow speed at speed limit of 50kph of roads was applied to all hours for predicting the total hourly emissions in this assessment as a conservative approach.

Model Year

- 3.45 For the purpose of finding the worst emission year, a sensitivity test has been conducted to calculate the vehicle exhaust emissions in different year by using the same VMT and the flow speed fractions. By using the peak hour flow speed at speed limit of 50kph of roads at all hours and Year 2030 morning peak VMT, the total daily NO_x and RSP emissions by 16 vehicle classes in different vehicle exhaust emission year from 2015 to 2030 are summarized in Appendix B6.
- 3.46 Comparing the total daily NO_x and RSP emissions under different vehicle exhaust emission years from Year 2015 to 2030, the highest vehicle emissions were found in Year 2015 and were decreased from Year 2015 to 2030. Therefore, as a conservative approach, the emissions using emission control scenario in Year 2015 were adopted for this Project.

Predicted Emission Factors by EMFAC-HK

- 3.47 As the output hourly emissions from the EMFAC-HK model are in tonnes per hour, they were firstly divided by the 2030 morning VMT to obtain the emission factors in grams per mile per vehicle. The calculated hourly maximum vehicle emission factors, as displayed by Table 3.5, at particular hours were then selected for incorporation into the air dispersion model as a conservative approach. These factors were adopted together with the forecasted morning peak traffic flow for year 2030 for the assessment. The calculation of fleet vehicle emission by 16 vehicle classes is provided in Appendix B7.

Table 3.5 Emission Factors for Year 2015 for Different Vehicle Classes

Vehicle Class	Description	2015 Emission Factors (grams/mile/vehicle)	
		NO _x	RSP
MC1	PC & LGV	0.1846	0.0099
MC3	Diesel PC & LGV<2.5t	0.5041	0.2159
MC4	Diesel PC & LGV 2.5-3.5t	0.3198	0.1234
MC5	PLB	0.4030	0.3769
MC6	LGV>3.5t	2.7024	0.2785
MC7	MGV & HGV 5.5-15t	5.5289	0.4734
MC8	MGV & HGV >=15t	6.8559	0.4344
MC10	DDFB	3.8658	0.1683
MC11	MC	1.0838	0.0703
Taxi3	Taxi	0.2987	0.0415
Taxi4	PrLB <3.5t	0.3525	0.2783
Taxi5	PrLB >3.5t	0.4467	0.3955
Taxi6	NFB <6.4t	2.0539	0.1411
Taxi7	NFB 6.4-15t	4.7710	0.3132
Taxi8	NFB >15t	4.9947	0.2675

Vehicle Class	Description	2015 Emission Factors (grams/mile/vehicle)	
		NO _x	RSP
Taxi10	SDFB	0.0000*	0.0000*

* The value is zero since there is no single deck franchised bus (SDFB) travelled within the study area

Inputs for CALINE4 Model

3.48 The composite fleet emission factors for the road links were calculated based on the Year 2030 morning peak hour traffic flow, vehicle composition and the fleet vehicle emission factors as presented in Table 3.5. The detailed calculation of the composited fleet average emission factors as inputs to the CALINE4 model are provided in Appendix B8.

3.49 The following are the meteorological conditions as inputs to the CALINE4 model:

- Wind speed: 1 m/s
- Wind direction: worst case wind directions
- Stability class: D
- Wind variability: 12°
- Surface roughness: 1 m
- Mixing height: 500 m

3.50 Since CALINE4 model can only predict maximum hourly concentrations, the 24-hour average pollutants levels have been calculated by multiplying the 1-hour pollutants levels by a factor of 0.4, which is suggested by "Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised, USEPA, EPA-454/R-92-019". NO₂ has been modelled by the ambient ratio method which assumes 20% of NO_x to be NO₂.

Impact Prediction and Evaluation

3.51 Taking into account vehicle emissions from open road networks and the background pollutant concentrations, the predicted 1-hour average NO₂, 24-hour average NO₂ and 24-hour average RSP concentrations were predicted and the highest pollutant concentrations at each ASR under the worst wind directions were calculated. Table 3.6 summarized the predicted maximum 1-hour average NO₂, 24-hour average NO₂ and 24-hour average RSP concentrations and the detailed predicted pollutant concentrations at different assessment levels are provided in Appendix B9.

Table 3.6 Predicted Maximum Pollutant Concentrations at the ASRs (Background Concentration Included)

ASR	Pollutant Concentration ($\mu\text{g}/\text{m}^3$)		
	NO ₂ (1-hour)	NO ₂ (24-hour)	RSP (24-hour)
AQO	300	150	180
A4	75	62	57
A6	133	85	69
A8	90	68	60
A10	79	63	58
A11	93	69	61
A13	126	82	68
A14	90	68	60
A18	87	67	59
A19	110	76	64
A24	80	64	57
A27	113	77	64
A31	81	64	57
A32	76	62	57
A33	80	64	57
A34	68	59	55
A35	78	63	57
A38	70	60	55
A39	107	75	63
A40	78	63	57
A43	85	66	58
A45	66	58	55
A49	86	66	59
A50	66	58	55
A51	68	59	55
A53	70	60	56
A54	73	61	56
P01	85	66	59
P02	91	68	60
P03	74	62	56
P04	106	74	62
P05	117	79	66
P06	144	89	72
P07	128	83	68
P08	77	63	57
P09	119	79	65
P10	111	76	63
P11	116	78	64
P12	110	76	63
P13	114	77	66

- 3.52 Based on the assessment results presented above, the predicted concentrations of the key air pollutant parameters (i.e., 1-hour average NO₂, 24-hour average NO₂ and 24-hour average RSP) would comply with the AQO.
- 3.53 From the results shown in Appendix B9, it is found that the maximum pollutant concentrations would occur at 1.5m above ground. The predicted maximum hourly average NO₂, 24-hour average NO₂ and 24-hour average RSP concentration contours at 1.5m above local ground are shown in Figures 3.2 to 3.4 respectively. As illustrated in Figures 3.2 to 3.4, there is no ASR within the contours of exceeding AQO limits.
- 3.54 As all the predicted NO₂ and RSP concentrations comply with the AQOs, no mitigation measure is required.

Residual impacts

- 3.55 No adverse residual impact is predicted during the operational phase of the Project.

Environmental Monitoring and Audit (EM&A)

- 3.56 It is recommended that construction phase EM&A is carried out with details provided in the separate EM&A manual.
- 3.57 Operational phase EM&A is considered not necessary as AQO are predicted to be achieved at all representative ASRs.

Conclusion

- 3.58 With proper implementation of dust control measures as required under the Air Pollution Control (Construction Dust) Regulation, construction dust can be controlled to acceptable levels and no significant impacts are anticipated. Gaseous emissions from the construction equipment are expected to be minimal. Operational air quality impacts are also expected to be insignificant.

4.0 NOISE IMPACT ASSESSMENT

Introduction

4.1 This section addresses the noise impacts during the construction and operational phases of the Project. The noise impacts have been evaluated and assessed in accordance with Annexes 5 and 13 of the EIA-TM.

Environmental Legislation, Standards and Guidelines

4.2 Relevant environmental legislations governing noise control are Noise Control Ordinance (NCO) (Cap 400) and Environmental Impact Assessment Ordinance (EIAO) (Cap 499). Relevant assessment criteria and guidelines of the assessment approaches have been given in the following Technical Memoranda issued under the NCO and EIAO:

- Technical Memorandum on Noise from Construction Work other than Percussive Piling (GW-TM);
- Technical Memorandum on Noise from Construction Work in Designated Areas (DA-TM); and
- Technical Memorandum on Environmental Impact Assessment Process (EIA-TM).

Construction Noise

4.3 Construction noise criteria for daytime hours of 07:00-19:00 hours on any day not being a Sunday or general holiday are stipulated in Annex 5 of EIA-TM and shown in Table 4.1 below.

Table 4.1 Noise Criteria for Daytime Construction Activities

Uses / Noise Sensitive Receivers	0700 to 1900 hours on any day not being a Sunday or general holiday Leq(30 min) dB(A)
Domestic Premises	75
Educational institutions including kindergartens, nurseries and all others where unaided voice communication is required	70 (65 During Examinations)

Note: The above standards apply to uses which rely on opened windows for ventilation.

Operational Noise

4.4 Annex 5 of the EIA-TM stipulates the traffic noise criteria during the operational phase, as shown in Table 4.2.

Table 4.2 Relevant Road Traffic Noise Criteria

Uses / Noise Sensitive Receivers	Peak Hour Traffic L ₁₀ (1 hour) dB(A)
Domestic Premises	70

Educational institutions, Places of Public Worship	65
Clinics, homes for the aged	55

Note: The above standards apply to uses which rely on opened windows for ventilation.

- 4.5 The above noise criteria shall be viewed as the maximum permissible noise levels assessed at 1m from the external façade of the noise sensitive uses which rely on opened windows for ventilation.
- 4.6 For the operational noise impact assessment on road traffic, roads within 300 m from the Project boundary have been included. Traffic noise impacts for the following scenarios are predicted:
1. Original Scenario: assessment based on the peak hour traffic flow at the design year, i.e., maximum traffic projection within a 15 years period without the Project;
 2. Unmitigated Scenario: assessment based on the maximum traffic projection within 15 years of the design year after completion of the modification works;
 3. Mitigated Scenario: assessment with the proposed mitigation measures, only necessary when significant traffic noise impact is predicted; and
 4. Prevailing Scenario: assessment on existing traffic noise level only necessary when residual impact is predicted.
- 4.7 Given Kam Tin Road and Lam Kam Road (i.e., rural roads) are not within the meaning of Item A.1 of Schedule 2 of EIAO, the traffic noise impact is significant if the following conditions are met:
- Predicted unmitigated traffic noise level (i.e., “Unmitigated Scenario”) at the representative NSRs exceeds the noise criteria as listed in Table 4.2 by 1.0 dB(A) or more; and
 - Predicted unmitigated traffic noise level at the representative NSRs with the Project is greater than that without the Project (i.e., “Original Scenario”) by 1.0 dB(A) or more.
- 4.8 If any of the NSR cannot be protected by the proposed direction noise mitigation measures, indirect technical remedies for those NSR may be adopted provided that the residual impacts satisfy all three criterion below:
1. Predicted overall traffic noise level at the NSR must be above the specified noise level as listed in Table 4.2;
 2. Predicted overall noise level is at least 1.0 dB(A) more than the prevailing traffic noise level; and
 3. Noise contribution from the proposed road project (i.e. the new road) to the increase in predicted overall noise level is at least 1.0 dB(A).

Baseline Conditions

- 4.9 The assessment area is rural in nature. The dominant existing source comes from the road traffic on Kam Tin Road and Lam Kam Road.

Noise Sensitive Receivers (NSRs)

- 4.10 Existing and planned NSRs within 300 m from the Project boundary were identified in accordance with Section 3 in Annex 13 of the EIAO-TM.
- 4.11 In addition, it is confirmed that no noise sensitive uses within Pat Heung Division Police Station and Pat Heung Fire Station (refer to Appendix C4).
- 4.12 With reference to the confirmation from the Government Secretariat (refer to Appendix C2), there is no development schedule on the change of uses in the Shek Kong Barracks. In addition, the Government Secretariat also confirmed that there are some dormitory exists within the Shek Kong Barracks. According to the survey map published by Lands Department, "Church" and "Education Centre" was labelled within the Shek Kong Barracks. As confirmed by the Government Secretariat (refer to Appendix C2), the premises labelled as "Church" and "Education Centre" is currently used as office/recreational centre and warehouse, respectively, which is not considered as a NSR according to Annex 13 of EIAO-TM. Therefore, only the dormitory has been included in this assessment.
- 4.13 According to the map of the Kadoorie Farm and Botanic Garden (KFBG) provided in the KFBG's website and the site survey had been conducted within the KFBG in November 2008. No noise sensitive uses were found within the farm and only reception, office and animal exhibit were identified at nearby the Project boundary. As confirmed by the KFBG (refer to Appendix C3), there is no noise sensitive uses within KFBG.
- 4.14 Besides, planned NSRs on relevant published land use plans, including plans and drawings published by Lands Department has been checked and identified. These NSRs include all existing NSRs as well as potential planned/committed noise sensitive uses earmarked on the relevant Outline Zoning Plans (OZPs), Outline Development Plans (ODPs) and layout plans.
- 4.15 According to Planning Department's record, there is no Outline Development Plan (ODP) within 300 m study area. With reference to the information in the Statutory Planning Portal of the Town Planning Board (TPB), all planned sensitive uses of all approved planning applications within the study area have been identified.
- 4.16 Representative NSRs considered to be potentially most affected by noise were selected for the assessment. In order to assess the worst-case scenario of the noise impacts upon the planned NSRs, representative assessment locations for the planned NSRs have been selected at the site / zoning boundary facing the Project. Even though a new NSR have been constructed and occupied before the commencement of the road works within the zoning, the selected planned NSRs already representing as the worst-case scenario. The representative NSRs for the construction and operational noise impact assessment are summarised in Table 4.3 below, with their locations illustrated

in Figure 4.1. Photographs of the identified existing representative NSRs are provided in Appendix C1.

Table 4.3 Summary of the Identified Representative NSRs

NSR	Description	No. of Storeys	Assessment Level	mPD	Sensitive Use
N1	Kam Kwong Nepali Christian Church	1	1F	8.9	Place for Worship
N2	Village house at Kong Tai Road	1	1F	7.4	Residential
N3	Village house near Shek Kong	2	1F 2F	10.1 12.9	Residential
N4	Village house near Petrol Station	2	1F 2F	10.0 12.8	Residential
N5	Residential development near Kiu Tau Tsuen (under construction)	3	1F 2F 3F	9.9 12.9 15.9	Residential
N6	Kam Tin Clinic	2	1F 2F	10.1 13.1	Medical
N7	Village house, 18E, Shek Kong San Tsuen	1	1F	10.8	Residential
N8	Dormitory of Shek Kong Barrack	3	1F 2F 3F	11.7 14.5 17.3	Residential
N9	Village house of Shek Kong San Tsuen	1	1F	11.6	Residential
N10	Village house of Shek Kong San Tsuen	1	1F	10.9	Residential
N12	Low-rise residential building, 136, Season Villas	2	1F 2F	12.7 15.5	Residential
N13	Village house near Season Villas	2	1F 2F	14.6 17.4	Residential
N15	Village house near Season Villas	2	1F 2F	12.3 15.1	Residential
N16	Village house, 265, Kam Tin Road	2	1F 2F	13.0 15.8	Residential
N17	Village house near Shek Kong Vegetable Marketing Cooperation Society Limited	2	1F 2F	16.0 18.8	Residential
N18	Village house, Chung Ying Yuen	2	1F 2F	16.8 19.6	Residential
N19	Village house, Ching Yuen	2	1F 2F	17.2 20.0	Residential
N20	Village house, Lin Yuen	3	1F 2F 3F	18.0 20.8 23.6	Residential
N21	Village house near Pat Heung Police Station	2	1F 2F	18.2 21.0	Residential
N22	Village house, 82, Green Villa	3	1F 2F 3F	19.7 22.5 25.3	Residential
N24	Village house, Lee Ka Yuen	2	1F 2F	19.8 22.6	Residential
N25	Village house, 28A – 28B, Wang Toi Shan Yau Uk Tsuen	3	1F 2F 3F	21.9 24.7 27.5	Residential

NSR	Description	No. of Storeys	Assessment Level	mPD	Sensitive Use
N26	Yan Wo Home for Aged	3	1F 2F 3F	23.0 25.8 28.6	Home for Aged
N27	Village house near Petrol Station (under construction)	3	1F 2F 3F	23.0 25.8 28.6	Residential
N28	Village house, 94B, Wang Toi Shan San Tsuen	3	1F 2F 3F	23.9 26.7 29.5	Residential
N29	Village house, 46 – 47, Wang Toi Shan Lo Uk Tsuen	3	1F 2F 3F	24.3 27.1 29.9	Residential
N30	Shun Fook Home for Aged	3	1F 2F 3F	23.6 26.4 29.2	Home for Aged
N31	Village house, 30, Wang Toi Shan Lo Uk Tsuen	2	1F 2F	25.0 27.8	Residential
N32	Block 9, Evergreen International Hong Kong Association	3	1F 2F 3F	26.0 28.8 31.6	Home for Aged
N33	Village house	2	1F 2F	29.4 32.2	Residential
N34	Village house, Fau Wan Court	3	1F 2F 3F	38.8 41.6 44.4	Residential
N35	Village house near Pine Hill Villa	2	1F 2F	43.0 45.8	Residential
N36	Village house opposite to Pine Hill Villa	2	1F 2F	42.6 45.4	Residential
N37	Village house, Pine Hill Villa	3	1F 2F 3F	47.7 50.5 53.3	Residential
N38	Village house	3	1F 2F 3F	47.7 50.5 53.3	Residential
N39	Village house near Pat Heung Old Temple	2	1F 2F	45.0 47.8	Residential
N41	Village house of Kiu Court	3	1F 2F 3F	45.8 48.6 51.4	Residential
N42	Village house near Pat Heung Rural Committee	2	1F 2F	47.8 50.6	Residential
N43	Village house	3	1F 2F 3F	51.0 53.8 56.6	Residential
N44	Village house near Route Twisk	3	1F 2F 3F	52.4 55.2 58.0	Residential
N45	Village house	1	1F	54.1	Residential
N46	Cheung Chau Court	5	1F 2F 3F 4F 5F	59.9 62.9 65.9 68.9 71.9	Residential
N47	4, Shropshire Road	2	1F 2F	71.4 74.4	Residential
N48	Village house	1	1F	61.8	Residential

NSR	Description	No. of Storeys	Assessment Level	mPD	Sensitive Use
N49	Village house	1	1F	71.5	Residential
N50	Village house	2	1F 2F	84.1 86.9	Residential
N51	Village house (No. 151 Lam Kam Road)	1	1F	99.2	Residential
N52	Village house	2	1F 2F	135.7 138.5	Residential
N53	Village house (No. 70 Lam Kam Road)	1	1F	151.6	Residential
N54	Village house (opposite side of Kadoorie Experimental Farm)	1	1F	158.7	Residential
P01 ⁽¹⁾	Planned village development (V Zone) at Kam Tin South OZP [Statutory Plan No.: S/YL-KTS/11]	3*	1F 2F 3F	9.0 11.8 14.6	Residential
P02 ⁽¹⁾	Planned residential development [R(D) Zone] at Kam Tin South OZP [Statutory Plan No.: S/YL-KTS/11]	2*	1F 2F	9.1 12.1	Residential
P03	Planned village house [Planning Application Case No.: A/YL-PH/540]	3**	1F 2F 3F	29.7 32.5 35.3	Residential
P04 ⁽¹⁾	Planned residential development [R(D) Zone] at Pat Heung OZP [Statutory Plan No.: S/YL-PH/11]	2*	1F 2F	54.8 57.8	Residential
P05 ⁽¹⁾	Planned village development (V Zone) at Kam Tin North OZP [Statutory Plan No.: S/YL-KTN/7]	3*	1F 2F 3F	8.8 11.6 14.4	Residential
P06 ⁽¹⁾	Planned village development (V Zone) at Kam Tin North OZP [Statutory Plan No.: S/YL-KTN/7]	3*	1F 2F 3F	9.4 12.2 15.0	Residential
P07 ⁽¹⁾	Planned residential development (R(D) Zone) at Kam Tin North OZP [Statutory Plan No.: S/YL-KTN/7]	2*	1F 2F	11.1 14.1	Residential
P08 ⁽¹⁾	Planned residential development (R(C)2 Zone) at Kam Tin North OZP [Statutory Plan No.: S/YL-KTN/7]	3*	1F 2F 3F	10.3 13.3 16.3	Residential
P09 ⁽¹⁾	Planned village development (V Zone) at Pat Heung OZP [Statutory Plan No.: S/YL-PH/11]	3*	1F 2F 3F	21.1 23.9 26.7	Residential
P10 ⁽¹⁾	Planned village development (V Zone) at Pat Heung OZP [Statutory Plan No.: S/YL-PH/11]	3*	1F 2F 3F	26.7 29.5 32.3	Residential
P11 ⁽¹⁾	Planned residential development (R(D) Zone) at Pat Heung OZP [Statutory Plan No.: S/YL-PH/11]	2*	1F 2F	32.9 35.9	Residential
P12 ⁽¹⁾	Planned village development (V Zone) at Shek Kong OZP [Statutory Plan No.: S/YL-SK/9]	3*	1F 2F 3F	47.4 50.2 53.0	Residential

NSR	Description	No. of Storeys	Assessment Level	mPD	Sensitive Use
P13 ⁽¹⁾	Planned village development (V Zone) at Shek Kong OZP [Statutory Plan No.: S/YL-SK/9]	3*	1F 2F 3F	51.9 54.7 57.5	Residential

Note:

⁽¹⁾ For the planned NSR at the land use zoning of "V" or "R", the calculation of construction noise level is excluded as no information showing the actual location of future noise sensitive development during Project construction.

* Permitted maximum building height or number of storey stated in the approved Outline Zoning Plan

** Number of storey stated in the approved planning application

Construction Noise Impact Assessment

Impact Identification

- 4.17 In order to complete the works within scheduled timeframe, the use of Powered Mechanical Equipment (PME) is unavoidable. Therefore, the use of PME in daytime is expected to be the major noise source during the construction of the Project. No construction works are scheduled to be undertaken during noise control restricted hours of all days during the evening and night-time (i.e. 19:00-07:00 hours); and all time during Sundays and public holidays. Notwithstanding, it will be the Contractor's responsibility to apply for a Construction Noise Permit (CNP) for any construction works planned to be undertaken during restricted hours in accordance with the Noise Control Ordinance (NCO). No percussive piling works will be required within the proposed project area.

Assessment Assumptions and Methodology

- 4.18 The Project is scheduled to commence in first quarter of 2011 and to be completed in third quarter of 2015. All construction tasks would be carried out during unrestricted hours (0700 to 1900 hours Monday to Saturday excluding general holidays). Details of construction tasks are as follows:
- Road upgrading (including minor excavation and minor slope works);
 - Road paving;
 - Geotechnical Work (Soil Nailing); and
 - Soldier Pile Wall Construction.
- 4.19 Due to temporary road traffic management is not allowing long road closure on one lane for dual carriageway, each active construction activity location shall be about 50 m in length at one lane of the road alignment at any one time. Assumed 50 m road work is constructed, the operation duration of each PME is estimated and tabulated in Table 4.4.

Table 4.4 Operation Duration of PME for the Construction of Road Work

Construction Stage	Involved PME	Duration
Road Breaking	Breaker + Generator	1 – 2 day(s)
Excavating	Excavator	1 – 2 day(s)

Construction Stage	Involved PME	Duration
Road Paving	Asphalt Paver	0.5 day
Road Compacting	Vibratory Roller	0.5 day

- 4.20 The geotechnical works and the soldier pile wall construction will only occur at the locations as indicates in Figure 4.1. There is only one work site for construction of soldier pile wall (as shown in Figure 4.1d). The geotechnical works have been included in the assessment on NSRs where locates within 100m from the work site. To represent a reasonable worst-case scenario it has been assumed that the geotechnical works will be undertaken concurrently with road works, unless specified in the later sections.
- 4.21 The construction of soldier pile wall has been included in the noise impacts assessment on NSRs N33, N34, N35 and P03. It is noted that there will be no concurrent use of PME for road works and construction of soldier pile wall except the use of breaker and generator within each work front.
- 4.22 The exact number and type of PME used for various construction activities will only be known after appointment of the works Contractor. However, assessment has been conducted based on the assumed PME inventory as listed in Appendix D1. The number for each PME has been assumed to be one within each construction work front. The percentage on-time for each PME has been assumed to be 100%, based on 30-minute working periods, except 50% on-time assumed for dump truck and lorry and 70% on-time assumed for rotary driller. The Project Proponent has confirmed that the PME inventory with the percentage on-time is practicable and practical to complete the works within scheduled timeframe and are available in Hong Kong (Appendix D2).
- 4.23 Similar to the assumptions on the PME inventory, the exact staging or phasing of construction arrangement will be determined by the contractor after appointment of the works. Assessment has been conducted based on the assumption that the length of each active construction site is up to 50m; and the minimum separation of construction sites is 300m. With reference to the findings in the Traffic Impact Assessment of the Project, the assumption is considered reasonable practicable. As such, cumulative construction noise from concurrent works of active construction sites is not anticipated. Accordingly, it is anticipated that each NSR can only be affected by one active construction site at any one time.
- 4.24 The construction noise impact at representative NSRs has been assessed based on standard acoustic principles and the assessment methodology as specified in the GW-TM and Annex 13 of the EIAO-TM.
- 4.25 The Sound Power Level (SWL) of the PME was determined from Table 3 of the GW-TM. The SWL also made reference to the British Standards BS 5228: Part 1:1997 – “Noise and Vibration Control on Construction and Open Sites”.
- 4.26 It is assumed that all PME required for a particular construction activity would be located at the notional probable source position of the road section where

such activity is to be performed. To predict the noise level, PME is divided into groups required for each construction task / stage. The sound pressure level of each construction task is calculated based on the number of PME and distance from the NSR. The noise levels at NSRs are then predicted by adding up the SWLs of all concurrent construction tasks.

- 4.27 A positive 3 dB(A) façade correction is added to the predicted noise levels in order to account for the facade effect at each NSR.

Potential Cumulative Impacts

- 4.28 As identified in Section 2, two of the designated projects (i.e., *Yuen Long, Kam Tin, Ngau Tam Mei & Tin Shui Wai Drainage Improvement Stage 1, Phase 2B - Kam Tin Secondary Drainage Channel KT13 (CE 67/98)* and *Drainage Improvement in Sha Tin and Tai Po Design and Construction (CE 50/2001)*) and one non-designated project (i.e., *Replacement and Rehabilitation of Water mains Stage 2; Mains in New Territories East – Investigation, Design and Construction (CE 6/2005)*) will be located at more than 1 km from this Project boundary. And 1 non-designated project (i.e. *Alternative Raw Water Supply to Yau Kom Tau Water Treatment Works from Au Tau Raw Water Pumping Station (Agreement No.: PWP 337WF)*) will be located at more than 300 m. Therefore, there should be no cumulative impacts from those projects.
- 4.29 Apart from the above, there are three non-designated projects (i.e., *Replacement and Rehabilitation of Water mains Stage 2 (Agreement No.: CE 1/2005)*, *Replacement and Rehabilitation of Water mains Stage 4 (Agreement No.: CE 10/2008)* and *Yuen Long and Kam Tin Sewerage and Sewage Disposal (Agreement No.: PWP 4235DS)*) which will potentially be constructing concurrently with this project. However, according to the temporary traffic arrangement concerns, the distance separation of more than 300 m should be maintained between the two active construction sites. Given there will be sufficient distance separation between two construction sites, no cumulative construction noise impacts are anticipated. In addition, there is one designated project (i.e., *Hong Kong Section of Guangzhou - Shenzhen - Hong Kong Express Rail Link*) will potentially be constructing concurrently with this project. As the EIA study of this railway project is in progress, there is no detailed construction methods and programme can be reviewed. As such, the EIA study of this railway project should take into account the potential cumulative impacts arising from the proposed Project. According to the Project Profile of this railway project (application no.: ESB-197/2008), most of the construction works would be carried out in underground condition. Therefore, no significant cumulative impacts are anticipated.

Assessment of Construction Noise Impacts (un-mitigated scenario)

- 4.30 Table 4.5 summarizes the predicted maximum construction noise levels at the representative NSRs under the un-mitigated scenario. Detailed calculations of the noise levels are provided in Appendix D3.

Table 4.5 Predicted Maximum Construction Noise Levels at the Representative NSRs (Un-mitigated Scenario)

NSR	Description	Predicted Noise Levels [Leq (30min)], dB(A)	Noise Criteria, dB(A)
N1	Kam Kwong Nepali Christian Church	70	70
N2	Village house at Kong Tai Road	63	75
N3	Village house near Shek Kong	76	75
N4	Village house near Petrol Station	80	75
N5	Residential development near Kiu Tau Tsuen (under construction)	75	75
N6	Kam Tin Clinic	92	70
N7	Village house, 18E, Shek Kong San Tsuen	92	75
N8	Dormitory of Shek Kong Barrack	86	75
N9	Village house of Shek Kong San Tsuen	85	75
N10	Village house of Shek Kong San Tsuen	86	75
N12	Low-rise residential building , 136, Season Villas	71	75
N13	Village house near Season Villas	98	75
N15	Village house near Season Villas	79	75
N16	Village house, 265, Kam Tin Road	80	75
N17	Village house near Shek Kong Vegetable Marketing Cooperation Society Limited	82	75
N18	Village house, Chung Ying Yuen	81	75
N19	Village house, Ching Yuen	90	75
N20	Village house, Lin Yuen	79	75
N21	Village house near Pat Heung Police Station	79	75
N22	Village house, 82, Green Villa	78	75
N24	Village house, Lee Ka Yuen	86	75
N25	Village house, 28A – 28B, Wang Toi Shan Yau Uk Tsuen	78	75
N26	Yan Wo Home for Aged	83	75
N27	Village house near Petrol Station (under construction)	93	75
N28	Village house, 94B, Wang Toi Shan San Tsuen	75	75
N29	Village house, 46 – 47, Wang Toi Shan Lo Uk Tsuen	86	75
N30	Shun Fook Home for Aged	78	75
N31	Village house, 30, Wang Toi Shan Lo Uk Tsuen	84	75
N32	Block 9, Evergreen International Hong Kong Association	79	75
N33	Village house	82	75
N34	Village house, Fau Wan Court	80	75
N35	Village house near Pine Hill Villa	79	75
N36	Village house opposite to Pine Hill Villa	79	75
N37	Village house, Pine Hill Villa	80	75
N38	Village house	81	75
N39	Village house near Pat Heung Old Temple	97	75
N41	Village house of Kiu Court	85	75
N42	Village house near Pat Heung Rural Committee	90	75
N43	Village house	81	75
N44	Village house near Route Twisk	78	75
N45	Village house	79	75

NSR	Description	Predicted Noise Levels [Leq (30min)], dB(A)	Noise Criteria, dB(A)
N46	Cheung Chau Court	65	75
N47	4, Shropshire Road	64	75
N48	Village house	74	75
N49	Village house	88	75
N50	Village house	78	75
N51	Village house (No. 151 Lam Kam Road)	79	75
N52	Village house	79	75
N53	Village house (No. 70 Lam Kam Road)	86	75
N54	Village house (opposite side of Kadoorie Experimental Farm)	66	75
P03	Planned village house	77	75

Note: Noise levels exceeding the construction noise criteria are **bolded and underlined**.

- 4.31 In the absence of noise mitigation measures, it is found that the predicted construction noise levels at most of the representative NSRs will exceed the noise criteria.
- 4.32 In order to alleviate the construction noise impacts at the affected NSRs, implementation of noise mitigation measures such as use of quieter PME and / or erection of movable noise barriers are recommended.
- 4.33 The planned NSRs (i.e., P01 to P02 and P04 to P13) at the noise sensitive land use zoning (e.g., village house or residential development) may be subjected to potential construction noise impact if new NSRs have been constructed and occupied before the commencement of the road works. However, the noise exceedance should be limited to a certain distance from the construction work front (i.e., 50 m in length). Noise exceedance at this NSR will be anticipated if the road upgrading work or road paving work are less than 50 m or 30 m from the NSR, respectively.

Noise Mitigation Measures

- 4.34 Recommended noise mitigation measures include good site practices, the use of quieter PME, avoidance of concurrent construction activities within an active construction site, installation of acoustic enclosure for the hand-held breaker, erection of temporary noise barriers, application of the acoustic barrier for the rock drill and other measures as mentioned in the later Sections. The feasibility on application of these mitigation measures at the NSRs has been confirmed by the Project Proponents.

Implementation of Good Site Practices

- 4.35 Good site practices can reduce the noise impacts on affected NSRs, although the effectiveness of these practices can vary depending on actual site conditions, and hence it is difficult to quantify effectiveness. The recommended practices are as follows:
- PMEs should be kept to a minimum and the parallel use of them should be avoided;

- Intermittent use of PME which can be shut down between work periods or throttled down to a minimum;
- Mobile PME should be sited as far from NSRs as possible;
- PME known to emit noise strongly in one direction should be orientated to direct away from the nearby NSRs;
- Only well-maintained plant should be operated on-site and PME should be serviced regularly during the construction programme; and

Use of Quieter PME

- 4.36 Using the quieter PME is considered as a practical measure to significantly reduce the noise impacts. Quieter PME are defined as having SWLs less than those listed in the GW-TM, and such PME for various construction activities are proposed in Table 4.6 and in accordance with BS 5228: Part I 1997 unless specified. These PME are known to be available in Hong Kong.

Table 4.6 List of Proposed Quieter PME for Construction Phase

PME	ID code*	SWL, dB(A)
Road Works		
<i>Stage 1</i>		
Excavator, wheeled/tracked	C.8-15 ⁽¹⁾	103
Excavator, wheeled/tracked	QPME ⁽²⁾	93
Lorry	C.8 25 ⁽¹⁾	96
<i>Stage 2</i>		
Asphalt Paver	C.8-24 ⁽¹⁾	101
Roller, vibratory	C.3-115 ⁽¹⁾	102
Soldier Pile Wall		
Excavator, wheeled/tracked	C.8-15 ⁽¹⁾	103
Concrete Pump	C.6-36 ⁽¹⁾	106

(1) Those PME with format C.X-XXX are quiet equipment with SWLs extracted from BS5228: Part 1: 1997.

(2) Details of the plant with code "QPME" can be assessed from the EPD's webpage:
<http://www.epd.gov.hk/cgi-bin/npg/gpme/index.pl?lang=eng>

- 4.37 It should be noted that the Contractor has the flexibility to select preferred quieter PME models on the condition that the total SWLs of the selected quieter PME plants are less than or equal to the SWLs shown in Appendix D1.

Avoidance of Concurrent Works

- 4.38 Restriction on road works and geotechnical works should be avoided to be undertaken concurrently near NSR N53. The Project Proponent has

confirmed that this restriction is practicable. By considering the effectiveness of the noise mitigation measure, it is considered that implementation on other NSRs are not necessary.

Erection of Temporary Noise Barriers

- 4.39 The erection of temporary noise barriers provide noise attenuation by screening NSRs from stationary and mobile plants from direct line-of-sight in shadow zone. The use of movable barriers with skid footing and a small cantilevered upper portion can be adopted. The height of the noise barriers shall be designed such that the active PME cannot be directly viewed from the affected NSRs and with a length to height ratio at least 5:1 and a superficial material surface density $> 10 \text{ kgm}^{-2}$. With this temporary noise barrier configuration a noise reduction of 10 dB(A) and 5 dB(A) can be achieved for stationary and mobile PME, respectively.
- 4.40 Due to the site constraints, only N27 have been found practicable for erection of temporary noise barrier. Figure 4.2 shown a typical cross-section diagram of the proposed temporary noise barrier at NSR N27.

Acoustic Screen / Enclosure

- 4.41 Acoustic enclosures, which completely cover the noisy part of PME, can provide significant noise reduction. Enclosing the hand-held breaker in an acoustic enclosure with suitable ventilation can provide a noise reduction up to 20 dB(A) (Table B.1 of BS5228 refers). Adopting a conservative approach, a noise reduction of 10 dB(A) was assumed in the calculation. The enclosure shall be built with a material density of $> 7 \text{ kgm}^{-2}$ with sound absorption lining of at least 25mm thick, 80kg/m^3 mineral wool to reduce the noise reverberation and noise being reflected out through openings and enclosed the hand-held breaker as much as possible.
- 4.42 For the geotechnical work and soldier pile wall construction, an acoustic screen shall be installed at the crawler rig in order to block the line of sight from the elevated noise source to the affected NSRs. It is assumed 5 dB(A) noise reduction could be achieved from the screen with minimum 50mm thick sound absorbing lining (e.g. 96 kgm^{-3} mineral wool) and 6mm thick steel backing.

Summary of Noise Mitigation Measures

- 4.43 Table 4.7 presents the proposed noise mitigation measures to be implemented at the NSRs during construction.

Table 4.7 Locations of Adoption of Proposed Noise Mitigation Measures to be Implemented at the NSRs during Construction

NSR	Proposed Mitigation Measures			
	Quieter PME	Temporary Noise Barrier	Enclosure for Breaker	Noise Screen for Rock Drill / Rotary Driller
N1	-	-	-	-
N2	-	-	-	-
N3	Y ⁽¹⁾	-	-	-
N4	Y ⁽¹⁾	-	-	-

NSR	Proposed Mitigation Measures			
	Quieter PME	Temporary Noise Barrier	Enclosure for Breaker	Noise Screen for Rock Drill / Rotary Driller
N5	-	-	-	-
N6	Y ⁽²⁾	-	Y	-
N7	Y ⁽²⁾	-	Y	-
N8	Y ⁽¹⁾	-	Y	-
N9	Y ⁽¹⁾	-	Y	-
N10	Y ⁽¹⁾	-	Y	-
N12	-	-	-	-
N13	Y ⁽²⁾	-	Y	-
N15	Y ⁽¹⁾	-	-	-
N16	Y ⁽¹⁾	-	-	-
N17	Y ⁽¹⁾	-	Y	-
N18	Y ⁽¹⁾	-	Y	-
N19	Y ⁽²⁾	-	Y	-
N20	Y ⁽¹⁾	-	-	-
N21	Y ⁽¹⁾	-	-	-
N22	Y ⁽¹⁾	-	-	-
N24	Y ⁽¹⁾	-	Y	-
N25	Y ⁽¹⁾	-	-	-
N26	Y ⁽¹⁾	-	Y	-
N27	Y ⁽²⁾	Y	Y	-
N28	-	-	-	-
N29	Y ⁽¹⁾	-	Y	-
N30	Y ⁽¹⁾	-	-	-
N31	Y ⁽¹⁾	-	Y	-
N32	Y ⁽¹⁾	-	-	-
N33	Y ⁽¹⁾	-	Y	-
N34	Y ⁽¹⁾	-	Y	Y
N35	Y ⁽¹⁾	-	-	-
N36	Y ⁽¹⁾	-	-	-
N37	Y ⁽¹⁾	-	-	-
N38	Y ⁽¹⁾	-	-	-
N39	Y ⁽²⁾	-	Y	-
N41	Y ⁽¹⁾	-	Y	-
N42	Y ⁽²⁾	-	Y	-
N43	Y ⁽¹⁾	-	-	-
N44	Y ⁽¹⁾	-	-	-
N45	Y ⁽¹⁾	-	-	-
N46	-	-	-	-
N47	-	-	-	-
N48	-	-	-	-
N49	Y ⁽²⁾	-	Y	Y
N50	Y ⁽¹⁾	-	-	-
N51	Y ⁽¹⁾	-	-	-
N52	Y ⁽¹⁾	-	-	-
N53	Y ⁽¹⁾	-	Y	Y

NSR	Proposed Mitigation Measures			
	Quieter PME	Temporary Noise Barrier	Enclosure for Breaker	Noise Screen for Rock Drill / Rotary Driller
N54	-	-	-	-
P03	Y ⁽¹⁾	-	-	-

Note:

- 1) Use of QPME with medium size excavator.
- 2) Use of QPME with mini-size excavator.

Assessment of Construction Noise Impacts (mitigated scenario)

4.44 After implementation of mitigation measures (as proposed in Table 4.7), the predicted maximum construction noise levels at the representative NSRs are summarized in Table 4.8 and detailed calculations are provided in Appendix D3.

Table 4.8 Predicted Maximum Construction Noise Levels at the Representative NSRs (Mitigated Scenario)

NSR	Description	Predicted Noise Levels [Leq (30min)], dB(A)	Criteria, dB(A)
N1	Kam Kwong Nepali Christian Church	70	70
N2	Village house at Kong Tai Road	63	75
N3	Village house near Shek Kong	70	75
N4	Village house near Petrol Station	74	75
N5	Residential development near Kiu Tau Tsuen (under construction)	75	75
N6	Kam Tin Clinic	79	70
N7	Village house, 18E, Shek Kong San Tsuen	79	75
N8	Dormitory of Shek Kong Barrack	75	75
N9	Village house of Shek Kong San Tsuen	74	75
N10	Village house of Shek Kong San Tsuen	75	75
N12	Low-rise residential building , 136, Season Villas	71	75
N13	Village house near Season Villas	84	75
N15	Village house near Season Villas	73	75
N16	Village house, 265, Kam Tin Road	74	75
N17	Village house near Shek Kong Vegetable Marketing Cooperation Society Limited	71	75
N18	Village house, Chung Ying Yuen	70	75
N19	Village house, Ching Yuen	78	75
N20	Village house, Lin Yuen	74	75
N21	Village house near Pat Heung Police Station	73	75
N22	Village house, 82, Green Villa	72	75
N24	Village house, Lee Ka Yuen	75	75
N25	Village house, 28A – 28B, Wang Toi Shan Yau Uk Tsuen	72	75
N26	Yan Wo Home for Aged	72	75
N27	Village house near Petrol Station (under construction)	77	75
N28	Village house, 94B, Wang Toi Shan San Tsuen	75	75
N29	Village house, 46 – 47, Wang Toi Shan Lo Uk Tsuen	75	75

NSR	Description	Predicted Noise Levels [Leq (30min)], dB(A)	Criteria, dB(A)
N30	Shun Fook Home for Aged	72	75
N31	Village house, 30, Wang Toi Shan Lo Uk Tsuen	73	75
N32	Block 9, Evergreen International Hong Kong Association	74	75
N33	Village house	71	75
N34	Village house, Fau Wan Court	73	75
N35	Village house near Pine Hill Villa	75	75
N36	Village house opposite to Pine Hill Villa	73	75
N37	Village house, Pine Hill Villa	74	75
N38	Village house	75	75
N39	Village house near Pat Heung Old Temple	<u>83</u>	75
N41	Village house of Kiu Court	74	75
N42	Village house near Pat Heung Rural Committee	75	75
N43	Village house	75	75
N44	Village house near Route Twisk	72	75
N45	Village house	73	75
N46	Cheung Chau Court	65	75
N47	4, Shropshire Road	64	75
N48	Village house	74	75
N49	Village house	75	75
N50	Village house	73	75
N51	Village house (No. 151 Lam Kam Road)	73	75
N52	Village house	74	75
N53	Village house (No. 70 Lam Kam Road)	74	75
N54	Village house (opposite side of Kadoorie Experimental Farm)	66	75
P03	Planned village house	73	75

Note: Noise levels exceeding the construction noise standards are **bolded and underlined**.

4.45 In view of the results listed in Table 4.8, the predicted construction noise levels with noise mitigation measures at the majority of the representative NSRs shall comply with the corresponding construction noise criteria. However, 6 existing NSRs may exceed the noise criteria at the different stages of construction works.

4.46 By comparing against the affected area of the unmitigated scenario as stated in Section 4.33, after the adoption of quieter equipment and the implementation of mitigation measures, the affected area with noise exceedance should be reduced to 10 m and 12 m for the road upgrading work and road paving work, respectively.

Residual Impacts during Construction Phase

4.47 After implementing all practical noise mitigation measures, including the adoption of quieter PME, avoidance of concurrent works, acoustic enclosure for the hand-held breaker, erection of temporary noise barriers, application of the acoustic screen for the rock drill and rotary driller and other measures, the predicted mitigated noise levels at most NSRs will comply with noise criteria.

However, residual impacts at some NSRs are still anticipated. The list of NSRs subject to residual construction noise impacts are summarized in Table 4.9.

Table 4.9 NSRs Subjected Residual Construction Noise Impacts

NSR	Description	Predicted Noise Levels [$L_{eq(30min)}$], dB(A)		Criteria, dB(A)
		Road Up-grading	Road Paving	
N6	Kam Tin Clinic	<u>78</u>	<u>79</u>	70
N7	Village house, 18E, Shek Kong San Tsuen	<u>78</u>	<u>79</u>	75
N13	Village house near Season Villas	<u>84</u>	<u>81</u>	75
N19	Village house, Ching Yuen	<u>76</u>	<u>78</u>	75
N27	Village house near Petrol Station (under construction)	<u>77</u>	<u>76</u>	75
N39	Village house near Pat Heung Old Temple	<u>83</u>	<u>83</u>	75

Note: Noise levels exceeding the construction noise standards are **bold and underlined**.

4.48 Due to close proximity to the construction work, the predicted construction noise level at the above 6 NSRs will exceed the noise criteria even though the proposed mitigation measures have been implemented. The exceedance of 1 to 9 dB(A) above the noise criteria are mainly contributed due to the road paving work.

4.49 Table 4.10 summaries the site specific measures implemented at the 6 NSRs subjected to residual construction noise impact.

Table 4.10 Site Specific Mitigation Measures Implemented at NSRs Subjected to Residual Construction Noise Impact

NSR	Use of Quieter PME*	Avoidance of Concurrent Works	Erection of Noise Enclosure for Hand-held Breaker	Erection of Temporary Barrier	Constraints Encountered for Erection of Temporary Barrier
N6	Y	Y	Y	N	<ul style="list-style-type: none"> Insufficient space at construction area; Erection of Temporary Barrier is considered not feasible due to vehicle access need to be maintained at the nearby houses / uses.
N7	Y	Y	Y	N	<ul style="list-style-type: none"> Insufficient space at construction area; Erection of Temporary Barrier is considered not feasible due to vehicle access need to be maintained at the nearby houses / uses.
N13	Y	Y	Y	N	<ul style="list-style-type: none"> Insufficient space at construction area; Erection of Temporary Barrier is considered not feasible due to vehicle access need to be maintained at the nearby houses / uses.
N19	Y	Y	Y	N	<ul style="list-style-type: none"> Insufficient space at construction area; Erection of Temporary Barrier is considered not feasible due to vehicle access need to be maintained at the nearby houses / uses.
N27	Y	Y	Y	Y	N/A
N39	Y	Y	Y	N	<ul style="list-style-type: none"> Insufficient space at construction area; Erection of Temporary Barrier is considered not feasible due to vehicle access need to be maintained at the nearby houses / uses.

Note:

* Use of Quieter PME (see the list of Quieter PME in Table 4.6) including implementation of good site practices.

- 4.50 The alternative quieter PME have been considered and listed in Table 4.6. The noisy equipments have been replaced by the quieter PME such as the use of lorry to replace the dump truck. In order to further mitigate the construction noise impact upon the concerned locations (i.e., NSRs N6, N7, N13, N19, 27 and N39), the Contractor should explore to select commonly available and quieter PME models that the SWLs of the selected quieter PME plants are less than or equal to the SWLs shown in Appendix D1.
- 4.51 The use of quieter alternative construction method have been considered as stated in Section 2.7. As Kam Tin Road and Lam Kam Road are two-lane carriageway, construction noise impact can be reduced through the bound by bound construction of one lane. The affected area due to Project construction will be limited as each active work front will be restricted to about 50 m in length and about 300 m distance separation between two active work fronts should be maintained. Therefore, the duration of Project construction at each work front would be shorten at one time. In addition, avoidance of concurrent use of PME have been implemented.
- 4.52 The use of acoustic enclosures to the hand-held breaker have been considered to mitigate the noise impacts. On the other hand, the construction work front will direct face to those NSRs, a temporary vehicle access will be maintained. However, the erection of temporary noise barrier will create an obstruction to the vehicle access upon the NSRs N6, N7, N13, N19 and N39. In addition, the space for the footing of the temporary noise barrier is about 2m width. There is not enough space at the construction site for the erection of temporary noise barrier near those NSRs. Therefore, the erection of temporary noise barriers are not considered practicable near NSRs N6, N7, N13, N19 and N39. The exceedance of noise criteria by 2 dB(A) at NSR N27 is still anticipated even though the erection of temporary noise barrier.
- 4.53 Therefore, all practical effective noise mitigation measures have been fully explored and exhausted to reduce the nuisance to the public arising from the construction works.
- 4.54 Although the construction of the entire 5.2 km road Project could last for 4 to 5 years, the scale of the construction works at each active construction site is relatively small (i.e., 50 m in length). Therefore, the time of road work construction involved use of PME is relatively short as listed in Table 4.4. In addition, the exceedance should be limited to a certain time periods where the road works are carried out very close to the NSRs (e.g., by less than 12m from N13).
- 4.55 As Kam Tin Road and Lam Kam Road are two-lane carriageway, only one lane road closure will be allowed. Therefore, the duration of exceedance is assumed to be from two active construction sites of two lanes. The duration of the residual impacts on the subjected NSRs are estimated based on the operation duration of the PME (as listed in Table 4.4) and are summarized in Table 4.11.

Table 4.11 Residual Impacts on the NSRs

NSR	No. of Dwellings	Stage of Construction			
		Road Up-grading		Road Paving	
		Max. Residual Noise Level, dB(A)	Duration of Exceedance	Max. Residual Noise Level, dB(A)	Duration of Exceedance
N6	1	78	2 – 3 days	79	Within 2 days
N7	1	78	2 – 3 days	79	Within 2 days
N13	1	84	6 days	81	Within 2 days
N19	1	76	2 – 3 days	78	Within 2 days
N27	3	77	2 – 3 days	76	Within 2 days
N39	1	83	6 days	83	Within 2 days

Note: The duration of exceedance is estimated based on two work fronts for the construction of two-lane carriageway.

- 4.56 As mentioned in Section 4.16, there are some land use zoning in the vicinity of the proposed Project which may have potential planned NSRs such as village houses located close to the construction work front in future. They may be affected by the construction works of the Project if they are occupied prior to the construction. As mentioned in Section 4.33, noise exceedance at these potential NSRs will be anticipated if the road upgrading work or road paving work are less than 50 m or 30 m from the NSR, respectively. The above mentioned noise mitigation measures would be adopted to minimize the potential construction noise impact. After the adoption of quieter equipment and the implementation of mitigation measures, the affected area with noise exceedance should be reduced to 10 m and 12 m for the road upgrading work and road paving work, respectively. Assumed the potential planned NSRs located at the construction work boundary, the duration of the residual impacts on those NSRs are estimated less than 6 days for the road upgrading work and 2 days for the road paving work.
- 4.57 It is recommended that more detailed construction work programme should be established by the Contractor before actual construction work and applicable noise mitigation measures should be implemented according to the actual site condition and constraints in order to minimize the potential construction noise impact.
- 4.58 In addition, a detailed work programme according to the environmental monitoring and audit manual should be provided by the Environmental Team (ET) of the Contractor, and to be approved by Independent Environmental Checker (IEC) before actual implementation.

Operational Noise Impact Assessment

Impact Identification

- 4.59 During the operation of the Project, it may increase the road traffic noise impacts on the nearby NSRs. In order to determine whether the road traffic noise impact due to a road improvement project would be considered significant, the road traffic noise impact assessment was carried out.
- 4.60 Road traffic noise from Kam Tin Road and Lam Kam Road within the proposed Project area is the major noise sources during operational phase.
- 4.61 As confirmed by the Project Proponent (Appendix D2), the existing road type (Kam Tin Road and Lam Kam Road are rural road) will not be changed after completion of the Project. Therefore, the Project is not within the meaning under item A.1 of Part 1, Schedule 2 of the EIAO: “A road which is an expressway, trunk road, primary distributor road or district distributor road including new roads, and major extensions or improvements to existing roads”.

Assessment Methodology

- 4.62 According to Section 5.1 in Annex 13 of the EIAO-TM and EIAO Guidance Note No. 12/2005, traffic noise impact is assessed based on the peak hour traffic flow for the worst year within 15 years upon commencement of operation of the Project (i.e., design year). The proposed upgrading roads under the Project are scheduled to be operated in Year 2015. Therefore, the projected year 2030 traffic data in the Final Traffic Impact Assessment (TIA) Report as accepted by Transport Department is adopted in the assessment. The morning and afternoon peak hour traffic flows are presented in Appendix A1.
- 4.63 Appendix A2 contains relevant correspondences with Transport Department on the agreement of traffic data and assessment assumptions. It should be noted that the Project will not affect the traffic volume on the existing roads.
- 4.64 As shown in Appendix A1, roads within 300m from the boundary of the proposed study area have been included in the assessment. The traffic speed for all roads including Kam Tin Road and Lam Kam Road adopted in the traffic noise model is 50 kph and a section of Kam Tin Bypass (~40 m in length within the study area) is 70 kph.
- 4.65 The road surface type of the existing road (i.e., bitumen or concrete) was assumed except a section of Kam Tin Bypass at 70 kph (i.e., pervious road surface). With reference to the confirmation from the Highways Department (refer to Appendix D2), the road surface type of the existing road shown in Appendix A1 is considered valid and bitumen surface will be paved along the entire road sections of the Project.
- 4.66 The existing roadside noise barriers along Kam Tin Bypass and Tung Wui Road have been included in the assessment. As-built drawings for these barriers have been attached in Append D4.
- 4.67 The road alignments, surrounding buildings and all other structures that could have noise screening are inputted in the road traffic noise model. The roads

are divided into segments and each of the road segment assigned a road width, road surface type, road design speed and traffic volume with percentage of heavy vehicles. Traffic noise levels are calculated at the noise assessment point, 1.2 m above each floor and 1 m away from the façade of the selected representative NSRs. A sample input file with the computer plot of the roadNoise model used in the traffic noise prediction are given in Appendix D5.

- 4.68 Traffic noise levels are predicted by the roadNoise model with algorithm based on the UK Department of Transport Calculation of Road Traffic Noise (CRTN) 1988 developed by the UK Department of Transport.
- 4.69 The operational noise impacts are predicted under the following scenarios:
- “Original Scenario”, i.e., “without Project” scenario at Year 2030; and
 - “Unmitigated Scenario”, i.e., “with Project” scenario at Year 2030.
- 4.70 Road traffic noise level are presented in terms of noise levels exceeded for 10% of the one-hour period for the hour having the peak traffic flow (i.e. $L_{10,1\text{-hour}}$, dB(A)).

Assessment Results

- 4.71 Operational noise impact assessment under the “Original Scenario” and “Unmitigated Scenario” has been conducted at the identified existing and planned NSRs. The results at each level of the identified representative NSRs based on morning and afternoon peak traffic flow are presented in Table 4.12 and Table 4.13, respectively.

Table 4.12 Predicted Road Traffic Noise Level at Each Identified NSR (Morning Peak)

Predicted Noise Level, L_{10} (1-hr) dB(A)							
NSR	Floor	Height, mPD	“Original Scenario”	“Unmitigated Scenario”	Difference (“Unmitigated Scenario” - “Original Scenario”)	Noise Standard under EIAO-TM	Noise Impact considered as significant ⁽¹⁾
N1	1	8.9	77.0	77.0	0.0	65	No
N2	1	7.4	67.6	67.6	0.0	70	No
N3	1	10.1	72.2	72.2	0.0	70	No
	2	12.9	73.8	73.6	-0.2	70	No
N4	1	10.0	75.1	75.0	-0.1	70	No
	2	12.8	76.1	76.0	-0.1	70	No
N5	1	9.9	65.2	65.2	0.0	70	No
	2	12.9	70.2	70.2	0.0	70	No
	3	15.9	73.0	73.0	0.0	70	No
N6	1	10.1	81.0	81.8	0.8	55	No
	2	13.1	81.8	82.4	0.6	55	No
N7	1	10.8	80.7	80.7	0.0	70	No
N8	1	11.7	78.4	78.8	0.4	70	No
	2	14.5	79.3	79.7	0.4	70	No
	3	17.3	79.5	79.8	0.3	70	No
N9	1	11.6	78.2	78.1	-0.1	70	No

NSR	Floor	Height, mPD	Predicted Noise Level, L ₁₀ (1-hr) dB(A)			Noise Standard under EIAO-TM	Noise Impact considered as significant ⁽¹⁾
			"Original Scenario"	"Unmitigated Scenario"	Difference ("Unmitigated Scenario" - "Original Scenario")		
N10	1	10.9	75.0	75.0	0.0	70	No
N12	1	12.7	69.7	69.8	0.1	70	No
	2	15.5	70.2	70.3	0.1	70	No
N13	1	14.6	81.4	82.3	0.9	70	No
	2	17.4	82.1	82.8	0.7	70	No
N15	1	12.3	74.0	74.1	0.1	70	No
	2	15.1	75.1	75.2	0.1	70	No
N16	1	13.0	74.9	74.9	0.0	70	No
	2	15.8	75.8	75.7	-0.1	70	No
N17	1	16.0	76.5	76.9	0.4	70	No
	2	18.8	77.1	77.7	0.6	70	No
N18	1	16.8	75.6	76.2	0.6	70	No
	2	19.6	76.4	77.2	0.8	70	No
N19	1	17.2	78.8	77.9	-0.9	70	No
	2	20.0	81.3	80.5	-0.8	70	No
N20	1	18.0	75.5	74.6	-0.9	70	No
	2	20.8	76.3	75.6	-0.7	70	No
	3	23.6	76.7	76.0	-0.7	70	No
N21	1	18.2	75.7	75.7	0.0	70	No
	2	21.0	76.1	76.3	0.2	70	No
N22	1	19.7	73.3	73.1	-0.2	70	No
	2	22.5	74.2	74.0	-0.2	70	No
	3	25.3	74.7	74.5	-0.2	70	No
N24	1	19.8	76.8	76.7	-0.1	70	No
	2	22.6	78.0	77.8	-0.2	70	No
N25	1	21.9	72.0	72.0	0.0	70	No
	2	24.7	72.7	72.8	0.1	70	No
	3	27.5	73.1	73.2	0.1	70	No
N26	1	23.0	75.5	75.6	0.1	55	No
	2	25.8	76.3	76.4	0.1	55	No
	3	28.6	76.6	76.6	0.0	55	No
N27	1	23.0	80.1	80.6	0.5	70	No
	2	25.8	80.5	80.8	0.3	70	No
	3	28.6	79.9	80.2	0.3	70	No
N28	1	23.9	71.2	71.2	0.0	70	No
	2	26.7	71.8	71.8	0.0	70	No
	3	29.5	72.2	72.2	0.0	70	No
N29	1	24.3	76.2	76.6	0.4	70	No
	2	27.1	77.1	77.5	0.4	70	No
	3	29.9	77.3	77.6	0.3	70	No
N30	1	23.6	72.7	72.8	0.1	55	No
	2	26.4	73.6	73.6	0.0	55	No

NSR	Floor	Height, mPD	Predicted Noise Level, L ₁₀ (1-hr) dB(A)			Noise Standard under EIAO-TM	Noise Impact considered as significant ⁽¹⁾
			"Original Scenario"	"Unmitigated Scenario"	Difference ("Unmitigated Scenario" - "Original Scenario")		
	3	29.2	74.1	74.1	0.0	55	No
N31	1	25.0	75.4	75.6	0.2	70	No
	2	27.8	76.4	76.6	0.2	70	No
N32	1	26.0	73.6	73.7	0.1	55	No
	2	28.8	74.2	74.4	0.2	55	No
	3	31.6	74.6	74.7	0.1	55	No
N33	1	29.4	75.2	75.4	0.2	70	No
	2	32.2	76.0	76.1	0.1	70	No
N34	1	38.8	72.8	72.8	0.0	70	No
	2	41.6	74.3	74.2	-0.1	70	No
	3	44.4	75.0	75.0	0.0	70	No
N35	1	43.0	73.9	74.1	0.2	70	No
	2	45.8	74.7	74.8	0.1	70	No
N36	1	42.6	72.9	72.9	0.0	70	No
	2	45.4	74.1	74.1	0.0	70	No
N37	1	47.7	74.3	74.5	0.2	70	No
	2	50.5	75.0	75.1	0.1	70	No
	3	53.3	75.2	75.4	0.2	70	No
N38	1	47.7	73.8	74.0	0.2	70	No
	2	50.5	74.7	74.9	0.2	70	No
	3	53.3	75.1	75.3	0.2	70	No
N39	1	45.0	81.8	81.9	0.1	70	No
	2	47.8	82.0	82.0	0.0	70	No
N41	1	45.8	76.4	76.5	0.1	70	No
	2	48.6	77.4	77.5	0.1	70	No
	3	51.4	77.7	77.8	0.1	70	No
N42	1	47.8	77.7	77.6	-0.1	70	No
	2	50.6	78.6	78.5	-0.1	70	No
N43	1	51.0	76.0	76.2	0.2	70	No
	2	53.8	76.8	76.9	0.1	70	No
	3	56.6	77.1	77.1	0.0	70	No
N44	1	52.4	74.8	75.0	0.2	70	No
	2	55.2	75.6	75.7	0.1	70	No
	3	58.0	76.0	76.0	0.0	70	No
N45	1	54.1	68.8	69.4	0.6	70	No
N46	1	59.9	68.1	68.2	0.1	70	No
	2	62.9	68.9	69.1	0.2	70	No
	3	65.9	69.4	69.5	0.1	70	No
	4	68.9	69.7	69.9	0.2	70	No
	5	71.9	70.1	70.2	0.1	70	No
N47	1	71.4	67.3	67.7	0.4	70	No
	2	74.4	67.7	68.0	0.3	70	No

NSR	Floor	Height, mPD	Predicted Noise Level, L ₁₀ (1-hr) dB(A)			Noise Standard under EIAO-TM	Noise Impact considered as significant ⁽¹⁾
			"Original Scenario"	"Unmitigated Scenario"	Difference ("Unmitigated Scenario" - "Original Scenario")		
N48	1	61.8	68.5	68.9	0.4	70	No
N49	1	71.5	78.3	79.1	0.8	70	No
N50	1	84.1	68.6	68.7	0.1	70	No
	2	86.9	70.3	70.3	0.0	70	No
N51	1	99.2	69.1	68.6	-0.5	70	No
N52	1	135.7	72.2	72.3	0.1	70	No
	2	138.5	73.9	74.0	0.1	70	No
N53	1	151.6	81.4	81.5	0.1	70	No
N54	1	158.7	74.9	75.2	0.3	70	No
P01	1	9.0	79.3	79.3	0.0	70	No
	2	11.8	79.2	79.2	0.0	70	No
	3	14.6	79.0	79.0	0.0	70	No
P02	1	9.1	78.5	78.5	0.0	70	No
	2	12.1	78.4	78.4	0.0	70	No
P03	1	29.7	72.6	72.9	0.3	70	No
	2	32.5	73.3	73.7	0.4	70	No
	3	35.3	73.7	74.0	0.3	70	No
P04	1	54.8	79.6	79.8	0.2	70	No
	2	57.8	79.1	79.3	0.2	70	No
P05	1	8.8	81.5	81.5	0.0	70	No
	2	11.6	81.3	81.3	0.0	70	No
	3	14.4	81.0	81.0	0.0	70	No
P06	1	9.4	83.0	83.0	0.0	70	No
	2	12.2	83.3	83.4	0.1	70	No
	3	15.0	82.6	82.7	0.1	70	No
P07	1	11.1	83.3	83.3	0.0	70	No
	2	14.1	83.6	83.6	0.0	70	No
P08	1	10.3	75.3	75.3	0.0	70	No
	2	13.3	77.0	76.9	-0.1	70	No
	3	16.3	77.7	77.7	0.0	70	No
P09	1	21.1	81.3	81.3	0.0	70	No
	2	23.9	81.6	81.6	0.0	70	No
	3	26.7	80.9	80.9	0.0	70	No
P10	1	26.7	82.0	81.9	-0.1	70	No
	2	29.5	82.2	82.2	0.0	70	No
	3	32.3	81.6	81.6	0.0	70	No
P11	1	32.9	81.9	81.8	-0.1	70	No
	2	35.9	81.5	81.5	0.0	70	No
P12	1	47.4	81.6	81.7	0.1	70	No
	2	50.2	82.1	82.2	0.1	70	No
	3	53.0	81.4	81.6	0.2	70	No
P13	1	51.9	83.3	83.4	0.1	70	No

Predicted Noise Level, L ₁₀ (1-hr) dB(A)							
NSR	Floor	Height, mPD	"Original Scenario"	"Unmitigated Scenario"	Difference ("Unmitigated Scenario" - "Original Scenario")	Noise Standard under EIAO-TM	Noise Impact considered as significant ⁽¹⁾
	2	54.7	83.4	83.5	0.1	70	No
	3	57.5	82.6	82.8	0.2	70	No

Note:

- 1) The noise considered as significant if predicted noise level of "Unmitigated Scenario" > noise standards under EIAO-TM and the traffic noise level with the road project (i.e., "Unmitigated Scenario") is equal or greater than that without the road project (i.e., "Original Scenario") at the design year by 1.0 dB(A) or more.

Table 4.13 Predicted Road Traffic Noise Level at Each Identified NSR (Afternoon Peak)

Predicted Noise Level, L ₁₀ (1-hr) dB(A)							
NSR	Floor	Height, mPD	"Original Scenario"	"Unmitigated Scenario"	Difference ("Unmitigated Scenario" - "Original Scenario")	Noise Standard under EIAO-TM	Noise Impact considered as significant ⁽¹⁾
N1	1	8.9	78.0	78.0	0.0	65	No
N2	1	7.4	68.2	68.2	0.0	70	No
N3	1	10.1	72.8	72.8	0.0	70	No
	2	12.9	74.4	74.2	-0.2	70	No
N4	1	10.0	75.7	75.6	-0.1	70	No
	2	12.8	76.7	76.6	-0.1	70	No
N5	1	9.9	65.8	65.8	0.0	70	No
	2	12.9	70.8	70.8	0.0	70	No
	3	15.9	73.6	73.6	0.0	70	No
N6	1	10.1	81.6	82.4	0.8	55	No
	2	13.1	82.4	83.0	0.6	55	No
N7	1	10.8	81.3	81.3	0.0	70	No
N8	1	11.7	79.0	79.4	0.4	70	No
	2	14.5	79.9	80.3	0.4	70	No
	3	17.3	80.1	80.4	0.3	70	No
N9	1	11.6	78.8	78.7	-0.1	70	No
N10	1	10.9	75.6	75.6	0.0	70	No
N12	1	12.7	70.3	70.4	0.1	70	No
	2	15.5	70.8	70.9	0.1	70	No
N13	1	14.6	82.0	82.9	0.9	70	No
	2	17.4	82.7	83.4	0.7	70	No
N15	1	12.3	74.6	74.7	0.1	70	No
	2	15.1	75.7	75.8	0.1	70	No
N16	1	13.0	75.5	75.5	0.0	70	No
	2	15.8	76.4	76.3	-0.1	70	No
N17	1	16.0	77.1	77.5	0.4	70	No
	2	18.8	77.7	78.3	0.6	70	No
N18	1	16.8	76.2	76.8	0.6	70	No
	2	19.6	77.0	77.8	0.8	70	No
N19	1	17.2	79.4	78.4	-1.0	70	No

NSR	Floor	Height, mPD	Predicted Noise Level, L ₁₀ (1-hr) dB(A)			Noise Standard under EIAO-TM	Noise Impact considered as significant ⁽¹⁾
			"Original Scenario"	"Unmitigated Scenario"	Difference ("Unmitigated Scenario" - "Original Scenario")		
	2	20.0	81.9	81.0	-0.9	70	No
N20	1	18.0	76.1	75.1	-1.0	70	No
	2	20.8	76.9	76.1	-0.8	70	No
	3	23.6	77.2	76.5	-0.7	70	No
N21	1	18.2	76.2	76.2	0.0	70	No
	2	21.0	76.7	76.8	0.1	70	No
N22	1	19.7	73.6	73.4	-0.2	70	No
	2	22.5	74.5	74.3	-0.2	70	No
	3	25.3	75.0	74.8	-0.2	70	No
N24	1	19.8	77.1	76.9	-0.2	70	No
	2	22.6	78.3	78.1	-0.2	70	No
N25	1	21.9	72.2	72.2	0.0	70	No
	2	24.7	72.9	73.0	0.1	70	No
	3	27.5	73.4	73.4	0.0	70	No
N26	1	23.0	75.7	75.8	0.1	55	No
	2	25.8	76.5	76.6	0.1	55	No
	3	28.6	76.8	76.8	0.0	55	No
N27	1	23.0	80.3	80.8	0.5	70	No
	2	25.8	80.7	81.0	0.3	70	No
	3	28.6	80.1	80.4	0.3	70	No
N28	1	23.9	71.4	71.4	0.0	70	No
	2	26.7	72.0	72.0	0.0	70	No
	3	29.5	72.4	72.4	0.0	70	No
N29	1	24.3	76.4	76.8	0.4	70	No
	2	27.1	77.3	77.7	0.4	70	No
	3	29.9	77.5	77.8	0.3	70	No
N30	1	23.6	72.9	73.0	0.1	55	No
	2	26.4	73.8	73.8	0.0	55	No
	3	29.2	74.3	74.3	0.0	55	No
N31	1	25.0	75.6	75.8	0.2	70	No
	2	27.8	76.6	76.8	0.2	70	No
N32	1	26.0	73.8	73.9	0.1	55	No
	2	28.8	74.4	74.6	0.2	55	No
	3	31.6	74.8	74.9	0.1	55	No
N33	1	29.4	75.4	75.6	0.2	70	No
	2	32.2	76.2	76.3	0.1	70	No
N34	1	38.8	73.0	73.0	0.0	70	No
	2	41.6	74.5	74.4	-0.1	70	No
	3	44.4	75.2	75.2	0.0	70	No
N35	1	43.0	74.1	74.3	0.2	70	No
	2	45.8	74.9	75.0	0.1	70	No
N36	1	42.6	73.1	73.1	0.0	70	No

NSR	Floor	Height, mPD	Predicted Noise Level, L ₁₀ (1-hr) dB(A)			Noise Standard under EIAO-TM	Noise Impact considered as significant ⁽¹⁾
			"Original Scenario"	"Unmitigated Scenario"	Difference ("Unmitigated Scenario" - "Original Scenario")		
N37	2	45.4	74.3	74.3	0.0	70	No
	1	47.7	74.5	74.7	0.2	70	No
	2	50.5	75.2	75.3	0.1	70	No
N38	3	53.3	75.4	75.6	0.2	70	No
	1	47.7	74.0	74.2	0.2	70	No
	2	50.5	74.9	75.1	0.2	70	No
N39	3	53.3	75.3	75.5	0.2	70	No
	1	45.0	82.0	82.1	0.1	70	No
	2	47.8	82.2	82.2	0.0	70	No
N41	1	45.8	76.6	76.7	0.1	70	No
	2	48.6	77.6	77.7	0.1	70	No
	3	51.4	77.9	78.0	0.1	70	No
N42	1	47.8	77.9	77.8	-0.1	70	No
	2	50.6	78.8	78.7	-0.1	70	No
N43	1	51.0	76.1	76.2	0.1	70	No
	2	53.8	76.8	76.9	0.1	70	No
	3	56.6	77.1	77.2	0.1	70	No
N44	1	52.4	74.8	75.0	0.2	70	No
	2	55.2	75.6	75.7	0.1	70	No
	3	58.0	76.0	76.0	0.0	70	No
N45	1	54.1	67.9	68.5	0.6	70	No
N46	1	59.9	68.9	69.0	0.1	70	No
	2	62.9	69.6	69.7	0.1	70	No
	3	65.9	70.0	70.1	0.1	70	No
	4	68.9	70.3	70.4	0.1	70	No
	5	71.9	70.6	70.7	0.1	70	No
N47	1	71.4	67.7	68.0	0.3	70	No
	2	74.4	67.9	68.2	0.3	70	No
N48	1	61.8	67.5	68.0	0.5	70	No
N49	1	71.5	77.3	78.1	0.8	70	No
N50	1	84.1	67.7	67.7	0.0	70	No
	2	86.9	69.3	69.3	0.0	70	No
N51	1	99.2	68.1	67.6	-0.5	70	No
N52	1	135.7	71.2	71.3	0.1	70	No
	2	138.5	72.9	73.0	0.1	70	No
N53	1	151.6	80.4	80.5	0.1	70	No
N54	1	158.7	73.9	74.2	0.3	70	No
P01	1	9.0	80.1	80.1	0.0	70	No
	2	11.8	80.0	80.0	0.0	70	No
	3	14.6	79.8	79.8	0.0	70	No
P02	1	9.1	79.8	79.8	0.0	70	No
	2	12.1	79.7	79.7	0.0	70	No

NSR	Floor	Height, mPD	Predicted Noise Level, L ₁₀ (1-hr) dB(A)			Noise Standard under EIAO-TM	Noise Impact considered as significant ⁽¹⁾
			"Original Scenario"	"Unmitigated Scenario"	Difference ("Unmitigated Scenario" - "Original Scenario")		
P03	1	29.7	72.8	73.2	0.4	70	No
	2	32.5	73.5	73.9	0.4	70	No
	3	35.3	73.9	74.2	0.3	70	No
P04	1	54.8	79.8	80.0	0.2	70	No
	2	57.8	79.3	79.5	0.2	70	No
P05	1	8.8	82.5	82.5	0.0	70	No
	2	11.6	82.3	82.3	0.0	70	No
	3	14.4	82.0	82.0	0.0	70	No
P06	1	9.4	83.6	83.6	0.0	70	No
	2	12.2	83.9	84.0	0.1	70	No
	3	15.0	83.2	83.3	0.1	70	No
P07	1	11.1	83.9	83.9	0.0	70	No
	2	14.1	84.2	84.2	0.0	70	No
P08	1	10.3	75.9	75.9	0.0	70	No
	2	13.3	77.6	77.5	-0.1	70	No
	3	16.3	78.3	78.3	0.0	70	No
P09	1	21.1	81.5	81.5	0.0	70	No
	2	23.9	81.8	81.8	0.0	70	No
	3	26.7	81.1	81.1	0.0	70	No
P10	1	26.7	82.2	82.1	-0.1	70	No
	2	29.5	82.4	82.4	0.0	70	No
	3	32.3	81.8	81.8	0.0	70	No
P11	1	32.9	82.1	82.0	-0.1	70	No
	2	35.9	81.7	81.7	0.0	70	No
P12	1	47.4	81.8	81.9	0.1	70	No
	2	50.2	82.3	82.4	0.1	70	No
	3	53.0	81.6	81.7	0.1	70	No
P13	1	51.9	83.3	83.4	0.1	70	No
	2	54.7	83.4	83.5	0.1	70	No
	3	57.5	82.7	82.8	0.1	70	No

Note:

1) The noise considered as significant if predicted noise level of "Unmitigated Scenario" > noise standards under EIAO-TM and the traffic noise level with the road project (i.e., "Unmitigated Scenario") is equal or greater than that without the road project (i.e., "Original Scenario") at the design year by 1.0 dB(A) or more.

4.72 As presented in Table 4.12 and Table 4.13, the predicted traffic noise levels with the road project (i.e., "Unmitigated Scenario") are not greater than that without the road project (i.e., "Original Scenario") at the design year by 1.0 dB(A) or more, the traffic noise impact from the Project is considered not significant.

4.73 The proposed road works would upgrade the existing road sections into 7.3m wide single two lane carriageway and the associated pedestrian access on both sides of the roads. Therefore, to widen the pedestrian access may increase the distance between some of the NSRs and the roads as a result of

decreasing in traffic noise levels (if the road alignment is shifted away from the NSR). Moreover, the 2-lane road sections will be separated by central divider (e.g., CH17+10 to CH18+80) which will also increase the distance separation between one road lane and the NSR as a result of decreasing in traffic noise levels as well. Therefore, the traffic noise levels at some representative NSRs would have no change or even decrease after the Project and all NSRs will not experience any significant additional noise impact after the operation of the Project.

Noise Mitigation Measures

- 4.74 Direct noise mitigation measures are not considered necessary as the increases of traffic noise impacts are less than 1.0 dB(A) at any of the representative NSRs.

Residual Impacts during Operation

- 4.75 Although the overall noise levels at some NSRs would exceed the traffic noise criterion, noise exceedances at these NSRs are due to the existing roads. No residual impact is predicted during the operational phase of the Project.

Environmental Monitoring and Audit (EM&A)

- 4.76 Since it is anticipated that there will be potential adverse impacts during construction, construction phase EM&A shall be conducted to ensure the recommended mitigation measures are effectively implemented.
- 4.77 Operational noise monitoring is not considered necessary.

Conclusion

- 4.78 Practical noise mitigation measures such as use of quieter PMEs and erection of temporary noise barriers are proposed to minimize the noise impact during the construction phase. It is recommended that more detailed construction work programme should be established by the contractor and applicable noise mitigation measures should be implemented according to the actual site condition and constraints, in order to minimize the residual construction noise impact. EM&A has been proposed to ensure the implementation and effectiveness of the mitigation measures.
- 4.79 Operational road traffic noise impact has been predicted based on morning and afternoon peak traffic flow at the design year of 2030. The predicted traffic noise levels with the project (i.e., "Unmitigated Scenario") are not greater than that without the road project (i.e., "Original Scenario") at the design year by 1.0 dB(A) or more. It is concluded that the traffic noise impact due to the project is considered insignificant. Hence, direct noise mitigation measures are not considered necessary.

5.0 WATER QUALITY IMPACT ASSESSMENT

Introduction

- 5.1 This section presents a background of the current condition of surface waters in the form of streams and channels in the Project area, and describes the potential impacts on water quality associated with Project construction and operation. Mitigation measures are proposed and residual impacts are evaluated as appropriate.
- 5.2 The water quality assessment and evaluation has been conducted in accordance with the guidelines and criteria as presented in Annexes 14 and 6 of the Technical Memorandum on Environmental Impact Assessment Process (EIA-TM), respectively.

Legislation, Standards and Practice Notes

- 5.3 The following legislation, Standards and Practice Notes were considered in the assessment:
- Water Pollution Control Ordinance (Cap. 358): Water Quality Objectives (WQOs) for Deep Bay Water Control Zone (WCZ);
 - Water Pollution Control Ordinance (Cap. 358): WQOs for Tolo Harbour Supplementary WCZ;
 - Water Pollution Control Ordinance (Cap. 358): Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters;
 - EIAO (Cap. 499): Annexes 6 and 14 of TM-EIAO;
 - EPD's Practice Notes for Professional Persons ProPECC PN 1/94 "Construction Site Drainage"; and,
 - Water Supplies Department (WSD) guidelines on protection of Water Gathering Ground (Appendix E1).
- 5.4 Table 5.1 summarises the objectives for inland waters of the Deep Bay and Tolo Harbour Supplementary WCZ.

Table 5.1 Water Quality Objectives for Inland Waters

Parameters	Water Quality Objectives
pH	6.5 – 8.5
Suspended solids (SS)	Annual median 20 mg/L
Dissolved oxygen (DO)	4 mg/L
Chemical oxygen demand (COD)	15 mg/L

5-day Biochemical Oxygen Demand (BOD5) 3 mg/L

Baseline Conditions

- 5.5 Water courses within the project area comprise the channelized Kam Tin River and a number of natural streams with unpolluted and polluted sections. The direction of flow is towards the Kam Tin River and ultimately Inner Deep Bay to the northwest for those water courses near Shek Kong Barracks and Wang Toi Shan Shan Tsuen, and the towards Lam Tsuen River and ultimately Tolo Harbour to the east for those water courses near Kadoorie Experimental Farm.
- 5.6 Observations during site visits conducted in April and May 2008 indicate that streams at the east of the project area were clean. By contrast, surface waters at the east of the Project area were grey and turbid with occasional odour detected, indicating organic pollution. These field observations are consistent with the latest EPD's water quality index (WQI), with Lam Tsuen River classed as "Excellent" but Kam Tin River classed as having a "bad" or "very bad" WQI in 2006.
- 5.7 Table 5.2 shows the water quality monitoring data at Lam Tsuen River and Kam Tin River in 2006.¹ These indicated that the water quality in Lam Tsuen River is much better than in Kam Tin River, with higher DO but lower SS, BOD5, COD, *E. coli* and NH3-N.

Table 5.2 Summary of EPD Water Quality Monitoring Data for Lam Tsuen River and Kam Tin River in 2006

Parameter	TR12H (Lam Tsuen River)	KT2 (Kam Tin River)
DO (mg/l)	8.6 (7.8 – 9.5)	2.7 (1.1 – 6.1)
pH	7.3 (7.1 – 7.6)	7.3 (7.2 – 7.5)
SS (mg/l)	1 (1 – 3)	40 (9 – 140)
BOD5 (mg/l)	1 (1 – 1)	61 (11 – 120)
COD (mg/l)	4 (2 – 6)	130 (23 – 300)
<i>E. coli</i> (cfu/100ml)	580 (230 – 3,200)	1,200,000 (130,000 – 4,300,000)
NH3-N (mg/l)	0.02 (0.01 – 0.04)	18.00 (4.20 – 40.00)

- 5.8 The overall compliance of the WQOs in Lam Tsuen River is 95% due to the continued enforcement of the WPCO, the implementation of the Tolo Harbour Sewerage Master Plan Stage 1 and connection of village houses to the public sewer. As sewerage works continue in the area, the water quality of the water course is likely to improve further in the coming years.

¹ River Water Quality in Hong Kong in 2006, published by EPD.

- 5.9 Overall compliance of the WQOs in Kam Tin River is 39%, due to pollution from livestock farms and unsewered villages. With the implementation of the Livestock Waste Control Scheme and Yuen Long & Kam Tin Swerage Master Plan, the situation is expected to gradually improve.
- 5.10 It is noted that there is an encroachment of about 60m of the water gathering zone located at the eastern end of the Project (Figure 5.1).

Water Sensitive Receivers (WSRs)

- 5.11 Identified WSRs within 300m of the Project boundary include water gathering ground from the project eastern end, local streams near Kadoorie Experimental Farm, Ling Wan Monastery, Wong Chuk Yuen, Sheung Tsuen and Kam Tin Bypass; nullah near Wang Toi Shan Hung Mo Tam, Shek Kong Barracks and the channelized Kam Tin River. Locations of the WSRs are provided in Figure 5.1.

Construction Phase Impact Assessment

Impact Identification

- 5.12 Potential water quality impacts may arise from general road construction works and associated facilities. Key sources of impact may include:
- Surface runoff from rainfall and wind erosion of exposed surface areas, and material stockpiles and vehicle wheel washing facilities;
 - Wash water from dust suppression measures;
 - Spillage of chemicals, lubrication oils, solvent and petroleum products; and
 - Sewage from the construction workforce.
- 5.13 In particular, surface run-off into receiving water courses during and immediately after rainstorm events is a concern. Sediment laden run-off would result in deteriorating water quality and may result in induced effects on aquatic ecological resources. However, given both the magnitude and duration of works it is anticipated that unacceptable water quality impacts can be avoided with the proper implementation of appropriate construction run-off management practices referred in ProPECC PN 1/94 Construction Site Drainage.
- 5.14 Domestic sewage generated by the construction workforce shall be appropriately managed to avoid the potential adverse impacts of uncontrolled sewage discharge into nearby water courses. Portable chemical toilets shall be appropriately located on site in proximity to all key works areas where they shall remain and be maintained in good working order for the convenience of the workforce for the duration of the works.

Potential Cumulative Impacts during Construction Phase

- 5.15 As stated in Section 2, there is only one designated project within 500m of the Project boundary (i.e., *Hong Kong Section of Guangzhou - Shenzhen - Hong Kong Express Rail Link*) and will potentially be constructing concurrently with

this project. According to the Project Profile of this railway project (application no.: ESB-197/2008), most of the construction works would be carried out in underground condition. Therefore, no significant cumulative impacts are anticipated. Concurrent non-designated projects in the vicinity of the Project have been summarized in Table 2.1. Only minor local-scale impacts arising from the construction activities of these projects are anticipated. With these concurrent projects are distant from the proposed Project area, no significant cumulative impacts are anticipated.

Specific Protection of the Water Gathering Ground

- 5.16 As the Project boundary fall within about 60m of the water gathering ground located at the eastern end of the Project, potential water quality impacts associated with the Project construction may be arise. The contractor shall comply with the “Condition of Working within Water Gathering Ground” (attached in Appendix E1) during Project construction.
- 5.17 In addition, the following control measures should be implemented during Project construction:
- The provision of temporary toilet facilities within the Water Gathering Ground, if any, is subject to approval of the Director of Water Supplies. As a minimum requirement temporary toilet facilities must be located more than 30m from any watercourse.
 - The contractor should be measures taken to minimise rainfall into the working areas and the perimeter of the work sites will be bounded to prevent ingress of rainfall during storm events; and to prevent off site migration of materials.
 - Notices should be posted at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the nearby environment.
- 5.18 As the Project should not have any permanent adverse effect on the gathering ground and the such measures in place, the water quality impact during the Project construction is considered insignificant.

Best Practice Control Measures

- 5.19 Details of the best practice measures are provided below:
- Wastewater from temporary site facilities should be controlled to prevent direct discharge to surface waters;
 - Storm drainage shall be directed to storm drains via adequately designed sand/silt removal facilities such as sand traps, silt traps and sediment basins. Channels, earth bunds or sand bag barriers should be provided on site to properly direct stormwater to such silt removal facilities. Catchpits and perimeter channels should be constructed in advance of site formation works and earthworks;
 - Silt removal facilities, channels and manholes shall be maintained and any deposited silt and grit shall be removed regularly, including specifically at the onset of and after each rainstorm;

- Rainwater pumped out from trenches or surface excavations should be discharged into storm drains via silt removal facilities;
- Open stockpiles (e.g. aggregates, sand and fill material) should be covered with a tarpaulin to avoid erosion during rainstorms;
- Exposed soil surface should be paved as soon as possible;
- Measures should be taken to prevent the washout of construction materials, soil, silt or debris into any drainage system;
- Discharges of surface run-off into foul sewers must always be prevented in order not to unduly overload the foul sewerage system;
- Vehicles and plant should be cleaned before they leave the construction site to ensure that no earth, mud or debris is deposited by them on roads. A wheel washing bay shall be provided at every site exit, as far as practicable;
- Wheel-wash overflow shall be directed to silt removal facilities before being discharged to the storm drain;
- Regular inspections of stilling basins and/or silt traps to ensure that sediment is not conveyed into the existing drainage system;
- Surface excavation should be carefully programmed to avoid wet-season operation. If it is unavoidable, any exposed top soils should be covered with a tarpaulin or other means;
- The contractor shall prepare an oil / chemical cleanup plan and ensure that leakages or spillages are contained and cleaned up immediately;
- Any fuels should be stored in bunded areas such that spillage can be easily collected. Waste oil should be collected and stored for recycling or disposal, in accordance with the Waste Disposal Ordinance.
- Sewage effluent should be handled by portable chemical toilets or sewage holding tanks. A licensed contractor is responsible for the sewage facilities maintenance, and regular sewage collection and disposal.

Operational Phase Impact Assessment

Impact Identification

- 5.20 Potential water quality impacts during the operational phase may arise from highway discharge. Material deposited and accumulated on the road surface, including dust / sediment, heavy metals and vehicle oil, will be washed from the carriageway during rainfall events into silt traps and the existing / proposed drainage system.
- 5.21 Given the negligible change in the forecast traffic volume and composition, the nature and volume of highway discharge will not significantly increase during Project operation. In addition, there will be no sewage generation during Project operation, no adverse impacts are anticipated.

Environmental Monitoring and Audit

- 5.22 Since no significant water quality impacts are expected during the construction and operational phases, water quality monitoring is not considered necessary. However, regular site inspections are recommended to be conducted during construction phase in order to ensure the mitigation measures are implemented properly.

Conclusion

- 5.23 With the implementation of the mitigation measures during the construction and operation phases of the Project, no significant water quality impacts are anticipated. The implementation of the mitigation measures shall be included to the works contracts. Regular site inspections are recommended during construction to ensure the measures are implemented properly.

6.0 WASTE MANAGEMENT

Introduction

- 6.1 This section provides an evaluation of the potential waste management implications associated with the construction and operation phases of the Project, and assesses the potential environmental impacts associated with the handling and disposal of wastes and materials.
- 6.2 The operation phase of the upgrading of Kam Tin Road and Lam Kam Road would generate wastes associated with roadside littering and road maintenance activities, and the amount would be expected to be minimal. The potential environmental impacts arising from the handling and disposal of the small quantity of waste are anticipated to be negligible and therefore have not been evaluated.
- 6.3 The potential hazard and land contamination issues and impacts associated with the upgrading of Kam Tin Road and Lam Kam Road were assessed in accordance with Section 3.4.4.2(iii) of the EIA Study Brief (ESB-170/2007) in this section.

Environmental Legislation and Criteria

Waste Management

- 6.4 The criteria and guidelines for evaluating and assessing waste management implications are set out in Annex 7 and Annex 15 of the EIAO-TM.
- 6.5 In carrying out the assessment, reference has been made to the Waste Disposal Ordinance (Cap. 354) and subsidiary legislation such as the Waste Disposal (Chemical Waste) (General) Regulation sets requirements for the storage, handling and transportation of all waste types.
- 6.6 Other relevant documents and guidelines are also applicable to waste management and disposal in Hong Kong:
- Works Branch Technical Circular No. 2/93, Public Dumps;
 - ETWB Technical Circular (Works) No. 33/2002, "Management of Construction and Demolition Material Including Rock";
 - ETWB Technical Circular (Works) No. 19/2005, "Environmental Management on Construction Sites";
 - ETWB Technical Circular (Works) No. 15/2003, "Waste Management on Construction Sites"; and
 - Works Bureau Technical Circular No. 6/2002, "Enhanced Specification for Site Cleanliness and Tidiness".

Land Contamination

- 6.7 Land contamination impact assessment was conducted with reference to the “Guidance Note for Contaminated Land Assessment and Remediation” and “Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards and Car Repair /Dismantling Workshop” issued by EPD. In addition, the Risk-based Remediation Goals (RBRGs) stipulated in the “Guidance Manual for Use of Risk-based Remediation Goals for Contaminated Land Management” issued by EPD should be adopted as the criteria for assessing soil and groundwater contamination.
- 6.8 Further consideration of contamination issues is provided in Section 3 (Potential Contaminated land Issues) of Annex 19 “Guidelines for Assessment of Impact on Sites of Cultural Heritage and Other Impacts” of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM).

Waste Impact Assessment

Assessment Methodology

- 6.9 The criteria for evaluating the potential construction waste management implications are set out in Annex 7 of the EIAO-TM. The methods for assessing potential waste management impacts during construction follow those presented in Annex 15 of the EIAO-TM and include the following:
- Estimation of the types and quantities of the wastes to be generated;
 - Assessment of the secondary environmental impacts due to the management of waste with respect to potential hazards, air and odour emissions, noise, wastewater discharges and public transport; and
 - Assessment of the potential impacts on the capacity of waste collection, transfer and disposal facilities.

Impact Assessment & Evaluation

- 6.10 The following types of wastes are anticipated during the construction of the Project:
- Construction and demolition (C&D) material;
 - Chemical wastes; and
 - General refuse.

Construction and demolition (C&D) material

- 6.11 C&D material would be generated from the road upgrading works, associated slope and landscaping works on Kam Tin Road and Lam Kam Road during the course of the works between Year 2010 and 2015. The types of C&D material during the construction works would be soil, fill and artificial hard materials (e.g.

concrete/bituminous pavement). It is estimated that the total volume of the C&D material generated from the Project would be approximately 45,000m³.

- 6.12 All C&D materials generated shall be sorted on site into inert portion "inert C&D materials" including soil, building debris, broken rock, concrete, etc., and the non-inert portion is the "C&D wastes" comprising timber, paper, plastics, general refuse etc. The inert C&D materials, the reusable and/or recyclable materials shall be recovered before disposal of the waste portion off site as a last resort. The waste portion of the inert C&D materials may be disposed of at the public fill reception facility at Tuen Mun Area 38, and the C&D wastes at North East New Territories (NENT) Landfill in Ta Kwu Ling.
- 6.13 Different kinds of wooden materials are essential to the construction project. All wooden materials used on site should be kept separate from other wastes. Wooden boards will be reused on site several times until the quality of the boards is no longer suitable for re-use. On completion of construction project, remaining reusable wooden material can be sorted and used at other construction sites by the contractor.
- 6.14 Reusable steel and concrete panels shall be used as a preferred alternative to wooden formwork, falsework, and site fencing.
- 6.15 Methods to minimise the generation of C&D material will be addressed during detail design and in planning of the construction works. A Waste Management System will be incorporated into the Waste Management Plan (WMP) to effectively manage and avoid/reduce/minimise the generation of C&D material during construction.
- 6.16 To prevent fly-tipping of C&D materials, a Trip Ticket System will be implemented to monitor C&D wastes from the Project, a truck carrying debris should first obtain a ticket on leaving the construction site, then dump the debris at the designated location and finally have the ticket stamped and returned to the construction site.
- 6.17 The estimated amount of C&D waste to be disposed of landfill and public filling reception facility would be 2,000m³ and 20,000m³ respectively.

Chemical Waste

- 6.18 Construction plant and vehicle maintenance may generate a small amount of chemical wastes during construction works, such as cleaning fluids, solvents, lubrication oil and fuel.
- 6.19 The volume of chemical waste is difficult to quantify since it will depend upon the maintenance requirements and total number of plant utilised on site. However, the potential volume of chemical waste would be limited and anticipated in few cubic metres per month. The amount of chemical waste to be generated will be quantified in the site Waste Management Plan to be prepared by the Contractor.
- 6.20 Materials classified as chemical wastes will require special handling and storage arrangements before removal for appropriate treatment at the

Chemical Waste Treatment Facility (CWTF) or other licensed facilities. Wherever possible opportunities should be taken to reuse and recycle materials.

- 6.21 Storage, handling, transport and disposal of chemical waste should be arranged in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Waste published by the EPD. Provided that this occurs, and the chemical waste is disposed of at a licensed chemical waste treatment and disposal facility, the potential environmental impacts arising from the storage, handling and disposal of a small amount of chemical waste generated from the construction activities will be negligible.

General Refuse

- 6.22 The workforce would generate refuse comprising food scraps, waste paper, empty containers, etc. Such refuse will be properly collected on-site and transfer to the nearby refuse collection point. Disposal of refuse at sites other than approved waste transfer or disposal facilities will be prohibited. Effective collection of site wastes will prevent waste materials being blown around by wind, or creating an odour nuisance or pest and vermin problem. Waste storage areas will be well maintained and cleaned regularly.
- 6.23 The maximum number of construction workers to be employed is estimated to be about 80 workers. Based on a generation rate of 0.65 kg per worker per day, the maximum daily arising of general refuse during the construction period would be approximately 52 kg and this waste can be effectively controlled by normal measures. With the implementation of good waste management practices at the site, adverse environmental impacts are not expected to arise from the storage, handling and transportation of workforce wastes.

Summary of Waste Materials

- 6.24 Based on the assessment above, Table 6.1 presents the estimated volume of waste generation. In general, the inert portion of C&D materials should be disposed of to Public Fill Banks or other Public Filling Areas while the non-inert portion should be sent to landfill for disposal. Any potential for reuse of materials on site should be explored prior to disposal.

Table 6.1 Summary of Waste Generation during Construction Phase

Material Type	Source(s)	Quantity	Handling	Disposal / Treatment
C&D Materials	Excavation, minor modification of slope and road works	Excavation for drain laying = 20,000 m ³	Sort on-site into inert C&D material (public fill) and non-inert C&D waste	20,000 m ³ of inert C&D material (public fill) to be disposed of at public fill reception facility at Tuen Mun Area 38 for other beneficial uses
		Excavation for road resurfacing = 20,000 m ³		
		Excavation for slope work = 5,000 m ³	23,000 m ³ of inert C&D material reused on-site	2,000 m ³ of non-inert C&D waste to NENT landfill

Material Type	Source(s)	Quantity	Handling	Disposal / Treatment
		Total = 45,000 m ³	Wooden Material (reusable as lower grade shuttering or fencing on-site or other sites)	Final disposal to NENT Landfill
			Scrap metals (Reusable steel panels shall be used as site fencing)	To NENT Landfill if rejected by recycling companies.
Chemical Waste	Cleansing fluids, solvent, lubrication oil and fuel from construction plant and equipment	A few cubic metres per month (preliminary estimate)	Recycle on-site or by licensed companies and stored on-site in the designed containers	To Chemical Waste Treatment Facility or other licensed facility
General Refuse	Waste paper, discarded containers, etc. generated from workforce	Approximate 52 kg per day (preliminary estimate based on workforce of 80)	Provide on-site refuse collection points	To NENT landfill

Best Management Practices

- 6.25 While potentially significant waste management impacts are not envisaged, given the potential for secondary impacts (e.g., dust, noise, water quality and visual impacts) mitigation measures are required to ensure proper waste handling, storage, transportation and disposal throughout the construction works.
- 6.26 In line with Government's position on waste minimisation, the practice of avoiding and minimising waste generation and waste recycling should be adopted as far as practicable. Recommended mitigation measures to be implemented throughout the course of the construction phase:
- An on-site environmental co-ordinator should be identified at the outset of the works. The co-ordinator shall prepare an Environmental Management Plan (EMP) incorporating waste management in accordance with the requirements set out in the ETWB TCW No. 19/2005, Environmental Management on Construction Sites. The EMP shall include monthly and yearly Waste Flow Tables (WFT) that indicate the amounts of waste generated, recycled and disposed of (including final disposal site), and which should be regularly updated;
 - Spoil generated from the piling activities will need to be properly handled to minimise contamination to surface waters and any exposed ground areas due to leakage or improper storage (i.e. onto bare ground instead of into tanks);
 - The reuse/ recycling of all materials on site shall be investigated prior to treatment/ disposal off- site;

- Good site practices shall be adopted from the commencement of works to avoid the generation of waste, reduce cross contamination of waste and to promote waste minimisation;
- All waste materials shall be sorted on-site into inert and non-inert C&D materials, and where the materials can be recycled or reused, they shall be further segregated. Inert material, or public fill will comprise stone, rock, masonry, brick, concrete and soil which is suitable for land reclamation and site formation whilst non-inert materials include all other wastes generated from the construction process such as plastic packaging and vegetation (from site clearance);
- The Contractor shall be responsible for identifying what materials can be recycled/ reused, whether on-site or off-site. In the event of the latter, the Contractor shall make arrangements for the collection of the recyclable materials. Any remaining non-inert waste shall be collected and disposed of to the Public Filling Areas whilst any inert C&D materials shall be re-used on site as far as possible. Alternatively, if no use of the inert material can be found on-site, the materials can be delivered to a Public Fill Area or Public Fill Bank after obtaining the appropriate licence;
- With reference to ETWBTC (W) No.31/2004, Trip-ticket System for Disposal of Construction and Demolition Material, a trip ticket system should be established at the outset of the construction of the NLH/ helipad to monitor the disposal of C&D and solid wastes from the site to public filling facilities and landfills;
- Under the Waste Disposal (Chemical Waste) (General) Regulation, the Contractor shall register as a Chemical Waste Producer if chemical wastes such as spent lubricants and paints are generated on site. Only licensed chemical waste collectors shall be employed to collect any chemical waste generated at site. The handling, storage, transportation and disposal of chemical wastes shall be conducted in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes and A Guide to the Chemical Waste Control Scheme both published by EPD;
- A sufficient number of covered bins shall be provided on site for the containment of general refuse to prevent visual impacts and nuisance to the sensitive surroundings. These bins shall be cleared daily and the collected waste disposed of to the refuse transfer station. Further to the issue of ETWB TCW No. 6/2002A, Enhanced Specification for Site Cleanliness and Tidiness, the Contractor is required to maintain a clean and hygienic site throughout the Project works;
- All chemical toilets, if any, shall be regularly cleaned and the night-soil collected and transported by a licensed contractor to a Government Sewage Treatment Works facility for disposal;
- Tool-box talks should be provided to workers about the concepts of site cleanliness and appropriate waste management procedures, including waste reduction, reuse and recycling;
- The Contractor shall comply with all relevant statutory requirements and guidelines and their updated versions that may be issued during the course of Project construction.

Land Contamination Impact Assessment

Assessment Methodology

6.27 In order to identify and evaluate the potential contamination impacts associated with the Project, the following tasks have been undertaken in accordance with ProPECC PN 3/94 and the EPD Guidance Notes:

- Desktop study to review the current and historical land uses; and
- Site inspection to confirm the existing land uses.

6.28 In addition, the following sources of information have been collected and reviewed:

- Aerial photographs from Lands Department;
- Records and photographs from site visits.

Baseline Conditions

Site History

6.29 Table 6.2 shows the historical aerial photographs (as shown in Appendix F2) covering the study area was reviewed to evaluate any land use changes associated with potential contamination implication within the Project boundary.

Table 6.2 Summary of Historical Aerial Photograph Review

Year	Ref. No.	Observations
1964	3445, 3448, 3451, 3454, 3989, 4379, 4389, 4393	Kam Tin Road was constructed and the surrounding areas were mainly occupied by farmland and village housing. Lam Kam Road was constructed and mainly surrounded by undeveloped land.
1981	38309, 38321, 38317	
1985	A01333, A01337, A01341, A01344,	
1991	A26496, A26497	There was no apparent change in the road alignment noted in the period 1991 to 1995.
1995	CN10315, CN10313, CN10281, CN10244, CN10285	Village houses, clinic, open storage areas, parks and barracks were developed around the Project boundary
2004	CW57522, CW57519, CW57619, CW57676, CW57704, CW57708	No further change in road alignment / layout within the Project boundary was evident by 2004

Source of historical aerial photographs: Survey and Mapping Office, Lands Department.

Site Inspection

6.30 A site inspection was conducted in April 2008 to identify any contamination hotspots within the Project boundary. All accessible areas were inspected as far as practicable to collect information about the current activities undertaken

within the Project site. Photo-documentation was also undertaken if possible and provided in Appendix F1.

- 6.31 Based on the site observations, the areas around Lam Kam Road are mainly surrounded by the undeveloped area while Kam Tin Road is mainly surrounded by Shek Kong barracks, village houses and open space. Since the areas within the Project boundary have been covered by the existing Lam Kam Road and Kam Tin Road, it is therefore unlikely to have potential land contamination impacts from the existing land uses.
- 6.32 During the site inspections, some car repairing workshops and petrol filling stations were identified along the Kam Tin Road and Lam Kam Road which may potentially be existed contaminated soil.

Identification of Sensitive Receivers

- 6.33 During the Project construction, construction workers might be exposed to potential contaminated materials when they carry out the excavation and foundation works. The principal exposure path for workers include:
- Direct ingestion of contaminated soils through eating or drinking/ smoking on site;
 - Dermal contact with contaminated soils; and
 - Inhalation of contamination if the contaminants are volatile.
- 6.34 During the Project operation, no sensitive receivers are identified by considering the surrounding environment of the Project area.

Prediction of Potential Impacts

Potential Contaminated Sites near Project Boundary

- 6.35 Based on the findings obtained from the desktop studies and site inspections, it was found that five petrol filling stations (i.e., PFS 1 to PFS 5 as shown in Figure 6.1) and nine car repairing workshops (i.e., Site 1 to Site 9 as shown in Figure 6.1) were identified in the vicinity of the proposed Project. Photo-documentation of these petrol filling stations and car repairing workshops was provided in Appendix F5.
- 6.36 After review the historical aerial photographs from Lands Department, the operation periods of the petrol filling stations and car repairing workshops was estimated and summarized in Table 6.3.

Table 6.3 Operation Periods of the Petrol Filling Stations and Car Repairing Workshops

Petrol Filling Station	Operation Periods
PFS 1	After 1998 to current
PFS 2	After 1998 to current
PFS 3	After 1998 to current

Petrol Filling Station	Operation Periods
PFS 4	After 1990 to current
PFS 5	After 1949 to 2008
Site 1	After 1993 to current
Site 2	After 1998 to current
Site 3	After 1985 to current
Site 4	After 1985 to current
Site 5	After 1993 to current
Site 6	After 1993 to current
Site 7	After 1998 to current
Site 8	After 1993 to current
Site 9	After 1993 to current

- 6.37 Currently, PFS 1 to PFS 4 is still operating while PFS 5 is closed. The petrol filling stations were all concrete paved and tidy suggesting that potential land surface contamination from petrol filling activities is not anticipated. According to the response from the Feoso Oil Company (as shown in Appendix F3), there is no significant contamination at PFS1. Besides, no leakage of the underground fuel storage tanks was recorded at PFS1.
- 6.38 According to the incident records covered the operation periods of all five petrol filling stations (i.e., PFS 1 to PFS 5) provided by Fire Services Department (as shown in Appendix F4), there is no oil leakage incident recorded for the concerned five petrol filling stations. As there is no oil leakage happened in the petrol filling stations, there is no indication of any significant contamination and it can be assumed that the underground fuel storage tanks are subject to appropriate integrity testing to prevent leakage. Furthermore, since petrol filling station usually would execute their product loss prevention checking for the underground tanks and associated pipelines; and filling facilities, possibility of unattended product loss is unlikely. Migration of contaminants from these petrol filling station to the Project area is not anticipated.
- 6.39 In addition, as the five petrol filling stations (i.e., PFS 1 to PFS 5) would not encroach upon the Project area, the land of these petrol filling stations will not be handed over to the Project Proponent either in whole or in portion. Therefore, further site investigation for these petrol filling stations will not be recommended.
- 6.40 As the car repairing workshops of Site 2, Site 5 to Site 9 would be located outside the Project boundary, it is anticipated that contaminated materials would not be encountered for these area during the construction of the Project. The land of these car repairing workshops will not be handed over to the Project Proponent either in whole or in portion. Therefore, further site investigation for these car repairing workshops will not be recommended.

- 6.41 The car repairing workshops of Site 1, Site 3 and Site 4 would potentially be encroached upon the Project boundary. During the site inspection of Site 1, an observable area of Site 1 is concrete-paved where no apparent oil stain was found, and no chemical storage was observed. The car repairing and dismantling activities was observed within the encroached area upon the Project boundary.
- 6.42 The car repairing workshops of Site 3 and Site 4 was observed that area is concrete-paved where no apparent oil stain was found, and no chemical storage was observed. The car repairing and dismantling activities was observed within the car repairing workshops but outside the Project boundary. contaminating activities are only happened at the inner portion of the car repairing workshops that is away from the project boundary. The encroached area upon the Project boundary is not involved the contaminating activities.
- 6.43 According to Table 2.3 of “Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards and Car Repair /Dismantling Workshop” issued by EPD, a full-scale site investigation should be conducted as the length of operation of these car repairing workshops is more than 5 years and there is no practice of recording spill incidents. However, detailed site investigation for contamination is not possible at this stage as these car repairing workshops is still under operation by the site operator. The further site investigation and soil sampling confirm the likelihood of contamination could be conducted during project construction after these sites have been handed over or access can be arranged for site investigation.

Further Investigations

- 6.44 As there could be possibilities of land contamination at the area of the car repairing workshops (i.e., Site 1, Site 3 and Site 4) encroached upon the project boundary, a land contamination investigation shall be carried out at these sites to identify the possible land contamination at these locations. The project proponent will engage a competent and experienced professional to carry out a detailed contamination assessment and remediation, if necessary.

Sampling Plan for Site Investigation

- 6.45 Site investigation have identified that the area of the car repairing workshops (i.e., Site 1, Site 3 and Site 4) encroached upon the project boundary are potential contaminated area. A total of 8 trial pits are proposed for the purpose of initial screening of the potential contaminated area. The indicative location plans of the proposed Site Investigation (SI) sampling locations are illustrated in Figure 6.2. The selection of potential chemicals of concern recommended for laboratory analysis at each proposed sampling location is referenced from the nature of each area. As recommended in the “Guidance Notes for Investigation and Remediation of Contaminated Sites of Petrol Filling Stations, Boatyards and Car Repair /Dismantling Workshop”, sampling parameters for each location have been selected and shown in Table 6.4.

Table 6.4 Sampling and Testing Plan

Location	Area encroached upon the project boundary	Proposed no. of trial pit location	Sampling Depth and Frequency	Testing Parameters
Site 1	~ 160 m ²	4	Soil samples at depths of 0.5, 1.5 and 3.0 m bgl. One groundwater sample per location if encountered.	Heavy metals (lead, chromium, zinc, copper), VOCs (benzene, toluene, ethylbenzene, xylene) and SVOCs (polyaromatic hydrocarbons),TPH
Site 3	~ 70 m ²	2	Soil samples at depths of 0.5, 1.5 and 3.0 m bgl. One groundwater sample per location if encountered.	Heavy metals (lead, chromium, zinc, copper), VOCs (benzene, toluene, ethylbenzene, xylene) and SVOCs (polyaromatic hydrocarbons),TPH
Site 4	~ 30 m ²	2	Soil samples at depths of 0.5, 1.5 and 3.0 m bgl. One groundwater sample per location if encountered.	Heavy metals (lead, chromium, zinc, copper), VOCs (benzene, toluene, ethylbenzene, xylene) and SVOCs (polyaromatic hydrocarbons),TPH

6.46 The exact sampling locations of the SI shall be determined on site and subject to fine adjustment due to site specific conditions (e.g. locations, presence of foundations, underground utilities, delivery pipes and services). The location should be agreed with competent and experienced professional prior to drilling/excavation and sampling.

6.47 If serious contamination is revealed during the SI, more sampling locations or more number of samples at the specific trial pit / borehole should be recommended to determine the exact extent of contamination.

Soil Sampling and Depth of Sampling

6.48 As the excavation work should not be more than 3.0m below the encroach area of Site 1, Site 3 and Site 4, drilling of trial pit and collection of soil samples should be conducted at depths of 0.5m, 1.5m and 3.0m. The on-site competent and experienced professional will decide the appropriate depths for sampling on a point by point basis.

6.49 At each sampling location/depth, sufficient quantity of soil sample (as specified by the laboratory) should be taken. All soil samples should be uniquely labeled. All samples should be stored at 0 - 4 °C whilst in the field or in transit.
Strata Logging

6.50 Strata logging for boreholes should be undertaken during the course of drilling/digging and sampling by experienced field personnel. The logs should include the general stratigraphic description, depth of soil sampling, sample notation and level of groundwater (if encountered). The presence of rocks/boulders/cobbles and foreign materials such as metals, wood and plastics should also be recorded.

Groundwater Sampling

- 6.51 It is proposed to collect groundwater samples if groundwater is encountered at the sampling locations. For each proposed borehole sampling location, a groundwater sampling well should be installed into the boreholes if groundwater is encountered. After installation of the monitoring wells, the depth to water table at all monitoring wells should be measured. The wells should then be allowed to stand for a day to permit groundwater conditions to equilibrate.
- 6.52 Prior to groundwater sampling, the monitoring wells should be purged to remove fine-grained materials and to collect freshly refilled representative groundwater samples. Time for each groundwater purging/recharge should be recorded as well as the estimated groundwater flow.
- 6.53 After purging, one groundwater sample should then be collected at each well using Teflon bailer and decanted into appropriate sample vials or bottles in a manner that minimizes agitation and volatilization of VOCs from the samples. All samples should be uniquely labeled.
- 6.54 Immediately after collection, groundwater samples should be transferred to new, clean, laboratory-supplied glass jars for sample storage/transport. The sampling glass jars should be of "darken" type. Groundwater samples should be placed in the glass jars with zero headspace and promptly sealed with a septum-lined cap. Immediately following collection, samples should be placed in ice chests, cooled and maintained at a temperature of 0 - 4°C until delivered to the analytical laboratory.

Sample Size and Handling Procedures

- 6.55 All equipment in contact with the ground should be thoroughly decontaminated between each excavation, drilling and sampling event to minimise the potential for cross contamination. The equipment (including drilling pit, digging tools and soil/groundwater samplers) should be decontaminated by steam cleaning or high-pressure hot water jet, then washed by phosphate-free detergent and finally rinsed by distilled / deionised water.
- 6.56 Prior to sampling, the laboratory responsible for analysis should be consulted on the particular sample size and preservation procedures that are necessary for each chemical analysis.
- 6.57 The sample containers should be laboratory cleaned, sealable, water-tight, made of glass or other suitable materials with aluminum or Teflon-lined lids, so that the container surface will not react with the sample or adsorb contaminants. No headspace should be allowed in the containers which contain samples to be analysed for VOCs, Petroleum Carbons Range or other volatile chemicals.
- 6.58 The containers should be marked with the sampling location codes and the depths at which the samples were taken. If the contents are hazardous, this should be clearly marked on the container and precautions taken during transport. Samples should be stored at between 0 - 4 °C but never frozen. Samples should be delivered to laboratory within 24 hours of the samples being

collected and analysed within the respective retention period but should not more than 10 days.

Quality Control and Quality Assurance (QA/QC)

6.59 A proper QA/QC program shall be established to ensure that the data collected are accurate and representative of actual soil and groundwater conditions. The QA/QC programme shall include the following:

- Laboratory blanks;
- Batch duplicates;
- Duplicate control samples;
- Certificated reference materials; and
- Single control sample.

Interpretation of Results

6.60 With reference to the "Guidance Note for Contaminated Land Assessment Remediation", interpretation of results should make reference from the "Guidance Manual for Use of Risk-based Remediation Goals for Contamination Management". The soil and groundwater samples collected for this study will be compared with Risk-based Remediation Goals (RBRGs) as stipulated in Table 2.1 and Table 2.2 of the "Guidance Manual for Use of Risk-based Remediation Goals for Contamination Management".

6.61 The RBRGs are developed based on a risk assessment approach to suit the local environmental conditions and community needs in Hong Kong. Decisions on contaminated soil and groundwater remediation are based on the nature and extent of the potential risks that are posed to human receptors as a result of exposure to chemicals in the soil and/or groundwater. Four types of land use scenarios are set under RBRGs to reflect the typical physical settings in Hong Kong under which people could be exposed to contaminated soil and groundwater. A description of each land use is as follows:

- Urban residential – Sites located in an urban area where main activities involve habitation by individuals. The typical physical setting is a high rise residential building situated in a housing estate that has amenity facilities such as landscaped yards and children's playgrounds. The receptors are residents who stay indoors most of the time except for a short period each day, during which they are outdoors and have the chance of being in direct contact with soil at landscaping or play areas within the estate.
- Rural residential – Sites located in a rural area where the main activities involve habitation by individuals. These sites typically have village-type houses or low rise residential blocks surrounded by open space. The receptors are rural residents who stay at home and spend some time each day outdoors on activities such as gardening or light sports. The degree of contact with the soil under the rural setting is more than that under the urban setting both in terms of the intensity and frequency of contact.

- Industrial – Any site where activities involve manufacturing, chemical or petrochemical processing, storage of raw materials, transport operations, energy production or transmission, etc. Receptors include those at sites where part of the operation is carried out directly on land and the workers are more likely to be exposed to soil than those working in multi-storey factory buildings.
- Public parks – Receptors include individuals and families who frequent parks and play areas where there is contact with soil present in lawns, walkways, gardens and play areas. Parks are considered to be predominantly hard covered with limited areas of predominantly landscaped soil. Furthermore, public parks are not considered to have buildings present on them.

6.62 In addition to the RBRGs, screening criteria (soil saturation limits, Csat, developed for Non-aqueous Phase Liquid (NAPL) in soil and water solubility limits for NAPL in groundwater) for the more mobile organic chemicals must be considered to determine whether a site requires further action.

6.63 Since this Project involves the construction of road including pedestrian walkway, the Study Area is considered to be occupied for industrial or public purpose in the future and the RBRGs for Industrial/ Public Park will be adopted as the assessment criteria for this land contamination assessment.

6.64 Following the Contamination Assessment Plan (CAP), a Contamination Assessment Report (CAR) will be prepared. The CAR will present the findings of the further site investigation where site access can be obtained and evaluate the level and extent of potential contamination within the project boundary. The CAR will evaluate the potential environmental and human health impacts based on the extent of potential contamination identified. If remediation is required, a Remediation Action Plan (RAP) will be prepared.

Possible Remediation Methods

6.65 Assumed that all excavated materials from the car repairing workshops of Site 1, Site 3 and Site 4 are contaminated. The amount of contaminated soil to be treated will be in the order of approximately 780 m³ [i.e., 260 m² (total encroached area) x 3 m (maximum excavation depth)]. However, the actual quantity of contaminated soils, if any, will need to be confirmed subject to further investigation, and expected to be less than that estimated under the worst-case scenario.

6.66 The actual remediation methods, if required, would depend on a number of factors including nature and extent of contamination as well as site and time availability. Therefore, a complete comparison of pros and cons of all possible remediation options is to be provided in the future RAP submission so as to justify the proposed remediation options and determine the best feasible option for contaminated soil treatment. The possible remediation measures for the contaminated soil is listed in follow:

- Recovery trenches or wells;
- Soil venting;

- Biotreatment;
- Immobilization; and
- Excavation followed by disposal at landfills.

Recommendations and Mitigation Measures

Recommendations

- 6.67 The Project Proponent shall engage a competent and experienced professional to prepare a detailed CAP for EPD's approval prior to the investigation.
- 6.68 Upon approval of the CAP, the Project Contractor shall carry out site investigation and sampling works in accordance with the approved CAP. If contamination was identified, CAR and RAP shall also be prepared and submitted to EPD for approval. Remediation measures as recommended in the RAP shall be fully implemented by the Project Contractor prior to commencement of construction works.
- 6.69 With regard to the above, all the land contamination assessments, including site investigations, supervision during the sampling works, preparation of the CAP, CAR and RAP shall be conducted by the competent and experienced professional who shall have adequate experience in land contamination assessment, investigation and remediation.

Mitigation Measures

- 6.70 As a general measures, the following environmental and safety precautionary measures should be implemented during construction works, in order to minimize the potential impact on health and contamination exposure to the site workers:
- Exposure to any contaminated materials can be minimised by the wearing of appropriate clothing and personal protective equipment;
 - Adequate training and instructions of the potential hazards associated with the contaminated materials shall be provided to site staff and workers;
 - Measures shall be implemented to prevent non-workers from approaching the identified potential contamination areas in order to avoid exposure to contaminants;
 - Where appropriate, the use of bulk handling equipment should be maximised to reduce the potential contacts between excavated contaminated materials and associated workers;
 - All temporary stockpiles of the materials shall be completely covered with waterproof material to avoid leaching of contaminants, especially during rainy season; and
 - Surface water shall be diverted around any contaminated areas or stockpiles to minimise potential runoff into excavations.

Evaluation of Residual Impacts

- 6.71 With the implementation of the recommended mitigation measures for the handling of any contaminated materials, no residual impact is anticipated during the construction of the proposed Project.

Environmental Monitoring and Audit

- 6.72 The areas of car repairing workshops (i.e., Site 1, Site 3 and Site 4) encroached upon the project boundary have been proposed for further investigation. A detailed CAP should be submitted to EPD for endorsement prior to conducting the contamination assessment works. Contamination assessment at the potential contaminated areas should follow the requirements laid out in the CAP. A CAR and RAP, where necessary, should be prepared based on the results obtained from the site investigation and submitted for EPD's approval. The contaminated area shall be remediated in accordance with the approved CAR/RAP. The specific EM&A requirements are detailed in the separate EM&A Manual.

Conclusion

- 6.73 An assessment of waste generation has been conducted, from which estimated quantities of key sources and types of waste have been estimated. Appropriate handling and treatment / disposal of the wastes shall ensure no adverse environmental impacts.
- 6.74 As a best practice measure it is proposed that regular site inspections and audits of construction phase waste management be undertaken as part of a broader construction phase EM&A programme.
- 6.75 An investigation of the historical and existing land uses in respect of land contamination, including a desktop study and site inspection has been conducted around the Project boundary. Recommendations for investigation and mitigation measures have been proposed for the potential contaminated sites, which shall be fully implemented accordingly.
- 6.76 It is considered that the potential land contamination issues can be adequately controlled with suitably planned construction and works in accordance with the remediation action plan and the recommended precautionary protection measures for workers.

7.0 ECOLOGICAL IMPACT ASSESSMENT

Introduction

- 7.1 This section presents the approach to and the findings of the ecological impact assessment. The assessment shall identify and quantify the potential ecological impacts to the natural environment and the associated wildlife groups and habitats / species arising from the proposed Project. Special attention shall be paid to avoid impacts on wildlife groups or habitats / species of conservation interests.
- 7.2 The proposed road upgrading works is a DP under the EIAO due to minor encroachment into the "Conservation Area" ("CA") zones adjacent to Kam Tin Road (OZP S/YL-PH/11) and Lam Kam Road (OZP S/YL-SK/9) that function as buffers to Lam Tsuen Country Park and Tai Mo Shan Country Park, respectively. A third outline zoning plan (OZP S/YL-KTN/7) covering part of the Study Area includes a CA zone along the northern side of the Kam Tin By-pass alignment, although this CA zone is not affected by the Project.
- 7.3 The CA zones adjacent to Lam Tsuen Country Park and Tai Mo Shan Country Park were established to give added protection to the Country Parks area. The "CA" adjacent to Kam Tin By-pass alignment was zoned to reflect the presence of the reconstructed wetland to compensate the loss of ecological sensitive areas from development of West Rail and Kam Tin By-pass.

Objectives

- 7.4 The aim of the ecological impact assessment is to examine the species and other components of the ecological habitats within the assessment area in order to protect, maintain or rehabilitate the natural environment. The assessment area (or Study Area) for the purpose of terrestrial ecological assessment shall include all areas within 500 metres from the Project site boundary and the areas likely to be impacted by the Project. For aquatic ecology, the Study Area shall be the same as the water quality impact assessment, i.e., all aquatic areas within 300 metres from the Project site boundary.
- 7.5 Specific objectives of the assessment include:
- Conduct desktop study and field surveys of at least four-months duration covering the wet season to establish an updated ecological baseline profile for the Study Area;
 - Identify and predict potential ecological impacts during Project construction and operation;
 - Evaluate the significance and acceptability of the identified impacts;
 - Recommend effective and practicable alternatives and mitigation measures;
 - Recommend the need for and the scope of an appropriate monitoring and audit programme.

Legislation, Standards & Guidelines

7.6 This ecological impact assessment has been conducted in accordance with a number of local legislation and guidelines on protection of species or habitats of conservation concern:

- Annexes 8 and 16 of the EIA-TM
- Forest and Countryside Ordinance (Cap. 96)
- Town Planning Ordinance (Cap. 131)
- Wild Animals Protection Ordinance (Cap. 170)
- The Environmental Impact Assessment Ordinance (Cap. 499)
- Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586)
- International Union for Conservation of Nature and Natural Resources (IUCN) Red Data Book
- Convention on International Trade in Endangered Species
- List of National Key Protected Species in the Mainland PRC
- EIAO Guidance Note Nos. 6/2002, 7/2002, 10/2004

Assessment Methodology

Literature Review

7.7 A literature review of ecological resources within and in proximity to the Study Area was undertaken for this assignment to guide survey methodologies and fieldwork locations. Key information and data sources under review include:

- Memoirs of the Hong Kong Natural History Society.
- EIA Report (EIA-074/2002) for Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1 Packages 1A-1T and 1B-1T – Kam Tin Trunk Sewerage Phase I and II.
- Kadoorie Farm and Botanic Garden (KFBG) 2005 Fauna Checklist.
- Fauna species recorded at KFBG up to 2008.
- Wildlife updates and sightings by KFBG (In: Porcupine!, Vol. 30 – 33)
- Shek, C.K., Chan, C.S.M. & Wan, Y.F. (2007) Camera Trap Survey of Hong Kong Terrestrial Mammals in 2002-06. Hong Kong Biodiversity, Agriculture, Fisheries and Conservation Department (AFCD) Newsletter. Issue No. 15, 1 – 11.
- Data extracted from 2002 – 2008 Territory-wide long term monitoring survey on major taxon groups (AFCD, unpublished data).
- Hong Kong Biodiversity Database (AFCD).

7.8 For nomenclature, local status and abundance of fauna species, reference was made to the Hong Kong Biodiversity Database (<http://www.afcd.gov.hk>, retrieved in August 2008). While for plant species nomenclature, reference was made to the Flora of Hong Kong (Volume 1 and Volume 2). For plant species origins and local abundance, reference was made to Xing et al. (2002) and Leung (2006), of which the local abundance refers to only the distribution of wild or spontaneous population / naturalized species.

Field Survey Methodology

7.9 Under each of the following sub-headings details for each of the focused field survey methodologies are presented. Prior to survey commencement all proposed methodologies were presented in an Inception Report to seek comments and gain approval by relevant government authorities, including but not limited to AFCD.

7.10 Figure 7.1 displays the Study Area and ecological baseline survey locations.

Habitat Survey / Mapping

7.11 A reconnaissance survey was first performed at the commencement of the survey period to characterize habitats and to select representative areas for detailed baseline surveys. Special attention shall be paid to the areas zoned "Conservation Areas" on outline zoning plans which will be directly impacted or encroached upon the proposed road works, and to all other areas in the Study Area deemed to be of actual conservation importance.

7.12 Following the reconnaissance survey, detailed habitat surveys were then performed and colour photographs of all habitat types, and any species or habitat features of ecological or conservation importance were taken. Habitats were identified and mapped within the Study Area based on Government aerial photos and verified / updated during the habitat surveys.

7.13 Key habitats along Lam Kam Road for survey include low shrub / grassland and plantation woodland associated with engineered slopes. The habitat character along Kam Tin Road is considerably more urbanized, although there are remnants of agricultural land, short sections of stream and small pockets of woodland where focused surveys have been undertaken.

Vegetation Survey

7.14 Due to the limited footprint of the proposed Project (Figure 2.1), most impacts upon vegetation will be limited to roadside clearance. The vegetation survey therefore aims to generate an inventory of plant species that occur within the project footprint and its 5m buffer zone which represents the typical extent of works from the existing road alignment. All efforts were made to identify species protected under local regulations, or any species of conservation importance either locally or regionally.

7.15 For the remaining locations within the Study Area that are more distant from the Project alignment, broad vegetation survey was conducted to identify key vegetation communities and dominant plant species that define / characterise the habitat types.

7.16 All vegetation surveys were conducted in parallel with the habitat surveys. Unlike fauna species, the seasonal / temporal effect on the occurrence of flora species is minimal, and hence there was no need to conduct monthly surveys throughout the EIA study period. Nevertheless, sufficient field surveys were performed to identify all areas of vegetation that will potentially be subject to site clearance activities.

7.17 Preliminary vegetation and habitat reconnaissance surveys were conducted in May 2008, with detailed surveys conducted in July and August 2008.

Avifauna Survey

- 7.18 A reconnaissance survey was conducted (in parallel with the habitat survey) to identify any habitats or areas of potential ecological importance for avifauna within the Study Area. A detailed baseline survey of avifauna was conducted using the point-count method within the selected sampling locations (Locations #1 - #4 in Figure 7.1) in order to estimate bird abundance for key habitats / areas.
- 7.19 Point-counts for avifauna survey were conducted in May, June and August 2008 in order to cover a 4-month period as specified in the EIA Study Brief. In each sampling event, ten minutes bird counts were conducted to record all birds seen or heard at each of 4 sampling locations that represent key project / habitat interface zones. Apart from fixed-point counts, transect surveys were also performed around the sampling locations in area at least 100m away from roadsides, including all areas to be encroached due to the proposed Project, so as to collect field data in more remote area.
- 7.20 Bird species were also actively searched and recorded in other locations within the Study Area to generate a complete list of bird species and to supplement the findings of point-count surveys. Any key bird activities such as feeding and breeding were also identified and described.
- 7.21 Avifauna surveys were undertaken on the following dates: 23rd May, 26th May, 27th May, 20th June, 23rd June, 13th August and 17th August 2008. Surveys were conducted during early morning (08:00 – 11:00) and late afternoon (16:00 – 18:00) during which birds are expected to be most active.

Stream Fauna (including Crustaceans and Fish) and Herpetofauna Survey

- 7.22 Water quality induced impacts on stream ecology such as potential surface runoff / discharge may arise from the proposed road upgrading works. The baseline water quality conditions in the Study Area are referred in Section 5 of this EIA Study Report. Specifically to support the ecological impact assessment, “walk-over” surveys were conducted through stream courses, channels or nullahs, and along the adjacent riparian habitats at Locations #3 and #4 (which includes the nearby Meander B) (Figure 7.2) in order to compile a list of key fauna species where the water courses intercept with works areas.
- 7.23 Additional stream fauna surveys were also conducted at the semi-natural stream near Location #1 (Figure 7.1), although this location is outside the Project footprint and no encroachment is anticipated.
- 7.24 Stream fauna were studied through active searching, direct observation and netting. Surveys of stream fauna and herpetofauna were conducted on 22nd May 2008 (night survey), 28th May 2008 (daytime survey), 20th June 2008 (day time survey), 30th June 2008 (night survey) and 12th August 2008 (daytime and night time surveys).

Invertebrate Survey (Butterflies and Dragonflies)

- 7.25 Butterfly surveys were conducted in parallel with, and at the same four locations as, the bird survey as displayed in Figure 7.1. Surveys were

conducted during the warmest part of the day, with all adult butterflies identified to species level. Similar to avifauna surveys, transect surveys were performed around each sampling location and covered areas at least 100m away from roadsides.

- 7.26 Butterfly surveys were conducted on 26th May, 27th May, 20th June, 23rd June, 13th and 17th August 2008.
- 7.27 Dragonfly surveys were conducted in parallel with, and at the same locations as, the stream surveys in May, June and August 2008.
- 7.28 At each survey location an ordinal scale were used to indicate relative abundance. Identification of species was aided by use 8 x 32 binoculars and a long-handled net.

Mammal Survey

- 7.29 It is expected that the well-maintained wildlife records by KFBG, and the data of on-going monitoring programmes for bat and other terrestrial mammal conducted by AFCD provide sufficient information of terrestrial mammal activity in the Study Area. Additional signs of mammal activity, such as tracks and scats, were also under observation during all field surveys in order to supplement information available through desk-top research.

Baseline Ecological Conditions

Habitat Types

- 7.30 The characteristics of each of the habitat types within the Study Area are presented under the following sub-headings. Habitat characterization is based upon the typical vegetation communities present and the degree of habitat stratification.
- 7.31 Table 7.1 below summarises the type and the approximate area of each different land habitat type within the Study Area. The approximate area of each defined land habitat type also includes area of stream courses / channels that pass through the habitat.
- 7.32 A total of 5.18 ha (~5.07 km) of channels and 6.85 ha (~6.73 km) semi-natural stream courses were identified within 500m Study Area.

Table 7.1 Habitat Types within the Study Area (Land)

Habitat Type	Area (hectares)	Area (% of Total)
Agriculture	81.3	12.9
Artificial Wetland	0.7	0.1
Grassland	50.4	8.0
Secondary Woodland	83.0	13.2

Urbanized / Disturbed Area	414.3	65.8
Study Area (for Terrestrial)	629.7	100%

7.33 Figure 7.2 displays the habitat map for the entire Study Area. More specific details of the various habitat types in the Study Area, including dominant and other notable species present, are provided in the following sub-sections.

Agriculture (Active and Abandoned)

7.34 Approximately 12.9% (or 81.3 hectares) of the Study Area is classified as agricultural land (Photo 1 in Appendix G1). However, active cultivation was only occasionally found along the streams on the southern side of Kam Tin Road. These areas are dominated by remnants of orchards and small-scale gardens interspersed with village houses. Dominant vegetation types on cultivated land generally include fruit tree species *Carica papaya*, *Clausena lansium*, *Dimocarpus longan*, *Litchi chinensis*, *Mangifera indica*, *Manihot esculenta* and *Syzygium jambos*, and ornamental tree species such as *Michelia x alba* adjacent to village houses and alongside footpaths.

7.35 Much of the area on the northern side of Kam Tin Road is dominated by abandoned fields / cultivation interspersed with remnants of open storage. Vegetation of these abandoned fields is dominated by weedy herbaceous species.

Artificial Wetland

7.36 Approximately 0.1 % (or 0.7 hectares) of the Study Area located along the northern boundary of the Kam Tin Bypass alignment belongs to artificial wetland (Photo 2 in Appendix G1), which serves as ecological compensation for the West Rail and Kam Tin Bypass projects. The wetland consists of some ornamental roadside tree plantings and common weedy herbaceous species such as *Bidens alba* and *Panicum maximum*. On-going monitoring surveys conducted by AFCD have recorded the scarce winter breeding resident, Greater Painted-snipe *Rostratula benghalensis* in the artificial wetland.

7.37 This habitat type is outside of the footprint of the proposed road widening works. No Greater Painted-snipe was recorded during the field surveys.

Grassland

7.38 Secondary grassland is mainly located in the upland area of Lam Tsuen Country Park, constituting approximately 8% (or 50.4 hectares) of the Study Area (Photo 3 in Appendix G1). This fire-maintained, semi-natural habitat is dominated by typical pioneer vegetation such as the fern *Dicranopteris pedata*, the grass species such as *Ischaemum* sp., *Paspalum* sp., *Arundinella setosa*, *Neyraudia reynaudiana*, and the shrub *Rhodomyrtus tomentosa*.

7.39 This habitat type is not present in the footprint of the proposed road widening works.

Secondary Woodland

- 7.40 Approximately 13.2% (or 83.0 hectares) of the Study Area belongs to secondary woodland (Photo 4 in Appendix G1). This type of habitat comprises of young secondary woodland established on engineered slopes along Lam Kam Road and Kam Tin Road, and the relatively less disturbed plantation woodland interspersed with naturally regenerating native vegetation towards the upland of Lam Tsuen Country Park and Tai Mo Shan Country Park.
- 7.41 The secondary woodland established on or atop those engineered slopes alongside the existing roads consists of mainly the exotic plantation species, *Acacia confusa*, and a low diversity of typical native species of disturbed vegetation types, such as *Alangium chinense*, *Bridelia tomentosa*, *Celtis sinensis*, *Cratogeomys cochinchinense*, *Ficus microcarpa*, *Ficus hispida*, *Litsea glutinosa*, *Macaranga tanarius* and *Microcos paniculata*.
- 7.42 More diverse and less disturbed secondary woodland was found toward uphill of Lam Tsuen Country Park, and the upland area behind the Kadoorie Farm and Botanic Garden and Kadoorie Agricultural Research Centre of the University of Hong Kong. These secondary woodland areas consist of pockets of *Acacia confusa* plantation and naturally regenerating *Machilus* dominating secondary native forest. The native forest communities consist of relatively denser understory vegetation dominated by typical understory species of native secondary forest, such as *Psychotria asiatica*.

Stream Courses / Channels / Meanders

- 7.43 A total of 5.18 ha (~5.07 km) of channels (Photo 5 in Appendix G1) and 6.85 ha (~6.73 km) semi-natural stream courses (Photo 6 in Appendix G1) were identified within 500m Study Area. All the channelized water courses within the Study Area belong to the Kam Tin water catchment and form parts of the Kam Tin River. Lowland semi-natural stream courses that run across or adjacent to the existing Lam Kam Road and Kam Tin Road sections flow from the headwaters of Tai Mo Shan and Tai To Yan.
- 7.44 The majority of Kam Tin River on the northern side of Kam Tin Road has been engineered, with concrete / grasscrete banks dominated by exotic weeds such as *Bidens pilosa* and *Panicum maximum*. The original riparian vegetation and its associated stream fauna have been lost. According to the on-going wetland monitoring reports for the West Rail, namely "MTRC West Rail Contract No. TSA-026: West Rail Ecological Monitoring and Adaptive Management Services" (Asia Ecological Consultants Ltd. 2007, 2008a, 2008b), there are a total of 12 land parcels of compensatory wetlands established in area to the north of the proposed Project Area for regular bird monitoring of the rare breeding and winter visitor species, Greater Painted-snipe and some other bird species by use of radio-tracking and field observation. Although all these wetland compensation areas are away from the proposed Project site boundary (outside of 500m ecological study area), detections of GPS were made at the drainage channel on the northern side of Kam Tin Road which is approximately 300m from the proposed Project boundary. However, no Greater Painted-snipe was recorded in field surveys of this EIA. Due to the limited footprint of the proposed road upgrading works and the distance (~300m) away from the Project site boundary, the proposed Project will not encroach into these roosting or breeding ground of Greater Painted-snipe. Several isolated meanders located next to Kam Tin River (Meanders A, B and C as displayed in

Figure 7.2) were assessed to have “medium” to “high” bird use in a consultancy study of AFCD (Black and Veatch Hong Kong Limited, 2005). Due to necessary geotechnical stability works, a gabion retaining wall will be constructed at the periphery of Meander B that lies immediately adjacent to the roadside as displayed in Figure 7.2a. The proposed retaining wall is approximately 90m in length, of which approximately 54m will lie along the periphery of Meander B. Approximately 117m² of the periphery of Meander B will be encroached due to the stability works. No encroachment is anticipated for Meander A and Meander C as they are all outside of the proposed works footprint. There will also be minor encroachment (approximately of 208m²) onto the drainage channel located at the western end of the road alignment, where a drainage discharge point will be constructed to connect the drainage of the existing Kam Tin Road. However, this section of drainage channel to be encroached upon has long been disturbed and polluted with domestic discharges.

- 7.45 There are a few streams that run through the lowland villages of Leung Uk Tsuen and Pat Heung, and intercept with the existing Kam Tin Road (at Location #3 and Location #4 in Figure 7.1). These lowland streams have been severely polluted (as shown in Photo 7 in Appendix G1) by domestic discharge from nearby villages. The riparian vegetation has been chronically disturbed and heavily invaded by exotic weeds such as *Panicum maximum* and *Mikania micrantha*. Most stream banks within the Study Area are comprised of stone or concrete retaining walls, with outlet pipes. Due to the high level of human disturbance and pollution, limited wildlife is expected.
- 7.46 There are semi-natural stream sections passing through the lowland woodland of KFBG and at the KFBG seedling nursery on Lam Kam Road. The stream habitat is less disturbed and well-vegetated, and partially sheltered by the woodland trees with dominant species include *Steculia lanceolata* and *Cleistocalyx operculatus*. These two streams are outside of the proposed works footprint and no encroachment will be anticipated.

Urbanized / Disturbed Area

- 7.47 This habitat type consists mainly of traffic roads, parks, village houses, open storage, construction sites and wasteland land. Dominant vegetation types include common weedy species in wasteland and along roadside, ornamental plantings adjacent to village houses and alongside Kam Tin Road and Lam Kam Road. The most common roadside tree plantings include the native tree *Celtis sinensis*, and exotic tree species *Casuarina equisetifolia* and *Melaleuca cajuputi* subsp. *cumingiana*, *Acacia confusa*. All the roadside planting species within the Study Area are widely planted locally. Detailed information of the roadside vegetation is presented under the sub-heading “Vegetation Survey” below.

Vegetation Survey

- 7.48 A total of 167 plant species were identified within the Project site boundary and its 5m buffer area, including 72 native species and 95 exotic species. A list of plant species recorded in the vegetation survey is presented in Appendix G2. Two tree individuals of *Aquilaria sinensis*, including the tree specimen no. 1717 (Figure 9.3G) and an undersized small tree (with height approximately 2.5m

and 80mm DBH), were recorded on two slopes (on the southern side of the alignment) at CHB 42+50, and between CHB 51+00 and CHB 51+10 respectively, as displayed in Figure 7.3. *Aquilaria sinensis* is listed as “vulnerable” in the IUCN Red List and scheduled under Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586). However, these two trees will not be affected due to the proposed Project. Appendix G19 displays the photographs of these two tree individuals.

- 7.49 Among the exotic species, 58 species are ornamental / landscape planting species, 13 species belong to fruit tree species and 24 species are naturalized exotic weeds or weeds of uncertain origins (pantropical or cosmopolitan species). The species composition represents typical vegetation communities of roadside habitats, which are usually dominated by ornamental plantings and naturalized weeds.
- 7.50 Of the native species recorded, the most dominant species such as *Ficus* sp., *Bridelia tomentosa*, *Macaranga tanarius*, *Celtis sinensis* are typical pioneer species that occur in disturbed lowland vegetation, such as those of forest margins, roadsides and wasteland.
- 7.51 The EIA Report (EIA-074/2002) for Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1 Packages 1A-1T and 1B-1T – Kam Tin Trunk Sewerage Phase I and II identified one 3-metre tall Humped Fig Tree *Ficus tinctoria* subsp. *gibbosa* on the concreted stream bank near Location #4 (Figure 7.1). The local abundance of this species is described as “restricted” in Xing et al. (2000). However, this tree specimen was missing during the vegetation survey in this EIA study.
- 7.52 Except for one tree individual of *Aquilaria sinensis*, no other rare or protected native plant species was recorded during the vegetation survey. Some planted exotic species are listed as “rarely recorded in wild population” under “Local Abundance” in Appendix G2, to indicate the abundance of wild populations of their cultivated escapes.

Avifauna

Literature Review

- 7.53 A total of 177 bird species were recorded in KFBG from 1995 to 2005 (Kendrick, 2005), of which only 53 species were recorded in the lower part of KFBG located at the eastern end of the proposed Project site. A list of bird species recorded in the lower part of KFBG was given in Appendix G3.
- 7.54 Among the 53 species recorded in the lower part of KFBG, most of them are resident species and are abundant in KFBG. These species include Spotted Dove *Streptopelia chinensis*, Red-whiskered bulbul *Pycnonotus jocosus*, Oriental Magpie Robin *Copsychus saularis*, Common Tailorbird *Orthotomus sutorius*, Great Tit *Parus major*, Fork-tailed Sunbird *Aethopyga christinae*, Japanese White-eye *Zosterops japonicus* and Eurasian Tree Sparrow *Passer montanus*. These species are also common in urban areas of Hong Kong.
- 7.55 A few records of common winter visitors and common passage migrants were also recorded in KFBG, including Asian House Martin *Delichon dasypus*, Red

Turtle Dove *Streptopelia tranquebarica*, Scarly Thrush *Zoothera daumaand* and White Wagtail *Motacilla alba* (Kendrick, 2005). However, some scarce visitor bird species, such as Eurasian Woodcock *Scolopax rusticola* were also recorded within the lower part of KFBG (Ades et al, 2006).

- 7.56 According to the ecological baseline monitoring data from 2002 to 2008 provided by AFCD (unpublished data), a total of 26 bird species were recorded within the Study Area (Appendix G4), of which 25 species are very common and widespread in Hong Kong. One uncommon resident species, Blue-winged Minla *Minla cyanouroptera* was previously recorded within Lam Tsuen Country Park by AFCD.

Field Surveys

- 7.57 A total of 35 species have been recorded in the Study Area from field survey. The counts of birds recorded range from 5 birds at Location #2 in June to 34 birds at Location #3 in August. Appendix G5 summaries the species richness and relative abundance of the birds recorded at each of the location points and those in the transect survey (along the proposed alignment in area up to 100m away from roadside).
- 7.58 The majority of bird species recorded in the survey locations belong to typical and common urban bird species, such as Chinese bulbul *Pycnonotus sinensis*, Common Tailorbird *Orthotomus sutorius*, Eurasian Tree Sparrow *Passer montanus*, Japanese White-eye *Zosterops japonica* and Red-whiskered bulbul *Pycnonotus jocosus*. These were also dominant species in the KFBG fauna checklist (Kendrick, 2005).
- 7.59 However, four bird species, including Common Myna *Acridotheres tristis*, Crested Goshawk *Accipiter Trivirgatus*, Orange-bellied Leafbird *Chloropsis hardwickii* and Rufous-capped Babbler *Stachyris ruficeps* are regarded as "uncommon" in the AFCD biodiversity database. These species were only occasionally observed during the survey and were recorded away from roadside (80-100m away from roads).

Stream Fauna and Herpetofauna

Literature Review

- 7.60 Fifty-six species of herpetofauna were recorded in KFBG from 1995 to 2005 (Appendix G6), including four protected species under the Wild Animals Protection Ordinance (Cap. 170): Hong Kong Newt *Paramesotriton hongkongensis*, Hong Kong Cascade Frog *Amolops hongkongensis*, Romer's Tree Frog *Philautus romeri* and Big-headed Terrapin *Platysternon megacephalum* (Kendrick, 2005). And the Big-headed Terrapin *P. megacephalum* is also listed as "endangered" in both IUCN red list and China red data book status.
- 7.61 Chinese Cobra *Naja atra* and King Cobra *Ophiophagus hannah*, which are protected under the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586) and regarded as "vulnerable" and "critically-endangered" on the China red data book status respectively, were also recorded in KFBG and within the EIA Study Area. And Banded Krait *Bungarus fasciatus* is

regarded as “endangered” in China red data book status. All protected species mentioned are widespread in Hong Kong. Most of them were found in the middle or upper part of KFBG which is far from the Proposed project boundary.

- 7.62 Two additional herpetofauna species were recorded from 2005 to 2006. And they are Mountain wolf snake and Chinese water snake (Ades et al, 2006). They were found in the lower part of KFBG.
- 7.63 Eleven amphibian species were recorded by AFCD from 2002 to 2008 within the EIA Study Area (Appendix G7). All are typical and common species of riparian habitat.
- 7.64 Five fish species were recorded in KFBG from 1995 to 2005, including Striped Loach *Schistura fasciolata*, Flat-headed loach *Oreonectes platycephalus*, Broken-band hillstream loach *Liniparhomaloptera disparis*, Sucker-belly loach *Pseudogastromyzon myersi* and Vietnam Catfish *Pterocryptis cochinchinensis* (Appendix G8). All of them are widespread species in Hong Kong.
- 7.65 Four fish species were recorded by AFCD from 2002 to 2008 in the EIA Study Area (Appendix G9), of which *L. disparis*, *P. myersi* and *S. fasciolata* were also recorded within KFBG. All the four species are common and widespread in Hong Kong.

Field Surveys

- 7.66 Most herpetofauna species were recorded at the adjacent agriculture land instead of stream courses. In total, nine amphibian and three reptile species were recorded from the surveyed streams and riparian habitats. The abundance of amphibian was relatively higher during the surveys conducted in June. Most recorded herpetofauna were common species in Hong Kong (Stephen et al, 1998). The recorded herpetofauna species in three streams was given in Appendix G10. Appendix 11 displays the site photos taken during the stream fauna surveys.
- 7.67 Except for Spotted Narrow-mouthed frog *Kalophrynus interlineatus*, the remaining seven species recorded by field surveys were also recorded by AFCD. All amphibian species recorded were widespread in Hong Kong.
- 7.68 Three common fish species were recorded, including *Gambusia affinis*, *Rhinogobius giurinus* and *Schistura fasciolata*.
- 7.69 Others stream fauna were recorded, including three species of Crustacea, two species of Diptera, one species of Trichoptera, two species of heteroptera, one species of Hirudinea and four species of Mollusc.
- 7.70 Water quality was poor with odour owing to the discharge of domestic sewage at stream #4 and downstream of stream #3. Pollution-tolerant benthos such as *Tubifex sp.* (Photo 8 in Appendix G11) and filament bacteria (Photo 9 in Appendix G11) were commonly seen on the stream bottom. However, the water quality was found better at the upstream of Stream #3. Some stream species such as *Macrobrachium hainanense* (Photo 10 in Appendix G11) and *Cryptopotamon anacoluthon* (Photo 11 in Appendix G11) which indicate good

water quality were recorded. Moreover, the number of benthos species was also higher at upstream #3 and stream #1. Appendix G12 displays the recorded in-stream fauna.

- 7.71 A few individuals of Hong Kong Newt *Paramesotriton hongkongensis* were recorded only in the additional surveys conducted in July and August 2008 at the stream near Location #1. This species is considered to have potential global concern (Fellowes et al, 2002), although it is widely distributed throughout the New Territories, Lantau Island and Hong Kong Island (AFCD Biodiversity Database). It is noted that this stream is located some 50m from the Project boundary, and would not be affected by the works.

Invertebrate (Butterflies and Dragonflies)

Literature Review

- 7.72 There is no background information on butterflies available in the study area.
- 7.73 There is no background information on dragonflies available in the study area.

Field Surveys

- 7.74 In total, 41 species of butterfly were recorded in the stream survey (Appendix G13), of which 31 species are common or widely distributed species in Hong Kong. There were 8 species recorded which are regarded as “uncommon” species in AFCD biodiversity database, of which *Troides aeacus* is protected under Cap.586 and considered to have “local concern” (Fellowes et al, 2002). All the uncommon species recorded are widespread in Hong Kong. Two rare butterfly species including *Celastrina lavendularis* and *Graphium cloanthus* at the sampling locations. These two species could also be occasionally found in KFBG (AFCD unpublished data).
- 7.75 There were 16 species of butterfly recorded among 3 representative streams. More butterfly species were recorded at stream #3 and #4 during the survey in June. Among the recorded species, Gaudy Baron *Euthalia lubentina lubentina* (Photo 6 in Appendix G11) is uncommon butterfly species in Hong Kong (Yiu et al, 2002). It was recorded at the agricultural land (Photo 4 in Appendix G11) adjacent to stream #3.
- 7.76 In addition, three dragonfly species and seven damselfly species were recorded along streams at Location #3 and #4. Relatively more dragonflies and damselflies were recorded in June. All recorded dragonfly and damselfly species were common in Hong Kong (Keith, 2003). Appendix G14 displays insect species recorded in the stream fauna surveys.

Mammals

Literature Review

- 7.77 There were 23 mammal species recorded from 1995 to 2005 in KFBG, of which 16 species are protected under Cap.170, including bats, primates, Chinese Pangolin, porcupine, squirrels, mongooses, civet and Reeves’ Muntjac. The

Chinese Pangolin *Manis pentadactyla auritus*, Leopard Cat *Prionailurus bengalensis* and Rhesus Macaque *Macaca mulatta* are species protected under Cap. 586. Species richness was found highest in the middle part of KFBG (Kendrick, 2005). A list of mammal species recorded in KFBG from 1995 to 2005 is shown in Appendix G15.

- 7.78 A camera trapping and droppings study conducted from 2007 to mid 2008 in KFBG suggests that mammals in larger size including East Asia Porcupine *Hystrix brachyura*, Masked Palm Civet *Paguma larvata*, Small Indian Civet *Viverricula indica*, Leopard Cat *Prionailurus bengalensis*, Rhesus Macaque *Macaca mulatta*, Eurasian Wild Pig *Sus scrofa* and Red Muntjac *Muntiacus muntjak* occur much more frequently at the upper level of the garden (*pers. comm.* Wan, 2008). As human activities are concentrated in the lower part of KFBG near the entrance, the upper part of KFBG may provide a relatively less disturbed habitat for mammals.
- 7.79 A Yellow-bellied weasel *Mustela kathiah* was recorded near KFBG lower stream area in April 2006 (Ades et al, 2006). This species is regarded as “rare” by AFCD assessment and of “local concern” (Fellowes et al, 2002).
- 7.80 Three mammals were recorded by ACFD in territory-wide long-term monitoring survey from 2002 to 2008, including Short-nosed Fruit Bat *Cynopterus sphinx*, Brown Noctule *Nyctalus noctula* and Pallas’s squirrel *Callosciurus erythraeus*. All of them are common and widespread in Hong Kong.

Field Surveys

- 7.81 No mammal was recorded at the four ecological baseline survey locations. However, a roost of Short-nosed Fruit Bat *Cynopterus sphinx* was found on the Chinese Fan-palm *Livistona chinensis* opposite to the main entrance of KFBG (Appendix G16). This fruit bat species is commonly distributed in the urban areas of Hong Kong. (Shek et al, 2006).

Ecological Evaluation of Various Habitats and Sites of Conservation Importance

- 7.82 Tables 7.2 to 7.7 summarise the evaluation of ecological habitats of concern in the Study Area. The results of desktop study and field surveys show that the artificial wetland adjacent to the western boundary of the Project Area, the drainage channel and several isolated meanders on the northern side of Kam Tin Road are areas of conservation importance within the Study Area due to their relatively high bird usage and / or presence of the rare winter breeding bird species, Greater Painted-snipe. The grassland connected to Lam Tsuen Country Park, the secondary woodland toward uphill of Lam Tsuen Country Park and that in the upland area behind the Kadoorie Farm and Botanic Garden and Kadoorie Agricultural Research Centre of the University of Hong Kong, and the semi-natural stream near sampling Location #1 (Figure 7.1 refers) were considered to have moderate ecological value. However, due to the limited footprint of the proposed Project, only minor encroachment is anticipated upon the periphery of Meander B (Figure 7.2a). No other habitats of ecological importance will be encroached upon.

Table 7.2 Ecological Evaluation of Agricultural Land

Criteria	Remarks
Naturalness	Human modified habitat
Size	81.3 hectares
Diversity	Low species diversity. Dominated by common fruit trees, ornamental plants and weedy vegetation.
Rarity	Not rare
Re-creatability	Readily re-creatable
Fragmentation	Highly fragmented by roads, footpaths, village houses, abandoned land and open storage.
Ecological Linkage	Generally connected to nearby stream courses and channels.
Potential Value	Potential value for habitat enhancement through re-vegetation
Nursery / Breeding Ground	A potential nursery ground for herpetofauna, insects and ground birds.
Age	Artificial habitat at early succession stage dominated by pioneer species and introduced species.
Abundance / Richness of Wildlife	Low
Ecological Value	Low

Table 7.3 Ecological Evaluation of Artificial Wetland

Criteria	Remarks
Naturalness	Human-modified habitat
Size	0.7 hectares
Diversity	Low species diversity dominated by roadside plantings and weedy vegetation.
Rarity	Relatively rare
Re-creatability	Can be recreated within a few years
Fragmentation	Fragmented by roads and other developments
Ecological Linkage	Connected to Kam Tin River channels of low species diversity.
Potential Value	Moderate potential value. Potential for habitat enhancement through re-vegetation and habitat management.
Nursery / Breeding Ground	A potential nursery ground for herpetofauna, insects and birds.
Age	Young

Criteria	Remarks
Abundance / Richness of Wildlife	Medium to High
Ecological	Medium

Table 7.4 Ecological Evaluation of Grassland

Criteria	Remarks
Naturalness	Anthropogenic fire-maintained semi-natural habitat
Size	50.4 hectares
Diversity	Low
Rarity	Common in upland area of Hong Kong
Re-creatability	It takes about <3 years for regeneration of secondary grassland after deforestation or hill fires.
Fragmentation	Continuous
Ecological Linkage	Connected to the upland grassland of Lam Tsuen Country Park
Potential Value	Low but can be increased through control of hill fire. Secondary session can be speeded up if hill fire ceases.
Nursery / Breeding Ground	Low value
Age	Relatively recent habitat though it can be quite persistent due to intermittent hill fires.
Abundance / Richness of Wildlife	Low
Ecological Value	Moderate due to its naturalness

Table 7.5 Ecological Evaluation of Secondary Woodland

Criteria	Remarks
Naturalness	Semi-natural habitat modified by afforestation
Size	83.0 hectares
Diversity	Moderate diversity dominated by both pioneer vegetation of disturbed habitat types, plantation species, and native secondary forest species.
Rarity	Not rare
Re-creatability	Plantation woodland can be readily re-created through afforestation. However, it would probably take up to 10 years for native secondary forest regeneration.

Criteria	Remarks
Fragmentation	The habitat is fragmented by Lam Kam Road.
Ecological Linkage	Connected to the secondary woodland of Lam Tsuen Country Park and Tai Mo Shan Country Park
Potential Value	Moderate potential value for woodland birds and other fauna species. The potential value can change over time and increase with habitat maturity.
Nursery / Breeding Ground	No record of nursery or breeding ground.
Age	Relatively more mature
Abundance / Richness of Wildlife	Moderate
Ecological Value	Moderate

Table 7.6 Ecological Evaluation of Streams / Meanders

Criteria	Remarks
Naturalness	Semi-natural lowland stream habitats
Size	6.85 ha / 6.73 km (within 500m from Project boundary)
Diversity	<p>Low diversity of in-stream fauna in heavily polluted lowland streams at Locations #3 and #4. Most of the herpetofauna species were recorded at adjacent agricultural land.</p> <p>More diverse in-stream fauna in stream near Location #1 where the stream is relatively less disturbed and more sheltered by nearby woodland vegetation.</p> <p>Several isolated meanders (Meander A, B, C as displayed in Figures 7.2) were assessed to have high bird use.</p>
Rarity	Not rare.
Re-creatability	Difficult to re-create after channelization
Fragmentation	Continuous
Ecological Linkage	Connected to headwaters from upland area
Potential Value	Potential value can be increased if pollution problem can be alleviated
Nursery / Breeding Ground	Potential nursery / breeding ground for herpetofauna and in-stream fauna
Age	Old
Abundance / Richness of Wildlife	<p>Low species abundance / richness of wildlife for the lowland stream courses interception with Kam Tin Road at Locations #3 and #4. Low to moderate abundance / richness of wildlife for the stream near Location #1.</p> <p>Moderate species richness for the isolated meanders due to past records of high bird use.</p>

Criteria	Remarks
Ecological Value	Low value for the lowland stream courses interception with Kam Tin Road at Locations #3 and #4. Low to moderate value for the stream near Location #1. Moderate ecological value for the isolated meanders.

Table 7.7 Ecological Evaluation of Channels

Criteria	Remarks
Naturalness	Artificial channels of Kam Tin River (on the northern side of Kam Tin Road)
Size	5.18 ha / 5.07 km (within 500m from Project boundary)
Diversity	Channels: minimal wildlife due to loss of original stream habitats and riparian vegetation. However, the rare and restricted winter visitor / breeding bird, Greater Painted-snipe (GPS) was occasionally detected at the drainage channel of the northern side of Kam Tin Road.
Rarity	Not rare.
Re-creatability	Easy to re-create
Fragmentation	Continuous
Ecological Linkage	Connected to semi-natural lowland stream courses
Potential Value	Potential value can be increased if pollution problem can be alleviated
Nursery / Breeding Ground	Potential nursery / breeding ground for herpetofauna and in-stream fauna
Age	Recently created habitat
Abundance / Richness of Wildlife	Generally low species abundance and richness of wildlife for the channels within the study area due to loss of originally stream habitats and riparian vegetation.
Ecological Value	Generally low value for the channels within the study area except for the drainage channel at the northern side of Kam Tin Road where high value was rated due to the presence of the restricted and rare breeding winter visitor, Greater Painted-snipe.

Table 7.8 Ecological Evaluation of Urbanized / Disturbed Area

Criteria	Remarks
Naturalness	Human-created habitats
Size	414.3 hectares
Diversity	Low diversity. Consists of mainly roadside or wasteland vegetation and mainly of naturalized exotic / weedy species of low ecological value.
Rarity	Not rare.

Criteria	Remarks
Re-creatability	Readily to be re-created
Fragmentation	Fragmented by semi-natural habitats, e.g. stream and woodland.
Ecological Linkage	Low ecological linkage due to habitat fragmentation
Potential Value	Low potential value.
Nursery / Breeding Ground	No nursery / breeding ground
Age	Relatively more recent habitat
Abundance / Richness of Wildlife	Low
Ecological Value	Low

Impact Assessment and Evaluation

Construction Impacts

7.83 Construction activities for the proposed projects may include site clearance, site formation for geotechnical works (cut and fill) on slopes alongside Lam Kam Road and Kam Tin Road, road paving, etc. The works shall be implemented from September 2010 through March 2015, i.e. a total of 48 months of construction works shall be anticipated.

7.84 Potential construction impacts due to the proposed road upgrading works shall include:

- Vegetation clearance / habitat loss;
- Disturbance to wildlife;
- Induced disturbance to species / habitats

7.85 Details of the construction impacts are presented under the following sub-headings.

Vegetation Clearance / Habitat Loss

7.86 The Works task with the most potential for vegetation impacts is the removal of roadside vegetation and slope vegetation / trees where geotechnical works will be involved to facilitate the proposed road upgrading works.

7.87 As evaluated from the habitat map overlaid with the proposed Project site boundary, a total of 6.6 hectares of additional land will be needed for the proposed road widening / upgrading works, which include 0.76 ha of (of which 0.75 ha belongs to human created habitats zoned as 'CA', including roadside and engineering slopes) secondary woodland, 0.53 ha of agricultural land and 5.31 ha of urbanized / disturbed land.

- 7.88 The proposed slope works will only encroach into CA zoned (land) areas at five main locations:
- Location (1): construction of a Soldier Pile Wall at section between CHB 28+90 and CHB 30+00 (Figure 2.2a);
 - Location (2): soil nailing at 2m stagger at section between CHB 49+40 and CHB 50+00 (Figure 2.2c);
 - Location (3): construction of retaining wall on mini-piles at section between CHB50+40 and CHB 51+20 (Figure 2.2c);
 - Location (4): fill slope re-compaction at section between CHB 50+10 and CHB 51+30 (Figure 2.2c);
 - Location (5): soil nailing and rock slope stabilization measures at section between CHB 51+20 and CHB 52+90 (Figure 2.2c);
- There will also be minimal road works encroached into CA areas (Location (6)) at section between CHB 44+40 and CH 44+80 (Figure 2.2b).
- 7.89 Appendix G17 displays the site photos of those CA areas which will be marginally encroached due to proposed slope works. As reviewed from the baseline surveys, the potential encroachment due to the proposed works will be limited only to roadside areas dominated by common roadside tree plantings (Photos 4 and 5 of Appendix G17), ornamental plantings and weedy vegetation (Photo 2 of Appendix G17), or existing concrete structures (Photos 1 and 3 of Appendix G17). Although approximately 0.75 ha of “CA” zone along Lam Kam Road and Kam Tin Road will be encroached upon, these areas are all disturbed roadside habitats or margins of engineered slopes / concrete structures.
- 7.90 Apart from encroachment into roadside vegetation, approximately 117m² of the periphery of Meander B and approximately 208m² of the drainage channel at the western end of the road alignment (Figure 7.2a), no habitat encroachment is anticipated for other surveyed habitat types, including stream courses, the majority of existing channels, abandoned meanders (Meanders A and C as displayed in Figure 7.2), naturally regenerating / spontaneous secondary woodland, artificial wetland, active agricultural land and grassland. As new roadside planting will be reprovided as presented in Section 9, and the drainage channel at the western end of the alignment will be subject to drainage improvement works only, no permanent habitat loss is anticipated in these areas. Permanent habitat loss is only limited to the periphery of the isolated meander (Meander B) which will be encroached by the gabion retaining wall. As there will only be minor excavation (approx. depth = 0.8m) followed with backfilling of rock fill for formation of the wall foundation (Appendix G18), the construction phase impact is considered to be low. In addition, gabion embankment is considered to have “moderate ecological value” in the “Guidelines on Environmental Considerations for River Channel Design”, Drainage Services Department Practice Note No. 1/2005, as the measure can allow establishment of new ecosystem within the newly constructed areas by providing habitat roughness and space for re-vegetation.

Disturbance to Wildlife

- 7.91 During construction there is potential for visual and noise disturbance of wildlife such as birds that may occasionally visit roadside habitats, although none were seen during the course of field surveys due to highly disturbed roadside environment. Wildlife use preference will be given to areas of secondary

woodland and lowland stream courses distant from the existing roads where shelter, nesting, feeding opportunities are greater and disturbance can be avoided.

- 7.92 As evidenced by the data in KFBG Fauna Checklist (KFBG, 2005), most of the fauna species recorded are concentrated in the middle and upper part of the Garden, i.e., beyond 500m from the proposed Project site boundary (Figures 7.1 and 7.2). As such, the existing utilisation of habitats away from the road will continue once the Project has been developed, and as such no adverse disturbance impacts are anticipated. Although species of conservation concern (Appendix G5) were occasionally recorded away from roadside habitat in the baseline survey, including Black Kite, Chinese Pond Heron, Crested Goshawk, Greater Coucal, Orange-bellied Leafbird, Rufous-capped Babbler and White-breasted Waterhen, these species are not considered sensitive to the proposed road upgrading project as they are mainly confined to the woodland area away from roadside (except for Black Kite which was only observed at high level away from the ground).
- 7.93 One exception to the general rule of utilising undisturbed habitats where they exist was the presence of a Short-nosed Fruit Bat roost in a Chinese Fan-palm along Lam Kam Road opposite to the entrance of KFBG. This tree is widely planted in the HKSAR, including along urban roads, and there are many examples where such bats have established roosts in urban Hong Kong (e.g., Kowloon Park and Victoria Park; *pers. obs.*) where manipulation of the palm leaf rib enables the bat to form a protective shield that avoids / limits human disturbance. This roost is located some 20m outside the proposed Project footprint and will not be directly affected by the works, although precautionary protective measures as provided in section 7.102 below shall be provided to ensure no adverse impacts on this tree / roost.
- 7.94 Overall, given the low ecological baseline value of the project footprint area and the readily accessible adjacent habitat of higher ecological value and less disturbance, the Project is not anticipated to generate any significant adverse disturbance impacts upon wildlife.

Induced Disturbance to Species / Habitats

- 7.95 There is potential for induced or secondary ecological impacts to arise from the Project should appropriate control measures not be taken. Impact sources primarily relate to construction run-off, waste materials and dust deposition on vegetation.
- 7.96 With the implementation of adequate avoidance / control measures as presented in Section 5 and Section 6 for the control of water quality and construction wastes, no adverse impacts are anticipated.

Operational Impacts

- 7.97 Road traffic is the only possible resultant disturbance to wildlife during Project operation. Due to close proximity to existing road traffic and the existing (high) level of disturbance along roadside, wildlife use preference is given in areas more remote from the roadside. In addition, the proposed works shall not

involve any change in the existing road alignment. As such, there shall be no significant visual intrusion upon Project operation.

- 7.98 Likewise, and as referred in Section 4, traffic noise from the operational Project will not change significantly from existing baseline conditions. Therefore, no significant disturbance to wildlife upon project operation is anticipated. Table 7.9 below summarises the significance of ecological impacts during construction and operation of the proposed Project in accordance with Annex 8 “*Criteria for Evaluating Ecological Impact*” of the Technical Memorandum of EIAO.

Table 7.9 Evaluation of Significance of Ecological Impacts

Criteria	Remarks
Habitat Quality	Construction of the Project will only result in minor encroachment into roadside habitats of low ecological value, and the periphery of Meander B (Figure 7.2) which was found to have high bird usage. No other habitats of ecological importance will be affected due to construction of the Project.
Species	No ecologically important species or their habitat(s) will be affected due to construction of the Project.
Size / Abundance	A total of 6.6 hectares of additional land will be needed for the proposed road widening / upgrading works, which mainly includes human created roadside and engineering slopes and urbanized / disturbed land. Construction of the Project will only result in minor encroachment into these roadside habitats of low species abundance, and the periphery of Meander A (Figure 7.2) which was found to have high bird usage. No other habitats of ecological importance will be lost due to construction of the Project.
Duration	The impact on roadside habitat is of short-term as new roadside plantings / vegetation will be reprovided after construction of the Project, though there will be permanent loss of approximately 117m ² meander periphery (Meander A of Figure 7.2) with replacement of gabion structures.
Reversibility	The impact (loss of roadside vegetation) is reversible as the roadside habitat is readily re-creatable through revegetation / landscaping. The loss of the periphery of the meander is irreversible.
Magnitude	Low due to limited footprint of the project / limited area of habitats to be affected / encroached.

Mitigation / Enhancement Measures and Construction Management

Mitigation / Enhancement Measures

- 7.99 As evaluated in the above sub-sections, impacts from direct habitat loss / vegetation clearance due to construction of the Project are considered low. No ecological mitigation measures are needed for vegetation clearance due to the proposed Project. However, landscaping mitigation measures including compensatory planting by use of a mix of native plant species, and re-vegetation of the upgraded Kam Tin Road and Lam Kam Road, and the slopes subject to necessary geotechnical works, as provided in Section 9 may serve as ecological enhancement measures to provide wider range of habitats for wildlife use.

Construction Management

- 7.100 The best practice guidelines for control of construction site run-off and for managing construction waste as given in Section 5 and Section 6 respectively shall be implemented as far as practicable, in order to avoid any indirect / induced construction impacts upon wildlife.

7.101 The following precautionary measures as referred in ETWB TC No. 5/2005 to avoid any possible impacts on natural stream courses and/ or nearby vegetation during construction phase shall be implemented:

- Temporary storage of construction materials shall be properly covered and located away from any stream courses.
- Construction debris and spoil shall be covered properly and disposed of as soon as possible to avoid being washed into nearby stream courses.
- Temporary access to the site shall be carefully planned and located to avoid disturbance impacts upon surface waters.
- Consideration shall be given to conducting the proposed works during the dry season when stream flow is low.

7.102 No plant species of conservation concern including *Aquilaria sinensis* shall be removed due to the Project. Identification labels shall be attached to the two tree specimens of *Aquilaria sinensis* to notify the site workers that the two tree individuals or any tree specimens of *A. sinensis* shall not be removed or damaged during construction works. Protection measures shall be implemented to avoid any possible construction impacts upon the fruit bat roost on the Chinese Fan-palm *Livistona chinensis* on Lam Kam Road. These measures shall include but not limited to the following:

- Establishment of a Tree Protection Zone in accordance with Environment, Transport and Works Bureau Technical Circular (Works) No. 29/2004, clause 17. No construction activities or construction storage shall be intruded into the designated Tree Protection Zone.
- Provision of a tree identification label to notify the site workers to protect the tree from construction damage throughout the construction period.

Potential Cumulative Impact

7.103 As stated in Section 2, there is only one designated project within 500m of the Project boundary (i.e., Hong Kong Section of Guangzhou - Shenzhen - Hong Kong Express Rail Link) and will potentially be constructing concurrently with this project. As the EIA study of this railway project is in progress, there are no detailed construction methods and programme can be reviewed. As such, the EIA study of this railway project should take into account the potential cumulative impacts arising from the proposed Project.

Residual Impacts

7.104 With the implementation of the mitigation measures and management guidelines as described above, no residual impact during in the construction and operational phases is anticipated.

Environmental Audit & Review

7.105 Since the impact from habitat loss due to the Project is predicted to be low, and there is no significant and adverse impact from disturbance to wildlife and indirect / induced impacts resulted from the proposed works during construction and operation, ecological monitoring is considered not necessary. However, regular site inspection is recommended to ensure adequate mitigation

measures / best practice guidelines are implemented throughout construction of the Project.

Conclusion

7.106 With the implementation of the mitigation measures and guidelines for construction management during the construction of the Project, no significant and adverse ecological impact shall be anticipated. The implementation of the mitigation measures / protection measures for the fruit bat roost shall be included to the works contracts. Regular site inspections are recommended during construction phase in order to ensure the mitigation measures are implemented properly.

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8.0 CULTURAL HERITAGE IMPACT ASSESSMENT

Introduction

- 8.1 The works for the project include the widening of approximately 5.2 kilometre road sections into 7.3 metres wide single two lane carriageways, provision of right turning lanes at approaches to major accesses, provision of laybys at suitable locations, provision of appropriate crossing facilities with refuge islands to meet pedestrian demands and associated slope and drainage works.
- 8.2 As stated in the project Study Brief any negative impacts to any identified Sites of Cultural Heritage should be identified for both the construction and operational phases of the project and measures should be proposed to mitigate any such identified impacts. As well, an Archaeological Impact Assessment will be conducted following the requirements listed in the EIA Study Brief.

Environmental Legislation, Policies, Plans, Standards and Criteria

- 8.3 Legislation, Standards, Guidelines and Criteria relevant to the consideration of Cultural Heritage impacts under this study include the following:
- Antiquities and Monuments Ordinance;
 - Environmental Impact Assessment Ordinance;
 - Hong Kong Planning Standards and Guidelines;
 - Technical Memorandum on Environmental Impact Assessment Process;
 - Guidelines for Archaeological Impact Assessment; and
 - DEVB TC(W) No. 11/2007.

Antiquities and Monuments Ordinance

- 8.4 The Antiquities and Monuments Ordinance (the Ordinance) provides the statutory framework to provide for the preservation of objects of historical, archaeological and palaeontological interest. The Ordinance contains the statutory procedures for the Declaration of Monuments. The proposed monument can be any place, building, site or structure, which is considered to be of public interest by reason of its historical, archaeological or palaeontological significance.
- 8.5 Under Section 6 and subject to sub-section (4) of the Ordinance, the following acts are prohibited in relation to certain monuments, except under permit;
- To excavate, carry on building works, plant or fell trees or deposit earth or refuse on or in a proposed monument or monument;
 - To demolish, remove, obstruct, deface or interfere with a proposed monument or monument.

- 8.6 The discovery of an Antiquity, as defined in the Ordinance must be reported to the Antiquities Authority (the Authority), or a designated person. The Ordinance also provides that, the ownership of every relic discovered in Hong Kong after the commencement of this Ordinance shall vest in the Government from the moment of discovery. The Authority on behalf of the Government may disclaim ownership of the relic.
- 8.7 No archaeological excavation may be carried out by any person, other than the Authority and the designated person, without a licence issued by the Authority. A licence will only be issued if the Authority is satisfied that the applicant has sufficient scientific training or experience to enable him to carry out the excavation and search satisfactorily, is able to conduct, or arrange for, a proper scientific study of any antiquities discovered as a result of the excavation and search and has sufficient staff and financial support.

Environmental Impact Assessment Ordinance

- 8.8 The Environmental Impact Assessment Ordinance (EIA/O) was implemented on 1 April 1998. Its purpose is to avoid, minimise and control the adverse impact on the environment of designated projects, through the application of the EIA process and the Environmental Permit (EP) system.

Hong Kong Planning Standards and Guidelines

- 8.9 Chapter 10 of the HKPSG details the principles of conservation of natural landscape and habitats, historical buildings and archaeological sites. It also addresses the issue of enforcement. The appendices list the legislation and administrative controls for conservation, other conservation related measures in Hong Kong, and Government departments involved in conservation.

Technical Memorandum on Environmental Impact Assessment Process

- 8.10 The general criteria and guidelines for evaluating and assessing impacts to Cultural Heritage are listed in Annexes 10 and 19 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM). The guidelines state that preservation in totality and measures for the integration of sites of cultural heritage into the proposed project will be a beneficial impact. It also states that destruction of a Site of Cultural Heritage must only be undertaken as a last resort.

Guidelines for Archaeological Impact Assessment

- 8.11 This document, as issued by the Antiquities and Monuments Office, outlines the specific technical requirement for conducting a terrestrial archaeological study. It includes the parameters and scope for desk-based research, and if required the field evaluation and the reporting requirements.

Development Bureau Technical Circular (Works) No. 11/2007: Heritage Impact Assessment Mechanism for Capital Works Projects

- 8.12 The technical circular contains the procedures and requirements for assessing heritage impact arising from the implementation of capital works projects. The circular defines the “heritage sites” that will be covered under the TC and outlines the details of the heritage impact assessment mechanism.

Archaeology

Assessment Methodology

Baseline Study

- 8.13 As stated in the Guidelines for Archaeological Impact Assessment, the purpose of the baseline study is to compile a comprehensive inventory of all sites of archaeological interest within a project Study Area. The results must be presented in a report that must include concrete evidence to show that the required processes have been satisfactorily completed. It also required to include a detailed inventory of all identified sites of archaeological interest and a full description of their cultural significance.
- 8.14 The first step that is undertaken is to identify all known sites of archaeological interest within and in the vicinity of the project Study Area and to calculate the archaeological potential of Study Areas that do not contain any known archaeological sites. The current project Study Area contains one archaeological site the Pat Heung Sheung Tsuen Archaeological Site. The following tasks are undertaken as required to gather the information necessary for the compilation of the report of the baseline study;

Task 1: Desk-based research

- 8.15 Firstly, desk-based research is carried out in order to identify and evaluate any areas of archaeological potential within the project Study Area. Cartographic sources, such as historical and geological maps, will be consulted for identification of former landforms. Area’s that are determined to be of archaeological potential will then be examined for the presence of existing impacts, this will include the identification of past land uses as well as the presence of utilities and road construction.
- 8.16 As well as the above research, the following is a non-exhaustive list of resources that will be consulted as part of the research programme: the Antiquities and Monuments Office published and unpublished papers and studies; publications on relevant historical studies; unpublished archival, papers, records; collections and libraries of tertiary institutions; historical documents which can be found in Public Records Office, Lands Registry, District Lands Office, District Office, Museum of History; cartographic and pictorial documentation and any previous archaeological impact assessment studies that have been previously conducted in the project study area.

Task 2: Site visit

- 8.17 To supplement the information gathered in the desk-based study, a site visit will be undertaken to identify current usage at any sites identified in the desk-based study as containing archaeological potential.

Task 3: Archaeological Field Investigation (if required)

- 8.18 If the results of the desk-based study and site visit indicate that there is insufficient data for purposes of identification of sites of archaeological interest, determination of cultural significance and assessment of impacts, an archaeological field investigation programme will be designed and submitted to the AMO for approval. Once approved, a qualified archaeologist must apply for a licence to undertake the archaeological excavation, which must be approved by the Antiquities Authority before issuance. The archaeological field investigation will consist of the following steps;
- 8.19 Test pit excavations are carried out to verify the archaeological potential within a certain area and to establish the horizontal spread of cultural material deposits and vertical sequence of cultural materials. The choice for the location of the test pit excavation will depend on various factors such as desk-based information, landforms as well as access issues. Hand digging of test pits measuring between 1m x 1m and 1.5 x 1.5m is carried out in order to determine the presence/absence of archaeological deposits and their stratigraphy. The contexts, finds and features identified in the test pit are recorded, soils described and relevant depths measured. Artefacts are recorded and collected. Photographs of sections and other relevant information are taken and section and ground plans, if required, are drawn. Hand excavation will continue until rock or decomposing rock or virgin soils are reached and no potential for archaeological soils or deposits exist. Additionally the test pit will be abandoned when the depth poses safety problems. The hand excavated test pit is backfilled and the site restored after full recording.

Reporting and Submission of Archive

- 8.20 A report of the findings of the archaeological survey will be compiled following the requirements as outlined in Guidelines for Archaeological Reports as issued by the AMO. Field records containing information regarding the physical location of the test pit, weather conditions, size, temporary bench mark, description of the soils and their measured depths, artefact and feature finds are kept for each pit. Photographs are taken and drawings and plans produced, finds are bagged, labelled and will form part of the project archive. The processing of recovered archaeological material and preparation of the project archive will follow the Guidelines for Archaeological Reports and Handling of Archaeological Finds and Archives as issued by the AMO.

Impact Assessment

- 8.21 The prediction and evaluation of both direct and indirect impacts must be undertaken to identify any potential adverse affects to all identified sites of archaeological interest within a project Study Area. A detailed description of the works and all available plans (with their relationship to the identified resources clearly shown) should be included, to illustrate the nature and degree of potential impacts. The impact assessment must adhere to the detailed requirements of Annexes 10 and 19 of the Technical Memorandum on Environmental Impact Assessment Process and the Guidelines for Archaeological Impact Assessment.

Mitigation Measures

- 8.22 As stated in the Guidelines for Archaeological Impact Assessment “Preservation in totality must be taken as the first priority”. If such preservation is not feasible, as in the case where the need for a particular development can be shown to have benefits that outweigh the significance of the site of archaeological interest, a programme of mitigation measures must be designed and submitted to the AMO for approval. The mitigation measures must be clearly listed and the party responsible for implementation and timing of the measures must also be included. Examples of mitigation measures include; rescue excavation and archaeological watching brief.

Desk-based review

Known Archaeological Sites

- 8.23 There is one archaeological site in the project Study Area, the Pat Heung Sheung Tsuen Archaeological Site (AM04-2022). The boundary of the archaeological site can be found in Figure 8.1. The site was originally identified as part of a survey undertaken in the area in 1999. Field testing was conducted and a total of 60 sherds (celadon and white porcelain) dating from the Song Dynasty were recovered. Based upon, the type, nature and quality of the finds it was postulated that Pat Heung Sheung Tsuen was a residential site dating from the Song period (HKIA 1999).

Previous Investigations in the Study Area

- 8.24 Agreement No CE 33/1999 Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1: Sewers, Rising Mains and Ancillary Pumping Stations Environmental Impact Assessment and Traffic Impact Assessment Study Non-Designated Projects (ERM 1999).
- 8.25 The Pat Heung Sheung Tsuen Archaeological Site was within the vicinity of the Study Area for the above cited project. Auger holes were undertaken in the near the village of Wang Toi Shan Yau Uk Tsuen to the Northeast of Kam Tin Road, the map from the above cited report showing the relevant auger holes (36 through 42) can be seen in Figure 8.2a. No archaeological findings were reported from these auger holes.

The 1999 HKIA Archaeological Survey in Kam Tin Road Area, Yuen Long

8.26 The survey for the project conducted test pits and auger holes along the length of Kam Tin Road, see map in Figure 8.2b for the approximate locations of the auger holes and test pits. The testing revealed a large quantity of Song Dynasty material in the vicinity of the Pat Heung Temple and based upon the findings of the survey, the report postulated that the material recovered indicated that the area contained a Song period residential site. As the extent of the area containing archaeological material could not be determined at the time of the survey, an area around the tested sections in the vicinity of the Pat Heung Temple was marked as the “Pat Heung Sheung Tsuen Archaeological Site”. No other areas containing archaeological material were identified in the survey.

Geological and Topographical Background

Table 8.1 Geological and Topographical Description of the Kam Tin Road Section of the Alignment

Section of Alignment (Kam Tin Road)	Map Ref	Geological Description	Topographical Description
From the Shek Kong Barracks to Wang Toi Shan Lo Uk Tsuen	See Figures 2.1a – 2.1c	Pleistocene terraced alluvium with a small section of Holocene alluvium near the Shek Kong Camp See Figure 8.3	The alignment runs along relatively flat, lowlying land with elevations ranging between 7 mPD and 28 m PD
Wang Toi Shan Lo Uk Tsuen to the north of Sheung Tsuen San Tsuen	See Figures 2.1c – 2.1e	Pleistocene debris flow deposits and grandiorite outcrops See Figure 8.3	The alignment in this area runs through a hilly area with elevations between 30 m PD and 42 m PD
Sheung Tsuen San Tsuen to start of Lam Kam Road	See Figure 2.1e	Northern section (at river) is characterised by Holocene alluvium and the remainder of the alignment down to the connection with Lam Kam Road consists of Pleistocene devris flow deposits. See Figure 8.3	This section of the alignment is again situated on relatively flat land with an elevation of approximately 50 m PD

Table 8.2 Geological and Topographical Description of the Lam Kam Road Section of the Alignment

Section of Alignment (Lam Kam Road)	Map Ref	Geological Description	Topographical Description
From connection of Kam Tin Road to end of alignment	See Figures 2.1e – 2.1f	Pleistocene debris flow deposits and grandiorite outcrops See Figures 8.4 and 8.5	The section of the alignment begins at an approximate elevation of 50 m PD and follows a steep hill side up to an elevation of 180 mPD.

*Existing Impacts***Table 8.3: Existing Impacts associated with the Kam Tin Road and Lam Kam Road Section of the Alignment**

Section of Alignment	Map Ref	Underground Utilities	Adjacent Land Use
Kam Tin Road	CLP Facilities Records Maps (06NE12B/06NE13A), (06NE13A/06NE13B), (06NE08D/06NE13B), (06NE08D/06NE14A/06NE09C/06NE13B), (06NE14A), (06NE14A/06NE14B), (06NE14B/06NE15C/06NE15A/06NE14D), (06NE15A/06NE14D/06NE15C) PCCW Survey Map (06NE14A/14B/14D/15A/15C) Towngas (16:1:35), (16:2:23), (16:3:3), (16:4:0)	<ul style="list-style-type: none"> • CLP cables • PCCW cables • Towngas pipeline 	<ul style="list-style-type: none"> • Light industrial and commercial units • Residential units • Open storage areas • Temporary structures
Lam Kam Road	PCCW Survey Map (06NE14A/14B/14D/15A/15C) Towngas (16:8:5) (16:5:53)	<ul style="list-style-type: none"> • PCCW cables • Towngas pipeline 	<ul style="list-style-type: none"> • The alignment is situated on steep hill slopes and there is no area for development on the sides of the road

Assessment of Archaeological Potential

- Kam Tin Road (Area within the Boundary of the Pat Heung Sheung Tsuen AS)*
- 8.27 Based upon the findings of the archaeological survey undertaken in 1999 by the Hong Kong Institute of Archaeology, the section of the project study area that falls within the Pat Heung Sheung Tsuen Archaeological Site has the potential to contain archaeological deposits. As the works will be limited to areas immediately adjacent to the existing road (see Figure 2.1e), existing impacts from underground utilities and previously undertaken road works make it unlikely for undisturbed archaeological deposits to be present. The detailed of underground utilities as shown in Appendix H1. This, however, does not preclude the existence of isolated or disturbed archaeological material to exist within the proposed works areas. However, as the previous disturbances to the impacted areas will limit the information that can be obtained from any archaeological material that may still exist within the project study area, no further investigation is recommended.

- Kam Tin Road (Area outside the Boundary of the Pat Heung Sheung Tsuen AS)*
- 8.28 Field surveys undertaken during the 1999 archaeological investigations (ERM 1999; HKIA 1999) did not identify any areas of archaeological potential outside of the Pat Heung Sheung Tsuen Archaeological Site in the Study Area of the alignment for the current project. No further investigation of the sections of the alignment that fall outside of the archaeological site are recommended.

- Lam Kam Road*
- 8.29 The Study Area for this section of the alignment is situated on steep hillsides running from approximately 50 mPD to 180 mPD in an area containing granite outcrops and characterised by debris flow deposits. As such, the area does not have the potential to contain archaeological deposits and no further investigation is recommended.

Construction Phase Impact AssessmentKam Tin Road

- Area within the Boundary of the Pat Heung Sheung Tsuen AS*
- 8.30 The proposed works have the potential to impact on isolated and/ or disturbed archaeological material.

- Area outside the Boundary of the Pat Heung Sheung Tsuen AS*
- 8.31 Field surveys undertaken during the 1999 archaeological investigations (ERM 1999; HKIA 1999) did not identify any areas of archaeological potential outside of the Pat Heung Sheung Tsuen Archaeological Site in the Study Area of the alignment for the current project.

Lam Kam Road

- 8.32 The Study Area for this section of the alignment is situated on steep hillsides running from approximately 50 mPD to 180 mPD in an area containing granite outcrops and characterised by debris flow deposits. As such, the area does not have the potential to contain archaeological deposits.

Operational Phase Impact Assessment

- 8.33 No impacts are expected to occur during the operational phase of the project.

Mitigation Recommendations

Kam Tin Road

Area within the Boundary of the Pat Heung Sheung Tsuen AS

- 8.34 As stated in Section 8.27, there is potential for disturbed or isolated archaeological material to be present in the project Study Area. The information that can be retrieved from such material is limited and does not warrant an archaeological watching brief. However, as precautionary measure, it will be a requirement of the EM&A Manual that if any antiquity or supposed antiquity is discovered during the course of the excavation works undertaken by the contractor, the project proponent shall report the discovery to the AMO immediately and shall take all necessary archaeological mitigation measures to preserve it'.

Area outside the Boundary of the Pat Heung Sheung Tsuen AS

- 8.35 No mitigation will be required for this section of the alignment during either the construction or operational phases of the project. However, as precautionary measure, it will be a requirement of the EM&A Manual that if any antiquity or supposed antiquity is discovered during the course of the excavation works undertaken by the contractor, the project proponent shall report the discovery to the AMO immediately and shall take all necessary archaeological mitigation measures to preserve it'.

Lam Kam Road

- 8.36 No mitigation will be required for this section of the alignment during either the construction or operational phases of the project. No mitigation will be required for this section of the alignment during either the construction or operational phases of the project. However, as precautionary measure, it will be a requirement of the EM&A Manual that if any antiquity or supposed antiquity is discovered during the course of the excavation works undertaken by the contractor, the project proponent shall report the discovery to the AMO immediately and shall take all necessary archaeological mitigation measures to preserve it'.

Built Heritage Impact Assessment

Introduction

- 8.37 As stated in the project Study Brief any Sites of Cultural Heritage that may be adversely impacted by the proposed project during either the construction or operational phases must be identified and mitigation measures proposed as appropriate. A Site of Cultural Heritage is "an antiquity or monument, whether being a place, building, site or structure or a relic, as defined in the Antiquities and Monuments Ordinance (Cap. 53) and any place, building, site or structure or a relic identified by the Antiquities and Monuments Office to be of

Archaeological, historical or Palaeontological significance.” No built heritage resources were identified as Sites of Cultural Heritage in the Study Brief.

Methodology

- 8.38 All works areas and a boundary of 50 metres from the identified works areas will make up the Study Area for the project.
- 8.39 A desk-based study to be undertaken to determine the presence of Sites of Cultural Heritage in the project Study Area. Sources such as those listed were consulted; the list of Declared Monuments and Graded Buildings as issued by the AMO; published and unpublished papers and studies; publications on relevant historical, anthropological and other cultural studies; unpublished archival, papers, records; collections and libraries of tertiary institutions; historical documents which can be found in Public Records Office, Lands Registry, District Lands Office, District Office, Museum of History; cartographic and pictorial documentation. The desk-based study has also included a review of previous BHIA's in the project Study Area.
- 8.40 A site visit to be conducted to ensure that no built heritage resources (that could qualify as Sites of Cultural Heritage as defined under the EIA/O) were present in the project Study Area.

Results of the Desk-based Study

- 8.41 No Sites of Built Cultural Heritage were identified in the desk-based study.

Results of the Site Visit

- 8.42 Although the desk-based study did not reveal the presence of any built heritage resources that could qualify as Sites of Built Cultural Heritage, a site visit was undertaken to confirm that no such sites with the potential to qualify as such were present in the project study area. The site visit confirmed that the Study Area does not contain any Sites of Built Cultural Heritage.

Construction and Operational Phase Impact Assessment

- 8.43 As no Sites of Built Cultural Heritage were identified in the project study area, no adverse impacts will arise during either phase of the project.

Mitigation Recommendations

- 8.44 No mitigation measures will be required during either phase of the project.

Conclusion

Archaeology

- 8.45 No further investigation is recommended for archaeological resources as the proposed works are limited to areas with existing impacts that would have damaged or destroyed any existing archaeological material. However, as a precautionary measure it will be a requirement of the EM &A Manual that if any antiquity or supposed Antiquity is discovered during the course of the

excavation works undertaken by the contractor, the project proponent shall report the discovery to the AMO immediately and shall take all necessary archaeological mitigation measures to preserve it'.

- 8.46 One Site of Cultural Heritage, the Pat Heung Sheung Tsuen Archaeological Site has been identified in the project Study Area, the impact assessment has concluded that no adverse impacts will arise from the project and no mitigation measures will be required for either the construction or operational phases.

Built Heritage

- 8.47 No Sites of Built Cultural Heritage were identified in the project Study Area, no mitigation will be required.

References

- 1) AMO File Pat Heung Sheung Tsuen Archaeological Site (AMO 04-2022).
- 2) Agreement No CE 33/1999 Yuen Long and Kam Tin Sewerage and Sewage Disposal Stage 1: Sewers, Rising Mains and Ancillary Pumping Stations Environmental Impact Assessment and Traffic Impact Assessment Study Non-Designated Projects (ERM 1999).
- 3) The 1999 Archaeological Survey in Kam Tin Road Area, Yuen Long (HKIA 1999)
- 4) Fung C M 1996. Yung Long Historical Relics and Monuments, Yung Long District Board, Hong Kong.
- 5) Cheng P H 2002. Century of New Territories Roads and Streets, Joint Publishing (H.K.) Company Limited, Hong Kong.
- 6) Survey and Mapping Office (Lands Dept) 2007 Hong Kong in Old Times: A Collection of Aerial Photographs Taken in 1964, Hong Kong
- 7) List of Graded Historic Buildings in Hong Kong (as at May 16 2008)
- 8) Antiquities and Monuments Office Leisure and Cultural Services Department (HKSAR Government) Website listing of Declared Monuments in Hong Kong (updated on July 11 2008)
- 9) Government Historic Sites as Identified by AMO (as at 7 December 2007)
- 10) List of Recorded Sites of Archaeological Interest in Hong Kong (as of December 2007)

9.0 LANDSCAPE AND VISUAL IMPACT ASSESSMENT

Introduction

- 9.1 This section of report addresses the potential landscape and visual impacts arising from the upgrading of the remaining 5.2km long section of Kam Tin Road and Lam Kam Road. In accordance with the criteria and guidelines as stated in Annex 10 and 18 of the TM and EIAO, Cap. 449, any potential landscape and visual impacts in the project resulted from both construction and operational phases will be assessed.
- 9.2 This aim of this report is to outline the landscape baseline conditions of existing landscape resources (LRs) and landscape character area (LCAs), the visual amenity, visually sensitive receivers (VSRs) and the planning and development control frameworks. Any potential impacts arising from the proposed road upgrading works will be identified in detail. Finally the report concludes by making recommendations for mitigation measures to alleviate the predicted construction and operational phase impacts and residual effect apparent after mitigation will also be discussed.

Environmental Legislation, Standards, Guidelines and Criteria

- 9.3 Legislation, Standards, Guidelines and Criteria relevant to the consideration of landscape and visual impacts in this report include the following:
- Environmental Impact Assessment Ordinance (Cap.499.S.16) and the Technical Memorandum on EIA Process (EIAO-TM), particularly Annexes 10 and 18;
 - Environmental Impact Assessment Ordinance Guidance Note 8/2002;
 - Town Planning Ordinance (Cap 131);
 - Study on Landscape Value Mapping of Hong Kong;
 - Hong Kong Planning Standards and Guidelines Chapter 4 and Chapter 11;
 - WBTC No. 25/92 - Allocation of Space for Urban Street Trees;
 - WBTC No. 7/2002 - Tree Planting in Public Works;
 - WBTC No. 25/93 – Control of Visual Impact of Slopes;
 - WBTC No. 24/95 – Specification Facilitating the Use of Concrete Paving Units made of Recycled Aggregates;
 - ETWB TCW No. 17/2002 - Improvement to the Appearance of Slopes;
 - ETWB TCW No. 13/2003A - Guidelines and Procedures for Environmental Impact Assessment of Government Projects and Proposals Planning for Provision of Noise Barriers;
 - ETWB TCW No. 34/2003 - Community Involvement in Greening Works;
 - ETWB TCW No. 2/2004 - Maintenance of Vegetation and Hard Landscape Features;
 - ETWB TCW No. 11/2004 – Cyber Manual for Greening;
 - ETWB TCW No. 29/2004 - Registration of Old and Valuable Trees, and Guidelines for their Preservation;
 - ETWB No. 36/2004 - Advisory Committee on the Appearance of Bridges and Associated Structures (ACABAS);
 - ETWB TCW No. 10/2005 – Planting on Footbridges and Flyovers;
 - ETWB TCW No. 3/2006 - Tree Preservation;

- HyDTC No. 5/2000 – Control in Use of Shotcrete (Sprayed Concrete) in Slope Works;
- HyDTC No. 10/2001 – Visibility of Directional Signs;
- HyDTC No. 9/2003 – Preservation of Granite Kerbs;
- HyDTC No. 3/2008 – Independent Vetting of Tree Works under the Maintenance of Highways Department; and
- Land Administration Office Instruction (LAOI) Section D-12 - Tree Preservation.

Assessment Methodology

9.4 The Project is a Designated Project under the EIAO and the methodology adopted for the Project conforms to the requirements of the EIAO. The methodology consists of the following tasks:

- Review of the Planning and Development Control Framework;
- Baseline study of landscape and visual resources;
- Landscape impact assessment;
- Visual impact assessment;
- Recommendation on landscape and visual mitigation measures; and
- Identification of residual impacts.

Landscape Baseline Review and Impact Assessment

9.5 The assessment of the potential impacts of a proposed scheme on the existing landscape comprises two distinct sections namely the baseline survey and the landscape impact assessment. Landscape Impact Assessment (LIA) Study Area is taken to include all areas within 500m of the site boundary.

9.6 A baseline survey of the existing landscape resources and landscape character has been undertaken based on a combination of desktop studies and site surveys. The landscape elements which contribute to the landscape character include:

- Local topography;
- Woodland extent and type;
- Other vegetation types;
- Built form (including scale and appearance);
- Patterns of settlement;
- Land use;
- Scenic spots;
- Details of local materials, styles, streetscapes, etc.;
- Prominent watercourses; and
- Cultural and religious identity.

9.7 The process of landscape characterisation draws on the information gathered in the desk top and site survey and provides an analysis of the way in which the elements including the identified landscape resources (LRs) interact to create the character of the landscape. The Study Area is then divided into broadly homogenous units of similar character which are called Landscape Character Areas (LCAs).

- 9.8 The sensitivity of the individual LRs and LCAs to change is rated using low, medium or high depending on the following factors:
- Condition, quality and maturity (maturity in this context refers to the age of the LR or LCA relative to its constituent components therefore a woodland containing mature trees would be considered to have a high level of maturity) of the LRs / LCAs;
 - Importance and rarity of special landscape elements (rarity being of either local, regional, national or global importance) and the significance of change to these LRs / LCAs from a local and regional/ LCAs from a local and regional perspective (therefore the sensitivity of a LR or LCA which is either rare in a local or regional context is greater than one which is common place);
 - Ability of the LRs / LCAs to accommodate change; and
 - Statutory or regulatory requirements relating to the landscape including its resources.
- 9.9 The next stage of the assessment process is the identification of the assessment of the magnitude of change (rated as negligible, small, intermediate or large) arising from the implementation of the proposals and the principal sources of impact based on the following factors:
- Scale of the development and proposed access road;
 - Compatibility of the project with the surrounding landscape;
 - Duration of impacts (temporary or permanent) under construction and operational phases; and
 - Reversibility of change.
- 9.10 The degree of significance of landscape impact is derived from the magnitude of change which the proposals will cause to the existing landscape context and its ability to tolerate the change, i.e. its condition / quality and sensitivity. This makes a comparison between the landscapes which would have existed in the absence of the proposals with that predicted as a result of the implementation of the proposals. The significance threshold for impacts to LRs and LCAs is rated as significant, moderate, slight or negligible. The impacts may be beneficial or adverse.
- 9.11 The significance threshold is derived from the following matrix:

Magnitude of Change caused by Proposals	Large	<i>Moderate Impact</i>	<i>Moderate / Significant Impact</i>	<i>Significant Impact</i>
	Intermediate	<i>Slight or Moderate Impact</i>	<i>Moderate Impact</i>	<i>Moderate or Significant Impact</i>
	Small	<i>Slight Impact</i>	<i>Slight or Moderate Impact</i>	<i>Moderate Impact</i>
	Negligible	<i>Negligible</i>	<i>Negligible</i>	<i>Negligible</i>
		Low	Medium	High
	Sensitivity of Landscape to Change			

- 9.12 The above matrix will apply in the assessment of the majority of situations, however, in certain cases a deviation from this may occur, e.g. the impact may be so major that a significant impact may occur to a LCA or LR with a low sensitivity to change.

Visual Baseline Review and Impact Assessment

- 9.13 The assessment of the potential visual impact of the scheme comprises two distinct parts:
- Baseline survey; and,
 - Visual impact assessment which includes the identification of the sources of visual impact, and their magnitude, that would be generated during construction and operational phases of the proposed scheme; and, identification of the principal visual impacts primarily in consideration of the degree of change to the baseline conditions.
- 9.14 The assessment area for the Visual Impact Assessment (VIA) in accordance with the study brief, is defined by the Visual Envelope (VE) which includes all areas from which the scheme proposals can be seen, or the area forms the view shed formed by natural / manmade features such as existing ridgelines, built development and for example areas of woodland / large trees. Within the VE a number of Zones of Visual Influence (ZVIs) are identified to demonstrate the visibility of various aspects of the scheme proposals. This is achieved through a combination of detailed walkover surveys, and desk-top study of topographic maps and photographs, and preparation of cross-sections to determine visibility of the improvement works from various locations.
- 9.15 The baseline survey of all views towards the proposals is undertaken by identifying:
- The VE and ZVIs as has been described above and may contain area where the proposals are either wholly or partially visible. This must also include indirect effects such as offsite construction activities; and
 - The visually sensitive receivers (VSRs) within the visual envelope whose views will be affected by the scheme.
- 9.16 The potential receivers are considered as four groups:
- **Views from residences** – the most sensitive of receivers due to the high potential of intrusion on the visual amenity and quality of life;
 - **View from workplaces / institutional and educational buildings** – less sensitive than above due to visual amenity being less important within these environments;
 - **Views from recreational landscapes** – including all areas apart from the above, e.g., public parks, recreation grounds, recreational trails, cultural sites etc. Sensitivity of this group depends on the length of stay and nature of activity, e.g. sitting in a park as opposed to an active sporting pursuit; and
 - **Views from public roads and railways** – including vehicle travellers and pedestrians with transitory views.
- 9.17 The assessment of sensitivity is also based on the quality and extent of the existing view. Therefore a view from a residential property, which would normally be considered the most sensitive view, may be less so if for example it is degraded by existing development or partially screened by intervening visual obstacles such as existing vegetation. Factors affecting the sensitivity of receivers for evaluation of visual impacts:
- Value and quality of existing views;
 - Availability and amenity of alternative views;

- Type of receiver population and estimated number of affected receiver population;
 - Duration or frequency of view; and,
 - Degree of visibility.
- 9.18 The location and direction of its view relative to the scheme also influences the sensitivity of each group. Typical viewpoints from within each of the visually sensitive groups are identified and their views described. Both present and future (planned visually sensitive receivers (PVSRs) are considered.
- 9.19 The factors affecting the magnitude of change for assessing the visual impacts include the following:
- Scale of the proposed project;
 - Compatibility of the project with the surrounding landscape forming the view; extent of visibility (level of potential blockage of the view described in the text);
 - Viewing distance;
 - Duration of impacts under construction and operational phases;
 - Reversibility of change ; and
 - Night glare effect.
- 9.20 Views available to the identified VSRs are rated according to their sensitivity to change using low, medium or high. The magnitude of change to the views will be classified as follows:
- Large: e.g. the majority of viewers affected / major change in view;
 - Intermediate: e.g. many viewers affected / moderate change in view;
 - Small: e.g. few viewers affected / minor change in view; and
 - Negligible: e.g. very few viewers affected / no discernible change in view.
- 9.21 The significance threshold for visual impact is rated in a similar fashion to the landscape impact, i.e. significant, moderate, slight and negligible. The impacts may be beneficial or adverse.
- 9.22 Therefore the impact is derived from the magnitude of change which the proposals will cause to the existing landscape context and its ability to tolerate the change, i.e. its quality and sensitivity. The significance threshold is derived from the following matrix:

Magnitude of Change caused by Proposals	Large	<i>Moderate Impact</i>	<i>Moderate / Significant Impact</i>	<i>Significant Impact</i>
	Intermediate	<i>Slight / Moderate Impact</i>	<i>Moderate Impact</i>	<i>Moderate / Significant Impact</i>
	Small	<i>Slight Impact</i>	<i>Slight / Moderate Impact</i>	<i>Moderate Impact</i>
	Negligible	<i>Negligible</i>	<i>Negligible</i>	<i>Negligible</i>
		Low	Medium	High
	Sensitivity of View to Change			

- 9.23 The above matrix will apply in the assessment of the majority of situations, however, in certain cases a deviation from this may occur, e.g. the impact may

be so major that a significant impact may occur to a view with a low sensitivity to change.

9.24 Table 9.1 below provides an explanation of the degree of impact for both landscape and visual aspects of the project.

Table 9.1 Degree of Impact

Impact	Description
Significant	Adverse / beneficial impact where the proposal would cause significant deterioration or improvement in existing landscape quality or visual amenity.
Moderate	Adverse / beneficial impact where the proposal would cause a noticeable deterioration or improvement in existing landscape quality or visual amenity.
Slight	Adverse / beneficial impact where the proposal would cause a barely perceptible deterioration or improvement in the existing landscape quality or visual amenity.
Negligible	No discernible change in the existing landscape quality or visual amenity.

Identification of Potential Landscape and Visual Impact Mitigation Measures

9.25 The purpose of mitigation is to avoid, reduce, and where possible remedy or offset any adverse effects on the environment arising from the proposed development. The ideal strategy for identifiable adverse impacts is avoidance. If this is not possible, alternative strategies of reduction, remediation and compensation should be explored.

9.26 Mitigation measures may be considered under two categories:

- General mitigation measures that intrinsically comprise part of the development design through an iterative process. This form of mitigation is generally the most effective; and
- Specific mitigation measures designed to specifically address the remaining (residual) adverse effects of the final development process.

9.27 General mitigation measures form integrated mainstream components of the project design focusing on the adoption of alternative designs or revisions to the basic engineering and architectural design to prevent and/or minimise adverse impacts including siting, access, layout, buildings and structures etc. The design philosophy can also describe the benefits to the design of alternative solutions, introduced to reduce potential adverse impacts, and indicate how these have been addressed.

9.28 Specific mitigation measures are specifically designed to mitigate the adverse impacts of the final development and are considered in the assessment of the landscape and visual impacts. These may take the form of remedial measures such as colour and textural treatment of building features; and compensatory measures such as the implementation of landscape design measures (e.g. tree planting, creation of new open space etc) to compensate for unavoidable adverse impacts and to attempt to generate potentially beneficial long-term impacts.

9.29 The agencies responsible for the funding, implementation, management of the mitigation measures have been identified and their approval-in-principle will be sought.

Residual Impacts

9.30 The Residual impacts are those, which remain after the proposed mitigation measures, have been implemented. This has been assessed both during the construction period and during the design year which is often taken to be 10 to 15 years after the proposed scheme has been opened to normal operation when the soft landscape mitigation measures are deemed to have reached a level of maturity which allows them to perform their original design objectives.

9.31 The level of impact is derived from the magnitude of change which the proposals will cause to the view which would have existed during this period if the proposed scheme had not been constructed and its ability to tolerate change, i.e. its quality and sensitivity taking into account the beneficial effects of the proposed mitigation. The significance threshold is derived from the matrices described separately above for the landscape and visual impacts.

9.32 In accordance with Annex 10 of the EIAO-TM a final conclusion is also made of the residual landscape and visual impacts attributable to the proposed scheme. The degree of residual impact is considered in accordance with the Residual Impact Significance Threshold Matrix in Table 9.2 below.

Table 9.2 Residual Impact Significance Threshold Matrix

Residual Impact	Description
Beneficial	The project will complement the landscape and visual character of its setting, will follow the relevant planning objectives and will improve overall and visual quality.
Acceptable	There will be no significant effects on the landscape and no significant visual effects caused by the appearance of the project, or no interference with key views.
Acceptable with mitigation	There will be some adverse effects, but these can be eliminated, reduced or offset to a large extent by specific measures.
Unacceptable	The adverse effects are considered too excessive and are would not be reduced to an acceptable level by mitigation.
Undetermined	Significant adverse effects are likely but the extent to which they may occur or may be mitigated cannot be determined from the study. Further detailed study will be required for the specific effects in question.

Graphic Presentation of Mitigation Measures

9.33 In order to illustrate these landscape and visual impacts and to demonstrate the effectiveness of the proposed landscape and visual mitigation measures, photomontages at selected representative viewpoints have been prepared to illustrate:

- Existing conditions;
- Day 1 of Operation Phase without Landscape and Visual Mitigation Measures;

- Day 1 of Operation Phase with Landscape and Visual Mitigation Measures; and
- Year 10 of Operation Phase with Landscape and Visual Mitigation Measures.

9.34 It is assumed that funding, implementation, management and maintenance of the mitigation proposals can be satisfactorily resolved according to the principles in ETWB TCW No. No. 2/2004 on Maintenance of Vegetation and Hard Landscape Features. All mitigation proposals in this report are practical and achievable within the known parameters of funding, implementation, management and maintenance. The suggested agents for the funding and implementation (and subsequent management and maintenance, if applicable) are indicated in Tables 9.16 and 9.17. Approval-in-principle to the implementation, management and maintenance of the proposed mitigation measures is required from the appropriate authorities.

Project Description

9.35 This Project is to upgrade the remaining unimproved sections of Kam Tin Road and Lam Kam Road from a substandard single two-lane carriageway into a standard 7.3m wide carriageway. Figure 1 Preliminary Layout Plan shows the proposed upgrading scheme. The location of this study is at Kam Tin Road section between Kam Tin Bypass and Lam Kam Road; and Lam Kam Road section between Kam Tin Road and Kadoorie Farm. The upgraded main road will include the improvement of pedestrian facilities, public transport lay-bys and right-turning lanes at major junction road to reduce to potential road safety problems such as fast vehicular traffic, sharp bends, hidden points of access, sub-standard gradients, inadequate lateral clearance, frequent usage of heavy vehicles and insufficient pedestrian crossing facilities.

- Carriageway to be widened to about 7.3m for a length of 2.7km utilising an asymmetrical widening approach with 0.7km of new pedestrian pavement;
- Provision of right-turning lanes at approaches to major accesses (one located at CH 1060-CH1090);
- Provision of lay-bys at suitable locations (including the existing bus stops) to accommodate the activities of buses and mini-buses (Located at CH440, CH480, CH800, CH820, CH1110, CH1540, CH1580, CH1920, CH2070, CH2170, CH2410, CH2460, CH2830, CH2850, CH3320, CH3440, CH3510, CH3670, CH4000, CH4250, CH4570, CH4620, CH5120 (total 23 lay-bys));
- Provision of appropriate crossing facilities to meet pedestrian crossing demands (Located at CH415, CH760, CH1230, CH1520, CH1960, CH2390, CH2800, CH3540 and CH3820 (Total 9 crossing facilities without a Refuge Island));
- Provision of appropriate crossing facilities with refuge islands to meet pedestrian crossing demands (Located at CH4270 and CH4540); and
- Associated slope and drainage works traffic aids and street lighting modification, landscaping works and environmental mitigation measures of required.

9.36 An important consideration during the design of the proposed upgrading scheme was to minimise landscape and visual impacts wherever possible particularly the large trees which line the carriageway. This section of Kam Tin Road and Lam Kam Road which will be upgraded is a rural road serving many road side developments and is lined by existing trees. In order to minimise impacts the proposed road alignment follows closely the existing alignment. It is designed based on the principle of minimising land resumption and environmental impacts but must also respond to the requirements for traffic engineering and road safety concerns. Therefore the proposed alignment and scheme proposals balance all of these concerns with traffic safety being paramount. During the design of the original scheme (Option A) the existing trees (particularly the large *Melaleuca quinquenervia* and the large trees with a trunk diameter of over 500mm) and the character of the landscape formed a constraint to the design. Much of the alignment will be accommodated without impacting upon the existing trees however in some locations the conflict with existing trees was unavoidable. In these situations the following measures have been taken to minimise potential impacts. Figure 9.14A to H show the scheme proposals and the recommendations for the treatment of the existing trees.

- In the section between Chainage CHA 4+20 and CHA 4+60 the location of the bus lay-by was determined by location of the junction and pedestrian crossing to the west of the carriageway. However the lay-by was moved as far west as possible to preserve two existing roadside trees.
- In the embankment section between Chainage CHA 8+10 and CHA 9+20 a gabion wall is proposed to avoid impacting a group of trees on the edge of the carriageway and a number of trees within a vegetated area to the north.
- In the section between Chainage CHA 10+60 and CHA 11+40 an L-shaped retaining wall is proposed to preserve existing trees to the north of the carriageway and reduce the potential impacts on adjacent village areas. The alignment in this section was determined by highway engineering and safety concerns.
- The widening of the bridge realignment of the approach road between Chainage CHA 13+50 and CHA 14+60 is required from a vehicular safety perspective and to provide a continuous pedestrian footpath along the southern side of the carriageway. Creating a safe alignment will impact on the trees to the north and south of existing alignment although the refinement and minimisation of the proposed works will allow the preservation of a number of trees within this section of the proposed scheme.
- In the section between Chainage CHA 17+10 and CHA 18+90 of Kam Tin Road, the existing single carriageway is proposed to be widened by converting it to dual carriageway. Although it involves resumption of a larger area of private land, the adoption of this approach would allow the preservation of four additional mature trees (two numbers of which have trunk diameter of some 2,000mm).

- The creation of a 1.5m high concrete wall and soil nailing on the slope above between Chainage 32+50 and CHA 33+50 are designed to minimise the impact on the trees to the north of the carriageway including a number of large trees with a trunk diameter of larger than 500mm.
- The design of the junction at Chainage CHA 38+30 was dictated by the requirements for traffic safety although the widening of the eastern side of the junction is designed to avoid the existing trees to the west.
- The location of the proposed cutting between Chainage CHA 40+50 and CHA 40+80 is designed to utilise an existing slope area preserving the existing topography to the south and minimise potential impacts to the adjacent village areas.
- One of the most significant impacts on existing trees will occur in two sections between Chainage CHA 41+90 and CHA 48+10 where the road alignment has been determined by traffic engineering and safety considerations. In this section the engineering scheme requires the road alignment to be straightened in addition to being widened. However the proposals have preserved trees in locations between the two main features a new cut slope and 4m high L-Shaped retaining wall. The proposals will also preserve approximately 25 trees with a trunk diameter of larger than 500mm. In this section the proposed works have also designed to take advantage of the existing engineering works rather than impact the natural hill slope to the north.
- The section between Chainage CHA 50+20 and CHA 51+30 utilises an existing cut slope for the proposed widening preserving a natural hill slope on the other side of the carriageway and preserving the existing trees and vegetation of this slope.

Consideration of Alternative Schemes

9.37 During the design development for the proposed scheme a number of alternative options were considered to avoid the potential landscape and visual impacts particularly the existing trees lining the road corridor. These alternatives to the design, working within the engineering and road safety constraints, formed the basis of Option B which is the preferred scheme. The sections forming the two alternative schemes (Option A and Option B) are shown on Figures 9.15 A to P Exploration of Alternative Schemes. Whilst the schemes share many of the same elements significant changes have been made at certain points along the road to preserve additional trees and minimise the potential impacts on landscape and visual amenity. Each section of Options A and B is shown next to each other to facilitate comparison. The main enhancements incorporated in Option B include the section between Chainage CHB41+90 and CHB49+30 of Lam Kam Road. Option A proposed to widen the carriageway northwards to avoid encroachment of the CA thereat while Option B is to widen southwards.

9.38 Upon a detailed comparison, Option B is adopted as the preferred option. A brief summary of the assessment findings is described below:

- (i) Overall the preferred option can preserve 46 more mature trees. In particular, three numbers of trees with a trunk diameter of greater than 1m can be preserved.
- (ii) The preferred option can avoid affecting the existing slopes at the north of the concerned road sections. The reduced geotechnical works give rise to less waste, noise, air quality, and landscape and visual impacts.
- (iii) The preferred option slightly encroaches upon the Conservation Area (CA). However, the concerned area is a paved footway with isolated trees, and hence the potential impact in terms of the loss of vegetation or degradation of landscape character is considered to be low.
- (iv) Apart from CA encroachment, another disadvantage of the preferred option is the need to resume larger areas of private land.

9.39 In the section between Chainage CHB48+00 and CHB48+80 of Lam Kam Road, the southern footway is proposed to be set back in order to preserve the existing road side trees.

9.40 In the section between Chainage CHB49+10 and CHB52+90 of Lam Kam Road, the preferred option upgrades the carriageway and the northern footway, but does not add a footway to the southern side of the carriageway. This arrangement will minimise the extent of the potential CA encroachment. Besides, considering that extensive geotechnical works will be required for adding the concerned footway this arrangement will reduce the potential landscape and visual impacts.

Review of Planning and Development Control Framework

9.41 A review of the existing planning studies and documents has been undertaken to gain an insight into the planned role of the site, its context and to help to determine if the project fits into the wider landscape context. The assessment does not consider all of the areas zoned on the OZP only those physically affected by the proposed works including the area within the Project Boundary and temporary construction or works areas. The location of these areas is shown on Figure 9.8. This review considered the following aspects of the identified planning designations:

- Zoning areas which would be physically affected by the proposals, that is where the implementation of the proposal works would lead to the actual loss of an area;
- The potential degradation of the landscape setting of an area which might effect the viability of it's landscape planning designation but not result in a loss of zoning area;
- The visual amenity enjoyed by future residents or users; and
- The general fit of the proposals into this future landscape.

9.42 The landscape relevant zoning within the Study Area include the following:

- Kam Tin North OZP (S/YL-KTN/7);
- Kam Tin South OZP (S/YL-KTS/11);
- Pat Heung OZP (S/YL-PH/11);

- Shek Kong OZP (S/YL-SK/9); and
- Lam Tsuen OZP (S/NE-LT/11).

Table 9.3 Review of Existing Planning and Development Control Framework

Land Use Zonings	Landscape Planning, Design and Conservation Intention of Zoning	Potential Impacts	Mitigation Measures and Future Outlook of the Area with the Proposed Works
Outline Zoning Plan number S/YL-KTN/7 Kam Tin North OZP			
1. Village Type Development (V)	This zone encompasses Wing Lung Wai and Kam Tin San Tsuen settlements. The planning intention of this zone is to reflect existing and other villages, and to provide land considered suitable for village expansion and reprovisioning of village houses affected by Government project.	The proposed road upgrading works will not affect this zone. 0m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.
2. Agriculture (AGR)	This zone encompasses the active agriculture field at Pang Ka Tsuen and the area above Kam Ta Road around Tsat Sing Kong. This zone intended primarily to retain and safeguard good quality agricultural land/ farm/fishponds for agricultural purposes. It is also intended to retain fallow arable land with good potential for rehabilitation for cultivation and other agricultural purposes.	The proposed works including the regarding of the existing embankment and construction of a 7m high gabion wall and 3.5m high L-shaped retaining wall will encroach on the existing agricultural area. 290 m ² / 0.0 ha (<1%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.
3. Residential Group C (R(C))	This zone encompasses Seasons Villas low-rise residential development. This zone is intended primarily for low-rise, low-density residential developments where commercial uses serving the residential neighbourhood may be permitted.	The proposed road upgrading works will not affect this zone. 0m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely

Land Use Zonings	Landscape Planning, Design and Conservation Intention of Zoning	Potential Impacts	Mitigation Measures and Future Outlook of the Area with the Proposed Works
			rural / semi-rural landscape.
4. Residential Group D (R(D))	This area encompasses Pang Ka Tsuen and Shek Kong San Tsuen low-rise village development. This zone intended preliminary for improvement and upgrading of existing temporary structures within the rural areas through redevelopment of existing temporary structure into permanent building. It is also intended for low-rise, low-density residential developments subject to planning permission from TPB.	The proposed road upgrading works will lead to the limited loss of area from this zone due to the widening of the carriageway and the provision of pedestrian footpath. 58m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.
5. Open Space (O)	Two areas abutting Kam Tin Road are zoned "O" to cater for needs of the local population. This zone is intended primarily for the provision of outdoor open-air public space for active and/or passive recreational uses serving needs of residents as well as the general public.	The proposed road upgrading works will lead to the limited loss of area from this zone due to the widening of the carriageway and the provision of pedestrian footpath. 400m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.
6. Other Specific Uses (OU)	This "OU" annotated "Petrol Filling Station" which situated to the south of Kam Tin Road near Shek Kong Barrack. It is intended primarily for the provision of petrol filling station.	The proposed road upgrading works will lead to the limited loss of area from this zone due to the widening of the carriageway and the provision of pedestrian footpath. 30m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.
7. Government / Institution / Community (G/IC)	This zone encompasses the existing clinic to the south of Kam Tin Road near the Shek Kong Barracks. This zone is intended primarily for the	The proposed road upgrading works will lead to the limited loss of area from this zone due	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning

Land Use Zonings	Landscape Planning, Design and Conservation Intention of Zoning	Potential Impacts	Mitigation Measures and Future Outlook of the Area with the Proposed Works
	provision of Government, institution or community facilities serving the needs of the local residents. It is also intended to provide land for uses directly related or in support of the work of the Government, organizations social services to meet community needs, and other institution establishments.	to the widening of the carriageway and the provision of pedestrian footpath and the creation of anew fill slope and 3.5m high L-shaped retaining wall. 30m ² / 0 ha (0%)	intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.
Outline Zoning Plan number S/YL-KTS/11 Kam Tin South OZP			
8. Residential Group D (R(D))	This zone encompasses Ng Ka Tsuen low-rise residential development. This zone intended preliminary for improvement and upgrading of existing temporary structures within the rural areas through redevelopment of existing temporary structure into permanent building. It is also intended for low-rise, low-density residential developments subject to planning permission from TPB.	The proposed road upgrading works will lead to the limited loss of area from this zone due to the widening of the carriageway and the provision of pedestrian footpath, and the construction of a 1.5m high mass concrete wall and the regarding of the existing slope. 120m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.
9. Village Type Development (V)	This zone encompasses Kat Hing Wai village settlement. The planning intention of this zone is to reflect existing and other villages, and to provide land considered suitable for village expansion and reprovisioning of village houses affected by Government project.	The proposed road upgrading works will lead to the limited loss of area from this zone due to the widening of the carriageway and the provision of pedestrian footpath. 200m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.
10. Other Specific Uses (OU)	This OU is annotated "Rural Use" and this zone is intended primarily for the preservation of the character of the rural area. This zone is located to the north of Shek Wu Tong and bounded by	The proposed road upgrading works will lead to the limited loss of area from this zone due to the widening of the carriageway	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting

Land Use Zonings	Landscape Planning, Design and Conservation Intention of Zoning	Potential Impacts	Mitigation Measures and Future Outlook of the Area with the Proposed Works
	Kam Sheung Road to the east, Kam Po Road to the west and Tung Wui Road to the north. It is defined as the area of archaeological potential.	and the provision of pedestrian footpath, and the reprovision of two bus laybys. 50m ² / 0 ha (0%)	proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.
Outline Zoning Plan number S/YL-PH/11 Pat Heung OZP			
11. Village Type Development (V)	This zone encompasses Leung Uk Tsuen, Wang Toi Shan Lo Uk Tsuen and Wang Toi Shan village settlement. The planning intention of this zone is to reflect existing and other villages, and to provide land considered suitable for village expansion and reprovisioning of village houses affected by Government project.	The proposed road upgrading works will lead to the limited loss of area from this zone due to the widening of the carriageway and the provision of pedestrian footpath. 400m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.
12. Open Storage (OS)	This zone encompasses the area of Wang Toi Shan Hung Mo Tam and to the south of Kam Tin Road at the south-eastern corner of the area. This zone is intended primarily for the provision of land for appropriate open storage uses and to regularize the already haphazard proliferation of open storage uses.	The proposed road upgrading works will lead to the loss of area from this zone due to the widening of the carriageway and the provision of pedestrian footpath. 2,250m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.
13. Industrial (Group D) (I(D))	This zone encompasses an area to the north of Kam Tin near Shek Kong Barracks. This zone intended primarily for industrial uses that cannot be accommodated in conventional flatted factories due to extensive lands and/or high ceiling requirement. It is also intended for the redevelopment of existing informal industrial uses, which are operated in workshop premises in	The proposed road upgrading works will lead to the loss of area from this zone due to the widening of the carriageway and the provision of pedestrian footpath, and the regrading of an existing slope. 1,000m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely

Land Use Zonings	Landscape Planning, Design and Conservation Intention of Zoning	Potential Impacts	Mitigation Measures and Future Outlook of the Area with the Proposed Works
	rural area, to properly designed permanent industrial buildings.		rural / semi-rural landscape.
14. Government / Institution / Community (G/IC)	This zone encompasses Pat Heung Fire Station and Pat Heung Police Station. This zone is intended primarily for the provision of Government, institution or community facilities serving the needs of the local residents. It is also intended to provide land for uses directly related or in support of the work of the Government, organizations social services to meet community needs, and other institution establishments.	The proposed road upgrading works will lead to the loss of area from this zone due to the widening of the carriageway and the provision of pedestrian footpath, and the construction of a 1.5m high L-shaped retaining wall and the regrading of existing slopes. 200m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.
15. Conservation Area (CA)	This zone encompasses the foot of Lam Tsuen Country Park. The planning intention is this zone is to protect and retain the existing natural landscape, ecological or topographical features of the area for conservation, educational and research purposes and to separate sensitive natural environments such as Country Park from adverse effect of development.	The proposed road upgrading works will lead to the loss of area from this zone due to the widening of the carriageway and the provision of pedestrian footpath, and the construction of an 8m high soldier pile wall. 200m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.
Outline Zoning Plan number S/YL-SK/9 Shek Kong OZP			
16. Conservation Area (CA)	This zone is encompasses the slope in the north-eastern and southern parts of the area for giving added protection to Lam Tsuen Country Park. The planning intention is this zone is to protect and retain the existing natural landscape, ecological or topographical features of the area for conservation, educational and research purposes and to separate sensitive natural environments such as Country Park from	The proposed road upgrading works will lead to the loss of area from this zone due to the widening of the carriageway and the provision of pedestrian footpath, and the regrading of existing slopes. 200m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.

Land Use Zonings	Landscape Planning, Design and Conservation Intention of Zoning	Potential Impacts	Mitigation Measures and Future Outlook of the Area with the Proposed Works
	adverse effect of development.		
17. Government / Institution / Community (G/IC)	This zone encompasses the existing Kadoorie Farm Agricultural Research Centre. This zone is intended primarily for the provision of Government, institution or community facilities serving the needs of the local residents. It is also intended to provide land for uses directly related or in support of the work of the Government, organizations social services to meet community needs, and other institution establishments.	The proposed road upgrading works will lead to the loss of area from this zone due to the widening of the carriageway and the provision of pedestrian footpath, and the construction of a 1.5m high L-shaped retaining wall and the regrading of existing slopes. 1,000m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.
18. Village Type Development (V)	This zone encompasses Sheung Tsuen village settlement. The planning intention of this zone is to reflect existing and other villages, and to provide land considered suitable for village expansion and reprovisioning of village houses affected by Government project.	The proposed road upgrading works will lead to the limited loss of area from this zone due to the widening of the carriageway and the provision of pedestrian footpath. 200m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.
19. Industrial (Group D) (I(D))	This zone encompasses Wong Chuk Yuen, to the north of Lam Kam Road and east of Kam Tin Road. This zone intended primarily for industrial uses that cannot be accommodated in conventional flatted factories due to extensive lands and/or high ceiling requirement. It is also intended for the redevelopment of existing informal industrial uses, which are operated in workshop premises in rural area, to properly designed permanent	The proposed road upgrading works will lead to the loss of area from this zone due to the widening of the carriageway and the provision of pedestrian footpath, and the regrading of an existing slope. 820m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.

Land Use Zonings	Landscape Planning, Design and Conservation Intention of Zoning	Potential Impacts	Mitigation Measures and Future Outlook of the Area with the Proposed Works
	industrial buildings.		
20. Residential Group D (R(D))	This zone encompasses the areas around Tai Ling and Lui King Tin to the west of Shek Kong Village. This zone intended preliminary for improvement and upgrading of existing temporary structures within the rural areas through redevelopment of existing temporary structure into permanent building. It is also intended for low-rise, low-density residential developments subject to planning permission from TPB.	The proposed road upgrading works will not affect this zone. 0m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.
Outline Zoning Plan number S/NE-LT/11 Lam Tsuen OZP			
21. Green Belt (GB)	This zone encompasses the northern wooded foothill of Kwan Yam Keng. The planning intention of this zone is primarily for defining the limits of urban and sub-urban development areas by natural features and to contain urban sprawl as well as provide passive recreational outlet.	The proposed road upgrading works will lead to the limited loss of area from this zone due to the widening of the carriageway and the provision of pedestrian footpath. 200m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.
22. Government / Institution / Community (G/IC)	This zone encompasses part of Kadoorie Experimental and Extension Farm. This zone is intended primarily for the provision of Government, institution or community facilities serving the needs of the local residents. It is also intended to provide land for uses directly related or in support of the work of the Government, organizations social services to meet community needs, and other institution establishments.	The proposed road upgrading works will lead to the limited loss of area from this zone due to the widening of the carriageway and the provision of pedestrian footpath. 120m ² / 0 ha (0%)	Given that the road is designed for the convenience and road safety of both local residential and general public; hence the proposed works are compatible to the planning intention for this area. The compensatory planting proposal alongside of the road will provide for the mitigation of the proposed engineering works and enhance the landscape and visual integration of the proposals within a largely rural / semi-rural landscape.

Encroachment of the Conservation Areas

- 9.43 The Project is a DP since part of its boundary encroaches upon the Conservation Area (CA) zoning as defined on relevant Outline Zoning Plans (OZPs), and as referred in Section 1.3 of the EIA Study Brief No. ESB-170/2007. The main areas of encroachment are described below:

CA at north of section between Chainage CHB 28+70 and CHB 30+10 of Kam Tin Road

- The proposed works within CA include construction of an earth retaining wall and reconstruction of existing footway. The concerned works are not arising from a change of road alignment. The earth retaining wall is to upgrade an existing roadside slope which has been assessed as being below the current safety standards. The footway reconstruction is required from a maintenance viewpoint.

CA at south of section between Chainage CHB 44+30 to CHB 44+80 of Lam Kam Road

- The proposed works within CA involve the widening of an existing carriageway, and the reconstruction of existing footway and carriageway. Options for the road alignment have been explored at this section and the current alignment is the preferred option. Although it slightly encroaches upon CA the alignment will allow the preservation of more mature trees.

CA at south of section between Chainage CHB 48+00 to CHB 52+30 of Lam Kam Road

- The proposed works within CA include the soil nailing of existing slopes and construction of a 2m high retaining wall. The concerned works are not due to the change of the road alignment. The proposed soil nailing is to upgrade the existing road side slopes which are assessed as being below the current safety standards. The proposed retaining wall is a safety measure to protect road users against the identified potential natural terrain hazards.

CA at north of section between Chainage CHB 50+20 to CHB 52+40 of Lam Kam Road

- The proposed works within CA include the widening of existing footway and carriageway, soil nailing of an existing slope, and re-compaction of an existing slope. Options for the road alignment have been explored at this section and the current alignment is the preferred option which will minimise geotechnical works and hence disturbance to existing areas. The proposed soil nailing and slope re-compaction are to upgrade an existing slope which is assessed as being below current safety standards.

- 9.44 The proposed works will encroach upon the land use zonings discussed in the LVIA including for example the loss of area zoned Conservation Area (CA) and some Open Space (OS) adjacent to the road. Other impacts include the loss of area in the Government / Institutional / Community (GI/C), Industrial (Group D) (I(D)), some loss of Residential (Group D) and Village Type Development (V) zonings although these are considered to be less significant from a landscape and visual perspective. Therefore although it is considered that the proposals

will generally fit within the future landscape planning framework as represented by the OZPs some amendment to the published land use plans is required. Given the above summary, the proposed upgrading of Kam Tin and Lam Kam Road largely fits into the planning and development control framework and integrates with the future outlook of the rural landscape context. The proposed upgraded road will be gazetted under Roads (Works, Use and Compensation) Ordinance (Cap. 370) and hence some zoning boundaries affected by the works should be revised.

Landscape and Visual Baseline Study

Baseline Conditions

- 9.45 This section describes the baseline study which reviews of the existing landscape establishes broad characteristics, identifies landscape resources, landscape character and visual amenity of Study Area. Any changes which arise as a result of the project during the construction and operational phase will be assessed.
- 9.46 The baseline Figures 9.2A to C show the existing LRs found within the 500m Study Area, Figures 9.3A to H illustrate existing trees located with the works area, Figures 9.4A to C show the extent of identified LCAs and Figures 9.5 A to I demonstrate the quality of LCAs with site photographs.

Landscape Resources (LRs)

LR1 Major Road Corridor

- 9.47 This LR refers to the major roads including Kam Tin Road, Lam Kam Road and some smaller adjacent side roads used for transportation and residential access. The construction work would affect the main part of the Kam Tin Road corridor. Some existing plantation is found alongside the carriageway forming part of the original mitigation measures implemented when the road was constructed and through natural colonisation of native and naturalised tree species. These trees are important to the landscape and visual amenity of the road corridor and are described under LR3 Roadside Plantation. Given the nature of the existing road corridor it is considered to have a relatively low landscape and amenity value. It is also considered that the presence of existing highway structures and its engineered nature results in a landscape resource which has a high ability to accommodate change and a low sensitivity to change.

LR2 Agricultural Fields

- 9.48 The Study Area contains extensive agricultural fields particularly associated with adjacent village settlements and includes areas which are both active and inactive. The remnant field areas are covered by a combination of grass and shrub areas with intermittent tree growth. The disturbed nature of many of the agricultural field areas, their fragmentary nature as a result of the encroachment of development and the cessation of agricultural activities in some areas has led to the degradation of this resource. The landscape and amenity value of this LR is generally considered to be low with a medium ability to accommodate change and a low sensitivity to change.

LR3 Roadside Plantation

- 9.49 This LR refers to the buffer planting along the transportation corridors of Kam Tin Road and Lam Kam Road and some adjacent side roads. Most of the vegetation is mature and established as part of the landscape and visual mitigation of the original road scheme. The most dominant species identified in the tree survey include *Melaleuca quinquenervia*, *Celtis sinensis*, *Macaranga tanarius*, *Acacia confusa*, *Bauhinia variegata*, *Ficus microcarpa*, *Casuarina equisetifolia* and *Hibiscus tiliaceus*. Except for *Macaranga tanarius* which is a common native tree species spontaneously colonizing disturbed habitats, all other dominant tree species are extensively planted locally. In addition the mature *Melaleuca quinquenervia* planted to create an avenue effect along a number of roads in the New Territories are important in establishing the character of the road corridor and provide an historic link with the original road construction. Based on the survey data this area contains no trees which meet the criteria for Old and Valuable Trees or Potentially Registerable Old and Valuable Trees in accordance with ETWB TCW No. 29/2004. Section 9.73 to 9.83 provides a summary of the findings of the tree survey and Appendix I1 a Tree Survey Schedule identifying the species, size and condition of each of the trees surveyed. The preservation of these trees was one of the key objectives in the design of the upgrading proposals and further opportunities for tree preservation will be explored as part of the detailed design stage of the project. Where this is not possible a compensatory tree planting proposal will be prepared as part of the proposed landscape and visual mitigation measures. Given the importance of this LR to the landscape and visual amenity of the road corridor it is considered to have a low ability to accommodate change and a high sensitivity to change.

LR4 Village Settlement

- 9.50 Village settlements are scattered alongside of the road corridor and the adjacent lowland rural landscape. They are characterized by extensive groups of 3-storey town houses which form the settlement pattern within the lowland landscape. The existing building forms include a combination of traditional dwellings although the majority of the buildings consist of newer type developments connected by narrow lanes and footpaths. Given the nature of the existing developments in these village areas this LR is considered to have a relatively low value. Further as much of it is already developed the LR is considered to have a medium ability to accommodate change and a medium sensitivity to development.

LR5 Hillside with Mixed Woodland

9.51 To the north east of the Study Area, patches of mixed woodland strands or vegetated knolls are interspersed with village settlements near the foothills of the Lam Tsuen Country Park and covers the lower hill slopes and stream courses of the upland areas. The secondary woodland includes a combination of plantation woodland and native tree species which have naturally colonised the area. The main tree species include pockets of *Acacia confusa* plantation together with some native species such as *Alangium chinense*, *Bridelia tomentosa*, *Celtis sinensis*, *Cratoxylum cochinchinense*, *Ficus microcarpa*, *Ficus hispida*, *Litsea glutionsa*, *Macaranga tanarius* and *Microcos paniculata*. Within these areas the naturally regenerating *Machilus* dominates the secondary native forest. These woodlands have a relatively dense understory dominated by typical native secondary forest species including *Psychotria asiatica*. This LR is characterised as a rural landscape in Shek Kong and Pat Heung Districts and some of it is classified as 'Conservation Areas' protected under the proposals for the development of the NWNT. The landscape and amenity value of this LR is high; it has a medium ability to accommodate change and high sensitivity to change.

LR6 Developed Rural Land

9.52 This area contains a combination of development types which are characteristic to rural areas of the NWNT. These include the conversion of agricultural fields to Open Storage and the facilities associated with institutional uses such as Shek Kong Barracks, light industrial buildings and junkyards. These areas extend for almost the entire length of the Study Area and have utilised the former agricultural fields between the village settlements. The Shek Kong Barracks site is characterised by regimented development pattern located either side of the central runway. The scale and form of the built structures are relatively alien to the smaller scale, organic layout of the village settlements. The replacement of the agricultural fields by these developments within the rural areas has significantly degraded the landscape and visual amenity of the area and so the LR is considered to have a low value. Given the piecemeal nature and level of development within this area is considered to have a high ability to accommodate change and a low sensitivity to change.

LR7 Grassland / Shrubland Mosaic

9.53 The Grassland / Shrubland Mosaic has two distinct characters the first in the abandoned agricultural fields where natural succession has lead to the intermittent growth of trees and shrubs, and the second on the lower hill slopes of the adjacent mountain and hill ranges. Although this LR marks a return of the landscape to a natural condition the loss of the traditional field patterns has a degraded the character of the rural landscape. These areas are considered to have a medium ability to accommodate change and a medium sensitivity to change.

LR8 Modified Watercourses

9.54 A section of the Kam Tin River within the Study Area has been widened or modified in phases for drainage improvement of coastal plain and lowland areas in NWNT since 1990s to resolve the flooding problems within these areas. This has resulted in the creation of wide water channels characterised by their engineered form and the loss of the meandering form that once characterised the river and significant riverside vegetation. This has been redressed to an extent by the preservation of abandoned meanders and the planting of new tree and shrub areas by way of mitigation. Although these watercourses largely disturbed by engineering works, they are still scenic elements in the local landscape context. This resource is considered to have a medium ability to accommodate change and a medium sensitivity to change.

LR9 Open Spaces and Sports Fields

9.55 The Study Area contains a number of open spaces and sports facilities including the sports pitches and athletics track in Shek Kong Barracks, a series of sports pitches in Wong Toi Shan, and three parks in Sheung Wan, and Shek Kong Village. These areas are characterised by closely mown, manicured lawn and traditional open space type landscapes. Although these facilities are contained within developed areas they are considered to have a low ability to accommodate change and a high sensitivity to change.

9.56 Table 9.4 provides an assessment of the sensitivity of the identified LRs and their sensitivity to change.

Table 9.4 Landscape Resources and their Sensitivity to Change

ID. No.	Landscape Resource / Area (m ²)	Quality of Landscape Resource (High / Medium / Low)	Importance and Rarity (High / Medium / Low)	Ability to accommodate Change (High / Medium / Low)	Local Significance of Potential Change (High / Medium / Low)	Regional Significance of Potential Change (High / Medium / Low)	Maturity (High / Medium / Low / N/A)	Sensitivity to Change (High / Medium / Low)
LR 1	Major Road / 114,915m ²	Low	Low	High	Low	Low	N/A	Low
LR2	Agricultural Fields / 860,000m ²	Low	Low	Medium	Low	Low	Medium	Low
LR3	Road Side Plantation / 79,560m ²	Medium	High	Low	High	Medium	Medium	High
LR4	Village Settlements / 1,342,000m ²	Low	Medium	Medium	Low	Low	High	Medium
LR5	Hillside with Mixed Woodland / 1,170,650m ²	High	Medium	Medium	Medium	Medium	High	High
LR6	Developed Rural Land / 2,009,600m ²	Low	Low	High	Low	Low	Low	Low
LR7	Grassland / Shrubland Mosaic / 336,400 m ²	Medium	Medium	Medium	Low	Low	Medium	Medium
LR8	Modified Watercourses	Medium	Medium	Medium	Low	Low	Low	Medium

ID. No.	Landscape Resource / Area (m ²)	Quality of Landscape Resource (High / Medium / Low)	Importance and Rarity (High / Medium / Low)	Ability to accommodate Change (High / Medium / Low)	Local Significance of Potential Change (High / Medium / Low)	Regional Significance of Potential Change (High / Medium / Low)	Maturity (High / Medium / Low / N/A)	Sensitivity to Change (High / Medium / Low)
	/ 217,330m ²							
LR9	Open Spaces and Sports Fields / 52,639m ²	Medium	Medium	Low	High	Medium	Medium	High

Landscape Character Areas (LCAs)

9.57 The landscape of the Study Area is characterized by a combination of the lowland village landscape with surrounded by largely abandoned agricultural fields and extensive open storage areas bounded by upland areas with wooded hill slopes giving way to shrub and coarse grassland. The lowland rural landscape is formed from the Kam Tin and Pat Heung Districts bisected by the course of the Kam Tin River and river retraining works. The main lowland landscape areas are situated in the western part of the Study Area. This lowland landscape gradually gives way to a more undulating and hill landscape in the eastern part of the Study Area. These upland areas include the Lam Tsuen Country Park and Kwun Yam Shan. The main village settlements are located adjacent to Kam Tin Road to the north and south of the alignment.

9.58 The rural landscape of the Study Area has been degraded due to the proliferation of Open Storage areas although significant fragments of active agricultural fields and scattered traditional village settlement patterns still exist. Figures 9.4A to C show the location of the LCAs which form the Study Area, and Figures 9.5A to I demonstrate how these various characters fit together and form the landscape context for the road corridor. The identified LCAs are briefly described below.

LCA1: Tsat Sing Kong Lowland Rural Landscape

9.59 This LCA is located to the north-west of the Study Area and is set at some distance from the proposed works. This lowland is largely characterised agricultural fields many of which are abandoned and modified for open storage, warehouse and light industrial uses. Given that this rural character is typical throughout the NWNT and that the majority of the area is degraded by the occupation of open storage, the ability of this LCA to accommodate change high and its sensitivity to change medium.

LCA2: Pang Ka Tsuen Lowland Rural and Low-rise Residential Landscape

9.60 This area, adjacent to the northern part of Kam Tin Road, is largely occupied by village settlements and residential developments. Pang Ka Tsuen is a typical village settlement with a combination of traditional and more modern 3-storey village houses. Of the newer residential developments Seasons Villa is typical and is classified as a medium scale extensive low-rise residential development. It characterised by 3-storey houses with private gardens and car parks. The modern architectural style of these houses contrasts with the more traditional

village settlements and adjacent rural areas. Given the character of this area, the level of development and the relatively discordant nature of this development it is considered that this LCA has a high ability to accommodate change and a low sensitivity to change.

LCA3: Kam Tin Lowland Rural Landscape

- 9.61 This area is located to the west of the study area adjacent to the Kam Tin Road roundabout. It is characterized by typical village settlements including Wing Lung Wai, Kam Tin San Tsuen, Kat Hing Wai and Tsz Tong Tsuen. Within and adjacent to these areas are a number of commercial and institution developments which again contribute to the discordant character of these areas particularly in juxtaposition to the fragmentary rural landscapes. Given the nature of this landscape it is considered that the ability of the LCA to accommodate change is high and its sensitivity to change is low.

LCA4: Shek Kong Barracks Landscape (Shek Kong)

- 9.62 This LCA refers to the military property situated at the south-west of the Study Area and adjacent to the proposed upgraded road. Shek Kong Barracks is a restricted area with a 3m parameter fence restricting unauthorised access. It is characterised by the regimented nature of the site layout located to the north and south of a main runway and the scale of the buildings and structures which contrasts with the finer textured and more organic layout of the surrounding village areas. The built environment ranges from large hanger and maintenance buildings to the smaller 3-storey accommodation blocks. The periphery of the site is fenced and contains areas of plantation woodland. Given the scale and the character of this LCA it is considered to have a medium ability to accommodate change and medium sensitivity to change.

LCA5: Wang Toi Shan Village Landscape

- 9.63 This area is characterized by extensive open storage and warehouse landuses and the settlement of Wang Toi Shan Village in the central part of Pat Heung. Different sections of Wang Shan Village are scattered throughout this area including Wang Toi Shan Law Uk Tsuen, Wang Toi Shan Yau Uk Tsuen, Wang Toi Shan Wing Ning Lei and Wang Toi Shan Shan Tsuen. The presence of extensive open storage and warehouse type developments has lead to a degradation of the landscape amenity of this LCA. The landscape is highly modified and disturbed due to the level, density and piecemeal nature of the existing development and this has lead to its fragmented character. Given these factors it is considered that the ability to accommodate change is high and sensitivity to change is low.

LCA6: Kam Tin Modified Water Course Landscape

- 9.64 This section of Kam Tin River within the Study Area has been widened and its course modified in phases as part of the drainage improvement of coastal plain and lowland areas in NWNT. The works were started in the 1990s and designed to resolve the flooding problems in these areas. Although these

watercourses are largely characterised by the engineered nature of their structures including the stabilisation of the river banks and maintenance access roads they still provide scenic elements in the local landscape context. They are reasonably tolerant to further development, hence it is considered to have a high ability to accommodate change and a medium sensitivity to change.

LCA7: Shek Kong Lowland Rural Landscape

- 9.65 This area is dominated by open storage interspersed with abandoned agricultural field and scattered 3-storey village developments alongside of Kam Tin Road. This rural lowland character is typical in NWNT. The south eastern part of the LCA also contains some mature woodland and tree groups at the periphery and within the village areas. This woodland contains a number of mature specimens of *Ficus* sp., *Bridelia tomentosa*, *Macaranga tanarius* and *Celtis sinensis*. Given that a large proportion of this area is a built environment for open storage and warehouses, with the exception of the village areas surrounded by woodland in the south east, the ability of the LCA to accommodate change is considered to be high and its sensitivity to change low.

LCA8: Lam Tsuen Country Park Hillside Landscape

- 9.66 This area refers to a conservation area which is situated to the north east of the Study Area. The coverage of this LCA includes the foothills of the Country Park and the landscape is characterised by the steep slopes of the uplands and the deeply incised valleys with its covering of woodland and shrubland giving way to grassland at higher elevations. Despite its proximity to developed areas within the surrounding lowlands and being crossed by a number of trails the landscape retains its natural landscape character. The landscape amenity of this LCA is high and is considered to have a low ability to accommodate change and a high sensitivity to change.

LCA9: Sheung Tsuen Lowland Rural Landscape

- 9.67 This LCA has a similar character to LCA3 although it is smaller in scale. The LCA is characterised by a typical village settlement including a combination of traditional dwellings and temples, in addition to newer 3-storey houses separated by a network of narrow lanes and footpaths. The area has a scattering of mature trees and is bounded by a peripheral woodland belt and scrub adjacent to abandoned fields. Given the disturbed and fragmentary nature of this LCA, the level of existing development and the abandonment of the existing agricultural fields it is considered that its ability to accommodate change is high and its sensitivity to change medium.

LCA10: Shek Kong Barracks Landscape (Shek Kong Tsuen)

- 9.68 This LCA refers to a military property situated to the south-east of the Study Area and adjacent to the proposed upgraded road. Shek Kong Barracks is a restricted area and is bounded by a 3m fence to prevent unauthorised access. The site is characterised by the regimented nature of its layout and the scale of

the buildings and structures which contrasts with the finer textured and more organic village settlements which surround it. This landscape is comparatively rare in Hong Kong and is characterised by its low-rise institutional buildings and mature tree growth being reminiscent of a period in Hong Kong's development. Given its relative rarity it is considered to have a medium ability to accommodate change and a medium sensitivity to change.

LCA11: Kwun Yam Shan Miscellaneous Rural Fringe Landscape

- 9.69 This area is occupied by Heliservices (Hong Kong) Limited and is characterised by the hard standing utilised by the landing area and the modified form of the landscape which surrounds it. Given the modification of the existing landscape this LCA is considered to have a high ability to accommodate change and a low sensitivity to change.

LCA12: Kwun Yam Shan Upland and Hillside Landscape

- 9.70 This LCA within the Study Area is characterised by the Kadoorie Experimental and Extension Farm which situated in the foothills of Kwun Yam Shan. The area consists of the main buildings of the farm surrounded to the south, east and west by a combination of remnant natural hillside and landscaped gardens. Due to its rural and landscaped nature this site is considered to have a low ability to accommodate change and a high sensitivity to change.

LCA13: Kam Tin Road and Lam Kam Road Corridor

- 9.71 This LCA is formed by the Kam Tin and Lam Kam Road corridors including the carriageway and part of the adjacent vegetation which lines it. The landscape is one characterised by the enclosure provided through a combination of the existing topography and the roadside trees. These features provide limited framed views extending towards the landscape beyond. Sections of the road corridor are lined by mature plantation woodland forming part of the original mitigation measures implemented when the road was constructed. In addition many of the trees have come to the site through natural colonisation of native and naturalised tree species. The dominant species identified include *Melaleuca quinquenervia*, *Celtis sinensis*, *Macaranga tanarius*, *Acacia confusa*, *Bauhinia variegata*, *Ficus microcarpa*, *Casuarina equisetifolia* and *Hibiscus tiliaceus*. Except for *Macaranga tanarius* which is a common native tree species spontaneously colonizing disturbed habitats, all other dominant tree species are extensively planted locally. In addition the mature *Melaleuca quinquenervia* planted to create an avenue effect along a number of roads in the New Territories are important in establishing the character of the road corridor and provide an historic link with the original road construction. Given the nature of the existing road corridor it is considered to have a relatively low landscape and amenity value. It is also considered that the presence of existing highway structures and its engineered nature alleviated to an extent by the mature roadside trees and plantation woodland results in a landscape character which has a medium ability to accommodate change and a medium sensitivity to change.

- 9.72 Table 9.5 provides an assessment of the sensitivity of the identified LCAs to change.

Table 9.5 Landscape Character Areas and their Sensitivity to Change

ID. No.	Landscape Character Area (LCA) / Area (m ²)	Quality of Landscape Character (High / Medium / Low)	Importance and Rarity (High / Medium / Low)	Ability to accommodate Change (High / Medium / Low)	Local Significance of Potential Change (High / Medium / Low)	Regional Significance of Potential Change (High / Medium / Low)	Sensitivity to Change (High / Medium / Low)
LCA1	Tsat Sing Kong Lowland Rural Landscape / 549,685 m ²	Medium	Low	High	Low	Low	Medium
LCA2	Pang Ka Tsuen Lowland Rural and Low-rise Residential Landscape / 263,397m ²	Medium	Low	High	Low	Low	Low
LCA3	Kam Tin Lowland Rural Landscape / 413,495m ²	Medium	Low	High	Low	Low	Low
LCA4	Shek Kong Barracks Landscape (Shek Kong) / 759,160m ²	Medium	Medium	Medium	Medium	Medium	Medium
LCA5	Wang Toi Shan Village Landscape / 129,345m ²	Medium	Low	High	Low	Low	Low
LCA6	Kam Tin Modified Water Course Landscape / 541,828m ²	Medium	Low	High	Medium	Medium	Medium
LCA7	Shek Kong Lowland Rural Landscape / 730,660m ²	Medium	Low	High	Low	Low	Low
LCA8	Lam Tsuen Country Park Hillside Landscape / 1,131,802m ²	High	Medium	Low	High	High	High
LCA9	Sheung Tsuen Lowland Rural Landscape / 91,360m ²	Medium	Low	High	Medium	Low	Medium
LCA10	Shek Kong Barracks Landscape (Shek Kong Tsuen) / 312,450m ²	Medium	Medium	Medium	Medium	Medium	Medium
LCA11	Kwun Yam Shan Miscellaneous Rural Fringe Landscape / 302,560m ²	Low	Low	High	Low	Low	Low
LCA12	Kwun Yam Shan Upland and Hillside Landscape / 737,000m ²	High	Medium	Low	High	High	High
LCA13	Kam Tin Road and Lam Kam Road Corridor / 47,555m ²	Medium	Medium	Medium	Medium	Medium	Medium

Existing Trees

- 9.73 The main concentrations of existing trees are located in the eastern portion of the site on the existing embankments and cut slopes although there is intermittent tree planting throughout its entire length. A preliminary tree survey for the route alignment was undertaken by the consultants and a total of approximately 1763 trees composed of 91 species were identified. Figure 9.3 shows the location of the existing trees while Appendix I1 contains the tree survey schedule. A detailed tree survey and tree removal application will be prepared and submitted for approval by the relevant government departments in accordance with ETWB TCW No. 3/2006, 'Tree Preservation' during the detailed design phase of the project. This more detailed information will be used to identify further opportunities for the modification of the scheme proposals and preserve additional trees.
- 9.74 The dominant species identified in the tree survey include *Melaleuca quinquenervia*, *Celtis sinensis*, *Macaranga tanarius*, *Acacia confusa*, *Bauhinia variegata*, *Ficus microcarpa*, *Casuarina equisetifolia* and *Hibiscus tiliaceus*. Except for *Macaranga tanarius* which is a common native tree species spontaneously colonizing disturbed habitats, the other dominant tree species are extensively planted locally. Approximately 188 large *Melaleuca quinquenervia*, located within the Study Area, were planted alongside the road to create an avenue effect similar to a number of rural roads within the New Territories. These trees are relatively large and make significant contribution to the landscape of the road corridor.
- 9.75 Being located close to the edge of the carriageway of Lam Kam Road and Kam Tin Road, the majority of the surveyed trees are frequently disturbed by road traffic (e.g. mechanical damage from the passage of large vehicles). Of the total 1763 numbers of trees assessed on site, 814 numbers (or 46.2%) trees were found to have a relatively poor physical form, including 337 numbers of trees that were found to have a poor health condition. In addition 33 numbers of trees were found to be dead.
- 9.76 Some 91 tree species were recorded during the preliminary tree survey, 50 species are exotic / introduced species (including 11 fruit tree species) which were previously planted at the site. The remaining 41 species are native, among which *Celtis sinensis* (190 nos. / 10.8%), *Macaranga tanarius* (76 nos. / 4.3%), *Ficus hispida* (39nos. / 2.3%), *Ficus microcarpa* (38 nos. / 2.2%), *Litsea glutinosa* (30nos. / 1.7%) and *Bridelia tomentosa* (13nos. / 0.8%) being the most dominant at the site. All these native tree species typically spontaneously colonize disturbed or human modified habitats such as roadside or wasteland, although *Celtis sinensis* and *Ficus microcarpa* are also widely planted along roadsides locally.
- 9.77 Although no trees which meet the criteria for an Old and Valuable Tree or Important Trees as defined by ETWB TCW No. 29/2004 and ETWB TCW No. 3/2006 or rare or protected tree species were recorded during the survey the Study Area does contain a number of relatively large roadside trees which will be preserved wherever possible. The proposals have been designed to avoid the location of these trees where practicable. As described in section 9.35 above the Option B Alternative Alignment was designed to avoid a number of significant trees and tree groups. The adoption of this option would allow the

preservation of an additional 46 number of trees. These proposals will be further refined during the detailed design stage of the project to explore further opportunities for tree retention.

Tree Retention

- 9.78 The tree survey report preliminarily identifies that out of the total 1763 nos. trees, 1286 nos. are to be retained at their original location. These retained trees include approximately 107 numbers of the large *Melaleuca quinquenervia* planted in the past to create an avenue effect.

Tree Transplantation Proposals

- 9.79 Where trees cannot be retained in-situ, the general presumption is to conduct transplanting where this is justified. The feasibility and need for transplanting is determined on a case-by-case basis according to key factors such as species, access, tree health and amenity value. Therefore it is recommended that some 6 trees are transplanted to new locations within the road corridor.

Tree Felling Proposals

- 9.80 The remaining 431 nos. trees are in conflict with the road upgrading proposals, will not make good candidates for transplantation and so are recommended for felling. In addition a further 33 dead trees will be removed for public safety and arboricultural reasons.

Tree Survey Summary

- 9.81 Table 9.6 summarizes the findings of the preliminary tree survey and the proposed treatment of the existing trees.

Table 9.6 Summary of Tree Recommendations

Recommended Treatment	Tree Numbers
Tree Retention (Including 30 nos. of retained trees requiring pruning)	1286
Tree Transplantation	6
Tree Felling	431
Total	1723

Note: It is also recommended that the 33 dead trees and 7 nos. Leucaena leucocephala identified during the survey be removed.

9.82 The preservation of existing trees particularly the large *Melaleuca quinquenervia* which were planted to create an avenue effect and the trees with a trunk diameter of larger than 500mm was an important consideration in the design of the scheme proposals. These scheme proposals were further reviewed during the development of Option B to identify opportunities for further tree preservation. Table 9.7 below provides a summary of the potential tree impacts under Options A and B, and the potential impacts on the large trees.

Table 9.7 Summary of Tree Recommendations for Options A and B

Recommended Treatment	Tree Numbers	
	Option A	Option B
Tree Retention		
Overall tree retention	1240	1286
<i>Melaleuca quinquenervia</i>	294	335
Trees with a trunk diameter of larger than 500mm	203	224
Trees requiring pruning	30	30
Tree Transplantation	29	6
Tree Felling	454	431
(i) Nos. of <i>Melaleuca quinquenervia</i> to be felled.	184	152
(ii) Nos. of trees with a trunk diameter of larger than 500mm to be felled.	92	81
Total	1723	1723

Note: It is also recommended that the 33 dead trees and 7 nos. *Leucaena leucocephala* identified during the survey be removed.

9.83 Based on the summary above it is apparent that the careful design of the scheme proposals will allow the preservation of the majority of the existing trees particularly those which have importance to the landscape character and visual amenity of the road corridor. However it should be noted that upgrading of the road including the widening of the carriageway can only adopt a parallel alignment to the tree lined existing road and so even with a combination of parallel or asymmetrical widening there is likely to be some impact on the existing trees. However the proposals have sought to minimise this potential impact wherever possible while also responding to concerns for road safety and engineering feasibility. The proposed treatment of the existing trees will be subject to the tree removal application which will be submitted to Lands Department for approval in the detailed design stage in accordance with ETWB TCW No. 03/2006 'Tree Preservation'.

Existing Visual Context

Visual Envelope

- 9.84 The Visual Envelope (VE), the area from which the proposed road widening works would be visible is largely limited by the existing vegetation and development lining the road corridor which limits views within the floor of the river valley. Therefore the majority of the engineering structures will only be visible to the village houses immediately adjacent to the road alignment and to vehicle travellers on Kam Tin and Lam Kam Road. As a result the extent of the visual envelope is confined to an area in relatively close proximity to the proposed road alignment. However longer distance, elevated views are available of the valley floor and the road alignment from the surrounding upland areas associated with the Lam Tsuen Country Park however the road corridor forms a small component of these views. The extent of the visual envelope and the locations of the identified VSRs are indicated on Figures 9.6A to C and Figure 9.7 provides an indication of the visual context.

Visual Sensitive Receivers

- 9.85 VSRs identified within the Zones of Visual Influence (ZVIs) are grouped according to village settlements, housing developments, vehicle travellers and pedestrians and occupational receivers whom have a view of the proposed road widening works. The selected VSRs are representative of the views available to people at each location and include the following:

- VSR1: Residents of Kiu Tau Tsuen;
- VSR2: Vehicle Travellers on Kam Tin Road to the north of Shek Kong Barracks (eastbound);
- VSR3: Pedestrians on Lam Kam Road to the north of Shek Kong Barracks;
- VSR4: Residents of Pang Ka Tsuen;
- VSR5: Kam Tin Clinic;
- VSR6: Residents of Shek Kong San Tsuen;
- VSR7: Residents of Seasons Villas;
- VSR8: An education centre within Shek Kong Barracks;
- VSR9: Residents of Leung Uk Tsuen;
- VSR10: Pat Heung Police Station;
- VSR11: Residents of Wang Toi Shan Yau Uk Tsuen;
- VSR12: Residents of Wang Toi Shan Lo Uk Tsuen;
- VSR13: Residents of Wang Toi Shan San Tsuen;
- VSR14: Vehicle Travellers on Kam Tin Road to the south of Wang Toi Shan Ho Lik Pui (eastbound);
- VSR15: Pedestrians on Kam Tin Road to the north of Shek Kong;
- VSR16: Residents of Wang Toi Shan Ho Lik Pui;
- VSR17: Home for aged named Evergreen International (HK) Association;
- VSR18: Residents of Pine Hill Villa;
- VSR19: Residents of Cheung Uk Tsuen;
- VSR20: Residents of Sheung Tsuen San Tsuen;
- VSR21: Sheung Uk Park;
- VSR22: Residents of Wong Chuk Yuen;
- VSR22A: Lam Kam Road near Wong Chuk Yuen (East Bound);

- VSR23: Residents of Shek Kong Village;
VSR24: Residents of Lui Kung Tin;
VSR25: Visitors to Kadoorie Farm;
VSR26: Trail Walkers in Lam Tsuen Country Park;
VSR27: Vehicle Travellers on Lam Kam Road to the south of Wong Chuk Yuen (East Bound);
VSR28A: Vehicle Travellers on Lam Kam Road (West Bound);
VSR28B: Vehicle Travellers on Lam Kam Road (East Bound);
VSR28C: Vehicle Travellers on Lam Kam Road (East Bound);
VSR29: Vehicle Travellers on Kam Tin Road to the south of Seasons Villas (East Bound);
VSR30: Pedestrians on Kam Tin Road to the south of Wong Chuk Yuen; and
VSR31: Residents of western Leung Uk Tsuen.

9.86 Figures 9.6A to C show the location of the VSRs and Figures 9.7A to B demonstrate the existing visual context. The identified VSRs and the sensitivity of their views towards the proposed scheme are briefly described below.

VSR 1: Residents of Kiu Tau Tsuen, VSR 4: VSR4: Residents of Pang Ka Tsuen and VSR 6: Residents of Shek Kong San Tsuen

9.87 These VSRs have partial and glimpsed views of the proposals due to the extent of the roadside vegetation, roadside structures and vegetation within and adjacent to the village settlements. Views are largely restricted to the houses on the periphery of the settlements due to the low lying nature of the landscape context and the density of the existing development. Despite the restricted nature of available views of the road the sensitivity of these VSRs is high.

VSR 2: Vehicle Travellers on Kam Tin Road to the north of Shek Kong Barracks (eastbound) and VSR3: Pedestrians on Lam Kam Road to the north of Shek Kong Barracks

9.88 These VSRs have open views along the visible section of the existing road corridor. The view is characterised by the existing road and its associated structures, and provides occasional views for a relatively few people. Therefore given the nature of this view it will have a low sensitivity to further change.

VSR 5: Kam Tin Clinic and VSR8: An education centre within Shek Kong Barracks

9.89 These VSRs have similar glimpsed views of the road corridor due to the existing roadside vegetation, the vegetation within the individual sites and the wall / fencing along the boundary of each of the sites. However VSR 5 has a relatively low sensitivity to change and VSR 8 a medium sensitivity to change due in part to the different number of people potentially viewing the proposals from each location.

VSR 7: Residents of Seasons Villas

9.90 The views for residents to the east of the development are screened while residents to the west have partial views of the road corridor. These views are

also partially blocked by the intervening vegetation and structures. Despite the extent of the available view this VSRs have a high sensitivity to further change as they are residential.

VSR 9: Residents of Leung Uk Tsuen, VSR10: Pat Heung Police Station, VSR11: Residents of Wang Toi Shan Yau Uk Tsuen, VSR12: Residents of Wang Toi Shan Lo Uk Tsuen, VSR 13: Residents of Wang Toi Shan San Tsuen, VSR16: Residents of Wang Toi Shan Ho Lik Pui and VSR17: Home for aged named Evergreen International (HK) Association

- 9.91 The extent and the nature of the views available to these VSRs are largely similar (except for VSR 16 which has partial views) with all views being glimpsed. This is due to the screening effect of a combination of roadside vegetation and vegetation adjacent each of the VSRs and intervening structures such as boundary walls. The quality of the existing views range from fair to poor and are generally available to an intermediate number of people with the exception of VSR 16 which has a larger number of VSRs. Views of the road corridor are largely restricted to buildings on the edge of settlements adjacent to the road. Therefore despite the similarity in the character of the views the residential VSRs have a high sensitivity to change due to the frequency of views whereas VSR 10 and VSR 17 (both Occupational VSRs) have a sensitivity of low and medium respectively.

VSR 14: Vehicle Travellers on Kam Tin Road to the south of Wang Toi Shan Ho Lik Pui (eastbound) and VSR15: Pedestrians on Kam Tin Road to the north of Shek Wong

- 9.92 These VSRs have open views along the visible section of the existing road corridor, a view which is characterised by the existing road and its associated structures, and provides occasional views for a relatively few people. Therefore given the nature of this view it will have a low sensitivity to further change.

VSR 18: Residents of Pine Hill Villa, VSR19: Residents of Cheung Uk Tsuen and VSR20: Residents of Sheung Tsuen San Tsuen

- 9.93 The extent and the nature of the views available to these VSRs are largely similar ranging from partial to glimpsed views. This is due the screening effect of a combination of roadside vegetation, the vegetation adjacent to each of the VSRs and intervening structures such as boundary walls. The quality of the existing views range from fair to poor and are generally available to an intermediate to large number of people. Views of the road corridor are largely restricted to buildings on the edge of settlements adjacent to the road. Therefore despite the restricted nature of the available views the sensitivity of these VSRs to further change is assessed as high due to their being residential and the frequency of views.

VSR 21: Sheung Uk Park

- 9.94 The recreational users of the park will have partial views of the proposals due to the screening effect of the boundary wall and the vegetation at the edge of the park. Therefore the sensitivity of the views available to these VSRs will be

medium due to a combination of the relative number of people who use the park, the frequency of their views and the screening effect of the intervening obstacles.

VSR 22: Residents of Wong Chuk Yuen, VSR23: Residents of Shek Kong Village and VSR24: Residents of Lui Kung Tin

- 9.95 The extent and the nature of the views available to these VSRs are largely similar with glimpsed views of the existing road corridor. This is largely due to the screening effect of a combination of roadside vegetation, the vegetation adjacent to each of the VSRs and intervening structures such as boundary walls. The quality of the existing views range from fair to poor and are generally available to a relatively large number of people. Views of the road corridor are largely restricted to buildings on the edge of settlements adjacent to the road. Therefore despite the restricted availability of views the sensitivity of these VSRs to further change is assessed as high due to their residential nature and the frequency of views.

VSR 25: Visitors to Kadoorie Farm and VSR 26: Trail Walkers in Lam Tsuen Country Park

- 9.96 Views of the proposals available to visitors to Kadoorie Farm would be largely screened by the existing topography and vegetation both within the Farm site and along the roadsides. The restricted nature of the view is largely due to combination of the screening effect of the existing topography, roadside vegetation and the proximity of the village development to the road alignment. Therefore given the restricted nature of the existing view and the extent of the visible works the sensitivity of the views available to VSR 25 are considered to be medium. Despite the greater viewing distance and more panoramic nature of the view the sensitivity of VSR 26 also considered to be medium.

VSR22A: Lam Kam Road near Wong Chuk Yuen (East Bound), VSR 27: Vehicle Travellers on Lam Kam Road (East Bound), VSR 28A,: Vehicle travellers on Lam Kam Road (West Bound), VSR28B: Vehicle travellers on Lam Kam Road (East Bound), VSR28C: Vehicle travellers on Lam Kam Road (East Bound); VSR29: Vehicle Travellers on Kam Tin Road to the south of Seasons Villas and VSR30: Pedestrians on Kam Tin Road to the south of Wong Chuk Yuen

- 9.97 These VSRs have open views along the visible section of the existing road corridor, a view which is characterised by the existing road and its associated structures, and is provides occasional views for a relatively few people. At the eastern end of the road alignment there is a greater prevalence of roadside slope features due to the more undulating nature of the existing topography. In some locations these features dominate existing views for vehicle travellers and pedestrians. Therefore given the nature of this view it will have a low sensitivity to further change.

VSR 31: Residents of Western Leung Uk Tsuen

- 9.98 The residents on the western side of this village settlement enjoy oblique framed views north towards the existing bridge crossing the tributary of the Kam Tin River. Views are framed to the east and west by existing vegetation which screens views of the road corridor on either side of the bridge. The views are available to an intermediate number of people however due to the frequency of views and the residential nature of this VSR the sensitivity to change is assessed as high.
- 9.99 Table 9.8 below determines the sensitivity of selected VSRs within the VE their ability to accommodate change.

Table 9.8 Visual Sensitive Receivers (VSRs) and their Sensitivity to Change

ID. No.	Key Visually Sensitive Receivers (VSRs) / Viewing Distance	Type of VSRs	Population of Viewers (Large / Intermediate / Few / Very Few)	Quality of Existing View (Good / Fair / Poor)	Direction of Main Views / Availability of Alternative Views (Yes/ No)	Amenity of Alternative Views (Good / Fair / Poor)	Degree of Visibility (Full / Partial / Glimpsed)	Frequency of View (Very Frequent/ Frequent/ Occasional / Rare)	Sensitivity to Change (Low / Medium / High)
VSR 1	Residents of Kiu Tau Tsuen / 105m	Residential	Intermediate	Poor	East / Yes	Poor	Partial	Frequent	High
VSR 2	Vehicle Travellers on Kam Tin Road to the north of Shek Kong Barracks (east bound) / 0m	Vehicle Travellers	Intermediate	Fair	East / No	N/A	Full	Occasional	Low
VSR 3	Pedestrians on Kam Tin Road to the north of Shek Kong Barracks / 0m	Pedestrians	Few	Fair	East and West / No	N/A	Full	Occasional	Low
VSR 4	Residents of Pang Ka Tsuen / 75m	Residential	Intermediate	Fair	South / Yes	Fair	Glimpsed	Frequent	High
VSR 5	Kam Tin Clinic / 30m	Occupational	Few	Fair	North / Yes	Fair	Glimpsed	Occasional	Low
VSR 6	Residents of Shek Kong San Tsuen / 70m	Residential	Intermediate	Poor	South / Yes	Fair	Glimpsed	Frequent	High
VSR 7	Residents of Seasons Villas / 125m	Residential	Intermediate	Poor	South / Yes	Fair	Partial	Frequent	High
VSR 8	An education centre within Shek Kong Barracks / 65m	Occupational	Few	Fair	North / Yes	Fair	Glimpsed	Frequent	Medium
VSR 9	Residents of Leung Uk Tsuen / 55m	Residential	Intermediate	Poor	North / Yes	Poor	Glimpsed	Frequent	High
VSR 10	Pat Heung Police Station / 40m	Occupational	Few	Fair	South / Yes	Fair	Glimpsed	Occasional	Low
VSR 11	Residents of Wang Toi Shan Yau Uk Tsuen / 80m	Residential	Intermediate	Poor	South / Yes	Poor	Glimpsed	Frequent	High
VSR 12	Residents of Wang Toi Shan Lo Uk Tsuen / 45m	Residential	Intermediate	Poor	South / Yes	Poor	Glimpsed	Frequent	High
VSR 13	Residents of Wang Toi Shan San Tsuen / 60m	Residential	Intermediate	Poor	South / Yes	Poor	Glimpsed	Frequent	High

ID. No.	Key Visually Sensitive Receivers (VSRs) / Viewing Distance	Type of VSRS	Population of Viewers (Large / Intermediate / Few / Very Few)	Quality of Existing View (Good / Fair / Poor)	Direction of Main Views / Availability of Alternative Views (Yes/ No)	Amenity of Alternative Views (Good / Fair / Poor)	Degree of Visibility (Full / Partial / Glimpsed)	Frequency of View (Very Frequent/ Frequent/ Occasional / Rare)	Sensitivity to Change (Low / Medium / High)
VSR 14	Vehicle Travellers on Kam Tin Road to the south of Wang Toi Shan Ho Lik Pui (East Bound) / 0m	Vehicle Travellers	Intermediate	Fair	East / No	N/A	Full	Occasional	Low
VSR 15	Pedestrians on Kam Tin Road to the north of Shek Kong / 0m	Vehicle Travellers	Intermediate	Fair	East / No	N/A	Full	Occasional	Low
VSR 16	Residents of Wang Toi Shan Ho Lik Pui / 60m	Residential	Large	Poor	South / Yes	Fair	Partial	Frequent	High
VSR 17	Home for aged named Evergreen International (HK) Association / 55m	Residential	Intermediate	Fair	North / Yes	Fair	Glimpsed	Frequent	Medium
VSR 18	Residents of Pine Hill Villa / 85m	Residential	Intermediate	Fair	South and West / Yes	Fair	Glimpsed	Frequent	High
VSR 19	Residents of Cheung Uk Tsuen / 150m	Residential	Large	Poor	East / Yes	Fair	Partial	Frequent	High
VSR 20	Residents of Sheung Tsuen San Tsuen / 55m	Residential	Large	Poor	East and West / Yes	Poor	Partial	Frequent	High
VSR 21	Sheung Uk Park / 25m	Recreational Users	Few	Fair	East / Yes	Fair	Partial	Frequent	Medium
VSR 22	Residents of Wong Chuk Yuen / 75m	Residential	Large	Fair	South and West / Yes	Fair	Glimpsed	Frequent	High
VSR 22A	Lam Kam Road near Wong Chuk Yuen (East Bound) / 0m	Vehicle Travellers	Large	Good	West / No	N/A	Full	Occasional	Low
VSR 23	Residents of Shek Kong Village / 185m	Residential	Large	Poor	North / Yes	Poor	Glimpsed	Frequent	High
VSR 24	Residents of Lui Kung Tin / 50m	Residential	Large	Poor	North / Yes	Poor	Glimpsed	Frequent	High
VSR 25	Visitors to Kadoore Farm / 60m	Trail Walkers	Few	Fair	North / Yes	Fair	Partial	Occasional	Medium
VSR 26	Trail Walkers in Lam Tsuen Country Park	Trail Walkers	Few	Fair	South and West / Yes	Fair	Partial	Occasional	Medium

ID. No.	Key Visually Sensitive Receivers (VSRs) / Viewing Distance	Type of VSRs	Population of Viewers (Large / Intermediate / Few / Very Few)	Quality of Existing View (Good / Fair / Poor)	Direction of Main Views / Availability of Alternative Views (Yes/ No)	Amenity of Alternative Views (Good / Fair / Poor)	Degree of Visibility (Full / Partial / Glimpsed)	Frequency of View (Very Frequent/ Frequent/ Occasional / Rare)	Sensitivity to Change (Low / Medium / High)
	/ 360m								
VSR 27	Vehicle Travellers on Lam Kam Road to the south of Wong Chuk Yuen (East Bound) / 0m	Vehicle Travellers	Intermediate	Fair	East / No	N/A	Full	Occasional	Low
VSR 28A	Vehicle Travellers on Lam Kam Road (West Bound) / 0m	Vehicle Travellers	Intermediate	Fair	West / No	N/A	Full	Occasional	Low
VSR 28B	Vehicle Travellers on Lam Kam Road (East Bound) / 0m	Vehicle Travellers	Intermediate	Fair	West / No	N/A	Full	Occasional	Low
VSR 28C	Vehicle Travellers on Lam Kam Road (East Bound) / 0m	Vehicle Travellers	Intermediate	Fair	West / No	N/A	Full	Occasional	Low
VSR 29	Vehicle Travellers on Kam Tin Road to the South of Seasons Villas / 0m	Vehicle Travellers	Intermediate	Poor	East and West / No	N/A	Full	Occasional	Low
VSR 30	Pedestrians on Kam Tin Road to the south of Wong Chuk Yuen / 0m	Pedestrians	Intermediate	Poor	East and West / No	N/A	Full	Occasional	Low
VSR 31	Residents of Western Leung Uk Tsuen / 40m	Residential	Few	Fair	North and West / Yes	Fair	Partial	Frequent	High

Landscape Impact Assessment

Sources of Landscape Impacts

9.100 The main landscape impacts will be limited to the road corridor and will involve the loss of existing trees and amenity areas with the proposed road widening impacting on the existing roadside verges, the creation of new cut slopes and retaining structures (based on existing structures), and the construction of highway structures including the widening of the existing bridge.

Construction Phase

9.101 During the construction phase, works will be limited to the area within the works boundary adjacent to the existing carriageway. The proposed scheme will involve the re-grading of the existing road embankment and cut slopes, and widening of the road footprint. Many of the potential impacts will arise from the loss of landscape resources and the temporary degradation of the existing landscape character caused by the construction work activities e.g. limited loss of existing trees, exposure of earthworks, re-grading of existing slopes, construction of new carriageway or widening of the exiting carriageway, construction of new pedestrian footpaths and the widening of the bridge over the tributary to the Kam Tin River to the south of Pat Heung. The areas surrounding the existing road corridor will be also disturbed due to the temporary works areas and contractor's compounds.

9.102 For the widened section of the proposed scheme there will inevitably be a loss of existing roadside vegetation. Although the road corridor is one characterised by the existing carriageway and its associated structures the loss of roadside planting will be a significant impact as it currently provides an important landscape and visual buffer between the road and adjacent areas. Based on the current preliminary recommendations some 1286 trees would be retained in-situ, 6 transplanted to new locations within the road corridor and 431 felled. However it should be noted that these recommendations are preliminary in nature and further opportunities for tree preservation will be explored during the detailed design stage of the project.

Operational Phase

9.103 The main impacts during the operational phase will be limited to the introduction of the new retaining structures largely located in the central and eastern portions of the road alignment. However the proposals have sought to minimise potential impacts through the careful design of the newly formed slopes and retaining walls, the preservation of existing trees, and the planting of new trees and shrubs.

9.104 Table 9.9 and 9.10 describe the magnitude of change for the Landscape Resources and Landscape Character Areas whereas Tables 9.11 and 9.12 describe the impact significance during the construction and operational stages of the project.

Table 9.9 Magnitude of Change for Landscape Resources

ID. No.	Landscape Resources / Area Affected by the Proposal (m ²)	Description of Impacts	Scale of the Development relative to Baseline Conditions (Nil / Small / Medium / Large)	Compatibility of the Project with Landscape Resource (Nil / Low / Medium / High)	Duration of Impacts (Nil / Short / Medium / Long)	Reversibility of Change (Yes / No / Not Applicable)	Magnitude of Change (Large/ Intermediate/ Small/ Negligible)	
							Construction	Operational
LR 1	Major Road / 85,142m ² (74.1%)	Construction work will undertake on existing major road which involve excavation, slope works	Large	High	Construction stage- Medium (4.5 years) Operation stage - Long	No	Large	Intermediate
LR2	Agricultural Field / 429m ² (0.05%)	Limited loss of existing resource due to the widening of the carriageway and pedestrian footpaths	Small	Low	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small
LR3	Road Side Plantation / 49,679m ² (62.4%)	Tree will be affected will be felled and transplanted due to conflict with the construction works.	Medium	Low	Construction stage- Medium (4.5 years) Operation stage - Long	Yes	Large	Medium
LR4	Village Settlement / 2,401m ² (0.18%)	Limited loss of existing resource due to the widening of the carriageway and pedestrian footpaths	Small	Low	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small
LR5	Hillside with Mixed Woodland / 601m ² (0.05%)	Limited loss of existing resource due to the widening of the carriageway and pedestrian footpaths	Small	Low	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small
LR6	Developed Rural Land / 4,158m ² (0.2%)	Limited loss of existing resource due to the widening of the carriageway and pedestrian footpaths	Small	Low	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small
LR7	Grassland / Shrubland Mosaic / 1,471m ² (0.44%)	Limited loss of existing resource due to the widening of the carriageway and pedestrian footpaths	Small	Low	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small

ID. No.	Landscape Resources / Area Affected by the Proposal (m ²)	Description of Impacts	Scale of the Development relative to Baseline Conditions (Nil / Small / Medium / Large)	Compatibility of the Project with Landscape Resource (Nil / Low / Medium / High)	Duration of Impacts (Nil / Short / Medium / Long)	Reversibility of Change (Yes / No / Not Applicable)	Magnitude of Change (Large/ Intermediate/ Small/ Negligible)	
							Construction	Operational
LR8	Modified Watercourse / 274m ² (0.13%)	Limited loss of existing resource due to the widening of the carriageway and pedestrian footpaths	Small	Low	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small
LR9	Open Spaces and Sports Fields / 0m ² (0%)	No direct impact	Nil	Nil	No direct impacts	Not Applicable	Negligible	Negligible

Table 9.10 Magnitude of Change for Landscape Character Areas

ID. No.	Landscape Character Areas / Area Affected by the Proposal (m ²)	Description of Impacts	Scale of the Development relative to Baseline Conditions (Nil / Small / Medium / Large)	Compatibility of the Project with Landscape Character Area (Nil / Low / Medium / High)	Duration of Impacts (Nil / Short / Medium / Long)	Reversibility of Change (Yes / No / Not Applicable)	Magnitude of Change (Large/ Intermediate/ Small/ Negligible)	
							Construction	Operational
LCA1	Tsat Sing Kong Lowland Rural Landscape / 0m ² (0%)	No direct impact	Small	Low	No direct impacts	No	Negligible	Negligible
LCA2	Pang Ka Tsuen Lowland Rural and Low-rise Residential Landscape / 959m ² (0.36%)	No direct impact although adjacent to the proposed upgraded road. The periphery of the residential area may be affected by the excavation and slope works	Small	Medium	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Negligible
LCA3	Kam Tin Lowland Rural Landscape / 0m ² (0%)	No direct impact although adjacent to the proposed upgraded road. The periphery of the residential area may affect by the excavation and slope works	Small	Medium	No direct impacts	No	Negligible	Negligible
LCA4	Shek Kong Barracks Landscape (Shek Kong) / 1,069m ² (0.14%)	Adjacent to the proposed upgraded road. The periphery of the LCA will be affected by the widening works.	Small	Medium	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small
LCA5	Wang Toi Shan Village Landscape / 2,158m ² (1.66%)	Adjacent to the proposed upgraded road. The periphery of the residential area may be affected by widening works	Small	Medium	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small
LCA6	Kam Tin Modified Water Course Landscape / 460m ² (0.35%)	Adjacent to the proposed upgraded road. The periphery of the LCA will be affected by the widening works.	Small	Low	No direct impacts	No	Small	Small
LCA7	Shek Kong Lowland Rural Landscape / 525m ²	Adjacent to the proposed upgraded road. The periphery of	Small	Medium	Construction stage- Medium (4.5 years) Operation stage -	Yes	Small	Small

ID. No.	Landscape Character Areas / Area Affected by the Proposal (m ²)	Description of Impacts	Scale of the Development relative to Baseline Conditions (Nil / Small / Medium / Large)	Compatibility of the Project with Landscape Character Area (Nil / Low / Medium / High)	Duration of Impacts (Nil / Short / Medium / Long)	Reversibility of Change (Yes / No / Not Applicable)	Magnitude of Change (Large/ Intermediate/ Small/ Negligible)	
							Construction	Operational
	(0.07%)	the LCA will be affected by the widening works.			Long			
LCA8	Lam Tsuen Country Park Hillside Landscape / 1,5650m ² (1.38%)	Adjacent to the proposed upgraded road. The periphery of the residential area may be affected by the excavation and slope works. Although it should be noted that this will not affect the actual Country Park.	Small	Low	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small
LCA9	Sheung Tsuen Lowland Rural Landscape 0 ² (0%)	Adjacent to the proposed upgraded road. The periphery of the residential area may be affected by the excavation and slope works	Small	Medium	No direct impacts	No	Negligible	Negligible
LCA10	Shek Kong Barracks Landscape (Shek Kong Tsuen) / 807m ² (0.25%)	Adjacent to the proposed upgraded road. The periphery of the barracks may be affected by the excavation and slope works	Small	Medium	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small
LCA11	Kwun Yam Shan Miscellaneous Rural Fringe Landscape / 280m ² (0.09%)	Adjacent to the proposed upgraded road. The periphery of the LCA will be affected by the widening works.	Small	Low	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small
LCA12	Kwun Yam Shan Upland and Hillside Landscape / 1,651m ² (0.22%)	Adjacent to the proposed upgraded road. The periphery of the LCA will be affected by the widening works.	Small	Low	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small
LCA13	Kam Tin Road and Lam Kam Road Corridor / 59,520m ² (91.4%)	Direct impacts on the full length of the road within the Study Area.	Large	High	Construction stage- Medium (4.5 years) Operation stage - Long	No	Large	Intermediate

Table 9.11 Significance of Impacts on Landscape Resources in the Construction and Operational Phases

ID. No.	Landscape Resources	Sensitivity (Nil / Low / Medium / High)	Magnitude of Change (Large/ Intermediate/ Small/ Negligible)		Significance Threshold (Unmitigated) (Negligible, Slight, Moderate and Significant)		Mitigation Measures	Significance Threshold (Mitigated) (Negligible, Slight, Moderate and Significant)	
			Construction	Operational	Construction	Operational		Construction	Operational
LR1	Major Road	Low	Large	Intermediate	Moderate	Moderate	CP1, OP1 and OP2	Moderate	Slight
LR2	Agricultural Field	Low	Small	Small	Slight	Slight	CP1, OP1, OP2, OP4	Slight	Slight
LR3	Road Side Plantation	High	Large	Small	Significant	Moderate	CP1, CP4, CP5, OP1, OP2, OP3 and OP4	Significant	Slight
LR4	Village Settlement	Medium	Small	Small	Moderate	Moderate	CP1, CP2, OP1, OP2 and OP4	Moderate	Slight
LR5	Hillside with Mixed Woodland	High	Small	Small	Moderate	Moderate	CP1, CP2, OP1, OP2 and OP4	Moderate	Slight
LR6	Developed Rural Land	Low	Small	Small	Slight	Slight	CP1, CP5, OP1, OP2 OP3 and OP4	Slight	Negligible
LR7	Grassland / Shrubland Mosaic	Medium	Small	Small	Slight	Slight	CP1, OP1, OP2 and OP4	Slight	Negligible
LR8	Modified Watercourse	Medium	Small	Small	Slight	Slight	CP1, OP1, OP2 and OP4	Slight	Negligible
LR9	Open Spaces and Sports Fields	High	Negligible	Negligible	Negligible	Negligible	N/A	Negligible	Negligible

Note: Significance threshold assessments adverse unless otherwise stated.

Table 9.12 Significance of Impacts on Landscape Character Areas in the Construction and Operational Phases

ID. No.	Landscape Character Areas	Sensitivity (Nil / Small / Medium / Large)	Magnitude of Change (Large / Intermediate / Small / Negligible)		Significance Threshold (Unmitigated) (Negligible / Slight / Moderate / Significant)		Mitigation Measures	Significance Threshold (Mitigated) (Negligible / Slight / Moderate / Significant)	
			Construction	Operational	Construction	Operational		Construction	Operational
LCA1	Tsat Sing Kong Lowland Rural Landscape	Medium	Negligible	Negligible	Negligible	Negligible	N/A	Negligible	Negligible
LCA2	Pang Ka Tsuen Lowland Rural and Low-rise Residential Landscape	Low	Small	Negligible	Slight	Negligible	CP1, CP2, CP3, OP1, OP2, OP3 and OP4	Slight	Negligible
LCA3	Kam Tin Lowland Rural Landscape	Low	Negligible	Negligible	Negligible	Negligible	N/A	Negligible	Negligible
LCA4	Shek Kong Barracks Landscape (Shek Kong)	Medium	Small	Small	Slight	Slight	CP1, CP2, OP1, OP2, OP3 and OP4	Slight	Slight
LCA5	Wang Toi Shan Village Landscape	Low	Small	Small	Slight	Slight	CP1, OP1 and OP2	Slight	Slight
LCA6	Kam Tin Modified Water Course Landscape	Medium	Small	Small	Slight	Slight	CP1, CP3, CP4, OP1, OP2 and OP4	Slight	Slight
LCA7	Shek Kong Lowland Rural Landscape	Low	Small	Small	Slight	Slight	CP1, OP1 and OP2	Slight	Slight
LCA8	Lam Tsuen Country Park Hillside Landscape	High	Small	Small	Slight	Slight	CP1, OP1 and OP2	Slight	Slight
LCA9	Sheung Tsuen Lowland Rural Landscape	Medium	Small	Small	Slight	Slight	CP1, OP1 and OP2	Slight	Slight
LCA10	Shek Kong Barracks Landscape (Shek Kong Tsuen)	Medium	Small	Small	Slight	Slight	CP1, CP2, OP1, OP2, OP3 and OP4	Slight	Negligible
LCA11	Kwun Yam Shan Miscellaneous Rural Fringe Landscape	Low	Small	Small	Negligible	Negligible	CP1, OP1 and OP2	Negligible	Negligible
LCA12	Kwun Yam Shan Upland and Hillside Landscape	High	Small	Small	Moderate	Moderate	CP1, CP2, OP1, OP2, OP3 and OP4	Moderate	Slight
LCA13	Kam Tin Road and Lam Kam Road Corridor	Medium	Large	Intermediate	Significant	Significant	CP1, OP1 and OP2	Significant	Moderate

Note: Significance thresholds assessment adverse unless otherwise stated.

Visual Impact Assessment

Source of Visual Impact

Construction Phase

- 9.105 Existing views are largely restricted to the road corridor due to the containment of the visual envelope. Views are screened by the adjacent built development, the existing landform, roadside planting and the planting associated with the village settlements and agricultural areas. Given the level of screening and the viewing distances the proposed works will form a minor component within the visual context of the identified VSRs. The potential impacts will be mitigated to an extent due to the containment of the works within the existing footprint, the immediate reinstatement of the works area and the new tree and shrub planting. With the exception of the vehicle travellers and pedestrians on Kam Tin Road and Lam Kam Road it is predicted that there will not be a significant adverse impact on the visual quality or amenity available to the identified VSRs.
- 9.106 There will be low level views towards the works from the adjacent village settlements and residential developments although due to the flat nature of the landscape and the relative density of the development views will largely be limited to the properties on the edge of each settlement. The views from properties within each development will be limited to an extent by the form of the existing houses on the periphery.
- 9.107 The potential impacts during the construction stage will be broadly similar before mitigation and after mitigation, and will range from moderate to slight adverse. This is due to the limited scope of the mitigation of the temporary construction phase impacts for a route alignment of this length. The main mitigation measures will involve the preservation and protection of existing trees, the treatment of the temporary works area and the early implementation where possible of the proposed tree and shrub planting.
- 9.108 The assessment contained in Table 9.14 concludes that for most VSRs the impacts will be limited to a slight to moderate adverse impact on visual amenity. The most significant impacts will be experienced by VSRs on the road including vehicle travellers and pedestrians. With the proposed preservation of existing trees and new tree and shrub planting proposals along the roadside it is thought that many of these impacts can be successfully mitigated by the design year which is normally considered to be approximately 10 to 15 years following the completion of the construction phase of the works.
- 9.109 The recommended landscape mitigation measures and residual impact on these VRSs is further discussed in Table 9.14.

Operational Phase

- 9.110 Through a combination and full implementation of the proposed mitigation measures it is considered that the proposals will not have a significant impact on the existing visual amenity of the road corridor. These measures include the planting of new trees and shrubs within the verge at the edge of the widened carriageway and infill planting on the existing slopes which will undergo

stabilisation measures, and the aesthetic treatment of the proposed retaining structures to minimise their potential visual impact.

9.111 During the operational phase before mitigation the impacts predicted for the construction phase of the project will persist. With the implementation of the proposed mitigation measures during the operational phase the predicted impacts will be alleviated to an extent. The most noticeable difference being apparent at the eastern end of the upgrading proposals where there are a number of engineering works designed to widen the road in areas of cutting and on embankment. Again the predicted impacts during this stage of the operation will range from moderate to slight adverse.

9.112 The identified VSRs and the magnitude of change apparent at each location are briefly described below.

VSR 1: Residents of Kiu Tau Tsuen, VSR 4: Residents of Pang Ka Tsuen and VSR 6: Residents of Shek Kong San Tsuen

9.113 These VSRs have partial and glimpsed views of the proposals due to the extent of the roadside vegetation, roadside structures and vegetation within and adjacent to the village settlements. Therefore only a small part of the upgrading proposals will be visible from these locations and given that the existing views of the carriageway the magnitude of change is considered to be small.

VSR 2: Vehicle Travellers on Kam Tin Road to the north of Shek Kong Barracks (eastbound), VSR3: Pedestrians on Lam Kam Road to the north of Shek Kong Barracks, VSR 14: Vehicle Travellers on Kam Tin Road to the south of Wang Toi Shan Ho Lik Pui (eastbound) and VSR15: Pedestrians on Kam Tin Road to the north of Shek Kong

9.114 These VSRs have open views along the visible section of the existing road corridor, a view which is characterised by the existing road and its associated structures, and is provides occasional views for a relatively few people. Therefore the magnitude of change is generally considered to be intermediate with a small magnitude of change for VSR 14 and 15 due to the less extensive nature of the works in these areas.

VSR 5: Kam Tin Clinic and VSR8: An education centre within Shek Kong Barracks

9.115 These VSRs have similar glimpsed views of the road corridor due to the existing road side vegetation, the vegetation within the individual sites and the walls / fencing along the boundary of each of the sites. Therefore only a small part of the proposals will be visible and given the existing view is of the existing road corridor the magnitude of change is considered to be small.

VSR 7: Residents of Seasons Villas

9.116 The views for residents to the east of the development are largely screened while residents to the west have partial views of the road corridor. These views are partially blocked by the intervening vegetation and structures. However this

VSR has a slightly more extensive view of the road corridor and so the magnitude of change is considered to be intermediate.

VSR 9: Residents of Leung Uk Tsuen, VSR10: Pat Heung Police Station, VSR11: Residents of Wang Toi Shan Yau Uk Tsuen, VSR12: Residents of Wang Toi Shan Lo Uk Tsuen, VSR 13: Residents of Wang Toi Shan San Tsuen, VSR16: Residents of Wang Toi Shan Ho Lik Pui and VSR17: Home for aged named Evergreen International (HK) Association

9.117 The extent and the nature of the views available to these VSRs are largely similar with all views except for VSR 16 (partial) being glimpsed due to the screening effect of existing roadside features. These include a combination of roadside vegetation and vegetation adjacent each of the VSRs and intervening structures such as boundary walls. The limited visual access to the road corridor means that only a small portion of the upgrading proposals will be visible and so the magnitude of change is considered to be small.

VSR 18: Residents of Pine Hill Villa, VSR19: Residents of Cheung Uk Tsuen and VSR20: Residents of Sheung Tsuen San Tsuen

9.118 The extent and the nature of the views available to these VSRs are largely similar ranging from partial to glimpsed views due to the screening effect of existing roadside features. These include a combination of roadside vegetation and vegetation adjacent to each of the VSRs and intervening structures such as boundary walls. The restricted nature of the available views and the nature of the works in this area results in a small magnitude of change.

VSR 21: Sheung Uk Park

9.119 The recreational users of the park will have partial views of the proposals due to the screening effect of the boundary wall and the vegetation at the edge of the park. Therefore given the restricted nature of the available views and the extent of the works the magnitude of change is considered to be small.

VSR 22: Residents of Wong Chuk Yuen, VSR23: Residents of Shek Kong Village and VSR24: Residents of Lui Kung Tin

9.120 The extent and the nature of the views available to these VSRs are largely similar with glimpsed views due to the screening effect of the roadside features. These include the existing roadside vegetation, the vegetation adjacent to each of the VSRs and intervening structures such as boundary walls. Therefore given this restricted visual access and the nature of the works in this area the magnitude of change is considered to be small.

VSR 25: Visitors to Kadoorie Farm and VSR 26: Trail Walkers in Lam Tsuen Country Park

9.121 Views of the proposals available to visitors to Kadoorie Farm would be largely screened by the existing topography and vegetation both within the Farm site and along the roadsides. Trail walkers in these locations enjoy an elevated and

relatively panoramic view above the valley landscape below although views of the existing road corridor are partial. The restricted nature of the view is largely due to combination of the screening effect of the existing topography, roadside vegetation and the proximity of the village development to the road alignment. Therefore given the restricted nature of the existing view and the extent of the visible works the magnitude of change for VSR 25 is considered to be small. Due to the greater viewing distance and more panoramic nature of the view VSR 26 is considered to be negligible.

VSR22A: Lam Kam Road near Wong Chuk Yuen (East Bound), VSR 27: Vehicle Travellers on Lam Kam Road to the south of Wong Chuk Yuen (East Bound), VSR 28A: Vehicle Travellers on Lam Kam Road (West Bound), VSR 28B: Vehicle Travellers on Lam Kam Road (East Bound), VSR 28C: Vehicle Travellers on Lam Kam Road (East Bound), VSR29: Vehicle Travellers on Lam Kan Tin Road to the south of Seasons Villas and VSR30: Pedestrians on Kam Tin Road to the south of Wong Chuk Yuen

9.122 These VSRs have open views along the visible section of the existing road corridor. This view, characterised by the existing road and its associated structures, provides occasional views for a relatively few people. At the eastern end of the road alignment there is a greater prevalence of roadside slope features due to the more undulating nature of the existing topography and the works to these features will have a larger change on the available views. Therefore given the more extensive nature of the works in this area the magnitude of change is considered to be intermediate.

VSR 31: Residents of Western Leung Uk Tsuen

9.123 The residents on the western side of this village settlement enjoy oblique framed views north towards the existing bridge crossing the tributary of the Kam Tin River. Views are framed to the east and west by existing vegetation which screens views of the road corridor on either side of the bridge. The scale of the works required to widen the bridge are relatively more extensive compared to the adjacent carriageway although the proposed works are based on an existing structure and partially screened as described above and so the magnitude of change is considered to be small.

Table 9.13 Magnitude of Change for Visually Sensitive Receivers

ID. No.	Visually Sensitive Receivers / Viewing Distance	Description of Impacts	Scale of the Development relative to Baseline Conditions (Nil / Small / Medium / Large)	Blockage of View (Nil / Small / Medium / Large)	Compatibility of the Project with Surrounding Landscape (Nil / Low / Medium / High)	Duration of Impacts (Nil / Short / Medium / Long)	Reversibility of Change (Yes / No / Not Applicable)	Magnitude of Change (Large / Intermediate / Small / Negligible)	
								Construction	Operational
VSR 1	Residents of Kiu Tau Tsuen / 105m	Impacts remote from location	Small	Small (Small portion of the proposals will be visible through the	High	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small

ID. No.	Visually Sensitive Receivers / Viewing Distance	Description of Impacts	Scale of the Development relative to Baseline Conditions (Nil / Small / Medium / Large)	Blockage of View (Nil / Small / Medium / Large)	Compatibility of the Project with Surrounding Landscape (Nil / Low / Medium / High)	Duration of Impacts (Nil / Short / Medium / Long)	Reversibility of Change (Yes / No / Not Applicable)	Magnitude of Change (Large / Intermediate / Small / Negligible)	
								Construction	Operational
				existing trees and roadside development)					
VS R 2	Vehicle Travellers on Kam Tin Road to the north of Shek Kong Barracks (east bound) / 0m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Medium	Nil (Open views of the proposals along the visible portion of the existing road)	Medium	Construction stage- Medium (4.5 years) Operation stage - Long	No	Intermediate	Intermediate
VS R 3	Pedestrians on Kam Tin Road to the north of Shek Kong Barracks / 0m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Medium	Nil (Open views of the proposals along the visible portion of the existing road)	Medium	Construction stage- Medium (4.5 years) Operation stage - Long	No	Intermediate	Intermediate
VS R 4	Residents of Pang Ka Tsuen / 75m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Small	Small (Small portion of the proposals will be visible through the existing trees and roadside development)	Medium	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small
VS R 5	Kam Tin Clinic / 30m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Small	Small (Small portion of the proposals will be visible through the existing trees and roadside development)	Medium	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small
VS R 6	Residents of Shek Kong San Tsuen / 70m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Small	Small (Small portion of the proposals will be visible through the existing trees and roadside development)	Medium	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small
VS R 7	Residents of Seasons Villas / 125m	Impacts associated with new 7m high gabion wall and loss of existing trees on embankment slope, and widening of the vehicular carriageway and pedestrian footpath.	Large	Small (Small portion of the proposals will be visible through the existing trees and roadside development and the slope feature will replace an existing feature of a similar scale)	Low	Construction stage- Medium (4.5 years) Operation stage - Long	No	Intermediate	Intermediate
VS R 8	An education centre	Impacts limited to at-grade widening of the	Small	Small (Small portion of the	Medium	Construction stage- Medium (4.5 years)	No	Small	Small

ID. No.	Visually Sensitive Receivers / Viewing Distance	Description of Impacts	Scale of the Development relative to Baseline Conditions (Nil / Small / Medium / Large)	Blockage of View (Nil / Small / Medium / Large)	Compatibility of the Project with Surrounding Landscape (Nil / Low / Medium / High)	Duration of Impacts (Nil / Short / Medium / Long)	Reversibility of Change (Yes / No / Not Applicable)	Magnitude of Change (Large / Intermediate / Small / Negligible)	
								Construction	Operational
	within Shek Kong Barracks / 65m	vehicular carriageway and pedestrian footpath.		proposals will be visible through the existing trees and roadside development)		Operation stage - Long			
VS R 9	Residents of Leung Uk Tsuen / 55m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Small	Small (Small portion of the proposals will be visible through the existing trees and roadside development)	Medium	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small
VS R 10	Pat Heung Police Station / 40m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Small	Small (Small portion of the proposals will be visible through the existing trees and roadside development)	Medium	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small
VS R 11	Residents of Wang Toi Shan Yau Uk Tsuen / 80m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Small	Small (Small portion of the proposals will be visible through the existing trees and roadside development)	Medium	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small
VS R 12	Residents of Wang Toi Shan Lo Uk Tsuen / 45m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Small	Small (Small portion of the proposals will be visible through the existing trees and roadside development)	Medium	Construction stage - Medium (4.5 years) Operation stage - Long	No	Small	Small
VS R 13	Residents of Wang Toi Shan San Tsuen / 60m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Small	Small (Small portion of the proposals will be visible through the existing trees and roadside development)	Medium	Construction stage - Medium (4.5 years) Operation stage - Long	No	Small	Small
VS R 14	Vehicle Travellers on Kam Tin Road to the south of Wang Toi Shan Ho Lik Pui (East Bound) / 0m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Small	Nil (Open views of the proposals along the visible portion of the existing road)	Medium	Construction stage- Medium (4.5 years) Operation stage - Long	No	Small	Small
VS R 15	Pedestrians on Kam Tin Road to the north of Shek	Impacts limited to at-grade widening of the vehicular carriageway	Small	Nil (Open views of the proposals along the visible portion of the existing	Medium	Construction stage - Medium (4.5 years) Operation stage - Long	No	Small	Small

ID. No.	Visually Sensitive Receivers / Viewing Distance	Description of Impacts	Scale of the Development relative to Baseline Conditions (Nil / Small / Medium / Large)	Blockage of View (Nil / Small / Medium / Large)	Compatibility of the Project with Surrounding Landscape (Nil / Low / Medium / High)	Duration of Impacts (Nil / Short / Medium / Long)	Reversibility of Change (Yes / No / Not Applicable)	Magnitude of Change (Large / Intermediate / Small / Negligible)	
								Construction	Operational
	Kong / 0m	and pedestrian footpath.		road)					
VS R 16	Residents of Wang Toi Shan Ho Lik Pui / 60m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Small	Small (Small portion of the proposals will be visible through the existing trees and roadside development)	Medium	Construction stage - Medium (4.5 years) Operation stage - Long	No	Small	Small
VS R 17	Home for aged named Evergreen International (HK) Association / 55m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Small	Small (Small portion of the proposals will be visible through the existing trees and roadside development)	Medium	Construction stage - Medium (4.5 years) Operation stage - Long	No	Small	Small
VS R 18	Residents of Pine Hill Villa / 85m	Construction of 1.5m high mass concrete wall and introduction of soil nails into existing slope (15 m long section at 1.5m centres) with limited loss of existing trees (largely screened from development) Widening of the vehicular carriageway and pedestrian footpath.	Medium	Small (Small portion of the proposals will be visible through the existing trees and roadside development and the scale of the slope stabilisation requirements will be similar to the existing situation)	Medium	Construction stage - Medium (4.5 years) Operation stage - Long	No	Small	Small
VS R 19	Residents of Cheung Uk Tsuen / 150m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Small	Small (Small portion of the proposals will be visible through the existing trees and roadside development)	High	Construction stage - Medium (4.5 years) Operation stage - Long	No	Small	Small
VS R 20	Residents of Sheung Tsuen San Tsuen / 55m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Small	Small (Small portion of the proposals will be visible through the existing trees and roadside development)	High	Construction stage - Medium (4.5 years) Operation stage - Long	No	Small	Small
VS R 21	Sheung Uk Park / 25m	Impacts limited to at-grade widening of the vehicular carriageway	Medium	Small (Small portion of the proposals will be visible	Medium	Construction stage - Medium (4.5 years) Operation stage -	No	Small	Small

ID. No.	Visually Sensitive Receivers / Viewing Distance	Description of Impacts	Scale of the Development relative to Baseline Conditions (Nil / Small / Medium / Large)	Blockage of View (Nil / Small / Medium / Large)	Compatibility of the Project with Surrounding Landscape (Nil / Low / Medium / High)	Duration of Impacts (Nil / Short / Medium / Long)	Reversibility of Change (Yes / No / Not Applicable)	Magnitude of Change (Large / Intermediate / Small / Negligible)	
								Construction	Operational
		and pedestrian footpath.		through the existing trees and roadside development)		Long			
VS R 22	Residents of Wong Chuk Yuen / 75m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Small	Small (Small portion of the proposals will be visible through the existing trees and roadside development)	Medium	Construction stage - Medium (4.5 years) Operation stage - Long	No	Small	Small
VS R 22A	Lam Kam Road near Wong Chuk Yuen (East Bound) / 0m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Medium	Nil (Open views of the proposals along the visible portion of the existing road)	Medium	Construction stage - Medium (4.5 years) Operation stage - Long	No	Intermediate	Intermediate
VS R 23	Residents of Shek Kong Village / 185m	Framed and filtered views of extensive engineering works at CHB 43 with intermediate tree loss. Widening of the vehicular carriageway and pedestrian footpath.	Small	Small (Despite the extent of the works in this area only a small portion of the proposals will be visible through the existing trees and roadside development)	Medium	Construction stage - Medium (4.5 years) stage - Long	No	Small	Small
VS R 24	Residents of Lui Kung Tin / 50m	Medium distance views of extensive engineering works at CHB 43 with intermediate tree loss. Widening of the vehicular carriageway and pedestrian footpath	Small	Small (Despite the extent of the works in this area only a small portion of the proposals will be visible through the existing trees and roadside development)	Medium	Construction stage - Medium (4.5 years) Operation stage - Long	No	Small	Small
VS R 25	Visitors to Kadoore Farm / 60m	Medium distance views of extensive engineering works at CHB 52 involving soil nails and rock stabilisation measures with no tree loss. Widening of the vehicular carriageway and pedestrian footpath.	Small	Small (Despite the extent of the works in this area only a small portion of the proposals will be visible due to the viewing angle and the screening effect of the existing trees and roadside development)	Low	Construction stage - Medium (4.5 years) Operation stage - Long	No	Small	Small

ID. No.	Visually Sensitive Receivers / Viewing Distance	Description of Impacts	Scale of the Development relative to Baseline Conditions (Nil / Small / Medium / Large)	Blockage of View (Nil / Small / Medium / Large)	Compatibility of the Project with Surrounding Landscape (Nil / Low / Medium / High)	Duration of Impacts (Nil / Short / Medium / Long)	Reversibility of Change (Yes / No / Not Applicable)	Magnitude of Change (Large / Intermediate / Small / Negligible)	
								Construction	Operational
VS R 26	Trail Walkers in Lam Tsuen Country Park / 360m	Impacts remote from location	Small	Small (The proposals form a small component of the overall view and screened by roadside vegetation and buildings)	High	Construction stage - Medium (4.5 years) Operation stage - Long	No	Negligible	Negligible
VS R 27	Vehicle Travellers on Lam Kam Road to the south of Wong Chuk Yuen (East Bound) / 0m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Medium	Nil (Open views of the proposals along the visible portion of the existing road)	Medium	Construction stage - Medium (4.5 years) Operation stage - Long	No	Intermediate	Intermediate
VS R 28A	Vehicle Travellers on Lam Kam Road (West Bound) / 0m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Medium	Nil (Open views of the proposals along the visible portion of the existing road)	Medium	Construction stage - Medium (4.5 years) Operation stage - Long	No	Intermediate	Intermediate
VS R 28B	Vehicle Travellers on Lam Kam Road (East Bound) / 0m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Medium	Nil (Open views of the proposals along the visible portion of the existing road)	Medium	Construction stage - Medium (4.5 years) Operation stage - Long	No	Intermediate	Intermediate
VS R 28C	Vehicle Travellers on Lam Kam Road (East Bound) / 0m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Medium	Nil (Open views of the proposals along the visible portion of the existing road)	Medium	Construction stage - Medium (4.5 years) Operation stage - Long	No	Intermediate	Intermediate
VS R 29	Vehicle Travellers on Kam Tin Road to the South of Seasons Villas / 0m	Close proximity views of the proposed engineering works including extensive soil nail proposals and sections of retaining wall using mini-piles and L-shaped retaining walls between 1.5 to 2m with minimal tree loss. Widening of	Medium	Nil (Open views of the proposals along the visible portion of the existing road)	Medium	Construction stage - Medium (4.5 years) Operation stage - Long	No	Intermediate	Intermediate

ID. No.	Visually Sensitive Receivers / Viewing Distance	Description of Impacts	Scale of the Development relative to Baseline Conditions (Nil / Small / Medium / Large)	Blockage of View (Nil / Small / Medium / Large)	Compatibility of the Project with Surrounding Landscape (Nil / Low / Medium / High)	Duration of Impacts (Nil / Short / Medium / Long)	Reversibility of Change (Yes / No / Not Applicable)	Magnitude of Change (Large / Intermediate / Small / Negligible)	
								Construction	Operational
		the vehicular carriageway and pedestrian footpath.							
VS R 30	Pedestrians on Kam Tin Road to the south of Wong Chuk Yuen / 0m	Impacts limited to at-grade widening of the vehicular carriageway and pedestrian footpath.	Medium	Nil (Open views of the proposals along the visible portion of the existing road)	Medium	Construction stage - Medium (4.5 years) Operation stage - Long	No	Intermediate	Intermediate
VS R 31	Residents of Western Leung Uk Tsuen / 40m	Impacts limited to widening of existing bridge to accommodate the vehicular carriageway and pedestrian footpath	Small	Small (Despite the extent of the works in this area only a small portion of the proposals will be visible through the existing trees and roadside development)	Medium	Construction stage - Medium (4.5 years) Operation stage - Long	No	Small	Small

Table 9.14 Significance of Impacts on Visually Sensitive Receivers in the Construction and Operational Phases

ID. No.	Visually Sensitive Receivers	Sensitivity (Nil / Small / Medium / Large)	Magnitude of Change (Large / Intermediate / Small / Negligible)		Significance Threshold (Unmitigated) (Negligible / Slight / Moderate / Significant)		Mitigation Measures	Significance Threshold (Mitigated) (Negligible / Slight / Moderate / Significant)		
			Construction	Operational	Construction	Operational		Construction	Operational	
									Day 1	Year 10
VSR 1	Residents of Kiu Tau Tsuen	High	Small	Small	Moderate	Moderate	CP1, OP1 and OP2	Moderate	Moderate	Moderate
VSR 2	Vehicle Travellers on Kam Tin Road to the north of Shek Kong Barracks (east bound)	Low	Intermediate	Intermediate	Moderate	Moderate	CP1	Moderate	Moderate	Moderate
VSR 3	Pedestrians on Kam Tin Road to the north of Shek Kong Barracks	Low	Intermediate	Intermediate	Moderate	Moderate	CP1, OP1 and OP4	Moderate	Moderate	Moderate
VSR 4	Residents of Pang Ka Tsuen (Photomontage Figure 9.13 Q to R)	High	Small	Small	Moderate	Moderate	CP1	Moderate	Moderate	Moderate
VSR 5	Kam Tin Clinic	Low	Small	Small	Slight	Slight	CP1	Slight	Slight	Slight
VSR 6	Residents of Shek Kong San Tsuen	High	Small	Small	Moderate	Moderate	OP1 and OP2	Moderate	Moderate	Moderate
VSR 7	Residents of Seasons Villas (Photomontage Figure 9.13 A to B)	High	Intermediate	Intermediate	Moderate	Moderate	CP1, CP2, OP1, OP2 and OP4	Moderate	Moderate	Moderate
VSR 8	An education centre within Shek Kong Barracks	Medium	Small	Small	Slight	Slight	CP1, OP1, OP2 and OP4	Slight	Slight	Slight
VSR 9	Residents of Leung Uk	High	Small	Small	Moderate	Moderate	CP1, OP1 and OP2	Moderate	Moderate	Moderate

ID. No.	Visually Sensitive Receivers	Sensitivity (Nil / Small / Medium / Large)	Magnitude of Change (Large / Intermediate / Small / Negligible)		Significance Threshold (Unmitigated) (Negligible / Slight / Moderate / Significant)		Mitigation Measures	Significance Threshold (Mitigated) (Negligible / Slight / Moderate / Significant)		
			Construction	Operational	Construction	Operational		Construction	Operational	
									Day 1	Year 10
	Tsuen									
VSR 10	Pat Heung Police Station (Photomontage Figure 9.13 C to D)	Low	Small	Small	Slight	Slight	CP1, OP1 and OP2	Slight	Slight	Slight
VSR 11	Residents of Wang Toi Shan Yau Uk Tsuen	High	Small	Small	Moderate	Moderate	CP1, OP1 and OP2	Moderate	Moderate	Moderate
VSR 12	Residents of Wang Toi Shan Lo Uk Tsuen	High	Small	Small	Moderate	Moderate	CP1 and OP1	Moderate	Moderate	Moderate
VSR 13	Residents of Wang Toi Shan San Tsuen	High	Small	Small	Moderate	Moderate	CP1, OP1 and OP2	Moderate	Moderate	Moderate
VSR 14	Vehicle Travellers on Kam Tin Road to the south of Wang Toi Shan Ho Lik Pui (East Bound) (Photomontage Figure 9.13 E to F)	Low	Small	Small	Slight	Slight	CP1 and OP1	Slight	Slight	Slight
VSR 15	Pedestrians on Kam Tin Road to the north of Shek Kong	Low	Small	Small	Slight	Slight	CP1, OP1, OP2 and OP4	Slight	Slight	Slight
VSR 16	Residents of Wang Toi Shan Ho Lik Pui	High	Small	Small	Moderate	Moderate	CP1 and OP1	Moderate	Moderate	Moderate
VSR 17	Home for aged named Evergreen International (HK)	Medium	Small	Small	Slight	Slight	CP1 and OP1	Slight	Slight	Slight

ID. No.	Visually Sensitive Receivers	Sensitivity (Nil / Small / Medium / Large)	Magnitude of Change (Large / Intermediate / Small / Negligible)		Significance Threshold (Unmitigated) (Negligible / Slight / Moderate / Significant)		Mitigation Measures	Significance Threshold (Mitigated) (Negligible / Slight / Moderate / Significant)		
			Construction	Operational	Construction	Operational		Construction	Operational	
									Day 1	Year 10
	Association									
VSR 18	Residents of Pine Hill Villa	High	Small	Small	Moderate	Moderate	CP1, OP1, OP2 and OP4	Moderate	Moderate	Moderate
VSR 19	Residents of Cheung Uk Tsuen	High	Small	Small	Moderate	Moderate	CP1, OP1 and OP2	Moderate	Moderate	Moderate
VSR 20	Residents of Sheung Tsuen San Tsuen	High	Small	Small	Moderate	Moderate	CP1 and OP1	Moderate	Moderate	Moderate
VSR 21	Sheung Uk Park (Photomontage Figure 9.13G to H)	Medium	Small	Small	Slight	Slight	CP1, CP5, OP1, OP2 and OP3	Slight	Slight	Slight
VSR 22	Residents of Wong Chuk Yuen (Photomontage Figure 9.13 S to T)	High	Small	Small	Moderate	Moderate	CP1, OP1, OP2 and OP4	Moderate	Moderate	Moderate
VSR 22A	Lam Kam Road near Wong Chuk Yuen (East Bound) (Photomontage Figure 9.13 I to J)	Low	Intermediate	Intermediate	Moderate	Moderate	CP1, OP1 and OP2	Moderate	Slight	Slight
VSR 23	Residents of Shek Kong Village	High	Small	Small	Moderate	Moderate	OP1 and OP2	Moderate	Moderate	Moderate
VSR 24	Residents of Lui Kung Tin	High	Small	Small	Moderate	Moderate	CP1, OP1, OP2 and OP4	Moderate	Moderate	Moderate
VSR 25	Visitors to Kadoorie Farm	Medium	Small	Small	Slight	Slight	CP1, OP1, OP2 and OP4	Slight	Slight	Slight
VSR 26	Trail Walkers in Lam Tsuen Country Park	Medium	Negligible	Negligible	Negligible	Negligible	CP1, OP1, OP2 and OP4	Negligible	Negligible	Negligible

ID. No.	Visually Sensitive Receivers	Sensitivity (Nil / Small / Medium / Large)	Magnitude of Change (Large / Intermediate / Small / Negligible)		Significance Threshold (Unmitigated) (Negligible / Slight / Moderate / Significant)		Mitigation Measures	Significance Threshold (Mitigated) (Negligible / Slight / Moderate / Significant)		
			Construction	Operational	Construction	Operational		Construction	Operational	
									Day 1	Year 10
VSR 27	Vehicle Travellers on Lam Kam Road to the south of Wong Chuk Yuen (East Bound)	Low	Intermediate	Intermediate	Moderate	Moderate	CP1, OP1, OP2 and OP4	Moderate	Moderate	Slight
VSR 28 A,	Vehicle Travellers on Lam Kam Road (West Bound) (Photomontage Figure 9.13 K to P)	Low	Intermediate	Intermediate	Moderate	Moderate	CP1, CP2, CP3, OP1, OP2, OP3 and OP4	Moderate	Moderate	Slight
VSR 28 B	Vehicle Travellers on Lam Kam Road (East Bound) (Photomontage Figure 9.13 K to P)	Low	Intermediate	Intermediate	Moderate	Moderate	CP1, CP2, CP3, OP1, OP2, OP3 and OP4	Moderate	Moderate	Slight
VSR 28 C	Vehicle Travellers on Lam Kam Road (East Bound) (Photomontage Figure 9.13 K to P)	Low	Intermediate	Intermediate	Moderate	Moderate	CP1, CP2, CP3, OP1, OP2, OP3 and OP4	Moderate	Moderate	Slight
VSR 29	Vehicle Travellers on Kam Tin Road to the South of Seasons Villas	Low	Intermediate	Intermediate	Moderate	Moderate	CP1, OP1 and OP2	Moderate	Moderate	Slight
VSR 30	Pedestrians on Kam Tin Road	Low	Intermediate	Intermediate	Moderate	Moderate	CP1, OP1, OP2 and OP4	Moderate	Moderate	Slight
VSR 31	Residents of Western Leung	High	Small	Small	Moderate	Moderate	CP1, OP1, OP2 and OP4	Moderate	Moderate	Slight

ID. No.	Visually Sensitive Receivers	Sensitivity (Nil / Small / Medium / Large)	Magnitude of Change (Large / Intermediate / Small / Negligible)		Significance Threshold (Unmitigated) (Negligible / Slight / Moderate / Significant)		Mitigation Measures	Significance Threshold (Mitigated) (Negligible / Slight / Moderate / Significant)		
			Construction	Operational	Construction	Operational		Construction	Operational	
									Day 1	Year 10
	Uk Tsuen (Photomontage Figure 9.13 U to V)									

Cumulative Impacts

9.124 A number of projects are currently in progress or planned within the Study Area, which will result in landscape and visual impact during the degradation of landscape character and visual amenity, and loss of landscape resources. These planned projects are described together with the likely cumulative impacts in table 9.15 below.

Table 9.15 Concurrent Projects and Potential Cumulative Impacts

Interfacing Project	Implementation Programme	Project Status	Description of Project	Potential Cumulative Impacts
WSD “Replacement and Rehabilitation of Water mains Stage 2 – Mains in New Territories West	2007 to 2011 Mid 2009 to 2015	Under planning Under construction	Works site along the remaining sections of Kam Tin Road for watermain connections at isolation locations. Works site between 0+00 and 17+00 for laying of watermain of size ranging from DN180 to DN450.	It is understood that the works involve the water mains below the western section of Kam Tin Road and so there will be some overlap in the proposed works during 2009 and 2010. However based on similar projects it is likely that any cumulative impacts will be limited to the construction phase with the excavation of the road surface and so during the operational phase there are likely to be negligible impacts from this project.
DSD 4235DS “Yuen Long and Kam Tin Sewerage and Sewage Disposal (Package 2A-1T)”	Mid 2009 to 2015	Under planning	Works site between CH0+00 and CH39+70 for laying of sewers of size ranging from DN225 to DN400 and of depth 5m to 7m below ground.	The works involve the laying of sewers at a depth of 5 to 7m below the ground for the length of Kam Tin Road. This project is currently under planning however there will be some overlap in the construction programme with the works due to commence in mid 2009. Based on similar projects the potential impacts are likely to be largely limited to the construction phase of the project with the excavation of the road and as such there are likely to be negligible impacts from this project during the operational phase of the project.
HyD “The Guangzhou-Shenzhen-Hong Kong	End 2009 to 2015	Under planning	Works site between CH12+70 and CH16+00 for construction of	The proposed works will involve the construction of the proposed railway facilities in the central section of Kam Tin Road to the north of Shek Kong

Interfacing Project	Implementation Programme	Project Status	Description of Project	Potential Cumulative Impacts
Express Rail Link (XRL)			railway facilities (stream diversion, box culvert, etc.).	Barracks. It is understood that the main part of the alignment will be in tunnel constructed by Tunnel Boring Machine and drill and blast methods however there will be a cut and cover section containing stabling sidings and emergency rescue station near Shek Kong. It is believed that this portion of the scheme will be located to the east of Shek Kong Barracks and pass below the adjacent section of Kam Tin Road. Exact details of the project are unknown at the time of writing however if the construction programme commences at the end of 2009 there may be some overlap of the construction activities depending on the phasing of the XRL. It is likely that if the projects are concurrent there will be significant cumulative impacts during the construction period although based on current understanding the operational impacts of the XRL will be limited to the above ground structures.
CLP cable laying works	2012 to 2014	Under planning	Works site between CH12+90 and CH28+60 for laying of 132kV cable.	It is understood that the works involve the laying of a 132kV cable below eastern section of Kam Tin Road, however the works will not commence until the completion of the upgrading works for Kam Tin Road and Lam Kam Road and so there will be no cumulative impacts during the construction phase of the two projects. As the cables are being laid underground there will be no operational cumulative impacts.
WSD 9236WF "Mainlaying between Kan Tin Shi and Route Twisk Roundabout"	Not known	Inception Stage – Cat. C Project	Works site between CH0+00 and CH39+70 for laying of watermain.	It is understood that the works involve the laying of a watermain below the western section of Kam Tin Road, however the timing of the works is unknown. If there is an overlap in the programmes any potential cumulative impacts are likely to be limited to the construction phase of the projects. Following the completion of the construction works there will be no cumulative impacts.

9.125 Although the exact details are unknown it is likely that appropriate landscape and visual mitigation measures have been incorporated into the design of each of the approved projects and will be incorporated within the design of the projects currently under planning. It is understood that for the majority of the projects described above the works involve the laying of underground utilities below the surface of Kam Tin Road and so based on similar previous projects the potential cumulative impacts are likely to be limited to the overlap in the construction programmes. Given that these utilities will be underground there is unlikely to be any cumulative impacts during their operational phases. It is envisaged that the works would be relatively minor in nature; hence, the potential concurrent projects would unlikely to contribute to a significant cumulative impact to the Landscape Resources and Landscape Character, and the visual amenity enjoyed by adjacent VSRs.

9.126 One project which could potentially cause significant cumulative impacts is the construction of the proposed Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL) although this is contingent on the phasing of the works. It is likely that the cut and cover method utilised for the construction of the subterranean stabling sidings and emergency rescue station near Shek Kong and any associated construction works areas will cause significant impacts to the central portion of the Study Area during the construction phase. As the project is currently under planning no information is available concerning the exact nature of this component of the XRL, its timing or the mitigation measures to be employed. However based on similar projects it is likely that with the exception of the proposed above ground structures and with the successful restoration of the construction site that the impacts arising from the XRL will be largely limited to the construction phase of the project.

Recommended Mitigation Measures

9.127 The landscape mitigation measures described in this report are at a level which both demonstrates their ability to alleviate the potential landscape and visual impacts identified in the assessment and also to allow the proposals to be carried forward during the detailed design stage. More detailed landscape proposals will be developed during the initial stages of the design and construction phase of this project following the completion of the detailed Tree Survey Report. The measures are designed to address both the construction and operational phases of the project.

9.128 The landscape and visual mitigation measures are described both in a generic sense for measures, which apply to all of the project site and in terms of the proposed landscape strategy for the amenity areas within the project site. The aim of the mitigation measures is to:

- Alleviate where possible those landscape and visual impacts which are unavoidable through the option selection process including the site planning for the widening proposals, construction options for the proposed site formation and geotechnical works, the proposed bridge widening (located on a tributary of the Kam Tin River to the south of Pat Heung) and the provision of bus stops and lay-bys;
- Establish a coherent and integrated landscape framework for the project site drawing together the visually disparate components of the proposed development and integrating the proposals within their rural context; and
- Provide a co-ordinated approach between the ecological and landscape mitigation proposals where there is an interface.

General Mitigation Measures

9.129 In accordance with the EIAO TM, the hierarchy for landscape and visual impact mitigation is first avoidance of impact, then minimisation of impact and finally compensation of impact. As has been described in the project description in this report, the current proposals have been undertaken to fulfil the following objectives:

- Minimisation of potential impacts on landscape resources along the existing road corridor particularly the existing roadside trees;

- Restoration and enhancement of existing roadside landscapes through planting new trees utilising wherever possible native tree species following the completion of the construction phase of the project; and
- Utilisation of innovative greening measures for new site formation and geotechnical works including new cut slopes and retaining walls.

9.130 In accordance with the EIAO TM, mitigation measures for the construction and operational phases of the project have been designed to minimise predicted landscape and visual impacts, and to compensate for lost landscape resources as far as is possible given the project constraints.

Specific Mitigation Measures

9.131 This section describes a series of mitigation measures designed to alleviate impact and where possible compensate for the loss of landscape resources, change of landscape character and visual amenity for VSRs resulting from the construction and operational phases of the project. It is assumed that funding, implementation, management and maintenance of the mitigation proposals can be satisfactorily resolved according to the principles in ETWB TCW No. No. 2/2004 on Maintenance of Vegetation and Hard Landscape Features. Approval-in-principle to the implementation, management and maintenance of the proposed mitigation measures will be sought from the appropriate authorities.

9.132 The proposed planting of trees as part of the mitigation measures and in compensation for the trees affected by the proposed works will utilise species which are native to Hong Kong to enhance the ecological value of the roadside planting and minimise potential maintenance inputs. The final location of the proposed roadside trees will be subject to the detailed design including for example the location of underground utilities, and the requirements for road signage and lighting. The trees will be planted as light standard and standard sized stock for the following reasons:

- Many of the native tree species are only commercially available in small sized stock;
- The proposed planting areas are largely on slopes and so the use of large sized trees are inappropriate for sloping conditions;
- Previous experience has shown that small sized trees adapt to their new growing conditions more quickly than larger sized tree stock and so they have a faster growth rate reaching the size of their larger counterparts in a relatively short time; and
- This adaptability to the new growing conditions also results in a reduced management and maintenance requirement (including continued irrigation) compared to larger sized tree stock.

9.133 Tables 9.16 and 9.17 describe the proposed mitigation measures for the construction and operational stages of the project.

Table 9.16 Proposed Construction Phase Mitigation Measures

Mitigation Code	Mitigation Measure	Funding Agency	Implementation Agency
CP1	<p>Preservation of Existing Vegetation - The proposed works should avoid disturbance to the existing trees as far as practicable within the works areas. Based on the preliminary tree survey some 1286 trees can be preserved in-situ including 107 numbers of the large <i>Melaleuca quinquenervia</i> and approximately 224 numbers of the large trees with a trunk diameter of over 500mm.</p> <p>It is recommended that a full tree survey and tree removal application be undertaken and submitted for approval by the relevant government departments in accordance with ETWB TCW No. 03/2006, 'Tree Preservation' during project detailed design. The application will include details of the compensatory planting proposals and specifications for the protection of existing trees.</p> <p>Trees not in conflict with the proposals will be protected by fencing as appropriate to prevent canopy and root zone damage from excavation works, vehicles and material storage.</p>	HyD	HyD
CP2	<p>Preservation of Existing Topsoil - Topsoil disturbed during the construction phase will be tested using a standard soil testing methodology and where it is found to be worthy of retention stored for re-use. The soil will be stockpiled to a maximum height of 2m and will be either temporarily vegetated with hydroseeded grass during construction or covered with a waterproof covering to prevent erosion. The stockpile should be turned over on a regular basis to avoid acidification and the degradation of the organic material, and reused after completion. Alternatively, if this is not practicable, it should be considered for use elsewhere, including other projects.</p>	HyD	HyD
CP3	<p>Works Area and Temporary Works Areas - The landscape of these works areas should be restored to its original status or new amenity area following the completion of the construction phase. Construction site controls shall be enforced, where possible, to ensure that the landscape and visual impacts arising from the construction phase activities are minimised including the storage of materials, the location and appearance of site accommodation and the careful design of site lighting to prevent light spillage. Screen hoarding will be erected around the temporary works area.</p>	HyD	HyD
CP4	<p>Programme for Mitigation Planting - Replanting of disturbed vegetation should be undertaken at the earliest possible stage during the construction phase of the project to maximise its effect during the operational phase.</p>	HyD	HyD
CP5	<p>Transplantation of Existing Trees – Where existing trees cannot be avoided the potential for transplanting the trees to new locations within the road corridor would be examined. As a result some 6 trees are recommended to be transplanted under the current proposal. The final recipient sites should be, as far as space allows, adjacent to their current locations alongside of the carriageway to retain their contribution</p>	HyD	HyD

Mitigation Code	Mitigation Measure	Funding Agency	Implementation Agency
	to the local landscape context. The exact location of the recipient sites will subject to the findings of the detailed tree survey and felling application undertaken at the detailed design stage and upon to the approval by relevant departments.		

Note: The responsibilities for the funding, implementation, management and maintenance of the mitigation proposals will be resolved according to the principles contained in ETWB TCW No. No. 2/2004 on Maintenance of Vegetation and Hard Landscape Features.

Table 9.16 shall be read in conjunction with Table 10.6

Table 9.17 Proposed Operational Phase Mitigation Measures

Mit. Code	Mitigation Measure	Funding Agency	Implementation Agency	Maintenance/ Management Agency
OP1	<p>Implementation of the road widening proposals will include:</p> <p>Integrated design approach – the alignment and structures associated with the widened road should be integrated, as far as technically feasible, with existing roadside structures and the landscape context to reduce the potential cumulative impact of the proposed works. The location and orientation of the associated structures should where possible avoid landscape and visually sensitive areas such as woodland, shrubland and agricultural fields.</p> <p>Treatment of highway structures - the architectural design should seek to reduce the apparent visual mass of the engineering structures through the use of textured finishes and colour blocking. Earth tones are preferred as these match the existing landscape and visual context.</p>	HyD	HyD	HyD
OP2	<p>Roadside Planting – These planting areas will utilise largely native tree and shrub species either with high canopy and thin foliage to allow visual access in the views from the adjacent landscape to the distant roadside or rural landscape or dense foliage at selected locations to provide shaded environment for pedestrians and the creation, where space allows, of the avenue effect originally created through the planting of an <i>Melaleuca quinquenervia</i>, along the edge of the carriageway.</p> <p>Native tree planting on the existing and proposed cut slopes will improve the ecological connectivity between existing woodland habitats with the advantage of creating a more coherent landscape framework. These areas include the planting of approximately 3,031m² of mass woodland planting. The species selection will include <i>Bischofia trifoliata</i>, <i>Bridelia tomentosa</i>, <i>Castanopsis fissa</i>, <i>Celtis sinensis</i>, <i>Cinnamomum camphora</i>, <i>Cratoxylum cochinchinense</i>, <i>Cyclobalanopsis</i></p>	HyD	HyD	LCSD/HyD

Mit. Code	Mitigation Measure	Funding Agency	Implementation Agency	Maintenance/ Management Agency
	<p><i>myrsinifolia, Ficus hispida, Gordonia axillaris, Litsea glutinosa, Macaranga tanarius, Mallotus paniculatus, Microcos paniculatus, Sapium discolour, Sapium sebiferum and Schima superba.</i></p> <p>Approximately 559 number large specimens of <i>Melaleuca quinquenervia</i> will be utilised within the immediate roadside areas and within the new central median.</p> <p>These species are considered in the planting proposal to create a comprehensive planting framework that could enhance both ecological and landscape value of the context.</p> <p>The extent of the proposed mitigation planting is indicated in Figures 9.12 A to H.</p>			

Mit. Code	Mitigation Measure	Funding Agency	Implementation Agency	Maintenance/ Management Agency
OP3	<p>Compensatory Planting Proposals - the preliminary planting proposals for the proposed works include some 3,031m² of new mass woodland planting and 559 specimen trees utilising a combination of light standard to standard sized stock in general roadside planting areas as shown in Figures 9.12A to H. Trees forming part of the roadside and slope planting will provide amenity and shaded area for the pedestrians using the roadside pavements and utilise species native to Hong Kong. These proposals will be subject to the detailed design stage of the project.</p>	HyD	HyD	LCSD/HyD
OP4	<p>Treatment of Retaining Wall and Slopes – The design and implementation of the aesthetic appearance of the retaining wall and slopes will be undertaken in accordance with GEO Publication No. 1/2000 "Technical Guidelines on Landscape Treatment and Bio-engineering for Man-made Slopes and Retaining Walls", WBTC No. 29/93 on control of Visual Impact of Slopes and WBTC No. 17/2002 on Improvement to the Appearance of Slopes.</p> <p>The engineered structures will be aesthetically enhanced through the use of soft landscape works including tree and shrub planting to give these man-made features a more natural appearance and blending them into the local rural landscape. Light standard sized tree planting will be used on the face of soil cut slopes with a gradient of less than 30 degrees, at the crest and toe of the slope, and within berm planters as has been described in OP2 above. These smaller, younger plants will adapt to their new growing conditions more quickly than larger sized stock and establish a naturalistic effect more rapidly.</p> <p>Slopes with a gradient of greater than 30 degrees will be hydroseeded using a mixture of native trees and shrubs. Based on the current proposals some 6,173m²</p>	HyD	HyD	LCSD/HyD

Mit. Code	Mitigation Measure	Funding Agency	Implementation Agency	Maintenance/ Management Agency
	<p>of hydroseeding will be applied to the road slopes.</p> <p>Vertical greening measures shall also be considered on engineering structures. This includes the use of climbing and trailing plants both planted at the crest and toe of the features, and within pockets within the slopes. It is proposed that native species be used to enhance the ecological value of the road corridor and minimise potential maintenance requirements. These measures will be applied to the retaining walls and newly regraded slopes features.</p> <p>The extent of the proposed mitigation planting and the location of the proposed retaining walls and regraded slopes are indicated in Figures 9.12 A to H.</p>			

Note: The responsibilities for the funding, implementation, management and maintenance of the mitigation proposals will be resolved according to the principles contained in ETWB TCW No. No. 2/2004 on Maintenance of Vegetation and Hard Landscape Features

Table 9.17 shall be read in conjunction with Table 10.6

Programme for Landscape Works

9.134 The landscape works will closely follow the completion of the construction of the proposed road engineering works. The construction of the Project is scheduled to be commenced in 2011 and be completed in 2015 with a duration of approximately 54 months. For the purposes of this assessment the design year is taken as approximately 10 years after the scheme opening when the proposed soft landscape mitigation measures have reached a level a level of maturity which enables them to perform the mitigation role. The landscape works will be implemented at the earliest possible time in the planting season immediately following the sectional completion of the construction works. The implementation schedule of landscape works is presented in Table 10.6 of Section 10 in this report and in the EM&A Manual.

Operational (Residual) Landscape and Visual Impacts

9.135 Overall, in terms of residual landscape and visual impacts the main effects will primarily result from the interruption of existing roadside landscapes. The proposed works will affect the roadside verges and planting areas for the majority of the length of the Kam Tin and Lam Kam Roads within the Study Area and so the mitigation strategy is important to the amelioration of any potential impacts. However it should also be noted that the existing alignment has a significant number of engineered structures including shotcrete covered cut slopes particularly at the eastern end of the alignment and that the proposed works largely involve the modification of these existing slopes.

- 9.136 Despite careful planning the proposals will also affect a number of trees and so a comprehensive tree planting scheme is proposed to not only compensate for the loss of existing vegetation. These proposals are also designed to where possible enhance the landscape and visual amenity of the road corridor. Based on the preliminary findings of the tree survey report it is recommended that out of total of approximately 1763 trees some 1286 trees are retained in-situ, 6 trees are transplanted to new locations within the road corridor and some 431 trees are felled. A further 33 dead trees would be removed for reasons of public safety and woodland hygiene. As part of the compensatory planting it is recommended that some 3,031m² of mass woodland planting would be established. These recommendations, however, are preliminary in nature and subject to the further development of the scheme proposals during the detailed design stage of the project. Therefore given a combination of the nature of the existing condition of the road corridor and the proposed mitigation measures it is considered that the road widening proposals will not cause a permanent impact to landscape character and resources. Further the proposals will have a relatively low level of disturbance to the visual context and visual amenity available to VSRs as the proposed works are largely screened from views.
- 9.137 The planting proposals also forms part of compensatory planting proposals for the loss of landscape resources, such as existing trees, as there will be a net gain of roadside planting, it will benefit to the future landscape and ecology context within the Study Area.
- 9.138 A series of computer generated images or photomontages have been prepared for the proposed schemes are presented as Figures 9.13 A to V. The location of the vantage points used for these images has been identified on Figures 9.6 A to C. The locations have been selected to represent the views available to residential and occupational VSRs along the Kam Tin Road and Lam Kam Road. The views demonstrate the screening effect of the existing roadside vegetation and the built structures which line the road. In addition a number of vantage points were selected along the road representing the views available to vehicle travellers and pedestrians. Although these VSRs are less sensitive than the residential VSRs they would have the most open view of the proposals. The vantage points selected for the VSRs represent a cross section of the locations which would be subject to the most significant impacts.
- 9.139 The photomontages of the proposed scheme show the existing conditions, Day 1 of the Operational Phase without Landscape and Visual Mitigation Measures; and Day 1 and Year 10 of the Operational Phase with Landscape and Visual Mitigation Measures. The final image Operational Phase is designed to demonstrate the predicted residual impacts, which would exist in the design year during the operational phase usually taken as between 10 and 15 years after the completion of the construction phase.

Conclusion

- 9.140 This section summarises the potential landscape and visual impacts arising from the implementation of the proposed Project and highlights the potential residual impacts after full establishment of the recommended landscape and

visual mitigation measures. Given the scale of the project and the careful design of the road widening works, the preservation of as many of the existing trees as possible including the larger roadside trees, the planting of new trees and shrubs, and the aesthetic treatment of the proposed retaining structures the potential landscape and visual impacts are not considered to be significant. given the scale of the project. As has been demonstrated the design of the alignment has given careful consideration to the preservation of landscape resources (including trees), landscape character and visual amenity while also responding to concerns for road safety and engineering feasibility. The design of the preferred scheme (Option B) has undergone an iterative process of refinement to further minimise potential impacts. This has resulted in the preservation of additional trees and the maintenance of the more sensitive untouched landscapes through the use where possible of previously engineered slopes and embankments for the widening proposals.

- 9.141 The landscape mitigation measures recommended in the LVIA are designed to alleviate the potential and visual impacts and to ensure that at implementation the Project will fit into the existing landscape and visual context. These measures include the careful design of the engineering works to minimize the potential impacts upon the existing landscape resources within the road corridor and the visual amenity for both nearby residents and vehicle travellers and pedestrians. This includes the existing trees which line the road and are important to both the landscape context of the road corridor and in screening the road in views from adjacent VSRs. Another important aspect of the landscape mitigation approach is the planting of new trees and shrubs utilizing native species where possible to restore and enhance the landscape setting and visual amenity of the road and its ecological value. Under normal circumstances the proposed tree planting is considered to have reached a stage of maturity sufficient to perform the mitigation role for which it was designed within 10 to 15 years after planting. However the planting proposals will serve to mitigate some of the predicted impact at a much earlier stage and the trees will continue to grow to full maturity following the 10 to 15 year period.
- 9.142 The proposed works will partially encroach upon the land use zonings discussed in the LVIA including for example the loss of an area zoned conservation area (CA) and some Open Space (OS) adjacent to the road. Other impacts include the loss of area zoned Government / Institutional / Community (GI/C), Industrial (Group D) (I(D)), some loss of Residential (Group D) and Village Type Development (V) although these are considered to be less significant from a landscape and visual perspective. Therefore although it is considered that the proposals will generally fit within the future landscape planning framework as represented by the OZPs some amendment to the published land use plans is required.
- 9.143 Given the above summary, the proposed upgrading of Kam Tin and Lam Kam Road largely fits into the planning and development control framework and integrates with the future outlook of the rural landscape context. The proposed upgraded road will be gazetted under Roads (Works, Use and Compensation) Ordinance (Cap. 370) and hence some zoning boundaries affected by the works should be revised.

Landscape Impacts

Preservation of Existing Trees

- 9.144 Based on the findings of the preliminary tree survey approximately 1286 out of total 1763 existing trees surveyed within the proposed works boundary will be preserved in-situ and a further 6 trees transplanted to new locations within the Site. The design of the proposed engineering works has been carefully considered to retain as many of the existing trees in-situ as possible. Where trees have found to be in conflict with the works transplantation has been considered. The affected trees are largely non-native plantation species originally planted as part of the roadside amenity areas. Many of these existing trees have a poor form and condition which may be due to their growth in sloping conditions and the proximity of the trees to one another. The adoption of the revised scheme for Option B would allow the preservation of a further 46 trees including 224 number trees with a trunk diameter of larger than 500mm.
- 9.145 This tree loss will be compensated to an extent through the planting and growth to maturity of some 559 specimen trees at the edge of the widened carriageway to recreate the avenue effect created by the original planting of *Melaleuca quinquenervia*. In addition the proposals include the planting of some 3,031m² of mass woodland planting (approximately 335 number trees based on planting centres of 3.0m) as part of the restoration and enhancement of the areas affected by the proposed works and the infill planting of existing areas with intermittent tree coverage. Slopes with a gradient of steeper than 30 degrees would be hydroseeded with a native tree and shrub planting mix. Given the predicted felling of some 431 trees the proposed planting of 559 trees will compensate for the loss at a ratio of 1:1.3 (trees removed : trees planted).

Preservation of Landscape Resources

- 9.146 As the proposed works are limited to the existing road corridor, the predicted residual impacts on the majority of the landscape resources within the Study Area will be slight to negligible within the construction phase and Day 1 and mitigated to negligible as the works at Year 10 as the mitigation measures mature. These include LR6 Developed Rural Land Areas, LR7 Grassland / Shrubland Mosaic, LR8 Modified Watercourse and LR9 Open Spaces and Sports Fields. There would be moderate to slight adverse impacts for LR1 Major Road, LR3 Roadside Plantation, LR4 Village Settlement and LR5 Hillside Mixed Woodland during the construction phase and at Day 1 although these impacts would be mitigated to slight adverse at Year 10. The loss of LR2 Agricultural Fields would be slight adverse both in the construction and operational stages of the project.

Maintenance of Landscape Character

- 9.147 The proposed upgrading works will take place within a Study Area characterised by an existing tree lined road corridor containing relatively extensive engineering works and lined by areas of dense village development, with intermittent areas of open storage and light industrial uses. The proposals

have sought to preserve and where possible enhance the landscape character of the road corridor through the careful design (and implementation) of the upgrading proposals. This includes the preservation of existing trees, the proposed planting of new tree and shrub areas and the design of new engineering structures designed to have an enhanced aesthetic appearance compared to the existing structures. With this approach to the design of the upgrading proposals and the adoption of landscape and visual mitigation measures the impacts LCA4 Shek Kong Barracks, LCA5 Wang Toi Shan Village, LCA6 Kam Tin Modified Water Course Landscape, LCA7 Shek Kong Lowland Rural Landscape, LCA8 Lam Tsuen Country Park Hillside Landscape and LCA 9 Sheung Tsuen Lowland Rural Landscape would be slight adverse during the construction and operational stages of the project due to the physical loss of area.

- 9.148 The potential impacts on LCA1, Tsat Sing Kong Lowland Rural Landscape, LCA3 Kam Tin Rural Landscape and LCA11 Kwun Yam Shan Miscellaneous Rural Fringe Landscape would be negligible due to the distance from the proposed scheme. The predicted impacts on LCA2 Pang Ka Tsuen Lowland Rural and Low-rise Residential Landscape would in the construction stage and at Day 1 be slight adverse however this impact would be mitigated to negligible at Year 10 with the growth to maturity of the proposed mitigation planting.
- 9.149 The predicted impacts on LCA10 Shek Kong Barracks Landscape (Shek Kong Tsuen) would be slight during construction stage as the works area due the proximity of the proposed works. These impacts would become negligible during the operational stage when the recommended landscape and visual mitigation measures are fully established. The predicted impacts on LCA12 Kwun Yam Shan Upland and Hillside Landscape would be moderate during construction stage and slight during the operational stage due to the proposed mitigation measures.
- 9.150 The potential impacts on LCA13 would be significant during construction stage due to the direct impacts along the full length of the road due to the upgrading works. With the implementation of the mitigation measures including the proposed roadside tree planting these impacts would be reduced to moderate adverse during the operational phase of the project.

Visual Impacts

- 9.151 Given the scale and nature of the Project, and the quality and extent of existing views the adjacent VSRs would be subject to a slight adverse impact. Factors influencing the level of predicted impact include the nature of the existing road corridor and engineering works, the quality of the existing visual amenity and the density of the existing villages, and the enclosure formed by the adjacent development and the preserved trees. In addition it should be noted that for many of the villages the views would only be available from properties on the periphery of the settlement. Views for the inner most houses would be blocked by the properties and vegetation at the edge of the village settlements. The main impacts would be experienced by two key groups. The first would be the vehicle travellers and pedestrians using the road alignment and the second the residential properties adjacent to the main engineering works. These works include the widening of the bridge and the proposed cuttings and extensions to the existing embankments.

- 9.152 For vehicle travellers and pedestrians (except VSR 2 Vehicle Travellers on Kam Tin Road to the north of Shek Kong Barracks (east bound) and VSR 3 Pedestrians on Kam Tin Road to the north of Shek Kong Barracks, VSR 14 Vehicle Travellers on Kam Tin Road to the south of Wang Toi Shan Ho Lik Pui (eastbound), VSR 15 Pedestrians on Kam Tin Road to the north of Shek Kong and VSR 22A Lam Kam Road near Wong Chuk Yuen (East Bound)) would have the 'moderate' mitigated impacts during the operational phase at Day 1 and the residual impacts during the Year 10 (when the tree and shrub planting has matured) would be slight adverse due to the extent of the works. Although the mitigation measures would realise some improvement and softening of the proposals the impacts would persist. However it should be remembered that the visual amenity for these VSRs is already characterized by the structures associated with the existing road corridor and so any changes to the visual amenity will not be significant. For vehicle travellers and pedestrians on Lam Kam Road to the east of the alignment the impacts during the design year would be mitigated from moderate to slight adverse due to proposed tree and shrub planting proposed for the extension to the cuttings and embankments.
- 9.153 For the residential VSRs the predicted impacts for VSR 1: Residents of Kiu Tau Tsuen, VSR4: Residents of Pang Ka Tsuen, VSR6: Residents of Shek Kong San Tsuen, VSR7: Residents of Seasons Villas, VSR9: Residents of Leung Uk Tsuen, VSR11: Residents of Wang Toi Shan Yau Uk Tsuen, VSR12: Residents of Wang Toi Shan Lo Uk Tsuen; VSR13: Residents of Wang Toi Shan San Tsuen; VSR16: Residents of Wang Toi Shan Ho Lik Pui; VSR18: Residents of Pine Hill Villa; VSR19: Residents of Cheung Uk Tsuen; VSR20: Residents of Sheung Tsuen San Tsuen; VSR22: Residents of Wong Chuk Yuen; VSR23: Residents of Shek Kong Village; and VSR24: Residents of Lui Kung Tin the predicted impacts would be moderate during the construction and operational phases of the project. It should be noted that these impacts represent the worst case scenario for these VSR's located at the edge of the settlements and that their existing views are characterised by Kam Tin and Lam Kam Roads. For residents of VSR 31 Residents of Western Leung Uk Tsuen the initial moderate adverse impacts predicted for the construction phase and at Day 1 would be mitigated to slight adverse by Year 10 as the proposed tree planting screening the bridge approach road matures.
- 9.154 It should be noted that the majority of the residential VSRs the existing views are partial or glimpsed due to the screening effect of the existing landform, roadside vegetation, and the vegetation associated with individual settlements, and existing built development. Further views of the road corridor are largely limited to residences on periphery of the existing settlements with views for the houses beyond screened due to the density of the existing development and the relatively flat topography of the inhabited areas. Given the restricted nature of these views and hence visual access to the scheme proposals the level of the predicted impacts derives more from the nature and sensitivity of the residential VSR than the magnitude of change arising from the proposals which would be apparent in these views.
- 9.155 For the other VSRs namely the occupational, trail walkers and recreational users of the open space the predicted impacts during the construction phase Day 1 and Year 10 would be slight adverse to negligible. This is due to the restricted nature of the upgrading proposals and roadside character of the existing views, and the small part of the scheme proposals which would be

visible to them.

- 9.156 Therefore it is considered that upon the growth to maturity of the proposed compensatory and mitigation planting and restoration of disturbed areas, the widening proposals will not constitute a significant component in available views and that the Project can be successfully integrated within the existing landscape and visual context.

Conclusion on Significance of Residual Impact

- 9.157 Although the proposed widening of Kam Tin and Lam Kam Roads will have some slight to moderate residual impacts locally to the areas adjacent to the proposed works, mainly due to tree loss and the appearance of engineered structures upon the full establishment of landscape and visual mitigation measures it is considered that the impacts will be largely mitigated. Therefore in accordance with Annex 10, Paragraph 1.1(c) of the EIAO TM, the landscape and visual impacts of the proposed works would be 'acceptable with mitigation' (following the growth to maturity of the proposed tree planting 10 to 15 years following the completion of the construction phase of the project) that is to say 'there would be some adverse effects, but these can be eliminated, reduced or offset to a large extent by specific measures.

10.0 IMPLEMENTATION SCHEDULE OF RECOMMENDED MITIGATION MEASURES

Table 10.1 Implementation Schedule for Air Quality Control

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation of Measures	Who to implement the measures?	Location	What requirements or standards for the measures to achieve?
Construction Phase					
S.3.14	<p>As a best practice measure to ensure compliance with the Air Pollution Control (Construction Dust) Regulation it is suggested that the following control measures be incorporated into contract documentation:</p> <ul style="list-style-type: none"> • Works area for site clearance shall be sprayed with water before, during and after the operation so as to maintain the entire surface wet; • All dusty materials shall be sprayed with water immediately prior to any loading, unloading or transfer operation so as to maintain the dusty materials wet; • Hoarding of not less than 2.4 m above ground shall be provide, as far as practicable, along the site boundary which is next to the public areas; • Restricting heights not higher than 1.5m above ground from which materials are to be dropped, as far as practicable to minimise the fugitive dust arising from unloading/ loading; • Any stockpile of dusty materials shall be covered entirely by impervious sheeting; and/ or placed in an area sheltered on the top and 4 sides; • Immediately before leaving a construction site, all vehicles shall be washed to remove any dusty materials from its body and wheels; and • Where a vehicle leaving a construction site is carrying a load of dusty materials, the load shall be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle. 	During construction / Operation Time (07:00 – 19:00 form Monday to Saturday except public holiday)	Contractor	Within the boundaries of all construction sites	APCO (Cap. 311); Air Pollution Control (Construction Dust) Regulation; EIA-TM (Annex 4)
Operational Phase					
Nil					

Table 10.2 Implementation Schedule for Noise Control

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation of Measures	Who to implement the measures?	Location	What requirements or standards for the measures to achieve?
Construction Phase					
S.4.35	<p>The recommended good site practices are as follows:</p> <ul style="list-style-type: none"> • PMEs should be kept to a minimum and the parallel use of them should be avoided; • Intermittent use of PME which can be shut down between work periods or throttled down to a minimum; • Mobile PME should be sited as far from NSRs as possible; • PME known to emit noise strongly in one direction should be orientated to direct away from the nearby NSRs; • Only well-maintained plant should be operated on-site and PME should be serviced regularly during the construction programme; and • Material stockpiles and other structures (e.g. site hoarding) should be effectively utilised, wherever practicable, in screening noise from on-site construction activities. 	During construction / Operation Time (07:00 – 19:00 form Monday to Saturday except public holiday)	Contractor	Within the boundaries of all construction sites	EIA-TM; NCO; Noise from Construction Work Other Than Percussive Piling (GW-TM)
S.4.36	Using the quieter PME is considered as a practical measure to reduce the noise impacts. Quieter PME are defined as having SWLs less than those listed in the GW-TM.	During construction / Operation Time (07:00 – 19:00 form Monday to Saturday except public holiday)	Contractor	Within the boundaries of all construction sites	EIA-TM; NCO; Noise from Construction Work Other Than Percussive Piling (GW-TM)
S.4.38	Restriction on road works and geotechnical works should be avoided to be undertaken concurrently near NSR N53.	During construction / Operation Time (07:00 – 19:00 form Monday to Saturday except public holiday)	Contractor	Within work boundary near NSR N53	EIA-TM; NCO; Noise from Construction Work Other Than Percussive Piling (GW-TM)
S.4.39 to 4.40	Adoption of the temporary noise barriers will be provided at NSRs N27. The height of the noise barriers shall be such that the active PME cannot be directly viewed from the affected NSRs and with a length to height ratio at least 5:1 and a superficial material surface density > 10 kgm ⁻² .	During construction / Operation Time (07:00 – 19:00 form Monday to Saturday except public holiday)	Contractor	Within work boundary near NSR N27	EIA-TM; NCO; Noise from Construction Work Other Than Percussive Piling (GW-TM)

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation of Measures	Who to implement the measures?	Location	What requirements or standards for the measures to achieve?
S.4.41	Enclosing the hand-held breaker in an acoustic enclosure with suitable ventilation. The enclosure shall be built with a material density of $> 7 \text{ kgm}^{-2}$ with sound absorption lining of at least 25mm thick, 80kg/m^3 mineral wool to reduce the noise reverberation and noise being reflected out through openings and enclosed the hand-held breaker as much as possible.	During construction / Operation Time (07:00 – 19:00 form Monday to Saturday except public holiday)	Contractor	Within the boundaries of all construction sites	EIA-TM; NCO; Noise from Construction Work Other Than Percussive Piling (GW-TM)
S.4.42	For the soldier pile wall construction, an acoustic screen shall be installed at the crawler rig with minimum 50mm thick sound absorbing lining (e.g. 96 kgm^{-3} mineral wool) and 6mm thick steel backing.	During construction / Operation Time (07:00 – 19:00 form Monday to Saturday except public holiday)	Contractor	Within the work boundaries for the soldier pile wall construction	EIA-TM; NCO; Noise from Construction Work Other Than Percussive Piling (GW-TM)
Operational Phase					
Nil					

Table 10.3 Implementation Schedule for Water Quality Control

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation of Measures	Who to implement the measures?	Location	What requirements or standards for the measures to achieve?
Construction Phase					
S.5.14	Domestic sewage generated by the construction workforce shall be appropriately managed to avoid the potential adverse impacts of uncontrolled sewage discharge into nearby water courses. Portable chemical toilets shall be appropriately located on site in proximity to all key works areas where they shall remain and be maintained in good working order for the convenience of the workforce for the duration of the works.	During construction / Operation Time (07:00 – 19:00 form Monday to Saturday except public holiday)	Contractor	Within the boundaries of all construction sites	EIA-TM; WPCO (Cap. 358); ProPECC Note PN1/94
S.5.17	<p>The following control measures should be implemented within water gathering ground:</p> <ul style="list-style-type: none"> • The provision of temporary toilet facilities within the Water Gathering Ground, if any, is subject to approval of the Director of Water Supplies. As a minimum requirement temporary toilet facilities must be located more than 30m from any watercourse. • The contractor should be measures taken to minimise rainfall into the working areas and the perimeter of the work sites will be bounded to prevent ingress of rainfall during storm events; and to prevent off site migration of materials. • Notices should be posted at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the nearby environment. 	During construction / Operation Time (07:00 – 19:00 form Monday to Saturday except public holiday)	Contractor	Within the boundaries of all construction sites fall into water gather ground	EIA-TM; WPCO (Cap. 358); ProPECC Note PN1/94; WSD's guidelines on protection of Water Gathering Ground
Appendix E1	<p>Conditions of Working within Water Gathering Ground:</p> <p>(a) Adequate measures shall be taken to ensure that no pollution or siltation occurs to the catchwater and catchments.</p> <p>(b) No earth, building materials, fuel oil or toxic materials and other materials which may cause contamination to the water gathering grounds are allowed to be stocked or stored on site.</p> <p>(c) All surplus spoil shall be removed from water gathering ground as soon as possible.</p> <p>(d) Temporary drains with silt traps shall be constructed at the boundary of the site prior to the commencement of any earthwork.</p> <p>(e) Regular cleaning of the silt traps shall be carried out to ensure that they function properly at all time.</p> <p>(f) All excavated or filled surfaces which have the risk of erosion shall be protected from erosion at all time.</p> <p>(g) Facilities for washing the wheels of vehicles before leaving the site shall be provided.</p> <p>(h) Any construction plant which causes pollution to catchwater or catchment due to leakage of</p>	During construction / Operation Time (07:00 – 19:00 form Monday to Saturday except public holiday)	Contractor	Within the boundaries of all construction sites fall into water gather ground	WSD's guidelines on protection of Water Gathering Ground

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation of Measures	Who to implement the measures?	Location	What requirements or standards for the measures to achieve?
	<p>oil or fuel shall be removed off site immediately.</p> <p>(i) Any soil contamination with fuel leaked from plant shall be removed off site and the voids arising from removal of contaminated soil shall be replaced by suitable material to the approval of the Director of Water Supplies.</p> <p>(j) Provision of temporary toilet facilities is to be subject to the approval of the Director of Water Supplies.</p> <p>(k) All waterworks access roads must be maintained unobstructed at all time.</p> <p>(l) Site formation plans shall be submitted to W.S.D. for approval prior to commencement of work.</p> <p>(m) No structure or temporary works shall be erected in the catchwaters without prior approval of W.S.D.</p> <p>(n) The Contractor shall be responsible for cleaning frequently any waterworks roads and associated drainage works of mud and debris.</p> <p>(o) The Contractor shall limit the gross weight of the vehicles imposed on the waterworks access along catchwaters to 5 tonnes and the axle load to 3 tonnes. He shall apply to W.S.D. with details of his vehicles for using the access.</p> <p>(p) The approval for using the access may be withdrawn on written notice to the Contractor by W.S.D. at their absolute discretion.</p> <p>(q) The Contractor shall recover immediately his vehicle which fill into the catchwater or stream bed or pay to Government on demand the cost of recovery that may be necessary through the occurrence of any incident cause by the Contractor.</p> <p>(r) The Contractor shall carry out repair or reinstatement works to the satisfaction of W.S.D. or pay to Government on demand the cost of repair and reinstatement to any waterworks installations that shall or may be necessary at any time as a result of damage caused by the Contractor or others under his charge.</p> <p>(s) No chemicals including fertilizers shall be used without the prior approval form W.S.D.</p> <p>(t) Use of pesticides is not allowed within the water gathering grounds. The storage and discharge of pesticide or toxicant, flammable or toxic solvents, petroleum oil or tar and other toxic substances are strictly prohibited within the water gathering ground.</p>				
S.5.19	<p>Details of the best practice measures are provided below:</p> <ul style="list-style-type: none"> Wastewater from temporary site facilities should be controlled to prevent direct discharge to surface waters; 	During construction / Operation Time (07:00 – 19:00 form Monday to Saturday	Contractor	Within the boundaries of all construction	EIA-TM; WPCO (Cap. 358); ProPECC Note

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation of Measures	Who to implement the measures?	Location	What requirements or standards for the measures to achieve?
	<ul style="list-style-type: none"> ● Storm drainage shall be directed to storm drains via adequately designed sand/silt removal facilities such as sand traps, silt traps and sediment basins. Channels, earth bunds or sand bag barriers should be provided on site to properly direct stormwater to such silt removal facilities. Catchpits and perimeter channels should be constructed in advance of site formation works and earthworks; ● Silt removal facilities, channels and manholes shall be maintained and any deposited silt and grit shall be removed regularly, including specifically at the onset of and after each rainstorm; ● Rainwater pumped out from trenches or surface excavations should be discharged into storm drains via silt removal facilities; ● Open stockpiles (e.g. aggregates, sand and fill material) should be covered with a tarpaulin to avoid erosion during rainstorms; ● Exposed soil surface should be paved as soon as possible; ● Measures should be taken to prevent the washout of construction materials, soil, silt or debris into any drainage system; ● Discharges of surface run-off into foul sewers must always be prevented in order not to unduly overload the foul sewerage system; ● Vehicles and plant should be cleaned before they leave the construction site to ensure that no earth, mud or debris is deposited by them on roads. A wheel washing bay should be provided at every site exit, as far as practicable; ● Wheel-wash overflow shall be directed to silt removal facilities before being discharged to the storm drain; ● Regular inspections of stilling basins and/or silt traps to ensure that sediment is not conveyed into the existing drainage system; ● Surface excavation should be carefully programmed to avoid wet-season operation. If it is unavoidable, any exposed top soils should be covered with a tarpaulin or other means; ● The contractor shall prepare an oil / chemical cleanup plan and ensure that leakages or spillages are contained and cleaned up immediately; ● Any fuels should be stored in bunded areas such that spillage can be easily collected. Waste oil should be collected and stored for recycling or disposal, in accordance with the Waste Disposal Ordinance. ● Sewage effluent should be handled by portable chemical toilets or sewage holding tanks. A licensed contractor is responsible for the sewage facilities maintenance, and regular sewage collection and disposal. 	<p>except public holiday)</p>		<p>sites</p>	<p>PN1/94</p>
<p>Operational Phase</p>					
<p>Nil</p>					

Table 10.4 Implementation Schedule for Waste Control

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation of Measures	Who to implement the measures?	Location	What requirements or standards for the measures to achieve?
Construction Phase					
S.6.12	<p><i>Construction and Demolition (C&D) Material</i></p> <ul style="list-style-type: none"> All C&D materials generated shall be sorted on site into inert portion "inert C&D materials" including soil, building debris, broken rock, concrete, etc., and the non-inert portion is the "C&D wastes" comprising timber, paper, plastics, general refuse etc. The inert C&D materials, the reusable and/or recyclable materials shall be recovered before disposal of the waste portion off site as a last resort. The waste portion of the inert C&D materials may be disposed of at the public fill reception facility at Tuen Mun Area 38, and the C&D wastes at North East New Territories (NENT) Landfill in Ta Kwu Ling. 	Prior to and during construction activities	Contractor	Within the boundaries of all construction sites as well as transportation routes to designated areas for off-site disposal of materials	Annex 7 of EIA-TM
S.6.20 & S.6.21	<p><i>Chemical Wastes</i></p> <ul style="list-style-type: none"> Materials classified as chemical wastes will require special handling and storage arrangements before removal for appropriate treatment at the Chemical Waste Treatment Facility (CWTF) or other licensed facilities. Wherever possible opportunities should be taken to reuse and recycle materials. Storage, handling, transport and disposal of chemical waste should be arranged in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Waste published by the EPD. Provided that this occurs, and the chemical waste is disposed of at a licensed chemical waste treatment and disposal facility, the potential environmental impacts arising from the storage, handling and disposal of a small amount of chemical waste generated from the construction activities will be negligible. 	Prior to and during construction activities	Contractor	Within the boundaries of all construction sites as well as transportation routes to designated areas for off-site disposal of materials	Waste Disposal (Chemical Waste) (General) Regulation Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes
S.6.22	<p><i>General Refuse</i></p> <ul style="list-style-type: none"> General refuse will be properly collected on-site and transfer to the nearby refuse collection point. Disposal of refuse at sites other than approved waste transfer or disposal facilities will be prohibited. Effective collection of site wastes will prevent waste materials being blown around by wind, or creating an odour nuisance or pest and vermin problem. Waste storage areas will be well maintained and cleaned regularly. 	Prior to and during construction activities	Contractor	Within the boundaries of all construction sites as well as transportation routes to designated areas for off-site disposal of materials	Public Health and Municipal Services Ordinance (Cap. 132)

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation of Measures	Who to implement the measures?	Location	What requirements or standards for the measures to achieve?
S.6.26	An on-site environmental co-ordinator should be identified at the outset of the works. The co-ordinator shall prepare an Environmental Management Plan (EMP) incorporating waste management in accordance with the requirements set out in the ETWB TCW No. 19/2005, Environmental Management on Construction Sites. The EMP shall include monthly and yearly Waste Flow Tables (WFT) that indicate the amounts of waste generated, recycled and disposed of (including final disposal site), and which should be regularly updated;	Prior to and during construction activities	Contractors	Within the boundaries of all construction sites as well as transportation routes to designated areas for off-site disposal of materials	ETWB Technical Circular (ETWBTC) No. 15/2003
S.6.26	Spoil generated from the piling activities will need to be properly handled to minimise contamination to surface waters and any exposed ground areas due to leakage or improper storage (i.e. onto bare ground instead of into tanks);	Prior to and during construction activities	Contractors	Within the boundaries of all construction sites as well as transportation routes to designated areas for off-site disposal of materials	ETWB Technical Circular (Works) (ETWBTCW) No. 34/2002
S.6.26	The reuse/ recycling of all materials on site shall be investigated prior to treatment/ disposal off-site;	Prior to and during construction activities	Contractors	Within the boundaries of all construction sites as well as transportation routes to designated areas for off-site disposal of materials	ETWBTCW No. 33/2002, ETWBTC No. 15/2003
S.6.26	Good site practices shall be adopted from the commencement of works to avoid the generation of waste, reduce cross contamination of waste and to promote waste minimisation;	Prior to and during construction activities	Contractors	Within the boundaries of all construction sites as well as transportation routes to designated areas for off-site disposal of materials	ETWBTCW No. 33/2002

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation of Measures	Who to implement the measures?	Location	What requirements or standards for the measures to achieve?
S.6.26	All waste materials shall be sorted on-site into inert and non-inert C&D materials, and where the materials can be recycled or reused, they shall be further segregated. Inert material, or public fill will comprise stone, rock, masonry, brick, concrete and soil which is suitable for land reclamation and site formation whilst non-inert materials include all other wastes generated from the construction process such as plastic packaging and vegetation (from site clearance);	Prior to and during construction activities	Contractor	Within the boundaries of all construction sites as well as transportation routes to designated areas for off-site disposal of materials	ETWBTCW No. 33/2002, ETWBTCW No. 34/2002
S.6.26	The Contractor shall be responsible for identifying what materials can be recycled/ reused, whether on-site or off-site. In the event of the latter, the Contractor shall make arrangements for the collection of the recyclable materials. Any remaining non-inert waste shall be collected and disposed of to the Public Filling Areas whilst any inert C&D materials shall be re-used on site as far as possible. Alternatively, if no use of the inert material can be found on-site, the materials can be delivered to a Public Fill Area or Public Fill Bank after obtaining the appropriate licence;	Prior to and during construction activities	Contractor	Within the boundaries of all construction sites as well as transportation routes to designated areas for off-site disposal of materials	ETWBTCW No. 33/2002, ETWBTCW No. 34/2002
S.6.26	With reference to ETWBTC (W) No.31/2004, Trip-ticket System for Disposal of Construction and Demolition Material, a trip ticket system should be established at the outset of the construction of the NLH/ helipad to monitor the disposal of C&D and solid wastes from the site to public filling facilities and landfills;	Prior to and during construction activities	Contractor	Within the boundaries of all construction sites as well as transportation routes to designated areas for off-site disposal of materials	ETWB TC(W) 31/2004
S.6.26	Under the Waste Disposal (Chemical Waste) (General) Regulation, the Contractor shall register as a Chemical Waste Producer if chemical wastes such as spent lubricants and paints are generated on site. Only licensed chemical waste collectors shall be employed to collect any chemical waste generated at site. The handling, storage, transportation and disposal of chemical wastes shall be conducted in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes and A Guide to the Chemical Waste Control Scheme both published by EPD;	Prior to and during construction activities	Contractor	Within the boundaries of all construction sites as well as transportation routes to designated areas for off-site disposal of materials	Waste Disposal (Chemical Waste) (General) Regulation, Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes, Guide to the Chemical Waste Control Scheme

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation of Measures	Who to implement the measures?	Location	What requirements or standards for the measures to achieve?
S.6.26	A sufficient number of covered bins shall be provided on site for the containment of general refuse to prevent visual impacts and nuisance to the sensitive surroundings. These bins shall be cleared daily and the collected waste disposed of to the refuse transfer station. Further to the issue of ETWB TCW No. 6/2002A, Enhanced Specification for Site Cleanliness and Tidiness, the Contractor is required to maintain a clean and hygienic site throughout the Project works;	Prior to and during construction activities	Contractor	Within the boundaries of all construction sites as well as transportation routes to designated areas for off-site disposal of materials	ETWBTCW No. 6/2002A, ETWBTC No. 15/2003
S.6.26	All chemical toilets, if any, shall be regularly cleaned and the night-soil collected and transported by a licensed contractor to a Government Sewage Treatment Works facility for disposal;	Prior to and during construction activities	Contractor	Within the boundaries of all construction sites as well as transportation routes to designated areas for off-site disposal of materials	ETWBTCW No. 6/2002A, ETWBTC No. 15/2003
S.6.26	Tool-box talks should be provided to workers about the concepts of site cleanliness and appropriate waste management procedures, including waste reduction, reuse and recycling;	Prior to and during construction activities	Contractor	Within the boundaries of all construction sites as well as transportation routes to designated areas for off-site disposal of materials	ETWBTCW No. 15/2003

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation of Measures	Who to implement the measures?	Location	What requirements or standards for the measures to achieve?
S.6.26	The Contractor shall comply with all relevant statutory requirements and guidelines and their updated versions that may be issued during the course of Project construction.	Prior to and during construction activities	Contractor	Within the boundaries of all construction sites as well as transportation routes to designated areas for off-site disposal of materials	EIA-TM
S.6.67 to 6.69	The area of car repairing workshops of Site 1, Site 3 and Site 4 encroached upon the project boundary have been proposed for further investigation. The Project Proponent shall engage a competent and experienced professional to prepare a detailed CAP for EPD's approval prior to the investigation. Upon approval of the CAP, the Project Contractor shall carry out site investigation and sampling works in accordance with the approved CAP. If contamination was identified, CAR and RAP shall also be prepared and submitted to EPD for approval. Remediation measures as recommended in the RAP shall be fully implemented by the Project Contractor prior to commencement of construction works. With regard to the above, all the land contamination assessments, including site investigations, supervision during the sampling works, preparation of the CAP, CAR and RAP shall be conducted by the competent and experienced professional who shall have adequate experience in land contamination assessment, investigation and remediation.	Prior to and during construction activities	Contractor	Within the work boundaries near the car repairing workshops (i.e., Site 1, Site 3 and Site 4)	EIA-TM

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation of Measures	Who to implement the measures?	Location	What requirements or standards for the measures to achieve?
S.6.70	<p>As a general measures, the following environmental and safety precautionary measures should be implemented during construction works, in order to minimize the potential impact on health and contamination exposure to the site workers:</p> <ul style="list-style-type: none"> ◆ Exposure to any contaminated materials can be minimised by the wearing of appropriate clothing and personal protective equipment; ◆ Adequate training and instructions of the potential hazards associated with the contaminated materials shall be provided to site staff and workers; ◆ Measures shall be implemented to prevent non-workers from approaching the identified potential contamination areas in order to avoid exposure to contaminants; ◆ Where appropriate, the use of bulk handling equipment should be maximised to reduce the potential contacts between excavated contaminated materials and associated workers; ◆ All temporary stockpiles of the materials shall be completely covered with waterproof material to avoid leaching of contaminants, especially during rainy season; and ◆ Surface water shall be diverted around any contaminated areas or stockpiles to minimise potential runoff into excavations. 	During construction activities	Contractor	Within the boundaries of all construction sites	EIA-TM
Operational Phase					
Nil					

Table 10.5 Implementation Schedule for Ecology

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation of Measures	Who to implement the measures?	Location	What requirements or standards for the measures to achieve?
Construction Phase					
S.7.99	Impacts from direct habitat loss / vegetation clearance due to construction of the Project should be mitigated through implementation of compensatory planting and re-vegetation of the upgraded Kam Tin Road and Lam Kam Road, and the slopes subject to necessary geotechnical works, as provided in Section 8.	During construction	Contractor	At all construction work sites.	ETWB TC No. 3/2006; EIA-TM
S.7.100	The best practice guidelines for control of construction site run-off and for managing construction waste as given in Section 5 and Section 6 respectively shall be implemented as far as practicable, in order to avoid any indirect / induced construction impacts upon wildlife.	During construction	Contractor	At all construction work sites	As mentioned in Table 10.3 and Table 10.4
S.7.101	<p>The following precautionary measures as referred in ETWB TC No. 5/2005 to avoid any possible impacts on natural stream courses and/ or nearby vegetation during construction phase shall be implemented:</p> <ul style="list-style-type: none"> ■ The proposed works shall preferably be carried out during the dry season where flow in the stream is low. ■ To minimize disturbance caused to the substrates of the stream and riparian vegetation, temporary access to the site shall be carefully planned and located. Any temporary access tracks on streambed shall be kept to the minimum width and length, and the crossings shall be supported by stilts above the streambed. ■ Temporary storage of construction materials shall be properly covered and located away from any stream courses. ■ Construction debris and spoil shall be covered properly and disposed of as soon as possible to avoid being washed into nearby stream courses. 	During construction	Contractor	At all construction work sites	ETWB TC No.5/2005

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation of Measures	Who to implement the measures?	Location	What requirements or standards for the measures to achieve?
7.102	<p>No plant species of conservation concern including <i>Aquilaria sinensis</i> shall be removed due to the Project. Identification labels shall be attached to the two tree specimens of <i>Aquilaria sinensis</i> to notify the site workers that the two tree individuals or any tree specimens of <i>A. sinensis</i> shall not be removed or damaged during construction works. Protection measures shall be implemented to avoid any possible construction impacts upon the fruit bat roost on the Chinese Fan-palm <i>Livistona chinensis</i> on Lam Kam Road. These measures shall include but not limited to the following:</p> <ul style="list-style-type: none"> ■ Establishment of a Tree Protection Zone in accordance with Environment, Transport and Works Bureau Technical Circular (Works) No. 29/2004, clause 17. No construction activities or construction storage shall be intruded into the designated Tree Protection Zone. ■ Provision of a tree identification label to notify the site workers to protect the tree from construction damage throughout the construction period. 	During construction	Contractor	<p>Two trees of <i>Aquilaria sinensis</i> at Lam Kam Road (as displayed in Figure 7.3)</p> <p>The Chinese Fan-palm <i>Livistona chinensis</i> at Lam Kam Road (Appendix G16)</p>	Nil.

Table 10.6 Implementation Schedule for Landscape and Visual

EIA Ref.	Mit. Code	Recommended Mitigation Measures	Location	Funding	Implementation / Maintenance Agent	Relevant Standard or Requirement	Implementation Stages			Timing of Implementation	Objectives of the Recommended Measure and Main Concern to address
							D	C	O		
Construction Phase											
Table 9.16	CP1	Preservation of Existing Vegetation									
	CP1.1	To retain trees that have high amenity or ecology value and contribute most to the landscape and visual amenity of the site and its immediate environs.	Site	Project Proponent	Project Landscape Architect / HyD's Contractor	TM-EIA Annex 18, ETWB TCW No. 2/2004 & WBTC No. 3/2006	✓			Throughout design phase	To minimise the disturbance to the existing landscape resources.
	CP1.2	Creation of precautionary area around trees to be retained equal to half of the trees canopy diameter. Precautionary area to be fenced.	Site	Project Proponent	HyD's Contractor / HyD's Contractor	TM-EIA Annex 18, ETWB TCW No. 2/2004 & WBTC No. 3/2006		✓		Before construction phase commence	To ensure the success of the tree preservation proposals.
	CP1.3	Prohibition of the storage of materials including fuel, the movement of construction vehicles, and the refuelling and washing of equipment including concrete mixers within the precautionary area.	Site	Project Proponent	HyD's Contractor / HyD's Contractor	TM-EIA Annex 18, ETWB TCW No. 2/2004 & WBTC No. 3/2006		✓		Throughout construction phase	To ensure the success of the tree preservation proposals.

EIA Ref.	Mit. Code	Recommended Mitigation Measures	Location	Funding	Implementation / Maintenance Agent	Relevant Standard or Requirement	Implementation Stages			Timing of Implementation	Objectives of the Recommended Measure and Main Concern to address
							D	C	O		
	CP1.4	Phased segmental root pruning for trees to be transplanted over a suitable period (determined by species and size) prior to lifting or site formation works which affect the existing rootball of trees identified for retention. The extent of the pruning will be based on the size and the species of the tree in each case.	Site	Project Proponent	HyD's Contractor / HyD's Contractor	TM-EIA Annex 18, ETWB TCW No. 2/2004 & WBTC No. 3/2006		✓		Throughout construction phase	To ensure the success of the tree preservation proposals.
	CP1.5	Pruning of the branches of existing trees identified for transplantation and retention to be based on the principle of crown thinning maintaining their form and amenity value.	Site	Project Proponent	HyD's Contractor / HyD's Contractor	TM-EIA Annex 18, ETWB TCW No. 2/2004 & WBTC No. 3/2006		✓		Throughout construction phase	To ensure the success of the tree preservation proposals.
	CP1.6	The watering of existing vegetation particularly during periods of excavation when the water table beneath the	Site	Project Proponent	HyD's Contractor / HyD's Contractor	TM-EIA Annex 18, ETWB TCW No. 2/2004 & WBTC No. 3/2006		✓		Throughout construction phase	To ensure the success of the tree preservation proposals.

EIA Ref.	Mit. Code	Recommended Mitigation Measures	Location	Funding	Implementation / Maintenance Agent	Relevant Standard or Requirement	Implementation Stages			Timing of Implementation	Objectives of the Recommended Measure and Main Concern to address
							D	C	O		
		existing vegetation is lowered.									
	CP1.7	The rectification and repair of damaged vegetation following the construction phase to it's original condition prior to the commencement of the works or replacement using specimens of the same species, size and form where appropriate to the design intention of the area affected	Site	Project Proponent	HyD's Contractor / HyD's Contractor	TM-EIA Annex 18, ETWB TCW No. 2/2004 & WBTC No. 3/2006		✓		Throughout construction phase	To ensure the success of the tree preservation proposals.
	CP1.8	All works affecting the trees identified for retention and transplantation will be carefully monitored. This includes the key stages in the preparation of the trees, the implementation of protection measures and health monitoring through out the construction period	Site	Project Proponent	HyD's Contractor / HyD's Contractor	TM-EIA Annex 18, ETWB TCW No. 2/2004 & WBTC No. 3/2006		✓		Throughout construction phase	To ensure the success of the tree preservation proposals.
	CP1.9	Detailed landscape and tree preservation proposals will be submitted to the	Site	Project Proponent	Project Landscape Architect / NA	TM-EIA Annex 18, ETWB TCW No. 2/2004 & WBTC	✓			Throughout design phase	To ensure the tree preservation and planting proposals are integrated with the existing

EIA Ref.	Mit. Code	Recommended Mitigation Measures	Location	Funding	Implementation / Maintenance Agent	Relevant Standard or Requirement	Implementation Stages			Timing of Implementation	Objectives of the Recommended Measure and Main Concern to address
							D	C	O		
		relevant government departments for approval in accordance with ETWB TCW No. 2/2004 and WBTC No. 3/2006.				<u>No. 3/2006</u>					landscape context and that the landscape resources are preserved where appropriate.
	CP1.10	The tree preservation works should be implemented by approved Landscape Contractors and inspected and approved on site by a qualified Landscape Architect. A tree protection specification would be included within the contract documents.	Site	Project Proponent	Project Proponent / NA	TM-EIA Annex 18, ETWB TCW No. 2/2004 & WBTC <u>No. 3/2006</u>	✓	✓		Throughout design and construction phases	To ensure the tree preservation and planting proposals are integrated with the existing landscape context and that the landscape resources are preserved where appropriate.
Table 9.16	CP2	Preservation of Existing Topsoil									
	CP2.1	Topsoil disturbed during the construction phase should be tested using a standard soil testing methodology and where it is found to be worthy of retention stored for re-use.	Site	Project Proponent	HyD's Contractor / HyD's Contractor	TM-EIA Annex 18		✓		Throughout construction phase	To provide a viable growing medium suited to the existing conditions and reduce the need for the importation of top soil.

EIA Ref.	Mit. Code	Recommended Mitigation Measures	Location	Funding	Implementation / Maintenance Agent	Relevant Standard or Requirement	Implementation Stages			Timing of Implementation	Objectives of the Recommended Measure and Main Concern to address
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	CP2.2	The soil will be stockpiled to a maximum height of 2m and will be either temporarily vegetated with hydroseeded grass during construction or covered with a waterproof covering to prevent erosion.	Site	Project Proponent	HyD's Contractor / HyD's Contractor	TM-EIA Annex 18		✓		Throughout construction phase	To provide a viable growing medium suited to the existing conditions and reduce the need for the importation of top soil.
	CP2.3	The stockpile should be turned over on a regular basis to avoid acidification and the degradation of the organic material, and reused after completion. Alternatively, if this is not practicable, it should be considered for use elsewhere, including other projects.	Site	Project Proponent	HyD's Contractor / HyD's Contractor	TM-EIA Annex 18		✓		Throughout construction phase	To provide a viable growing medium suited to the existing conditions and reduce the need for the importation of top soil.
Table 9.16	CP3	Permanent and Temporary Works Areas									
	CP3.1	Where appropriate to the final design the landscape of these works areas should be restored following the completion of the construction phase.	Site	Project Proponent	HyD's Contractor / HyD's Contractor	TM-EIA Annex 18		✓		Through out construction phase	To minimise the disturbance to existing landscape resources and change of visual amenity.

EIA Ref.	Mit. Code	Recommended Mitigation Measures	Location	Funding	Implementation / Maintenance Agent	Relevant Standard or Requirement	Implementation Stages			Timing of Implementation	Objectives of the Recommended Measure and Main Concern to address
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	CP3.2	Construction site controls should be enforced including the storage of materials, the location and appearance of site accommodation and the careful design of site lighting to prevent light spillage.	Site	Project Proponent	HyD's Contractor / HyD's Contractor	TM-EIA Annex 18		✓		Through out construction phase	To minimise the disturbance to existing landscape resources and change of visual amenity.
	CP3.3	Screen the construction works throughout the construction phase through the use of screen hoarding along the periphery of the temporary works area.	Site	Project Proponent	HyD's Contractor / HyD's Contractor	TM-EIA Annex 18		✓		Through out construction phase	To minimise the disturbance to existing landscape resources and change of visual amenity.
Table 9.16	CP4	Programme for Mitigation Planting									
	CP4.1	Replanting of disturbed vegetation should be undertaken at the earliest possible stage of the construction phase	Site	Project Proponent	HyD's Contractor / HyD's Contractor	TM-EIA Annex 18, ETWB TCW No. 2/2004 & WBTC No. 3/2006		✓		After the site formation and on completion of planting area.	To minimise the disturbance to existing landscape resources and minimize the impacts on the visual amenity of the area.
Table 9.16	CP5	Transplantation of Existing Trees									

EIA Ref.	Mit. Code	Recommended Mitigation Measures	Location	Funding	Implementation / Maintenance Agent	Relevant Standard or Requirement	Implementation Stages			Timing of Implementation	Objectives of the Recommended Measure and Main Concern to address
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	CP5.1	The tree transplanting works should be implemented by approved Landscape Contractors and inspected and approved on site by a qualified Landscape Architect. A tree protection / transplanting specification would be included within the contract documents.	Site	Project Proponent	Project Proponent / NA	TM-EIA Annex 18, ETWB TCW No. 2/2004 & WBTC No. 3/2006	✓	✓		Throughout design and construction phases	To ensure the tree preservation and planting proposals are integrated with the existing landscape context and that valuable landscape resources are preserved where appropriate to the final design.
Operational Phase											
Table 9.17	OP1	Design of the road widening proposals									
	OP1.1	The alignment and structures associated with the widened road should be integrated, as far as technically feasible, with existing roadside structures and the landscape context to reduce the	Site	Project Proponent	Project Architects for design / HyD's contractor for implementation / HyD	TM-EIA Annex 18 and BD	✓		✓	Throughout design phase	Responsive design to integrate the proposals into their landscape and visual context.

EIA Ref.	Mit. Code	Recommended Mitigation Measures	Location	Funding	Implementation / Maintenance Agent	Relevant Standard or Requirement	Implementation Stages			Timing of Implementation	Objectives of the Recommended Measure and Main Concern to address
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		potential cumulative impact of the proposed works. The location and orientation of the associated structures should where possible avoid landscape and visually sensitive areas such woodland, shrubland and agricultural fields.									
	OP1.2	The architectural design should seek to reduce the apparent visual mass of the engineering structures through the use of textured finishes and colour blocking. Earth tones are preferred as these match the existing landscape and visual context.	Site	Project Proponent	Project Engineers / NA	TM-EIA Annex 18, HKPSG and BD	✓		✓	Throughout design phase	Responsive design to integrate the proposals into their landscape and visual context.
	OP1.3	The design of all engineered structures (retaining walls and new cut slopes) to be reviewed to incorporate greening measures such as tree, shrub	Site	Project Proponent	HyD	TM-EIA Annex 18	✓		✓	Throughout operation phase	Responsive design to integrate the proposals into their landscape and visual context.

EIA Ref.	Mit. Code	Recommended Mitigation Measures	Location	Funding	Implementation / Maintenance Agent	Relevant Standard or Requirement	Implementation Stages			Timing of Implementation	Objectives of the Recommended Measure and Main Concern to address
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		and ground cover planting. This includes the creation of soft solutions where possible and the incorporation of planters within the engineering structures to soften their visual form.									
Table 9.17	OP2	Roadside Planting									
	<u>OP2.1</u>	Create a landscape buffer area extending where space allows alongside the widened carriageway and reinstate an avenue effect originally created through the planting of a <i>Melaleuca quinquenervia</i> , along the edge of the carriageway.	Site	Project Proponent	HyD's Contractor / LCSD	TM-EIA Annex 18, HKPSG and BD	✓		✓	Throughout design phase	Planting will serve to visually integrate the proposals within the existing landscape framework.
	<u>OP2.2</u>	Utilise native tree species in the planting mix for the landscape buffer area and <i>Melaleuca quinquenervia</i> for avenue effect.	Site	Project Proponent	HyD's Contractor / LCSD	TM-EIA Annex 18, HKPSG and BD	✓		✓	Throughout design phase	Provide a linkage with the existing wooded areas creating a more coherent landscape framework whilst also improving the ecological connectivity between existing

EIA Ref.	Mit. Code	Recommended Mitigation Measures	Location	Funding	Implementation / Maintenance Agent	Relevant Standard or Requirement	Implementation Stages			Timing of Implementation	Objectives of the Recommended Measure and Main Concern to address
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											and proposed woodland habitats.
Table 9.17	OP3	Compensatory Planting Proposals									
	OP3.1	Native tree planting on the existing and proposed cut slopes include the planting of approximately 3,031m ² of mass woodland planting utilising light standard sized stock. The species selection shall include <i>Bischofia trifoliata</i> , <i>Bridelia tomentosa</i> , <i>Castanopsis fissa</i> , <i>Celtis sinensis</i> , <i>Cinnamomum camphora</i> , <i>Cratogeomys cochinchinense</i> , <i>Cyclobalanopsis myrsinifolia</i> , <i>Ficus hispida</i> , <i>Gordonia axillaris</i> , <i>Litsea glutinosa</i> , <i>Macaranga tanarius</i> , <i>Mallotus paniculatus</i> , <i>Microcos paniculatus</i> , <i>Sapium discolor</i> , <i>Sapium sebiferum</i> and <i>Schima superba</i> . Approximately 559 number large	Site	Project Proponent	Project Landscape Architect / Hyd's Contractor / LCSD	TM-EIA Annex 18, HKPSG and BD	✓		✓	Throughout design phase	The planting proposal seeks to compensate for the predicted tree loss resulting from the construction of the development, visually integrate the proposals within its existing landscape framework and provide an improved visual amenity.

EIA Ref.	Mit. Code	Recommended Mitigation Measures	Location	Funding	Implementation / Maintenance Agent	Relevant Standard or Requirement	Implementation Stages			Timing of Implementation	Objectives of the Recommended Measure and Main Concern to address
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		specimens of <i>Melaleuca quinquenervia</i> using standard sized trees will be utilised within the immediate roadside areas and within the new central median.									
	OP3.2	A qualified or Registered Landscape Architect will be involved in the design, construction supervision and monitoring, and maintenance period to oversee the implementation of the recommended landscape and visual mitigation measures including the tree preservation and landscape works on site.	Site	Project Proponent	Project Proponent / NA	TM-EIA Annex 18, HKPSG and BD	✓	✓		<u>Throughout design and construction phase</u>	The planting proposal seeks to compensate for the predicted tree loss resulting from the construction of the development, visually integrate the proposals within its existing landscape framework.
Table 9.17	OP4	Treatment of Retaining Wall and Slopes									
	OP4.1	The design and implantation of the aesthetic appearance of the proposed retaining	Site	Project Proponent	HyD	TM-EIA Annex 18	✓		✓	Throughout operation phase	Responsive design to integrate the proposals into their landscape

EIA Ref.	Mit. Code	Recommended Mitigation Measures	Location	Funding	Implementation / Maintenance Agent	Relevant Standard or Requirement	Implementation Stages			Timing of Implementation	Objectives of the Recommended Measure and Main Concern to address
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		walls and slopes will be undertaken in accordance with GEO Publication No. 1/2000 "Technical Guidelines on Landscape Treatment and Bio-engineering for Man-made Slopes and Retaining Walls". The engineering structures will be aesthetically enhanced through the use of soft landscape works including tree and shrub planting to give man-made slopes a more natural appearance.									and visual context.
	OP4.2	Light standard sized tree planting will be used on the face of soil cut slopes with a gradient of less than 30 degrees, at the crest and toe of the slope, and within berm planters. Slopes with a gradient of greater than 30 degrees will be hydroseeded using a mixture of native	Site	Project Proponent	HyD	TM-EIA Annex 18	✓		✓	Throughout operation phase	Responsive design to integrate the proposals into their landscape and visual context.

EIA Ref.	Mit. Code	Recommended Mitigation Measures	Location	Funding	Implementation / Maintenance Agent	Relevant Standard or Requirement	Implementation Stages			Timing of Implementation	Objectives of the Recommended Measure and Main Concern to address
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		trees and shrubs (6,173m ²).									
	OP4.3	Vertical greening measures shall also be considered on engineering structures including use of climbing and trailing plants both planted at the crest and toe of the features, and within pockets within the slopes.	Site	Project Proponent	HyD	TM-EIA Annex 18	✓		✓	Throughout operation phase	Responsive design to integrate the proposals into their landscape and visual context.

11.0 SUMMARY OF ENVIRONMENTAL OUTCOMES AND CONCLUSIONS

11.1 Environmental impacts associated with the proposed Project during the construction and operational phases have been assessed in this report. Mitigation measures have been proposed to reduce the environmental impacts, if necessary. Environmental Monitoring and Audit (EM&A) requirements have been recommended and detailed in the separated EM&A manual. The Implementation Schedule of the proposed mitigation measures has been included in Section 10. The major findings of the report are summarized below.

Air Quality Impacts

- 11.2 Due to the small amount of dust emissions from the active construction site, the dust impacts arising during the construction phase have been anticipated to be insignificant with the implementation of the dust suppression measures stipulated in the Air Pollution Control (Construction Dust) Regulation. EM&A is required to ensure proper implementation of the dust suppression measures.
- 11.3 According to the model predictions, no adverse air quality impact on the identified ASRs is expected from the traffic emissions.

Noise Impacts

- 11.4 Construction noise from the powered mechanical equipment (PME) has been predicted to cause adverse impacts on the identified NSRs due to the close proximity of these NSRs to the noisy plants. Mitigation measures such as quieter PME and temporary noise barrier/screen have been proposed to reduce the noise impacts. Residual impacts on some NSRs would be anticipated. Construction EM&A is recommended.
- 11.5 During the operational phase, no significant difference of the traffic noise impacts before and after the proposed Project has been predicted. No direct mitigation measure is required to reduce the traffic noise impacts.

Water Quality Impacts

- 11.6 With the implementation of the recommended mitigation measure such as control measures on the surface runoff and drainage from the works area, proper site management and good housekeeping practices, no adverse water quality impact on the receiving in-land water bodies has been anticipated during the construction phase. Routine site inspection during construction phase is recommended.

Waste Implications

- 11.7 With proper handling, transport and disposal of waste using the recommended good management and site practices, no significant environmental impacts during the construction phase has been expected. It is the contractor's responsibility to ensure that these practices and the mentioned Regulations and EPD's requirement are implemented in order to manage the wastes generated from the site properly. Regular site inspections of the waste management during the construction phase are recommended.

- 11.8 It is considered that the potential land contamination issues can be adequately controlled with suitably planned construction and works in accordance with the remediation action plan and the recommended precautionary protection measures for workers.

Ecology

- 11.9 With the implementation of the mitigation measures and guidelines for construction management during the construction of the Project, no significant and adverse ecological impact shall be anticipated. The implementation of the mitigation measures / protection measures for the fruit bat roost shall be included to the works contracts. Regular site inspections are recommended during construction phase in order to ensure the mitigation measures are implemented properly.

Landscape and Visual Impact

- 11.10 With the careful design of the road widening works to preserve as many of the existing trees as possible including the larger roadside trees, the planting of new trees and shrubs, and the aesthetic treatment of the proposed retaining structures the potential landscape and visual impacts are not considered to be significant given the scale of the project. The main mitigation approach has been to preserve existing landscape resources particularly trees as far as possible through the careful design of the proposals including the use of retaining walls to preserve existing trees on slopes. The potential loss of existing trees will be compensated through the planting of native species to restore and enhance the landscape setting and visual amenity of the road corridor and enhance its ecological value.
- 11.11 In total of 1723 existing trees, 1286 trees will be preserved in-situ and 6 trees will be transplanted to new locations within the road corridor. The affected trees are largely exotic, plantation species with many exhibiting a poor form and health condition. The compensatory planting proposals include some 559 specimen standard sized trees and 4,831m² of mass woodland planting using light standard sized trees to compensate for the loss of existing trees and enhance the landscape and visual amenity of the road corridor.
- 11.12 The residual impacts on most landscape resources will largely be slight adverse to negligible during Year 10 of the Operational Phase of the project. Impacts on the existing landscape character will be slight adverse to negligible due to the existing character of the road corridor and the enclosure provided by existing roadside trees and buildings and the growth to maturity of the proposed mitigation planting. The exception to this is the potential impact on LCA13 the existing road corridor where the significant adverse impacts of the construction phase of the project would be mitigated to moderate adverse with the growth of the proposed mitigation tree and shrub planting. The residual impacts for residential properties within the villages which line the route alignment would be moderate during Year 10. However it should be noted that the majority of the existing views available to residential VSRs are partial or glimpsed due to the screening effect of the existing landform, roadside vegetation, and the vegetation associated with individual settlements, and existing built development. Views of the road corridor are largely limited to residences on periphery of the existing settlements with views for the houses beyond

screened due to the density of the existing development and the relatively flat topography of the inhabited areas.

11.13 he predicted visual impacts for the vehicle travellers and pedestrians on Kam Tin and Lam Kam Roads will not be significant during Year 10, impacts will range from moderate to slight adverse when the proposed mitigation planting is fully established. In addition the existing views available to these VSRs are characterised by existing road and its associated structures and so the future view will not be significantly different.

11.14 For the other VSRs namely the occupational, trail walkers and recreational users of the open space the predicted impacts during the construction phase Day 1 and Year 10 would be slight adverse to negligible due to the restricted nature of the upgrading proposals and roadside character of the existing views, and the small part of the scheme proposals which would be visible to them.

Cultural Heritage Impacts

11.15 The proposed works have the potential to impact on isolated and/ or disturbed archaeological material and as a precautionary measure it will be a requirement of the EM &A Manual that if any antiquity or supposed Antiquity is discovered during the course of the excavation works undertaken by the contractor, the project proponent shall report the discovery to the AMO immediately and shall take all necessary archaeological mitigation measures to preserve it'