

**Highways Department
Works Division**

Agreement No. WD 7/2007

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

EIA REPORT: EXECUTIVE SUMMARY

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

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EIA Report: Executive Summary

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EIA REPORT: EXECUTIVE SUMMARY

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1.0 INTRODUCTION

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.

The Project

- 1.5 Figure 1.1 displays the location of the Project. The Project involves upgrading some 5.2 km of Kam Tin Road and Lam Kam Road to a standard width single two-lane carriageway, including improvements to pedestrian facilities and public transport laybys, and associated slope, drainage and landscape works.
- 1.6 The upgrade works are required as the existing width is sub-standard, and the safety hazard to road users is 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.
- 1.7 Specifically, the Project is a DP since part of the Project boundary encroaches upon 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:
- CA at north of section between Chainage CHB 28+70 and CHB 30+10 of Kam Tin Road;
 - CA at south of section between Chainage CHB 49+10 to CHB 52+40 of Lam Kam Road;
 - CA at south of section between Chainage CHB 48+00 to CHB 52+30 of Lam Kam Road; and
 - CA at north of section between Chainage CHB 50+20 to CHB 52+40 of Lam Kam Road.
- 1.8 Project construction is scheduled to commence in the first quarter of 2011 for completion in the third quarter of 2015. The works shall include paving, drainage and slope works. A works method has been devised that minimises impacts upon existing road side trees.
- 1.9 One Designated Project defined by the EIAO, namely, *Hong Kong Section of Guangzhou - Shenzhen - Hong Kong Express Rail Link* will be implemented. 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. 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.

2.0 AIR QUALITY IMPACT ASSESSMENT

Introduction

- 2.1 The air quality impacts during the construction and operational phases of the Project have been assessed and evaluated in accordance with the guidelines and criteria referred in Annexes 12 and 4 of the EIA-TM, respectively. Reference has also been made to other standards for the control of air pollutants from a variety of stationary and mobile sources established under the Air Pollution Control Ordinance. Baseline air quality conditions were derived using data from EPD's Tai Po Air Quality Monitoring Station.

Construction Air Quality Impact Assessment

- 2.2 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 necessary road traffic management arrangements, 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.
- 2.3 In addition, activities that may induce significant dust emissions such as extensive site formation and blasting are not required for Project development.
- 2.4 Gaseous emissions from properly maintained diesel-powered construction equipment shall not result in any significant impact during construction.
- 2.5 There may be localized dust emissions from concurrent construction activities from other projects, but the quantity of the spoil materials from the concurrent 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.
- 2.6 Although no adverse construction phase air quality impacts are anticipated, a number of best practice measures have been recommended to ensure compliance with the Air Pollution Control (Construction Dust) Regulation. It is also recommended that construction phase EM&A is conducted as a precautionary measure to ensure no ensure construction phase best practice measures are properly implemented and are effective.

Operational Air Quality Impact Assessment

- 2.7 The air dispersion model CALINE4 was adopted to predict vehicle exhaust emissions from the Project and major surrounding roads. The hourly NO₂, 24-hour average NO₂ and RSP concentrations at identified Air Sensitive Receivers (ASRs) were determined. The predicted peak traffic flows in the year 2030 were adopted to represent the worst-case scenario. The emission model EMFAC-HK was adopted to estimate the vehicle emission factors of NO_x and RSP.

- 2.8 All predicted 1-hour and 24-hour NO₂ and 24-hour RSP levels will comply with the Air Quality Objectives (AQOs) and hence no mitigation measures are required and no operational phase EM&A has been recommended.

3.0 NOISE IMPACT ASSESSMENT

Introduction

- 3.1 Construction and operational phase noise impacts have been assessed and evaluated in accordance with Annexes 13 and 5 of the EIA-TM, respectively. Noise control is also governed by the Noise Control Ordinance (NCO) (Cap 400), with relevant technical memoranda under the NCO for this assessment including those on Noise from Construction Work other than Percussive Piling (GW-TM) and Noise from Construction Work in Designated Areas (DA-TM).
- 3.2 Annex 5 of the EIA-TM stipulates the noise criteria to control the road traffic noise during the Project operation.
- 3.3 For the traffic noise impact assessment, the roads within 300m from the Project boundary have been included in the assessment. Traffic noise has been predicted for two scenarios: original scenario (maximum traffic projection without the Project) and unmitigated scenario (maximum traffic projection with the Project).
- 3.4 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 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.
- 3.5 If any of the NSR cannot be protected by the recommended direction noise mitigation measures, indirect technical remedies for those NSR may be adopted.

Construction Noise Impact Assessment

- 3.6 The use of Powered Mechanical Equipment (PME) in daytime is expected to be the major noise source during the construction of the Project. There shall be no percussive piling works within the project area, and no works are scheduled during noise control restricted hours.
- 3.7 The construction noise impact at representative NSRs has been conducted using an assumed PME inventory. The Project Proponent confirmed that the PME inventory list is practicable and practical to complete the works within scheduled timeframe and are available in Hong Kong.
- 3.8 The assessment results indicate adverse noise impacts are anticipated at most of the representative NSRs and noise mitigation measures will be required to reduce the construction noise impact to acceptable levels. Mitigation measures including good site practices, the use of quieter PME, avoidance of concurrent construction activities, installation of acoustic enclosure and erection of temporary noise barriers shall be necessary to reduce noise to an acceptable level.

- 3.9 Due to the proximity of some NSRs to the construction work, noise exceedances of relevant standard at several NSRs are expected even after all practical noise mitigation measures have been exhausted to minimise the noise impacts. Unavoidable residual impacts are predicated at six NSRs, namely N6, N7, N13, N19, N27 and N39. The exceedance of 1 to 9 dB(A) above the noise criteria are mainly contributed due to the road paving work. The expected exceedance periods at each respective sites are less than 6 working days (road upgrading work) and 2 working days (road paving work) respectively.
- 3.10 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.
- 3.11 No cumulative construction noise impacts are anticipated due to optimal Project scheduling, and due to the nature and distance separation of other construction projects. Although all practical effective noise mitigation measures have been fully explored and exhausted to minimize the residual impact arising from the construction works, it is anticipated that there will be potential adverse noise impacts during construction. Therefore, environmental monitoring and audit is proposed to ensure the recommended mitigation measures are effectively implemented.

Operational Noise Impact Assessment

- 3.12 Traffic noise levels at representative NSRs were predicted using the roadNoise model, based on the peak hour traffic flow of year 2030 adopted for the assessment. The traffic speed for all roads including Kam Tin Road and Lam Kam Road used in the model is 50 km/hour and a section of Kam Tin Bypass is 70 km/hour. All major roads within 300m of the Project area have been included in the assessment.
- 3.13 The predicted traffic noise contribution due to the proposed Project is less than 1.0 dB(A), the traffic noise impact from the Project is considered not significant. Hence, direct noise mitigation measures are not considered necessary during the operation phase.

4.0 WATER QUALITY IMPACT ASSESSMENT

Introduction

- 4.1 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 EIA-TM, respectively.
- 4.2 The relevant primary legislation is the Water Pollution Control Ordinance (Cap. 358), the associated Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters; and the Water Quality Objectives (WQOs) for the Deep Bay Water Control Zone (WCZ) and the Tolo Harbour Supplementary WCZ.
- 4.3 Water courses within the project area comprise the channelized Kam Tin River and a number of natural streams near Kadoorie Experimental Farm, Ling Wan Monastery, Wong Chuk Yuen, Sheung Tsuen and Kam Tin Bypass with unpolluted and polluted sections. The Project falls within two water control zones, with the Kam Tin River and its tributaries carrying waters generally polluted by organic pollution to the west towards Inner Deep Bay, and with the clean tributaries of the Lam Tsuen River flowing west towards Tolo Harbour. It is noted that there is an encroachment of about 60m of the water gathering zone located at the eastern end of the Project.
- 4.4 These observations are consistent with EPD's latest water quality index classifying Lam Tsuen River as "excellent" but Kam Tin River as "bad" or "very bad" in 2006. Overall compliance with WQOs for Kam Tin River and Lam Tsuen River is 39% and 95%, respectively, although implementation of the Yuen Long & Kam Tin Sewerage Master Plan is expected to gradually improve the situation.

Construction Phase Impact Assessment

- 4.5 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.
- 4.6 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. Regular site inspections are recommended during construction to ensure the mitigation measures are implemented properly.
- 4.7 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.

- 4.8 Concurrent projects are distant from the proposed Project area, and hence no significant cumulative impacts are anticipated.
- 4.9 As the Project boundary fall within about 60m of the water gathering grounds located at the eastern end of the Project, the water pollution control measures should be implemented. In addition, 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.

Operational Phase Impact Assessment

- 4.10 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.
- 4.11 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, no adverse impacts are anticipated.

5.0 WASTE MANAGEMENT

Introduction

- 5.1 The criteria and guidelines for evaluating and assessing waste management implications are set out in Annex 7 and Annex 15 of the EIA-TM. Reference has also been made to the Waste Disposal Ordinance (Cap. 354) and subsidiary legislation, and relevant circulars issued by ETWB and the Works Bureau.
- 5.2 “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 provides guidance on land contamination assessment.

Waste Impact Assessment

- 5.3 The following types of wastes are anticipated during the construction of the Project: construction and demolition (C&D) material; chemical wastes, and general refuse.
- 5.4 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.
- 5.5 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. 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.
- 5.6 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.
- 5.7 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.

- 5.8 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. However, the volume of chemical waste shall be limited and is anticipated to be no more than a few cubic metres per month. The volume of chemical waste generated shall be quantified in the Waste Management Plan to be maintained by the Contractor.
- 5.9 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.
- 5.10 The workforce would generate refuse comprising food scraps, waste paper, empty containers, etc. Such refuse will be collected on-site for disposal at an approved facility. 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.
- 5.11 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.
- 5.12 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.

Land Contamination Impact Assessment

- 5.13 In order to identify and evaluate the potential contamination impacts associated with Project development, a desktop study has been undertaken to review current and historical land uses and site inspection has been undertaken to confirm existing land uses. A review of applicable aerial photographs has also been conducted.
- 5.14 Land around Lam Kam Road is mainly undeveloped area, while Kam Tin Road is mainly surrounded by barracks, village houses and open space. Some car repair workshops and petrol filling stations were also found along Kam Tin Road and Lam Kam Road which may potentially be existed contaminated soil.
- 5.15 As there could be possibilities of land contamination at the Project area adjacent to the car repairing workshops, a further land contamination investigation shall be carried out at these sites to identify the possible land contamination at these locations.

- 5.16 With the implementation of the recommended mitigation measures for the handling of any contaminated materials, no adverse environmental impacts on land contamination for the Project are anticipated.

6.0 ECOLOGY IMPACT ASSESSMENT

Introduction

- 6.1 This section summarises the approach to and the findings of the ecological baseline survey and impact assessment. Key criteria for baseline evaluation and impact evaluation are presented in Annex 8 of the EIA-TM. Reference has also been made to various other legislation and standards for impact assessment and evaluation, including inter alia the Wild Animals Protection Ordinance (Cap. 170) and the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586).
- 6.2 The ecological assessment 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 Assessment Area (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.
- 6.3 A desk-top study of ecological resources was undertaken to guide survey methodologies and fieldwork locations for habitat mapping and surveys of vegetation, birds, invertebrates, stream fauna, herpetofauna and mammals. It was determined that over 65% of the terrestrial study area is occupied by urbanised / disturbed, with the remainder mainly comprising secondary woodland and (largely abandoned) agricultural land.
- 6.4 Species of conservation concern observed in the survey area in the past and / or through the 2008 field survey included a variety of bird and herpetofauna species. While the broader study area is diverse, areas close to the existing road / developed area are highly disturbed. Full details of the ecological baseline review are presented in the EIA Study Report.

Construction Phase Impact Assessment

- 6.5 Project construction activities shall include inter alia site clearance, cut and fill slope works alongside Lam Kam Road and Kam Tin Road, and paving. Potential impacts due to proposed construction shall include: vegetation clearance / habitat loss and wildlife disturbance.
- 6.6 Some 6.6 hectares of land will be required for the proposed Project development, mostly comprising 5.3 ha of urbanized / disturbed land. There shall also be a loss of 0.76 ha secondary woodland (almost all of which is under Conservation Area zoning) and 0.5 ha of agricultural land, approximately 117m² of the periphery of a meander and approximately 208m² of a drainage channel. As most of the affected habitat is disturbed areas dominated by common tree plantings, ornamental plantings and weeds. The secondary woodland affected is entirely associated with engineered slopes of occasionally moderate baseline value. Overall, the construction phase impacts due to habitat loss / vegetation clearance are anticipated to be low and shall be mitigated through compensatory planting.

- 6.7 Precautionary measures to avoid unnecessary impacts on natural stream courses and/ or nearby vegetation during construction phase shall be implemented, including proper temporary cover of stored construction materials, and storage away from streams. Protection measures shall be implemented to avoid any possible construction impacts upon the fruit bat roost in the Chinese Fan-palm on Lam Kam Road, including establishment of a Tree Protection Zone.
- 6.8 During construction activities the potential exists for visual and noise disturbance upon wildlife. However, such impacts are not anticipated to be significant given the large contiguous area of existing undisturbed secondary woodland and lowland stream course habitat that wildlife will already preferentially utilize.
- 6.9 Ecological monitoring is not considered necessary, although regular construction phase site inspections are recommended to ensure proper implementation of mitigation measures.

Operational Phase Impact Assessment

- 6.10 Road traffic is the only possible resultant disturbance to the nearby wildlife during project operation. Due to close proximity to road traffic and the existing (high) level of disturbance along the roadside, wildlife of conservation concern prefer to frequent areas distant from the roadside. As such, no significant disturbance impacts are anticipated.

7.0 CULTURAL HERITAGE IMPACT ASSESSMENT

Introduction

- 7.1 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.
- 7.2 The Antiquities and Monuments Ordinance provides the statutory framework for the preservation of objects of historical, archaeological and palaeontological interest, including the statutory procedures for the Declaration of Monuments. Also relevant are the EIA-TM and Chapter 10 of the Hong Kong Planning Standards and Guidelines.

Archaeology Impact Assessment

- 7.3 There is one Site of Cultural Heritage in the project Study Area, the Pat Heung Sheung Tsuen Archaeological Site (AM04-2022). The site was originally identified as part of a survey undertaken in the area in 1999 when 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).
- 7.4 As the Project works will be limited to areas immediately adjacent to the existing road, existing impacts from underground utilities and previously undertaken road works make it unlikely for undisturbed archaeological deposits to be present. 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 area 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.
- 7.5 As precautionary measures, should the contractor identify any antiquity or supposed antiquity during the course of the excavation works then the Antiquities and Monuments Office must be informed immediately. The project proponent shall take all necessary archaeological mitigation measures to preserve the antiquities.
- 7.6 Field surveys undertaken during 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. As such, no further investigation of alignment sections outside the archaeological site is recommended. However, as precautionary measures should the contractor identify any antiquity or supposed antiquity during the course of the excavation works then the Antiquities and Monuments Office must be informed immediately. The project proponent shall take all necessary archaeological mitigation measures to preserve the antiquities.
- 7.7 Regarding the Lam Kam Road sections of the alignment, these are 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. . However, as precautionary measures should the contractor identify any antiquity or supposed antiquity during the course of the excavation works then the Antiquities and Monuments Office must be informed immediately. The project proponent shall take all necessary archaeological mitigation measures to preserve the antiquities.

Built Heritage Impact Assessment

- 7.8 Although the desk-based study did not reveal the presence of any built heritage resources that could qualify as Sites of 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.

8.0 LANDSCAPE AND VISUAL IMPACT ASSESSMENT

- 8.1 This section summarises the approach to and the findings of the Landscape and Visual Impact Assessment. The key criteria for landscape and visual baseline study and impact assessment are presented in Annexes 10 and 18 of the EIA-TM. In addition the assessment report makes reference to other relevant legislation and standards for impact assessment and evaluation.
- 8.2 The Study Area for the preparation of the landscape impact assessment was to include all areas within 500 metres from the Project site boundary and the areas likely to be impacted by the Project. For the visual impact assessment the Study Area is based on the visual envelope, the area from which the proposals can be seen.
- 8.3 Landscape mitigation measures have been recommended to ameliorate the potential landscape and visual impacts, and ensure that upon implementation the Project will fit into the existing landscape and visual context. These measures include the careful design of the engineering measures 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.

No Impact on Planning and Development Control Framework

- 8.4 The proposed works will encroach upon the land use zonings discussed in the LVIA including for example the area zoned conservation area (CA) and the loss of some Open Space (OS) adjacent to the road. Other impacts include the loss of 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. While there may be some conflict between the Project and the future landscape planning framework as represented by the OZPs these impacts affect small areas of the identified zonings along the length of the proposed scheme. Therefore it is considered that given the nature of the impacts the scheme fits within the future landscape and visual context although further review to the published land use plans shall be considered.
- 8.5 Given the above 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

- 8.6 Although the detailed design of the proposed works is not yet available, the numbers of trees to be retained, transplanted and removed have been estimated based on the preliminary design. The estimated numbers will be updated in the tree removal application to be prepared and submitted to the Lands Department for approval in the detailed design stage in accordance with ETWB TCW No. 3/2006, 'Tree Preservation'.
- 8.7 Based on the findings of the preliminary tree survey approximately 1,286 trees surveyed within the proposed works boundary will be preserved in-situ and a further 6 trees by transplantation to a new location within the Site out of total 1763 existing trees. 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 in 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.
- 8.8 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 3.5m). This would form 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

- 8.9 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

- 8.10 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.
- 8.11 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.
- 8.12 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.
- 8.13 The potential impacts on LCA13 Kam Tin Road and Lam Kam Road Corridor 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

- 8.14 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 to moderate adverse visual 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 from 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.

- 8.15 For vehicle travellers and pedestrians (except VSRs 2 Vehicle Travellers on Kam Tin Road to the north of Shek Kong Barracks (east bound) and VSRs 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) and VSR 15 Pedestrians on Kam Tin Road to the north of Shek Kong) 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 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 the impacts during the design year would be mitigated from moderate to slight adverse due to the proposed tree and shrub planting proposed for the extension to the cuttings and embankments.
- 8.16 For the residential VSRs the predicted unmitigated and mitigated 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 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.
- 8.17 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.

- 8.18 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.
- 8.19 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.

Residual Impacts

- 8.20 Although the proposed upgrading 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, and with consideration of the restricted nature of existing views 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.

9.0 CONCLUSIONS

9.1 Environmental impacts associated with the proposed Project during the construction and operational phases have been summarized in this report, and mitigation measures have been proposed to reduce impacts to an acceptable level as necessary and supported by a programme of environmental monitoring and audit if appropriate.

9.2 The major conclusions of the environmental study are summarized below.

Air Quality Impacts

9.3 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.

9.4 According to the model predictions, no adverse air quality impact on the identified ASRs is expected from the traffic emissions.

Noise Impacts

9.5 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 quiet 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.

9.6 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

9.7 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

9.8 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.

- 9.9 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

- 9.10 Most of the immediate study area is occupied by urbanised / disturbed, with the remainder mainly comprising plantation secondary woodland and largely abandoned agricultural land. However there are undisturbed areas remote from the roadside where wildlife exists.
- 9.11 The main construction phase impact is associated with site clearance and geotechnical works, resulting in tree felling and removal of ground vegetation. These activities will primarily affect urbanized / disturbed land, but also some 0.76 hectares of secondary woodland dominated by common trees on engineered slopes, approximately 117m² of the periphery of a meander and approximately 208m² of a drainage channel. Site inspections are proposed to ensure mitigation measures are properly implemented.
- 9.12 Due to close proximity to road traffic and the existing road traffic disturbance along the roadside, wildlife of conservation concern prefer to frequent areas distant from the roadside. As such, no significant disturbance impacts are anticipated.

Landscape and Visual Impact

- 9.13 Given the nature of the proposed project and the full implementation of the proposed mitigation measures the potential residual landscape and visual impacts will not be significant and will be acceptable after mitigation. The proposals will take place within an existing road corridor and so impacts to landscape resources and the landscape character of the area will be limited. The main mitigation measures include the (i) preservation, where possible, of existing trees; (ii) the aesthetic consideration of the appearance of the main engineering structures and (iii) the planting of new native trees and shrubs in roadside areas. These planting proposals are designed to restore and enhance the landscape setting and visual amenity of the road and its ecological value.
- 9.14 In total of 1763 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 3,031m² 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.
- 9.15 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 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 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. 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.

- 9.16 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.
- 9.17 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.
- 9.18 Therefore upon the establishment of proposed compensatory planting and restoration of disturbed areas, the widening proposals will not constitute a significant component and that the Project can be successfully integrated within the existing landscape and visual context.

Cultural Heritage Impacts

- 9.19 The proposed works have the potential to impact on isolated and/ or disturbed archaeological material and as precautionary measures should the contractor identify any antiquity or supposed antiquity during the course of the excavation works then the Antiquities and Monuments Office must be informed immediately. The project proponent shall take all necessary archaeological mitigation measures to preserve the antiquities.'
- 9.20 No adverse impacts to Sites of Built Cultural Heritage will arise from the project and no mitigation measures will be required for either the construction or operational phases.