

Environmental Impact Assessment Ordinance (Cap. 499), Section 5(7)

Environmental Impact Assessment Study Brief No. ESB-238/2011

Project Title : Development of Lok Ma Chau Loop
(hereinafter referred as “the Project”)

Name of Applicant : Civil Engineering and Development Department
(hereinafter referred as “the Applicant”)

1. BACKGROUND

- 1.1 An application (No. ESB-238/2011) for an Environmental Impact Assessment (EIA) study brief under section 5(1)(a) of the Environmental Impact Assessment Ordinance (EIAO) was submitted by the Applicant on 3 November 2011 with a project profile (No. PP-455/2011) (hereinafter referred as “the Project Profile”).
- 1.2 As a result of the training of Shenzhen River, an area of about 87 ha, which previously lay to the north of the river course, became situated to the south of the re-aligned river. During the river training work, the Lok Ma Chau (LMC) Loop was used as a dumping ground for the sediments extracted from the old riverbed.
- 1.3 The Civil Engineering and Development Department and the Planning Department (CEDD) has commenced a comprehensive planning and engineering feasibility study for development of LMC Loop (the Study). The Study is to formulate a comprehensive plan for the development of the LMC Loop and the associated infrastructure based on higher education as the leading land use in the LMC Loop with some elements of new high-tech research and development facilities and creative industries incorporated. The Project comprises the developments and infrastructure within the LMC Loop and the adjacent areas in the Hong Kong side. The land uses alongside the infrastructure within the adjacent areas in HK will also be reviewed. CEDD previously applied for an EIA Study Brief under the EIAO, and the EIA Study Brief ESB-201/2008 was issued in January 2009. CEDD has now adjusted the Study Area for the infrastructure, to accommodate the revised alignment of the proposed transport infrastructure, basically the connection roads. The revised Study Area is shown in Appendix A, which includes LMC Loop of about 87 ha, and the adjoining areas in the Hong Kong side.
- 1.4 The Project is a designated project under Item 1 of Schedule 3 of the EIAO, which specifies “Engineering feasibility study of urban development projects with a study area covering more than 20 ha or involving a total population of more than 100,000”.
- 1.5 The Project also includes all individual project(s) that fall under Schedule 2 of the EIAO to be identified under section 2.1(x) of this study brief.
- 1.6 In accordance with section 5(1)(a) of the EIAO, a person who is planning a designated project shall apply to the Director of Environmental Protection (hereinafter referred as “the Director”) for an environmental impact assessment

- study brief to proceed with an environmental impact assessment study for the project.
- 1.7 Pursuant to section 5(7)(a) of the EIAO, the Director issues this EIA study brief to the Applicant to carry out an EIA study.
- 1.8 The purpose of this EIA study is to provide information on the nature and extent of environmental impacts arising from the construction and operation of the developments proposed under the Project and related works that take place concurrently. This information will contribute to decisions by the Director on:
- (i) the overall acceptability of any adverse environmental consequences that are likely to arise as a result of the Project and associated works, and their related staged implementation;
 - (ii) the conditions and requirements for the detailed design, construction and operation of the Project to mitigate against adverse environmental consequences wherever practicable; and
 - (iii) the acceptability of residual impacts after the staged as well as the full implementation of the Project and the related proposed mitigation measures are implemented.

2. OBJECTIVES OF THE EIA STUDY

- 2.1 The objectives of the EIA study are as follows:
- (i) to describe the Project together with the requirements for carrying out the Project;
 - (ii) to identify and describe elements of the community and environment likely to be affected by the Project and/or likely to cause adverse impacts on the sensitive uses at the Project, including both the natural and man-made environment and associated environmental constraints;
 - (iii) to provide information on the consideration of alternatives to avoid or minimize the potential adverse environmental impacts on the sensitive uses at the Project and adjacent areas that may be subject to (i) the adverse environmental impacts of the Project and/or (ii) the adverse impacts of the existing/committed/ planned developments in the Project site and adjacent areas; to compare the environmental benefits and dis-benefits of each of different options; to provide justifications and constraints for selecting the preferred option(s); and to describe the part environmental factors played in the selection;
 - (iv) to identify and assess air quality impact, noise impact, water quality impact, waste management, land contamination, hazard to life, ecological impact, fisheries impact, landscape and visual impact, impacts on sites of cultural heritage, quantify emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;
 - (v) to identify the negative impacts and propose measures to avoid or provision

- of mitigation measures to minimize pollution, environmental disturbance and nuisance during construction and operation of the Project;
- (vi) to investigate the feasibility, practicability, effectiveness and implications of the proposed impact avoidance and/or mitigation measures;
 - (vii) to identify, predict and evaluate the residual environmental impacts (i.e. after practicable avoidance or mitigation measures) and the cumulative effects expected to arise during the construction and operation of the Project and associated works in relation to the sensitive receivers and potential affected uses;
 - (viii) to identify, assess and specify methods, measures and standards to be included in the detailed design, construction and operation of the Project and associated works which are necessary to mitigate these environmental impacts and cumulative effects and reduce them to the acceptable levels;
 - (ix) to 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 provision of any necessary modification;
 - (x) to identify individual project(s) that fall under Schedule 2 of the EIAO; to ascertain whether the EIA study has 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;
 - (xi) to 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 provision of any necessary modification; and
 - (xii) to design and specify environmental monitoring and audit requirements to ensure effective implementation of the recommended environmental protection and pollution control measures.

3. DETAILED REQUIREMENTS OF THE EIA STUDY

3.1 The Purpose

- 3.1.1 The purpose of this study brief is to scope the key issues of the EIA study and to specify the environmental issues that are required to be reviewed and assessed in the EIA report. The Applicant has to demonstrate in the EIA report that the criteria in the relevant sections of the Technical Memorandum on Environmental Impact Assessment Process (hereinafter referred to as “the TM”) issued under section 16 of the Environmental Impact Assessment Ordinance are fully complied with.

3.2 The Scope

- 3.2.1 The scope of this EIA study shall cover the Project mentioned in section 1.3 and 1.5 of this study brief and alternative development proposal(s) that may be recommended in the course of the EIA study. The EIA study shall cover the

combined impacts of the entire Project and associated works and the cumulative impacts of the existing, committed and planned developments in the vicinity of the Project and associated works sites in accordance with section 3.4 of the TM. The Applicant has indicated that the following major projects will likely interface with the Project:

- (i) Liantang/Heung Yuen Wai Boundary Control Point and Associated Works
- (ii) Land Use Planning for the Closed Area
- (iii) Cycle Tracks connecting North West New Territories with North East New Territories
- (iv) New Development Areas in North East New Territories
- (v) Stormwater Drainage Master Plan Study in the Northern New Territories
- (vi) Construction of a Secondary Boundary Fence and new sections of Primary Boundary Fence and Boundary Patrol Road
- (vii) The proposed Northern Link of the railway

Information on the potential impacts on the environment within the HKSAR boundary arising from any associated works of the Project outside the HKSAR boundary, and in combination with those impacts arising from the Project, shall also be provided to facilitate the Director's consideration on the overall acceptability of any adverse environment consequences that are likely to arise as a result of the Project.

3.2.2 The EIA study shall address the likely key issues described below together with any other key issues identified during the course of the EIA study:

- (i) the objective comparison of the environmental benefits and dis-benefits of different development scenarios with or without the Project, with a view to deriving the preferred development options and land use plans such as Preliminary Outline Development Plans (PODP), Recommended Outline Development Plan (RODP) and Recommended Layout Plan (RLP) for the Project that would avoid adverse environmental impacts and industrial/residential interfacing problems to the maximum practicable extent. Particular attention shall be given to the acceptability of the overall environmental performance of the Project at all stages throughout implementation and the cumulative effects due to interfacing planned, committed and existing projects in the vicinity of the Project;
- (ii) the potential land contamination associated with the historical land uses which have the potential to cause or have caused land contamination, such as but not limited to that LMC Loop served as dumping ground for mud extracted from the Shenzhen River training works, with a view to recommending soil remediation measures if necessary;
- (iii) the potential terrestrial and aquatic ecological impact arising from the Project on ecological sensitive areas, habitats and species, including but not limited to Mai Po Inner Deep Bay Ramsar Site, Mai Po Egrettry SSSI, Inner Deep Bay SSSI, Wetland Conservation Area (WCA) and Wetland Buffer Area (WBA) (both were defined under Town Planning Board Guidelines TPB PG-No. 12B), Hoo Hok Wai and Ta Sha Lok wetlands, fishponds, reedbeds, marshes and other wetlands, secondary woodlands, watercourses

- including the Shenzhen River and its meander as well as the natural streams at Ma Tso Lung
- (iv) the potential fisheries impacts arising from the construction and operation of the project;
 - (v) the potential construction and operation water quality impacts caused by the Project, in particular:
 - (a) domestic sewage, commercial, institutional and industrial effluent discharge from the Project;
 - (b) possible impact due to discharge from stormwater drainage system and surface runoff, taking into account the cumulative impact from existing and planned / committed projects in the vicinity of the Project, in particular, the Land Use Planning for the Closed Area Study, New Development Areas in North East New Territories; and
 - (c) other discharge arising from the Project that would cause increase in pollution loadings in nearby watercourses and channels.
 - (vi) the potential food safety implications if there are fishes or organisms in fishponds or water bodies possibly contaminated by the Project and would be eaten by human;
 - (vii) considerations on the use of clean fuels, low emission/mass transport system and renewable energy to minimize emissions from the Project. Potential air quality impact arising from the construction and operation of the Project and associated works; and the air quality impacts on air sensitive uses in the assessment area due to air pollutant emission sources identified according to section 3.4.4.3(iii) of this study brief;
 - (viii) the potential noise impact during construction and operational from fixed noise sources, road and rail traffic, and helicopter if any, on noise sensitive receivers identified in section 3.4.5.2(iii) of this study brief. Consideration should be given to adopt alternative alignment and design such as tunnel or suppress design for the new roads and railways under the Project in order to minimize the noise impact on identified sensitive receivers and the use of mitigation measures such as noise barriers;
 - (ix) the sewerage and sewage treatment implications to cope with discharges from population and any development from the Project, taking into account the capacity requirements for the existing, committed and planned developments in the vicinity of the Project;
 - (x) the potential impacts from public dumping areas, waste disposal facilities and waste disposal activities of various types of waste including demolition and excavated materials, refuse, chemical, industrial and special wastes to be generated from the Project;
 - (xi) the potential hazard to life from potential storage of explosive for construction under the Project;

- (xii) the potential landscape and visual impacts caused by the Project during construction and operation stages shall be considered. The glare impacts from the Project shall also be addressed;
- (xiii) the potential impacts from the Project on sites of cultural heritage, historic buildings and structures likely to be affected by the construction works of the Project;
- (xiv) the potential cumulative environmental impacts of the Project and associated infrastructure works, through interaction or in combination with other concurrent existing, committed and planned developments in the vicinity of the Project, and that those impacts may have a direct bearing on the environmental acceptability of the Project. Environmentally polluting sources in Shenzhen which may have a direct bearing on the cumulative impact shall be included in the assessment.

3.3 Consideration of Alternative Options and Construction Methods

The Need of Project

- 3.3.1 The Applicant shall provide information on the purpose and objectives of the Project and describe the scenarios with and without the Project. In addition, the scale of the development, including the plot ratio, should be discussed.

Consideration of Different Development Options and Landuse Plans

- 3.3.2 In deriving the preferred development option(s) and landuse plans for the Project, the Applicant shall consider and present information on identified feasible alternatives taking into account the relevant findings of those options as well as any alternative development proposals identified during the course of the EIA study. A comparison of the environmental benefits and dis-benefits of possible development options, in respect of landuse, road alignments, clean fuels, low emission transport system, renewable energy if any, built form, design, construction methods, sequence of works and staged implementation, shall be made on the sensitive areas within the assessment areas. The comparison shall assist informed-decisions to be made on the recommended preferred options, which shall in principle, avoid or minimize adverse environmental impacts to the maximum practicable extent. The EIA report shall focus on and describe adequately the part that environmental factors played in arriving at the preferred development option(s) for the Project.

3.4 Technical Requirements

- 3.4.1 The Applicant shall conduct the EIA study to address all environmental aspects of the Project and associated works as described in sections 3.1, 3.2 and 3.3 of this study brief. The assessment shall be based on the best available information at the time of the assessment.
- 3.4.2 The Applicant shall include in the EIA report details of the construction programme and methodologies. The Applicant shall clearly state in the EIA report the time

frame and work programmes of the Project and associated works and other concurrent projects, and assess the cumulative environmental impacts from the Project with all interacting projects, including staged implementation of the Project.

- 3.4.3 The EIA study shall include the following technical requirements on specific impacts.

3.4.4 Air Quality Impact

- 3.4.4.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing air quality impact as stated in Section 1 of Annex 4 and Annex 12 of the TM respectively.

- 3.4.4.2 The Applicant shall assess the air pollutant concentrations with reference to relevant sections of Guidelines for Local-Scale Air Quality Assessment Using Models given in Appendices B1 to B4, or other methodology as agreed by the Director.

- 3.4.4.3 The air quality impact assessment shall include the following:

(i) Determination of Assessment Area

The area for air quality impact assessment shall generally be defined by a distance of 500 metres expanded from the boundary of the Project. The assessment shall include but not limited to the existing, planned and committed sensitive receivers within the assessment area. Such assessment shall be based on the best available information at the time of the assessment. The assessment area could be extended to include major emission sources that may have bearing on determining the environmental acceptability of the Project.

(ii) Background and Analysis of Activities

- (a) Provide background information relating to air quality issues relevant to the Project, that has the potential to adversely affect the proposed new developments of the Project and associated works, description of the types of activities of the Project and associated works that may affect air quality during the construction and operation stages.
- (b) Give an account, where appropriate, of the consideration/measures that have been taken into consideration in the planning of the Project and associated works to abate the air pollution impact. The Applicant shall consider alternative construction methods/phasing programmes and alternative modes of operation to minimize the odour, constructional and operational air quality impacts respectively.
- (c) Present the background air quality levels in the assessment area for the purpose of evaluating the cumulative constructional and operational air quality impacts.

(iii) Identification of Air Sensitive Receivers (ASRs) and Examination of

Emission/Dispersion Characteristics

- (a) Identify and describe the representative existing, committed and planned ASRs likely be affected by the potential adverse environmental impacts caused by emission sources identified in section 3.4.4.3(iii)(b) of this study brief as arising from the Project within the assessment area (section 3.4.4.3(i) of this study brief), both on-site and off-site, including those earmarked on the relevant PODP, RODP and RLP of the Project, Outline Zoning Plans, Outline Development Plans, Layout Plans and other relevant published land use plans and any alternative development proposal(s) identified or recommended in the course of this EIA study. The Applicant shall select assessment points of the identified ASRs that would represent the worst impact point of these ASRs. A map clearly showing the locations and descriptions, such as names of buildings, uses and heights of the selected assessment points shall be included. The separation distances of these ASRs from the nearest emission sources shall also be given. For phased development, the Applicant should review the development programme, and where appropriate, to include occupiers of early phases as constructional impact ASRs if they may be affected by works of later phases.
- (b) Provide a list of air pollutant emission sources, including any nearby emissions which are likely to have impact related to the Project and related studies based on the analysis of construction and operation activities in section 3.4.4.3(ii)(a) of this study brief. Examples of constructional stage emission sources include stockpiling, blasting, concrete batching, material handling and vehicular movements on unpaved haul roads on site, etc. Examples of operational stage emission sources include vehicular emissions, stack emissions from industrial premises, odour emissions from sewage pumping stations, sewage treatment works and Shenzhen River, if any. Confirmation of the validity of the assumptions (e.g. volume of construction material handled, etc.) and the magnitude of the activities shall be obtained from the relevant government department / authorities and documented.

The Applicant shall identify chimneys and obtain relevant chimney emission data in the study area by carrying out a survey for assessing the cumulative air quality impact of air pollutants through chimneys. The Applicant shall ensure and confirm that the chimney emission data used in their assessment have been validated and updated by their own survey. If there are any errors subsequently found in their chimney emission data used, the Applicant shall be fully responsible and the submission might be invalidated.

- (c) The emissions from any associated works of the Project, and from any concurrent projects, identified as relevant during the course of the EIA study, shall be taken into account as contributing towards the overall cumulative air quality impact. The impacts as affecting the existing, planned and committed air sensitive receivers within the assessment area (section 3.4.4.3(i) of this study brief) shall be assessed, based on the best information available at the time of assessment.

(iv) Construction Phase Air Quality Impact

- (a) The Applicant shall follow the requirements stipulated under the Air Pollution Control (Construction Dust) Regulation to ensure that construction dust impacts are controlled within the relevant standards as stipulated in section 1 of Annex 4 of the TM. A monitoring and audit programme for the construction phase shall be devised to verify the effectiveness of the control measures proposed so as to ensure proper construction dust control.
- (b) If the Applicant anticipates a significant construction dust impact that will likely cause exceedance of the recommended limits in the TM at the ASRs despite incorporation of dust control measures, a quantitative assessment shall be carried out to evaluate the construction dust impact at the identified ASRs. The Applicant shall follow the methodology set out in section 3.4.4.3(vi) of this study brief when carrying out the quantitative assessment.
- (c) The assessment shall cover the cumulative dust impacts due to the construction works of the Project and any other relevant concurrent projects identified during the course of assessment.

(v) Operational Phase Air Quality Impact

- (a) The air pollution impacts of future road traffic shall be calculated based on the highest emission strength from road vehicles upon operation of the proposed road until 15 years after commissioning of the proposed comprehensive development. The Applicant shall demonstrate that the selected year of assessment represents the highest emission scenario given the combination of vehicular emission factors and traffic flow for the selected year. The Applicant shall propose any Fleet Average Emission Factors used in the assessment. If necessary, the Fleet Average Emission Factors shall be determined by a motor vehicle emission model such as EMFAC-HK model in accordance with section 4.4.2(c) of the TM and documented in the EIA report. The traffic flow data and assumptions such as the exhaust technology fractions, vehicle age/population distribution, traffic forecast and speed fractions that are used in the assessment shall be presented in the form of both summary table(s) and graph(s).
- (b) If vehicular tunnels and/or full enclosures are to be proposed in the Study, it is the responsibility of the Applicant to ensure that the air quality inside these proposed structures shall comply with Environmental Protection Department's (EPD's) "*Practice Note on Control of Air Pollution in Vehicle Tunnels*". When assessing air quality impact due to emissions from tunnels/full enclosures, the Applicant shall ensure prior agreement with the relevant tunnel ventilation design engineer over the amount and the types/kinds of pollutants emitted from these tunnel/full enclosures; and such assumptions shall be clearly and properly documented in the EIA report.

- (c) The Applicant shall calculate the expected air pollutant concentrations at the identified ASRs based on an assumed reasonable worst-case scenario. The evaluation shall be based on the strength of the emission sources identified in section 3.4.4.3(iii)(b) of this study brief. The Applicant shall follow section 3.4.4.3(vi) of this study brief when carrying out the quantitative assessment.

(vi) Quantitative Assessment Methodology

- (a) The Applicant shall conduct the quantitative assessment with reference to relevant sections of the modelling guidelines stated in section 3.4.4.2 of this study brief while making allowance for the specific characteristics of the Project. The specific methodology must be documented in such level of details (preferably with tables and diagrams) to allow the readers of the EIA report to grasp how the model has been set up to simulate the situation at hand without referring to the model input files. Detailed calculation of the pollutant emission rates for input to the model and a map showing all the road links shall be presented in the EIA report. The Applicant must ensure consistency between the text description and the model files at every stage of submissions for review.
- (b) The Applicant shall identify the key/representative air pollutant parameters (types of pollutants and the averaging time concentrations) to be evaluated and provide explanation for selecting such parameters for assessing the impact from the Project.
- (c) The Applicant shall calculate the cumulative air quality impact at the ASRs identified under section 3.4.4.3(iii) of this study brief and compare these results against the criteria set out in section 1 of Annex 4 in the TM. The predicted air quality impacts (both unmitigated and mitigated) shall be presented in the form of summary table(s) and pollution contours, to be evaluated against the relevant air quality standards and on any effect they may have on the land use implications. Plans of a suitable scale should be used to present pollution contours to allow buffer distance requirements to be determined properly.
- (d) If there is any direct technical noise remedy recommended in the Study, its air quality implications shall be assessed. For instance, if barriers that may affect dispersion of air pollutants are proposed, then the implications of such remedies on air quality impact shall be assessed. If tunnels or noise enclosures are proposed, then portal emissions of the tunnel/enclosed road sections and air quality inside the tunnel/enclosed road sections shall also be addressed. The Applicant shall highlight clearly the locations and types of agreed noise mitigating measures (where applicable), be they barriers, tunnel/road enclosure and their portals, and affected ASRs, on the contour maps for easy reference.

(vii) Mitigation Measures for Non-compliance

The Applicant shall propose remedies and mitigating measures where the predicted air quality impact exceeds the criteria set in section 1 of Annex 4 in

the TM. These measures and any constraints on future land use planning shall be agreed with the relevant government departments/authorities and be clearly documented in the EIA report. The Applicant shall demonstrate quantitatively that the resultant impacts after incorporation of the proposed mitigating measures will comply with the criteria stipulated in section 1 of Annex 4 in the TM.

(viii) Submission of Model Files

Input and output file(s) of model run(s) including those files for generating the pollution contours and emission calculation work sheets shall be submitted to the Director in electronic format together with the submission of the EIA report.

3.4.5 Noise Impact

3.4.5.1 The Applicant shall follow the criteria and guidelines as stated in Annexes 5 and 13 of the TM respectively for evaluating and assessing both the construction and operational noise impacts arising from the Project and associated works, including their staged implementation.

3.4.5.2 The noise impact assessment shall include the following :

(i) Determination of Assessment Area

The area for noise impact assessment shall generally include all areas within 300 metres from the boundary of the Project and associated works. The assessment area could be reduced accordingly if the first layer of noise sensitive receivers (NSRs), closer than 300 metres from the boundary of assessment area, provides acoustic shielding to those receivers at further distance behind. The assessment area shall be expanded to include NSRs at distance greater than 300 metres from the assessment area boundaries which are noise sensitive if they may be affected by the construction and operation of the Project and associated works”.

(ii) Provision of Background Information and Existing Noise Levels

The Applicant shall provide all background information relevant to the Project and associated works, including relevant previous or current studies. Unless required for determining the planning standards, such as those for planning of fixed noise sources, no existing noise levels are required except as set out below.

(iii) Identification of Noise Sensitive Receivers

(a) The Applicant shall refer to Annex 13 of the TM when identifying the NSRs. The NSRs shall include all existing NSRs and all planned/committed noise sensitive developments and uses earmarked on the relevant PODP, RLP and RODP of the Project, Outline Zoning Plans, Outline Development Plans, Development Permission Area Plans,

Layout Plans and other relevant published landuse plans, including any alternative development proposal(s) identified or recommended in the course of the EIA study. The photographs of all existing NSRs shall be appended to the EIA report.

- (b) The Applicant shall select assessment points to represent all identified NSRs for carrying out quantitative noise assessment described below. A map showing the location and description such as name of building, use, and floor of each and every selected assessment point shall be given. For planned noise sensitive land uses without committed site layouts, the Applicant shall use the relevant planning parameters to work out representative site layouts for the operational noise assessment purpose. However, such assumptions together with any constraints identified, such as setback of building, building orientation, extended podium, shall be agreed with the relevant responsible parties including Planning Department and Lands Department in accordance with section 6.3 of Annex 13 of the TM.

(iv) Provision of an Emission Inventory of the Noise Sources

The Applicant shall provide an inventory of noise sources, including representative construction equipment for construction noise assessment such as for tunneling and other construction works, and traffic flow/fixed plant equipment/railway/rolling stock, as appropriate, for operational noise assessment. Confirmation on the validity of the inventory shall be obtained from the relevant government departments/authorities and documented.

(v) Construction Noise Assessment

- (a) The assessment shall cover the cumulative noise impacts due to the construction works of the Project and associated works and any other relevant concurrent projects identified during the course of the EIA study.
- (b) The Applicant shall carry out assessment of noise impact from construction (excluding percussive piling) of the Project and associated works during day time, i.e. 7 a.m. to 7 p.m., on weekdays other than general holidays in accordance with the methodology stipulated in sections 5.3 and 5.4 of Annex 13 of the TM. The criteria in Table 1B of Annex 5 of the TM shall be adopted in the assessment.
- (c) To minimize the construction noise impact, alternative construction methods to replace percussive piling shall be proposed as far as practicable. In case blasting works will be involved, it should be carried out, as far as practicable, outside the sensitive hours of 7 p.m. to 7 a.m. on Monday to Saturday and any time on a general holiday, including Sunday. For blasting that must be carried out during the above-mentioned sensitive hours, the noise impact associated with the removal of debris and rocks should be fully assessed and adequate mitigation measures should be recommended to reduce the noise impact as appropriate.

- (d) If tunnelling work is involved, noise impact (including air-borne noise and ground-borne noise) associated with the operation of powered mechanical equipment, in particular tunnel boring machine or equivalent, shall be assessed. If tunnel boring machine is used and it is likely that ground-borne noise will affect NSRs, the assessment criteria and methodology/model for ground-borne noise shall be considered in accordance with section 4.4.2(c) of the TM and documented in the EIA report.
 - (e) If the unmitigated construction noise levels are found exceeding the relevant criteria, the Applicant shall propose practicable direct mitigation measures (including movable barriers, enclosures, quieter alternative methods, re-scheduling and restricting hours of operation of noisy task) particularly at open-cut areas, tunnel boring machine launching and retrieval shafts and tunnel portal(s) where related to the Project and associated works to minimize the impact. If the mitigated noise levels still exceed the relevant criteria, the duration of the noise exceedance shall be given.
 - (f) The Applicant shall formulate a reasonable construction programme as far as practicable such that no work will be required in the restricted hours as defined under the Noise Control Ordinance (NCO). In case the Applicant needs to evaluate whether construction works in restricted hours as defined under the NCO are feasible or not in the context of programming construction works, reference should be made to the relevant technical memoranda issued under the NCO. Regardless of the results of the construction noise impact assessment for restricted hours, the Noise Control Authority will process the Construction Noise Permit (CNP) application, if necessary, based on the NCO, the relevant technical memoranda issued under the NCO, and the contemporary conditions/situations. This aspect should be explicitly stated in the noise chapter and the conclusions and recommendations chapter in the EIA report.
- (vi) Operational Noise Assessment
- (a) Fixed Noise Sources
 - (a1) Assessment of Fixed Source Noise Levels

The Applicant shall identify all fixed noise sources within the assessment area, including but not limited to any permanent and temporary industrial noise source(s), ventilation system(s) of building(s) and/or tunnel(s), container back-up site(s), open storage site(s), vehicle repair workshop(s), public transport interchange(s), water pumping station(s), electrical substation(s), bus terminus, railway station(s), sewage treatment plant(s), sewage pumping station(s), open car/lorry park(s), refuse transfer station(s), concrete batching plant(s), construction material handling facilities, fire station(s), or ambulance depot(s).

The Applicant shall calculate the expected noise using standard acoustics principles. Calculations for the expected noise shall be based on assumed plant inventories and utilization schedule for the worst case scenario. The Applicant shall calculate the noise levels taking into account correction of tonality, impulsiveness and intermittency in accordance with the Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites. The cumulative impacts due to the fixed noise sources of the proposed developments and other existing noise sources shall also be assessed.

(a2) Presentation of Noise Levels

The Applicant shall present the existing and future noise levels in L_{eq} (30 min) at the NSRs at various representative floor levels (in mP.D.) on tables and plans of suitable scale.

A quantitative assessment at the NSRs for the existing, committed and planned fixed noise source(s) shall be carried out and compared against the criteria set out in Table 1A of Annex 5 of the TM. For noise matters not fully enlisted in Table 1A of Annex 5 of the TM, the criteria and assessment methodology shall be considered in accordance with section 4.4.2(c) of the TM and documented in the EIA report.

(a3) Proposals for Noise Mitigation Measures

The Applicant shall propose direct mitigation measures within the limits of the Project and associated works in all situations where predicted noise level exceeds criteria set out in Table 1A of Annex 5 of the TM to protect affected NSRs.

(b) Road Traffic Noise

(b1) Calculation of Noise Levels

The Applicant shall analyze the scope of the proposed road alignment(s) to identify road sections for the purpose of traffic noise impact assessment. In determining whether the traffic noise impact due to road improvement project/works is considered significant, detailed information with respect to factors including at least the change of nature of road, change of alignment and change of traffic capacity or traffic composition, and change of traffic flow pattern in the associated road networks, shall be assessed. The traffic noise impact shall be considered significant if the traffic noise level with all the road projects is greater than that without all of the road projects at the design year by 1.0 dB(A) or more. Figures showing extents of new/altered roads, existing roads and the associated road networks shall be provided in the EIA report.

The Applicant shall calculate the expected road traffic noise using methods described in the U.K. Department of Transport's "Calculation of

Road Traffic Noise” (1988). Calculations of future road traffic noise shall be based on the peak hour traffic flow in respect of the maximum traffic projection within a 15 years period upon commencement of operation of the proposed roadwork. The Applicant shall calculate traffic noise levels in respect of each road section and the overall noise levels from combined road sections (road sections within the meaning of Item A.1 of Schedule 2 of EIAO and other road sections) at NSRs. The EIA report shall contain sample calculations and input parameters for 10 assessment points as requested by the Director. The Applicant shall prepare and provide drawings (i.e. road-plots of the traffic noise model) of appropriate scale to show the road segments, topographic barriers, and assessment points of sensitive receivers input into the traffic noise model.

The Applicant shall provide input data sets of traffic noise prediction model adopted in the EIA study for the following scenarios :

- (1) unmitigated scenario after completion of modification at the design year;
- (2) mitigated scenario after modification work at the design year; and
- (3) prevailing scenario for indirect technical remedies eligibility assessment.

The data shall be in electronic text file (ASCII format) containing road segments, barriers and noise sensitive receivers information. CD-ROM(s) containing the above data shall be attached in the EIA report.

(b2) Presentation of Noise Levels

The Applicant shall present the prevailing and future traffic noise levels in L_{10} (1hour) at the NSRs at various representative floor levels in (m P.D.) on tables and plans of suitable scale.

A quantitative assessment at the NSRs for the proposed road alignments shall be carried out and compared against the criteria set out in Table 1A of Annex 5 of the TM. The potential noise impact of the Project shall be quantified by estimating the total number of dwellings, classrooms and other noise sensitive elements that will be exposed to noise levels exceeding the criteria set in Table 1A of Annex 5 of the TM.

(b3) Proposals for Noise Mitigation Measures

After rounding of the predicted noise levels according to the U.K. Department of Transport's “Calculation of Road Traffic Noise” (1988), the Applicant shall propose direct mitigation measures in all situations where the predicted traffic noise level exceeds the criteria set in Table 1A of Annex 5 in the TM by 1 dB(A) or more with significant noise

contribution from road traffic caused by the Project. The direct mitigation measures listed under section 6.1 of Annex 13 of the TM, including the option of alternative land use arrangement, shall be thoroughly explored and evaluated with a view to reducing the noise level at the NSRs concerned to the level meeting the relevant noise criteria. The feasibility, practicability, programming and effectiveness of the recommended mitigation measures shall be assessed in accordance with section 4.4.2(k) of the TM. Specific reasons for not adopting certain direct mitigation measures in the design to reduce the traffic noise to a level meeting the criteria in the TM or to maximize the protection for the NSRs as far as possible should be clearly and specifically quantified and laid down.

Sections of barriers proposed to protect existing NSRs shall be differentiated clearly from those proposed for the protection of future or planned NSRs as the latter is only required to be constructed before the occupation of the planned NSRs. To facilitate the phased implementation of barriers under this principle, a barrier inventory showing intended NSRs (i.e. existing NSRs as distinct from planned NSRs) to be protected by different barrier section to achieve different extent of noise reduction (to be quantified in terms of how many dB(A)) should be provided.

The total number of dwellings, classrooms and other noise sensitive element that will be benefited from and be protected by the provision of direct mitigation measures should be provided. In order to clearly present the extents/locations of the recommended noise mitigation measures, plans prepared from 1:1,000 or 1:2,000 survey maps showing the mitigation measures (e.g. enclosures/barriers, low noise road surfacing) shall be included in the EIA report.

The total number of dwellings, classrooms and other noise sensitive elements that will still be exposed to noise above the criteria with the implementation of all recommended direct mitigation measures shall be quantified. The Applicant shall provide in the EIA report the information of the recommended noise mitigation measures (such as barrier types, nominal dimensions at different cross-sections, extents/locations, lengths, mPD levels of barriers) in electronic format.

In case where a number of the NSRs cannot be protected by the recommended direct mitigation measures, the Applicant shall identify and estimate the total number of existing dwellings, classrooms and other noise sensitive elements which may qualify for indirect technical remedies, the associated implications for such implementation. For the purpose of determining the eligibility of the affected premises for indirect technical remedies, reference shall be made to the following set of three criteria :

- (1) the predicted overall noise level at the NSR from the new/altered road together with other traffic noise in the vicinity must be above a specified noise level (e.g. 70 dB(A) for domestic premises and 65

dB(A) for education institutions, all in $L_{10}(1hr)$);

- (2) the predicted overall noise level is at least 1.0 dB(A) more than the prevailing traffic noise level, i.e. the total traffic noise level existing before the works to construct the road were commenced; and
- (3) the contribution from the new/altered road to the increase in the predicted overall noise level must be at least 1.0 dB(A).

(c) Rail Noise Assessment

- (c1) The Applicant shall assess the airborne and ground-borne noise impacts from the existing Sheung Shui to Lok Ma Chau Spur Line and any proposed railway and trains relevant to this Project, including worst case scenario, normal, abnormal, transient and emergency operations, if applicable. Reference can be made to relevant previous studies such as the EIA report for the Sheung Shui to Lok Ma Chau Spur Line approved under the EIA Ordinance.
- (c2) For operational airborne noise, the criteria shall be the relevant noise levels contained in Table 1A in Annex 5 in the TM. The assessment methodology shall be documented in the EIA report for consideration in accordance with the TM.
- (c3) For operational ground-borne noise impact, the criteria and assessment methodology shall be documented in the EIA report for consideration in accordance with the TM. Site measurements at appropriate locations on a "like-to-like" basis (e.g. under similar situations) may be required in order to obtain the empirical input parameters required in the ground-borne noise model.
- (c4) The assessment shall also cover cumulative noise impact due to the Project and other railways in the vicinity, if any. The assessment methodology including the railway/train design noise level shall be documented in the EIA report for consideration in accordance with the TM.
- (c5) In assessing the noise level, the Applicant shall allow for deterioration in rail and rolling stock condition from brand new to an operating level and shall address the reasonable and worst case scenarios, taking into account any other planned noise sources. The Applicant shall present the noise levels in $Leq(30min)$, $Leq(24 hr)$ and L_{max} during the day and at night at the NSRs at various representative floor levels (in mPD) on tables and plans of suitable scale. The potential noise impact on existing and planned NSRs shall be quantified by estimating the total number of dwellings and/or classrooms and other sensitive elements that will be exposed to levels exceeding the relevant planning criteria and statutory limits.

- (c6) The Applicant shall make recommendations for noise amelioration/direct technical remedies for any existing or planned NSRs which would be subject to predicted cumulative noise level exceeding the relevant planning criteria and statutory limits in the appropriate design year.

(d) Helicopter Noise Impacts

- (d1) The Applicant shall carry out assessment of the noise impacts arising from the operation of existing/new helicopter pad(s), if any, and related off site facilities with respect to the criteria set in Table 1A of Annex 5 of the TM. The impact shall cover helicopter operation at the helicopter pad(s) and during its approach and departure from the helicopter pad(s). Where applicable, noise contours should be provided to facilitate appreciation of the extent of the potential noise impacts. The Applicant shall evaluate the reasonable worst-case scenarios in terms of flight types, flight paths, flight frequency and flight hours. For noise matters not fully listed in Table 1A of Annex 5 of the TM, the criteria and assessment methodology shall be considered in accordance with section 4.4.2(c) of the TM and documented in the EIA report.

- (d2) The Applicant shall propose direct mitigation measures in all situations where the noise level exceedance are predicted following the principle of section 6 of Annex 13 of the TM such as alternative land use arrangement. The total number of noise sensitive receivers that will be benefited from and be protected by the provision of direct mitigation measures should be provided. The total number of other noise sensitive receivers that will still be exposed to noise above the criteria with the implementation of all recommended direct mitigation measures shall be quantified.

(vii) Assessment of Side Effects and Constraints

The Applicant shall identify, assess and propose means to minimize any side effects and to resolve any potential constraints due to the inclusion of any recommended direct mitigation measures.

(viii) Evaluation of Constraints on Planned Noise Sensitive Developments / Landuses

For planned noise sensitive uses which will still be affected even with all practicable direct mitigation measures in place, the Applicant shall propose, evaluate and confirm the practicality of additional measures within the planned noise sensitive uses and shall make recommendations on how these noise sensitive uses will be designed for the information of and agreement by relevant parties.

The Applicant shall take into account agreed environmental requirements / constraints identified by the study to assess the development potential of concerned sites which shall be made known to and agreed by the relevant

parties.

(ix) Consideration of Mitigation Measures

In accordance with section 6 of Annex 13 of the TM, where the predicted noise impacts exceed the applicable noise criteria, direct mitigation measures as shown below shall be considered and evaluated in an appropriate manner:

- (a) alternative landuse arrangement
- (b) alternative siting
- (c) screening by noise tolerant buildings
- (d) setback of buildings
- (e) decking over
- (f) extended podium
- (g) building orientation
- (h) treatment of source
- (i) alternative alignment
- (j) noise barrier/enclosure
- (k) special building design
- (l) architectural features/balcony
- (m) open-textured road surfacing

3.4.6 Water Quality Impact

3.4.6.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing water pollution as stated in Annexes 6 and 14 of the TM respectively.

3.4.6.2 The area for this water quality impact assessment shall include all areas within a distance of 500m from the Project site boundary, including Shenzhen River and its meander, Lok Ma Chau, wetlands at Hoo Hok Wai and San Tin, and the natural watercourse at Ma Tso Lung. This study area could be extended to include other areas such as stream courses and associated water system(s), fish ponds in the vicinity being impacts by the Project if found justifiable.

3.4.6.3 The water quality impact assessment shall cover the following, but not limited to, major areas of concern:

- (i) Construction and operational impacts due to the Project and the works associated with sewage treatment and sewerage infrastructures;
- (ii) Potential impact for ingress of water pollutants to Shenzhen River and its meander, Inner Deep Bay, Hoo Hok Wai and San Tin wetlands, the natural watercourse at Ma Tso Lung and important habitats such as mangroves from storm water drainage system and surface runoff; and
- (iii) Potential impact for increased risks of flooding resulting from hydrological changes.

3.4.6.4 The Applicant shall identify and analyze physical, chemical and biological disruptions of marine and/or inland water, coastal water, natural stream course,

existing and new drainage system(s) arising from the construction and operation of the Project.

3.4.6.5 The Applicant shall address water quality impacts due to the construction and operational stages of the Project. Essentially the assessment shall address the following:

- (i) Collect and review of background information on the affected existing and planned water system(s), their respective catchments and sensitive receivers which might be affected by the Project;
- (ii) Characterize water quality of the water system(s), their respective catchment and sensitive receivers which might be affected by the Project based on existing best available information or through appropriate site survey and tests as appropriate;
- (iii) Identify and analyze physical, chemical and biological disruptions of marine and/or inland water, coastal water, existing, committed and planned drainage system arising from the Project. In particular, the assessment shall evaluate the extent of potential impact from the Project to the existing drainage regime in Shenzhen River and its meander, Inner Deep Bay, Hoo Hok Wai and San Tin wetlands, and the natural watercourse at Ma Tso Lung;
- (iv) Identify and analyze relevant existing and planned future activities, beneficial uses and sensitive receivers related to the water system(s). The Applicant shall refer to, *inter alia*, those developments and uses specified in the relevant PODP, RLP and RODP of the Project, Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published landuse plans;
- (v) Identify pertinent water quality objectives and establishment of other appropriate water quality criteria or standards for the water system(s) and all the sensitive receivers as mentioned in sections 3.4.6.5(i), (ii) and (iii) of this study brief, including ecological sensitive receivers for the assessments covered in section 3.4.13 of this study brief;
- (vi) Identify any alteration of water courses, natural streams, change of drainage system, change of flow regimes, change of ground water levels, change of catchment types or areas;
- (vii) Report on the adequacy of the existing sewerage and sewage treatment facilities for the handling, treatment and disposal of wastewater arising from the Project as required in section 3.4.7 of this study brief;
- (viii) Subject to the assessment findings and recommendations from the Sewerage and Sewage Treatment Implications under section 3.4.7 of this study brief, the Applicants shall identify and quantify the water quality impacts due to such findings and recommendations. The water quality concerns could include, but not limited to, possible sewage overflow or emergency bypass due to capacity constraints of the sewerage system, emergencies arising from the Project;

- (ix) Identify and quantify existing and likely future water pollution sources including point discharges and non-point sources to surface water runoff. An emission inventory on the quantities and characteristics of these existing and likely future pollution sources in the assessment area shall also be provided. Field investigation and laboratory test, as appropriate, shall be conducted to fill relevant information gaps;
- (x) Predict and quantify the impacts on the identified water systems and sensitive receivers due to sewage derived from the implementation of the Project including the cumulative impacts to Inner Deep Bay. All effluent generated shall require appropriate collection, treatment and disposal to ensure that there is no net increase in pollution load to Deep Bay;
- (xi) If contaminated groundwater is identified in the land contamination assessment covered in Section 3.4.9, the potential impacts during construction stage should be evaluated and properly addressed.
- (xii) Possible impacts include change in hydrology, flow regime, and water quality due to such changes. The prediction shall also take into account and include likely different construction stages or sequences, and different operational stages;
- (xiii) Should dredging be required, the Applicant shall evaluate and quantify the possible impacts arising from the dredging works by appropriate techniques agreed by the Director;
- (xiv) Assess the cumulative impacts due to other related concurrent and planned projects, activities or pollution sources along the identified water system(s) and sensitive receivers that may have a bearing on the environmental acceptability of the Project;
- (xv) Propose effective infrastructure upgrading or provision, water pollution prevention and mitigation measures to be implemented during the constructional and operational stages so as to reduce the water quality impacts to within acceptable levels of standards. No net increase of pollution load to Deep Bay should be ensured. Requirements to be incorporated in the project contract document shall also be proposed;
- (xvi) Analyze the provision and adequacy of the existing, committed and planned future facilities to reduce pollution arising from the storm water drainage system and surface water runoff during construction and operation of the Project; establish a storm water pollution control plan to minimize the potential water quality impact. The plan shall incorporate details such as locations, sizes and types of measures/installations and the best management practices; and
- (xvii) Evaluate and quantify residual impacts on the affected water system(s) and the sensitive receivers with regard to the appropriate water quality criteria, standards or guidelines.

3.4.7 Sewerage and Sewage Treatment Implications

- 3.4.7.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing impacts of the Project and associated works on the public sewerage, sewage treatment and disposal facilities as stated in section 6.5 in Annex 14 of the TM.
- 3.4.7.2 The Applicant shall study and assess the impacts of the sewage discharge from the Project. The assessment shall include the following :
- (i) investigate and review the existing, committed and planned sewerage networks and sewage treatment and disposal facilities in the area;
 - (ii) assess the sewerage system of the Project, including sewage treatment and disposal facilities, taking into account the projected flows and loads from the Project;
 - (iii) assess the impact of the Project on the existing, committed and planned sewerage system and sewage treatment and disposal facilities in the area;
 - (iv) prepare a Sewerage Master Plan for the Project using the latest version of the computerized analysis technique “INFOWORKS” or equivalent computer software agreed by the Director;
 - (v) identify sewerage upgrading works required for the sewerage network, sewage treatment and disposal facilities;
 - (vi) recommend interim upgrading of sewage treatment and disposal facilities and sewerage network as appropriate and prepare programme and cost estimate for such interim works; and
 - (vii) recommend permanent upgrading to the sewage treatment and disposal facilities and sewerage network, and develop a prioritized programme for implementation and prepare cost estimates.

3.4.8 Waste Management Implications

- 3.4.8.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing waste management implications as stated in Annexes 7 and 15 of the TM respectively.
- 3.4.8.2 The assessment of waste management implications shall cover the following:
- (i) Analysis of Activities and Waste Generation

The Applicant shall identify the quantity, quality and timing of the waste arising as a result of the construction and operation activities of the Project and associated works, based on the sequence and duration of these activities. The Applicant shall adopt the design, the general layout, the construction methods and the programme to minimize the generation of public fill/inert

construction and demolition (C&D) materials and maximize the use of public fill/inert C&D materials for other construction works.

(ii) Proposal for Waste Management

- (a) Prior to considering the disposal options for various types of wastes, opportunities for reducing waste generation, on-site or off-site re-use and recycling shall be fully evaluated. Measures which can be taken in the planning and design stages (e.g. by modifying the design approach) and in the construction stage for maximizing waste reduction shall be separately considered.
- (b) After considering all the opportunities for reducing waste generation and maximizing re-use, the types and quantities of the wastes required to be disposed of as a consequence shall be estimated and the disposal options for each type of waste shall be described in detail. The disposal method recommended for each type of waste shall take into account the result of the assessment in (c) below.
- (c) The impact caused by handling (including labeling, packaging and storage), collection, and reuse/disposal of wastes shall be addressed in detail and appropriate mitigation measures shall be proposed. This assessment shall cover the following areas :
- potential hazard;
 - air and odour emissions;
 - noise;
 - wastewater discharge; and
 - public transport.

(iii) Dredging/Excavation, Filling and Dumping

- (a) The Applicant shall identify and quantify as far as practicable all dredging/excavation, fill extraction, filling, reclamation, sediment/mud transportation and disposal activities and requirements. Potential fill source and dumping ground to be involved shall also be identified. Field investigation, sampling and chemical and biological laboratory tests to characterize the sediment/mud concerned shall be conducted as appropriate. Prior to the commencement of the tests, the Applicant shall propose the ranges of parameters to be analyzed; the number, type and methods of sampling; sample preservation; chemical and biological laboratory test methods to be used for consideration in accordance with Section 4.4.2(c) of the TM and documented in the EIA report. The categories of sediment/mud which are to be disposed of in accordance with a permit granted under the Dumping at Sea Ordinance (DASO) shall be identified by both chemical and biological tests and their quantities shall be estimated. If the presence of any serious contamination of sediment/mud which requires special treatment/disposal is confirmed, the Applicant shall identify the most appropriate treatment and/or disposal arrangement and demonstrate its feasibility. The Applicant shall provide supporting document, such as

agreement by the relevant facilities management authorities, to demonstrate the viability of any treatment/disposal plan.

- (b) The Applicant shall identify and evaluate the best practical dredging/excavation methods to minimize dredging/excavation and dumping requirements and demand for fill sources based on the criterion that existing sediment/mud shall be left in place and not to be disturbed as far as possible.

3.4.9 Land Contamination Impact

- 3.4.9.1 If any contaminated land uses as stated in Sections 3.1 and 3.2 of Annex 19 in the TM is identified, the Applicant shall carry out the land contamination Assessment as detailed from section 3.4.9.1 to 3.4.9.6 below and propose measures to avoid disposal. The Applicant shall follow the guidelines for evaluating and assessing potential land contamination issues as stated in sections 3.1 and 3.2 in Annex 19 of the TM.
- 3.4.9.2 The assessment area for land contamination impact shall include any potential land contamination site(s) within the Project and boundaries of all associated areas under the Project.
- 3.4.9.3 The Applicant shall provide a clear and detailed account of the present land use (including description of the activities, chemicals and hazardous substances handled with clear indication of their storage and location by reference to a site map) and a complete past land uses history in relation to possible land contamination (including accident records, change of land use(s) and the like, e.g. Lok Ma Chau Loop served as a dumping ground for sediment extracted from the Shenzhen River training works, the area near San Tin Highway / Fanling Highway predominately being used for open car parks, open storage yards and vehicle repairing workshops).
- 3.4.9.4 During the course of the EIA study, the Applicant shall submit a contamination assessment plan (CAP) to the Director prior to conducting the contamination impact assessment of the relevant land or site(s). The CAP shall include proposals with details on representative sampling and analysis required to determine the nature and the extent of the contamination of the relevant land or site(s).
- 3.4.9.5 Based on the CAP, the Applicant shall conduct a land contamination impact assessment and submit a contamination assessment report (CAR) to the Director. If land contamination is confirmed, a Remediation Action Plan (RAP) to formulate viable remedial measures with supporting documents, such as agreement by the relevant facilities management authorities, shall be submitted to the Director. The Applicant shall then clean up the contaminated land or site(s) according to the RAP, and a Remediation Report (RR) to demonstrate adequate clean-up should be prepared and submitted to the Director prior to the commencement of any development works within the site. The CAP, CAR and RAP shall be documented in the EIA report.

- 3.4.9.6 If there is / are potential contaminated site(s) inaccessible for preparing sampling and analysis during the course of the EIA study as required under section 3.4.9.4 of this study brief, e.g. due to site access problem, the Applicant's CAP shall include:
- (i) a review of the available information;
 - (ii) an initial contamination evaluation of this/these site(s) and possible remediation methods;
 - (iii) a confirmation of whether the contamination problem at this/these site(s) would be surmountable;
 - (iv) a sampling and analysis proposal which shall aim at determining the nature and the extent of the contamination of this/these site(s); and
 - (v) a schedule of submission of revised CAP (if necessary), CAR, RAP and RR upon this/these site(s) is/are accessible.

3.4.10 Hazard to Life

3.4.10.1 If the Project will use explosives (of Cat. 1 Dangerous Goods and/or prepared from Cat. 7 Dangerous Goods), the Applicant shall describe the statutory/licensing requirements with respect to explosives under the Dangerous Goods Ordinance (Cap. 295). The Applicant shall also document any guidelines and/or advice obtained from relevant departments/ authorities on the proposed transport and storage of explosives for the blasting activities.

3.4.10.2 The Applicant shall investigate alternative construction methods to avoid the use of explosives. If there is use of explosives for the construction activities and the storage or blasting location is in close proximity to populated areas and/or Potentially Hazardous Installation site, the Applicant shall carry out hazard assessment as follows:

- (i) Identify hazardous scenarios associated with the transport, storage and use of explosives and then determine a set of relevant scenarios to be included in a Quantitative Risk Assessment (QRA);
- (ii) Execute a QRA of the set of hazardous scenarios determined in (i), expressing population risks in both individual and societal terms;
- (iii) Compare individual and societal risks with the criteria for evaluating hazard to life stipulated in Annex 4 of the TM; and
- (iv) Identify and assess practicable and cost-effective risk mitigation measures.

The methodology to be used in the hazard assessment should be consistent with previous studies having similar issues.

3.4.11 Impact on Sites of Cultural Heritage

3.4.11.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing the cultural heritage impacts as stated in Annexes 10 and 19 of the TM and the Guidelines for Cultural Heritage Impact Assessment in Appendix C.

3.4.11.2 The assessment area shall be 300 metres expanded from the boundary of the Project. The cultural heritage impact assessment shall include archaeological impact assessment and built heritage impact assessment.

3.4.11.3 Archaeological Impact Assessment

The Applicant shall engage professional archaeologist(s) to review the archaeological potential of the assessment area taking the results of previous archaeological investigations and other background of the site into account. In case the existing information is inadequate or where the Project or associated works has not been adequately studied before, the archaeologist(s) shall conduct the investigations to assemble data.

The archaeologist(s) shall obtain licences from the Antiquities Authority prior to commencement of archaeological field investigations. Details of the archaeological impact assessment shall be prepared in accordance with section 4.4.2(c) of the TM.

Based on existing and collected data, the Applicant shall evaluate whether the proposed development(s) associated with the Project and associated works is (are) acceptable from archaeological preservation point of view. In case adverse impact on archaeological resources cannot be avoided, appropriate mitigation measures should be designed and recommended in the EIA report.

The Applicant shall draw necessary reference to relevant sections of the Guidelines for Cultural Heritage Assessment at Appendix C.

3.4.11.4 Built Heritage Impact Assessment

The Applicant shall conduct a built heritage impact assessment (BHIA), taking the results of previous BHIA and other background of the site into account, to identify known and unknown heritage items within the assessment area that may be affected by the Project and its associated works to assess the direct and indirect impacts on heritage items. Due consideration should be given to the built heritage aspect in the early planning stage. Opportunity should be given throughout this EIA study so that the identified built heritage could be well integrated into future development. The possible impact on the built heritage items identified by the previous and the proposed BHIA should be avoided / minimized. Appropriate mitigation measures to be proposed by the BHIA should be designed and implemented by the Project Proponent in agreement with the Antiquities and Monuments Office .

The Applicant shall draw necessary reference to relevant sections of the Guidelines for Cultural Heritage Assessment at Appendix C.

3.4.12 Landscape and Visual Impact

3.4.12.1 The Applicant shall follow the criteria and guidelines as stated in Annexes 10 and 18 of the TM and EIAO Guidance Note No. 8/2010 on “*Preparation of Landscape and Visual Impact Assessment under the Environmental Impact*”

Assessment Ordinance” for evaluating and assessing landscape and visual impacts of the Project and associated infrastructure and works, such as noise barriers and above ground structures, during both construction and operational stages. The assessment shall take into account all existing, committed and planned land uses and sensitive receivers.

- 3.4.12.2 The assessment area for the landscape impact assessment shall include areas within 500m from the site boundary of the Project, associated works, supporting facilities and essential infrastructures (including new roads), while the assessment area for the visual impact assessment shall be defined by the visual envelop of the Project. The defined visual envelope shall be shown on a plan and documented in the EIA report.
- 3.4.12.3 The Applicant shall review relevant PODP, RLP and RODP of the Project, Layout Plans, Outline Zoning Plans, Development Permission Area Plans, other relevant published landuse plans, planning briefs and studies which may identify areas of high landscape value, open space, amenity area, conservation area, and green belt designations. Any guidelines on landscape strategies, landscape frameworks, urban design concepts, building height profiles, special design areas, landmarks, designated view corridors breezeways, open space networks, landscape links that may affect the appreciation of the Project shall also be reviewed. The aim is to gain an insight to the future visual environment of the area so as to assess whether the Project can fit into the surrounding setting. Any conflict with statutory town plan(s) and any published land use plans should be highlighted and appropriate follow-up action should be recommended.
- 3.4.12.4 The Applicant shall describe, appraise, analyse and evaluate the existing and planned landscape resources and character of the assessment area. A system shall be derived for judging landscape and visual impact significance as required under the TM and EIAO Guidance Note No. 8/2010 *“Preparation of Landscape and Visual Impact Assessment under EIAO”*. Annotated oblique aerial photographs and plans of suitable scale showing the baseline landscape character areas and landscape resources and mapping of impact assessment shall be extensively used to present the findings of impact assessment. Descriptive text shall provide a concise and reasoned judgement from a landscape and visual point of view. The sensitivity of the landscape framework and its ability to accommodate change shall be particularly focused on. The Applicant shall identify the degree of compatibility of the Project with the existing and planned landscape setting. The landscape impact assessment shall quantify the potential landscape impact as far as possible, so as to illustrate the significance of such impacts arising from the Project. Clear mapping of the landscape impact is required. A tree survey shall be carried out and the impacts on existing trees shall be addressed. Cumulative landscape and visual impacts of the Project with other existing, committed and planned developments in the assessment area shall be assessed.
- 3.4.12.5 The Applicant shall assess the visual impacts of the Project. Clear illustrations including mapping of visual impact is required. The assessment shall adopt a systematic methodology and include the following:
- (i) Identification and plotting of visual envelope of the Project;

- (ii) Identification of the key groups of sensitive receivers within the visual envelope with regard to views from ground level, sea level and elevated vantage points;
- (iii) Description of the visual compatibility of the Project with the surrounding and the existing and planned setting, and its obstruction and interference with the key views of the assessment areas;
- (iv) Identification of the magnitude of changes of view caused by the Project and associated works, and the sensitivity for each sensitive receiver;
- (i) Identification of the severity of visual impacts on the basis of the magnitude of changes of view caused by the Project and associated works, and the sensitivity of the receivers identified in Point (iii). The visual impacts of the Project with and without mitigation measures shall be included so as to demonstrate the effectiveness of the proposed mitigation measures;
- (vi) clear evaluations and explanations of the factors considered in arriving the significance thresholds of visual impacts, and the factors / constraints in recommending the mitigation measures for visual impact.

3.4.12.6 The Applicant shall evaluate the merits of preservation in totality, in parts or total destruction of existing landscape and the establishment of a new landscape character area. In addition, alternative location, configuration, alignment, site layout, design, built-form, operational mode and construction method that will avoid or reduce the identified landscape and visual impacts shall be evaluated for comparison before adopting other mitigation or compensatory measures to alleviate the impacts. The mitigation measures proposed shall not only be concerned with damage reduction but shall also include consideration of potential enhancement of existing landscape and visual quality. The Applicant shall recommend mitigation measures to minimise adverse effects identified above, including provision of a master landscape plan.

3.4.12.7 The mitigation measures shall also include the preservation of vegetation and natural landscape resources, transplanting of mature trees, provision of screen planting, re-vegetation of disturbed lands, compensatory planting, woodland restoration, design of structure, provision of finishes to structure, colour scheme and texture of material used and any measures to mitigate the impact on the existing and planned land use and visually sensitive receivers. Parties shall be identified for the on going management and maintenance of the proposed mitigation works to ensure their effectiveness throughout the construction and operation phases of the Project. A practical programme and funding proposal for the implementation of the recommendation measures shall be provided.

3.4.12.8 Annotated illustration materials such as colour perspective drawings, plans and section / elevation diagrams, annotated oblique aerial photographs, photographs taken at vantage points, and computer-generated photomontage shall be adopted to illustrate the landscape and visual impacts of the Project. In particular, the landscape and visual impacts of the Project with and without mitigation measures

from representative viewpoints, particularly from views of the most severely affected visually sensitive receivers (i.e. worst case scenario), shall be properly illustrated in existing and planned setting at four stages (existing condition, Day 1 with no mitigation measures, Day 1 with mitigation measures and Year 10 with mitigation measures) by computer-generated photomontage so as to demonstrate the effectiveness of the proposed mitigation measures. Computer graphics shall be compatible with Microstation DGN file format. The Applicant shall record the technical details in preparing the illustration, which may need to be submitted for verification of the accuracy of the illustration.

3.4.13 Ecological Impact

- 3.4.13.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing ecological impact as stated in Annexes 8 and 16 of the TM respectively.
- 3.4.13.2 The assessment area for the purpose of terrestrial ecological assessment shall include all areas within 500 metres from the site boundaries of the proposed land based works areas or the area likely to be impacted by the Project and associated works. For aquatic ecology, the assessment area shall be the same as the water impact assessment or the area likely to be impacted by the Project and the associated works.
- 3.4.13.3 In the ecological impact assessment, the Applicant shall examine the flora, fauna and other components of the ecological habitats within the study area including those highlighted in Section 3.2.2(iii), with an aim to protect, maintain or rehabilitate the natural environment. In particular, the Project shall avoid or minimize impacts on recognized sites of conservation importance and other ecological sensitive areas. The assessment shall identify and quantify the potential ecological impacts associated with the Project and including the impacts of any haul roads and temporary access.
- 3.4.13.4 The assessment shall include the following:
- (i) review the data and findings of relevant studies and collate all the available information regarding the ecological characters of the assessment area;
 - (ii) evaluate the information collected and identify any information gap relating to the assessment of potential ecological impacts to the aquatic and terrestrial environment; and determine whether ecological surveys are required to bridge any identified information gap for the purpose of establishing a comprehensive and updated ecological profile in accordance with section 3.4.13.4(iv) below;
 - (iii) carry out necessary field surveys as determined under section 3.4.13.4(ii) of this study brief, the duration of which shall be at least 12 months covering both the wet and dry seasons, including flight path surveys of birds and investigations to verify the information collected, fill the information gaps identified and fulfill the objectives of the EIA study;

- (iv) establish an ecological profile of the assessment area based on data of relevant previous studies/surveys and results of additional ecological field surveys, and describe the characteristics of each habitat found. Major information to be provided shall include:
 - (a) description of the physical environment, including all recognized sites of conservation importance;
 - (b) habitats maps of suitable scale (1:1,000 to 1:5,000) showing the types and locations of habitats in the assessment area;
 - (c) ecological characteristics of each habitat type such as size, vegetation type, species present, dominant species found, species diversity and abundance, community structure, seasonal patterns, inter-dependence of the habitats and species, and presence of any features of ecological importance ;
 - (d) representative colour photographs of each habitat type and any important ecological features identified; and
 - (e) species found that are rare, endangered and/or listed under local legislation, international conventions for conservation of wildlife/habitats or Red Data Books;

- (v) Investigate and describe the existing wildlife uses of various habitats with special attention to those wildlife groups and habitats identified as having conservation interests including but not limited to –
 - (a) Fish ponds;
 - (b) Freshwater and brackish marshes, reedbeds and other wetlands;
 - (c) Mudflat and mangroves;
 - (d) Watercourses, in particular the Shenzhen River and its meander as well as natural streams at Ma Tso Lung
 - (e) Secondary woodlands;
 - (f) Mammals, in particular Eurasian Otter (*Lutra lutra*);
 - (g) Avifauna, in particular waterfowls, wetland-dependent and reedbed-associated species such as ardeids, waders, ducks, raptors, warblers, buntings, Great Cormorant (*Phalacrocorax carbo*), Greater Painted Snipe (*Rostratula benghalensis*), Black-faced Spoonbill (*Platalea minor*), Imperial Eagle (*Aquila heliaca*), Eurasian Eagle Owl (*Bubo bubo*) and Red-billed Starling (*Sturnus sericeus*);
 - (h) Herpetofauna in particular Three-banded Box Turtle (*Cuora trifasciata*)

- (i) Any other habitats and wildlife groups identified as having special conservation interests by the study.
- (vi) Identify and quantify, using suitable methodology, any direct, indirect, on-site, off-site, primary, secondary and cumulative ecological impacts such as destruction of habitats, reduction of species abundance/diversity, loss of feeding, nesting or/and breeding grounds, reduction of ecological carrying capacity, barrier effect and habitat fragmentation. The following shall be addressed in particular –
 - (a) The ecological impacts of loss of areas of conservation interest in particular those highlighted in Section 3.2.2(iii) and 3.4.13.4(v)(a)-(e) on temporary and permanent basis, due to the construction and operation of the Project;
 - (b) The ecological impacts due to disturbance during the constructional and operational stages of the project such as increase in noise, dust, effluent discharges, traffic and human activity, glare or other deterioration of environmental quality;
 - (c) The potential degradation of the ecological integrity of the Inner Deep Bay ecosystem as a result of the barrier effect on the ecological link between Hoo Hok Wai and Mai Po/San Tin wetlands, and fragmentation of the wetland habitats, caused by the Project;
 - (d) The ecological impacts as a result of any hydrological disruption, and water quality impact or sedimentation to Shenzhen River and its meander, Mai Po Inner Deep Bay Ramsar Site, Inner Deep Bay, inter-tidal mudflats, mangrove areas, fish ponds, and other wetlands due to drainage, runoff and effluent discharge from the constructional and operational stages of the Project;
 - (e) The impact on birds due to collision to new buildings, structures and noise barriers installed for noise abatement;
 - (f) The cumulative impacts of the project and other existing, committed and proposed developments in accordance with section 4.3.3 of the TM;
- (vii) demonstrate that the ecological impacts due to construction and operation of the Project and associated works are avoided to the maximum practicable extent, by consideration of all practicable alternatives (such as modification of landuse plans and layout, alternative road alignments, use of tunnels and suppress roads and use of other construction methods);
- (viii) evaluate the significance and acceptability of the ecological impacts identified using defined criteria in the TM or other appropriate method to be considered in accordance with Section 4.4.2(c) of the TM;
- (ix) recommend all practicable mitigation measures to avoid, minimize and/or compensate for the adverse ecological impacts identified. The mitigation measures may include, but not limited to, avoidance or minimization of

development footprint on any identified ecological sensitive areas, restriction in the development intensity and building height, preservation and/or establishment of ecological corridors and buffer zones, reinstatement of habitats temporarily affected by the proposed development to its original state and if possible with some enhancement features, on-site and/or off-site habitat/wetland compensation and avoiding or minimizing use of night time lighting and transparent/ reflective surfaces for building façade;

- (x) evaluate the feasibility and effectiveness of the recommended mitigation measures and define the scope, type, location, implementation arrangement, subsequent management and maintenance of such measures;
- (xi) determine and quantify as far as possible the residual ecological impacts after implementation of the proposed mitigation measures;
- (xii) evaluate the severity and acceptability of the residual ecological impacts using defined criteria in the TM or other appropriate method to be considered in accordance with Section 4.4.2(c) of the TM; and
- (xiii) recommend the need of any ecological monitoring programme required.

3.4.14 Fisheries Impact

3.4.14.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing fisheries impact as stated in Annexes 9 and 17 of the TM.

3.4.14.2 The area for fisheries impact assessment shall include all areas within 500m from the boundaries of the Project. This study area shall be extended to include other water systems of fisheries importance if they are found also being impacted by the construction or operation of the Project during the course of the EIA study. Special attention shall be given to the potential impacts on aquaculture activities and the loss of fish ponds.

3.4.14.3 The assessment shall cover any potential impact on both capture and culture fisheries, during the construction and operation of the Project.

3.4.14.4 Existing information regarding the assessment area shall be reviewed. Based on the review results, the study shall identify data gap and determine if there is any need for field surveys. If field surveys are considered necessary, the study shall recommend appropriate methodology, duration and timing for the field surveys.

3.4.14.5 The fisheries impact assessment shall include the following :

- (i) description of the physical environmental background;
- (ii) description and quantification of existing capture and culture fisheries activities;
- (iii) description and quantification of the existing fisheries resources (e.g. major fisheries products and stocks);

- (iv) identification of parameters (e.g. water quality parameters) and areas that are important to fisheries;
- (v) identification and quantification of any direct/indirect impacts to fisheries, such as permanent resumption and temporary occupation of fish ponds, deterioration of water quality of fish ponds, the surrounding streams and Deep Bay, hydrological disruptions such as draw-down of water table, blocking of access to the surrounding fish ponds, disturbance by construction noise and vibration, and possible restriction on pond culture related activities such as excavation (including formation and ploughing) due to the construction and operation of any tunnel(s) underneath;
- (vi) evaluation of impacts and proposal of any practical alternatives or mitigation measures with details on justification, description of scope and programme, feasibility as well as manpower and financial implications including those related to subsequent management and maintenance requirements of the proposals; and
- (vii) review the need for monitoring during the construction and operation phases of the Project and, if necessary, proposal of a monitoring and audit programme.

3.4.15 Landfill Gas Hazard

3.4.15.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing landfill gas hazards as stated in section 1.1(f) in Annex 7 and section 3.3 in Annex 19 of the TM respectively. The landfill gas hazard assessment shall be carried out in accordance with the 'Landfill Gas Hazard Assessment Guidance Note' (1997) issued by the Director and shall entail two components, which are qualitative risk assessment and landfill gas precautionary/protection design. Specifically, the assessment shall include the following technical tasks:

- (i) Review of background information (including landfill gas monitoring data) and studies related to the Ma Tso Lung Landfill;
- (ii) Identification of the nature and extent of the sources, including the likely concentrations and/or amounts of hazardous emissions which might have the potential for impacts on the Project;
- (iii) Identification of the possible pathways through the ground, underground cavities, utilities or ground water, and the nature of these pathways through which the hazardous emissions must traverse if they were to reach the Project;
- (iv) Identification of the potential receivers associated with the Project which are sensitive to the impacts of the hazardous emissions;
- (v) Qualitative assessment on the degree of risk which the hazardous emissions may impose on the receivers for each of the

source-pathway-receiver combinations; and

- (vi) Design of suitable level of precautionary measures and contingency plan for the Project and the potential receivers, if needed.

3.4.16 Impacts on the Restored Ma Tso Lung Landfill

- 3.4.16.1 The Applicant shall identify in the EIA report if the project encroaches within the site boundary of Ma Tso Lung Landfill or it affects landfill restoration and aftercare facilities. If positive, the applicant shall identify the potential impacts on the landfill restoration facilities of the restored Ma Tso Lung Landfill, which shall include but not limited to the capping system & drainage system, the leachate management system and the landfill gas management system, during the construction and operation of the Project. The Applicant shall then propose necessary mitigation and remedial measures to alleviate the impacts.

3.4.17 Documentation of Key Assessment Assumptions, Limitation of Assessment Methodologies and related Prior Agreement(s) with the Director

- 3.4.17.1 To facilitate efficient retrieval, a summary to include the assessment methodologies and key assessment assumptions adopted in this EIA study, the limitations of these assessment(s) methodologies/assumptions. The proposed use of any alternative assessment tool(s) or assumption(s) have to be justified by the Applicant, with supporting documents based on cogent, scientific and objectively derived reason(s). This summary and all related supporting documents shall be provided in the form of an Appendix to the EIA study report.

3.4.18 Impacts Summary

- 3.4.18.1 To facilitate effective retrieval of pertinent key information, a summary of environmental impacts in the form of a table (or in any other form as required by the Director) showing the assessment points (such as ASRs, NSRs), results of impact predictions, relevant standards or criteria, extents of exceedances predicted, impact avoidance measures considered, mitigation measures proposed and residual impacts (after mitigation) shall be provided to cover each individual impact in the EIA report. This impact summary shall form an essential part of the Executive Summary.

3.4.19 Summary of Environmental Outcomes

- 3.4.19.1 The Applicant shall include in the EIA report a summary of the key environmental outcomes arising from the EIA study, including the population and environmentally sensitive areas protected, environmentally friendly designs recommended, key environmental problems avoided, compensation areas included and the environmental benefits of environmental protection measures recommended.

3.4.20 Environmental Monitoring and Audit (EM&A) Requirements

- 3.4.20.1 The Applicant shall identify and justify in the EIA study whether there is any need for EM&A activities during the construction and operation phases of the Project and associated works and, if affirmative, to define the scope of the EM&A requirements for the Project in the EIA study.
- 3.4.20.2 Subject to the confirmation of the EIA study findings, the Applicant shall comply with the requirements as stipulated in Annex 21 of the TM. The Applicant shall also propose real-time reporting of construction monitoring data, wherever practicable, for the Project through a dedicated internet website.
- 3.4.20.3 The Applicant shall prepare a Project Implementation Schedule (in the form of a checklist as shown in Appendix D to this EIA study brief) containing all the EIA study recommendations and mitigation measures with reference to the Project and associated works implementation programme. A stand-alone implementation schedule shall be prepared for each of the individual Schedule 2 projects as described in sections 1.5 and 2.1(x) of this study brief.

4. DURATION OF VALIDITY

- 4.1 This EIA study brief is valid for 36 months counting from the date of its issuance. The Applicant shall advise the Director the date of commencement of the EIA study. If the EIA study does not commence within this period, the Applicant shall apply to the Director for a fresh EIA study brief before commencement of the EIA study.

5. REPORT REQUIREMENTS

- 5.1 In preparing the EIA report, the Applicant shall refer to Annex 11 of the TM for the contents of an EIA report. The Applicant shall also refer to Annex 20 of the TM, which stipulates the guidelines for review of an EIA report.
- 5.2 The Applicant shall supply the Director with the following number of copies of the EIA report and the executive summary:
- (i) 40 copies of the EIA report in English and 40 copies of the executive summary (each bilingual in both English and Chinese) as required under section 6(2) of the EIAO to be supplied at the time of application for approval of the EIA report.
 - (ii) when necessary, addendum to the EIA report and the executive summary submitted under section 5.2(i) of this study brief as required under section 7(1) of the EIAO, to be supplied upon advice by the Director for public inspection.
 - (iii) 20 copies of the EIA report in English and 50 copies of the executive summary (each bilingual in both English and Chinese) with or without Addendum as required under section 7(5) of the EIAO, to be supplied upon advice by the Director for consultation with the Advisory Council on the Environment.

- 5.3 The Applicant shall, upon request, make additional copies of the above documents available to the public, subject to payment by the interested parties of full costs of printing.
- 5.4 In addition, to facilitate the public inspection of the EIA report via the EIAO Internet Website, the applicant shall provide electronic copies of both the EIA report and the executive summary prepared in Hyper Text Markup Language (HTML) (version 4.0 or later) and in Portable Document Format (PDF version 1.3 or later), unless otherwise agreed by the Director. For the HTML version, a content page capable of providing hyperlink to each section and sub-section of the EIA report and the executive summary shall be included in the beginning of the document. Hyperlinks to all figures, drawings and tables in the EIA report and executive summary shall be provided in the main text from where the respective references are made. All graphics in the report shall be in interlaced GIF format.
- 5.5 The electronic copies of the EIA report and the executive summary shall be submitted to the Director at the time of application for approval of the EIA report.
- 5.6 When the EIA report and the executive summary are made available for public inspection under section 7(1) of the EIAO, the content of the electronic copies of the EIA report and the executive summary must be the same as the hard copies and the Director shall be provided with the most updated electronic copies.
- 5.7 To promote environmentally friendly and efficient dissemination of information, both hardcopies and electronic copies of future EM&A reports recommended by the EIA study shall be required.
- 5.8 To facilitate public involvement in the EIA process, the Applicant shall produce 3-dimensional electronic visualisations of the major findings (in particular the road traffic noise prediction, water quality and landscape and visual impacts) and elements of the EIA report, including baseline environmental information, the environmental situations with or without the project, key mitigated and unmitigated environmental impacts, and key recommended environmental mitigation measures so that the public can understand the Project and the associated environmental issues. The visualizations shall be based on the EIA report and released to the public. The 3-dimensional visualizations shall be developed and constructed such that they can be accessed and viewed by the public through an internet browser at a reasonable speed and without the need for software license requirement at the client's end. The visualizations shall be deposited in 10 copies of CD-ROM, DVD±R.

6. OTHER PROCEDURAL REQUIREMENTS

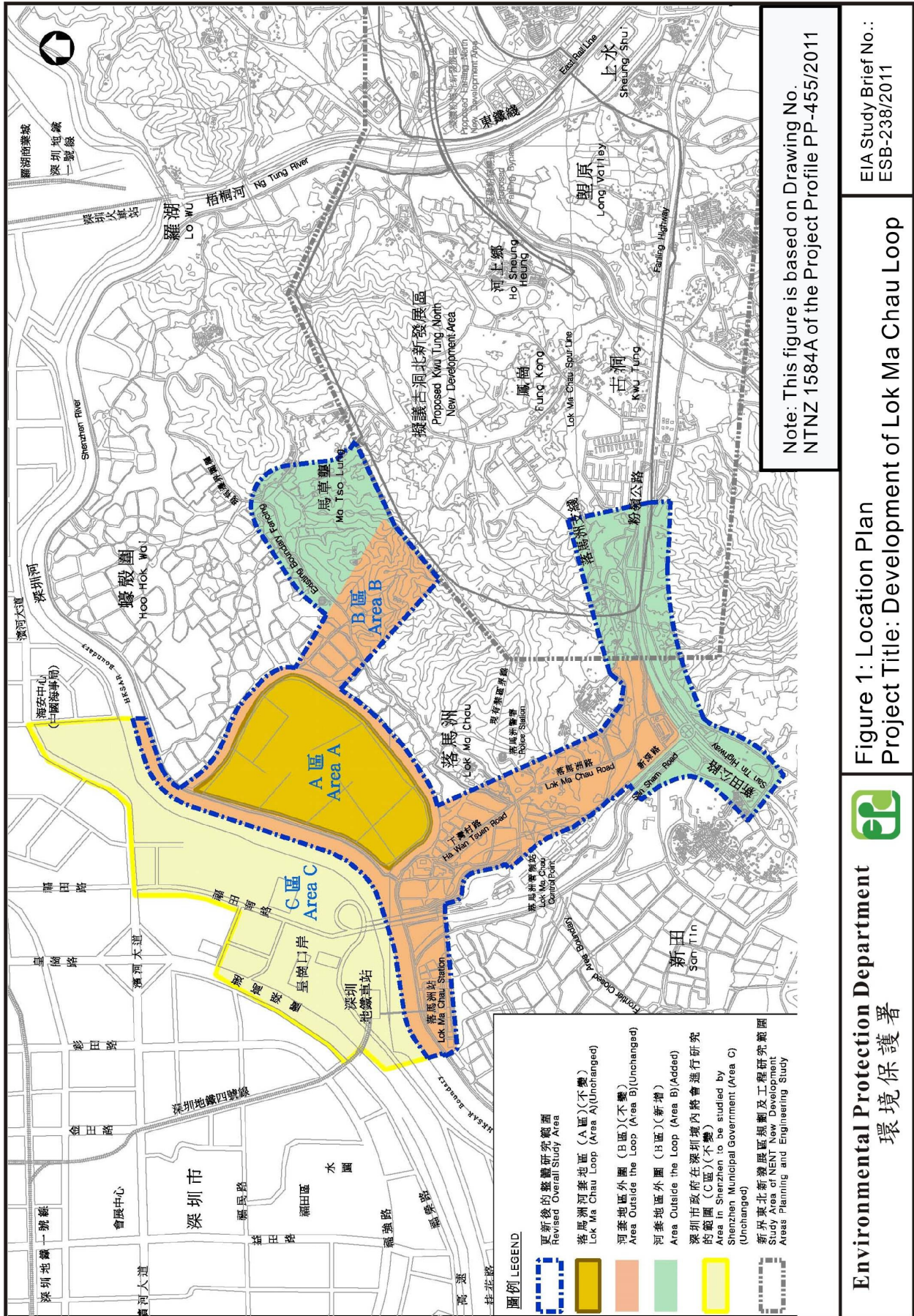
- 6.1 If there is any change in the name of Applicant for this EIA study brief during the course of the EIA study, the Applicant must notify the Director immediately.
- 6.2 If there is any key change in the scope of the Project mentioned in section 1.3 of this EIA study brief and in Project Profile (No. PP-455/2011), the Applicant must seek confirmation from the Director in writing on whether or not the scope of issues covered by this EIA study brief can still cover the key changes, and the additional

issues, if any, that the EIA study must also address. If the changes to the Feasibility Study fundamentally alter the key scope of the EIA study brief, the Applicant shall apply to the Director for a fresh EIA study brief.

--- END OF EIA STUDY BRIEF ---

December 2011
Environmental Assessment Division,
Environmental Protection Department

Appendix A



Appendix B-1**Guidelines on Choice of Models and Model Parameters in Air Quality Assessment**

[The information contained in this Appendix is only meant to assist the Applicant in performing the air quality assessment. The Applicant must exercise professional judgment in applying this general information for the Project.]

1. Introduction

- 1.1 To expedite the review process by the Authority and to assist project proponents or environmental consultants with the conduct of air quality modelling exercise which are frequently called for as part of environmental impact assessment studies, this paper describes the usage and requirements of a few commonly used air quality models.

2. Choice of Models

- 2.1 The models which have been most commonly used in air quality impact assessments, due partly to their ease of use and partly to the quick turn-around time for results, are of Gaussian type and designed for use in simple terrain under uniform wind flow. There are circumstances when these models are not suitable for ambient concentration estimates and other types of models such as physical, numerical or mesoscale models will have to be used. In situations where topographic, terrain or obstruction effects are minimal between source and receptor, the following Gaussian models can be used to estimate the near-field impacts of a number of source types including dust, traffic and industrial emissions.

<u>Model</u>	<u>Applications</u>
FDM	for evaluating fugitive and open dust source impacts (point, line and area sources)
CALINE4	for evaluating mobile traffic emission impacts (line sources)
ISCST3	for evaluating industrial chimney releases as well as area and volumetric sources (point, area and volume sources); line sources can be approximated by a number of volume sources.

These frequently used models are also referred to as Schedule 1 models (see attached list).

- 2.2 Note that both FDM and CALINE4 have a height limit on elevated sources (20 m and 10m, respectively). Source of elevation above these limits will have to be modelled using the ISCST3 model or suitable alternative models. In using the latter, reference should be made to the 'Guidelines on the Use of Alternative Computer Models in Air Quality Assessment' in Appendix B-3.
- 2.3 The models can be used to estimate both short-term (hourly and daily average) and long-term (annual average) ambient concentrations of air pollutants. The model

results, obtained using appropriate model parameters (refer to Section 3) and assumptions, allow direct comparison with the relevant air quality standards such as the Air Quality Objectives (AQOs) for the relevant pollutant and time averaging period.

3. Model Input Requirements

3.1 Meteorological Data

3.1.1 At least 1 year of recent meteorological data (including wind speed, wind direction, stability class, ambient temperature and mixing height) from a weather station either closest to or having similar characteristics as the study site should be used to determine the highest short-term (hourly, daily) and long-term (annual) impacts at identified air sensitive receivers in that period. The amount of valid data for the period should be no less than 90 percent.

3.1.2 Alternatively, the meteorological conditions as listed below can be used to examine the worst case short-term impacts:

Day time: stability class D; wind speed 1 m/s (at 10m height); worst-case wind angle; mixing height 500 m

Night time: stability class F; wind speed 1 m/s (at 10m height); worst case wind angle; mixing height 500 m

This is a common practice with using CALINE4 model due to its inability to handle lengthy data set.

3.1.3 For situations where, for example, (i) the model (such as CALINE4) does not allow easy handling of one full year of meteorological data; or (ii) model run time is a concern, the followings can be adopted in order to determine the daily and annual average impacts:

- (i) perform a frequency occurrence analysis of one year of meteorological data to determine the actual wind speed (to the nearest unit of m/s), wind direction (to the nearest 10°) and stability (classes A to F) combinations and their frequency of occurrence;
- (ii) determine the short term hourly impact under all of the identified wind speed, wind direction and stability combinations; and
- (iii) apply the frequency data with the short term results to determine the long term (daily / annual) impacts.

Apart from the above, any alternative approach that will capture the worst possible impact values (both short term and long term) may also be considered.

3.1.4 Note that the anemometer height (relative to a datum same for the sources and receptors) at which wind speed measurements were taken at a selected station should be correctly entered in the model. These measuring positions can vary greatly from station to station and the vertical wind profile employed in the model can be grossly distorted from the real case if incorrect anemometer height is used. This will lead to

unreliable concentration estimates.

- 3.1.5 An additional parameter, namely, the standard deviation of wind direction, σ_{θ} , needs to be provided as input to the CALINE4 model. Typical values of σ_{θ} range from 12° for rural areas to 24° for highly urbanised areas under 'D' class stability. For semi-rural such as new development areas, 18° is more appropriate under the same stability condition. The following reference can be consulted for typical ranges of standard deviation of wind direction under different stability categories and surface roughness conditions.

Ref.(1): Guideline On Air Quality Models (Revised), EPA-450/2-78-027R, United States Environmental Protection Agency, July 1986.

3.2 Emission Sources

All the identified sources relevant to a process plant or a study site should be entered in the model and the emission estimated based on emission factors compiled in the AP-42 (Ref. 2) or other suitable references. The relevant sections of AP-42 and any parameters or assumptions used in deriving the emission rates (in units g/s, g/s/m or g/s/m²) as required by the model should be clearly stated for verification. The physical dimensions, location, release height and any other emission characteristics such as efflux conditions and emission pattern of the sources input to the model should also correspond to site data.

If the emission of a source varies with wind speed, the wind speed-dependent factor should be entered.

Ref.(2): Compilation of Air Pollutant Emission Factors, AP-42, 5th Edition, United States Environmental Protection Agency, January 1995.

3.3 Urban/Rural Classification

Emission sources may be located in a variety of settings. For modelling purposes these are classified as either rural or urban so as to reflect the enhanced mixing that occurs over urban areas due to the presence of buildings and urban heat effects. The selection of either rural or urban dispersion coefficients in a specific application should follow a land use classification procedure. If the land use types including industrial, commercial and residential uses account for 50% or more of an area within 3 km radius from the source, the site is classified as urban; otherwise, it is classified as rural.

3.4 Surface Roughness Height

This parameter is closely related to the land use characteristics of a study area and associated with the roughness element height. As a first approximation, the surface roughness can be estimated as 3 to 10 percent of the average height of physical structures. Typical values used for urban and new development areas are 370 cm and 100 cm, respectively.

3.5 Receptors

These include discrete receptors representing all identified air sensitive receivers at their appropriate locations and elevations and any other discrete or grid receptors for supplementary information. A receptor grid, whether Cartesian or Polar, may be used to generate results for contour outputs.

3.6 Particle Size Classes

In evaluating the impacts of dust-emitting activities, suitable dust size categories relevant to the dust sources concerned with reasonable breakdown in TSP (< 30 µm) and RSP (< 10 µm) compositions should be used.

3.7 NO₂ to NO_x Ratio

The conversion of NO_x to NO₂ is a result of a series of complex photochemical reactions and has implications on the prediction of near field impacts of traffic emissions. Until further data are available, three approaches are currently acceptable in the determination of NO₂:

- (a) Ambient Ratio Method (ARM) - assuming 20% of NO_x to be NO₂; or
- (b) Discrete Parcel Method (DPM, available in the CALINE4 model); or
- (c) Ozone Limiting Method (OLM) - assuming the tailpipe NO₂ emission to be 7.5% of NO_x and the background ozone concentration to be in the range of 57 to 68 µg/m³ depending on the land use type (see also the EPD reference paper 'Guidelines on Assessing the 'TOTAL' Air Quality Impacts' in Appendix B-2).

3.8 Odour Impact

In assessing odour impacts, a much shorter time-averaging period of 5 seconds is required due to the shorter exposure period tolerable by human receptors. Conversion of model computed hourly average results to 5-second values is therefore necessary to enable comparison against recommended standard. The hourly concentration is first converted to 3-minute average value according to a power law relationship which is stability dependent (Ref. 3) and a result of the statistical nature of atmospheric turbulence. Another conversion factor (10 for unstable conditions and 5 for neutral to stable conditions) is then applied to convert the 3-minute average to 5-second average (Ref. 4). In summary, to convert the hourly results to 5-second averages, the following factors can be applied:

<u>Stability Category</u>	<u>1-hour to 5-sec Conversion Factor</u>
A & B	45
C	27
D	9
E & F	8

Under 'D' class stability, the 5-second concentration is approximately 10 times the hourly average result. Note, however, that the combined use of such conversion factors together with the ISCST results may not be suitable for assessing the extreme close-up impacts of odour sources.

Ref.(3): Richard A. Duffee, Martha A. O'Brien and Ned Ostojic, 'Odor Modeling – Why and How', Recent Developments and Current Practices in Odor Regulations, Controls and Technology, Air & Waste Management Association, 1991.

Ref.(4): A.W.C. Keddie, 'Dispersion of Odours', Odour Control – A Concise Guide, Warren Spring Laboratory, 1980.

3.9 Plume Rise Options

The ISCST3 model provides by default a list of the U.S. regulatory options for concentration calculations. These are all applicable to the Hong Kong situations except for the 'Final Plume Rise' option. As the distance between sources and receptors are generally fairly close, the non-regulatory option of 'Gradual Plume Rise' should be used instead to give more accurate estimate of near-field impacts due to plume emission. However, the 'Final Plume Rise' option may still be used for assessing the impacts of distant sources.

3.10 Portal Emissions

These include traffic emissions from tunnel portals and any other similar openings and are generally modelled as volume sources according to the PIARC 91 (or more up-to-date version) recommendations (Ref. 5, section III.2). For emissions arising from underpasses or any horizontal openings of the like, these are treated as area or point sources depending on the source physical dimensions. In all these situations, the ISCST3 model or more sophisticated models will have to be used instead of the CALINE4 model. In the case of portal emissions with significant horizontal exit velocity which cannot be handled by the ISCST3 model, the impacts may be estimated by the TOP model (Ref. 6) or any other suitable models subject to prior agreement with EPD. The EPD's 'Guidelines on the Use of Alternative Computer Models in Air Quality Assessment' should also be referred to in Appendix B-3.

Ref.(5): XIXth World Road Congress Report, Permanent International Association of Road Congresses (PIARC), 1991.

Ref.(6): N. Ukegunchi, H. Okamoto and Y. Ide "Prediction of vehicular emission pollution around a tunnel mouth", Proceedings 4th International Clean Air Congress, pp. 205-207, Tokyo, 1977.

3.11 Background Concentrations

Background concentrations are required to account for far-field sources which cannot be estimated by the model. These values, to be used in conjunction with model results for assessing the total impacts, should be based on long term average of monitoring data at location representative of the study site. Please make reference to the paper 'Guidelines on Assessing the 'TOTAL' Air Quality Impacts' in Appendix B-2 for further information.

3.12 Output

The highest short-term and long-term averages of pollutant concentrations at prescribed receptor locations are output by the model and to be compared against the relevant air quality standards specified for the relevant pollutant. Contours of

pollutant concentration are also required for indicating the general impacts of emissions over a study area. Copies of model files in electronic format should also be provided for EPD's reference.

Schedule 1

Air Quality Models Generally Accepted by Hong Kong Environmental Protection Department for Regulatory Applications as at 1 July 1998 : *

Industrial Source Complex Dispersion Model - Short Term Version 3 (ISCST3) or the latest version developed by U.S. Environmental Protection Agency

California Line Source Dispersion Model Version 4 (CALINE4) or the latest version developed by Department of Transportation, State of California, U.S.A.

Fugitive Dust Model (FDM) or the latest version developed by U.S. Environmental Protection Agency

* EPD is continually reviewing the latest development in air quality models and will update this Schedule accordingly.

Appendix B-2**Guidelines on Assessing the 'TOTAL' Air Quality Impacts**

[The information contained in this Appendix is only meant to assist the Applicant in performing the air quality assessment. The Applicant must exercise professional judgment in applying this general information for the Project.]

1. Total Impacts - 3 Major Contributions

- 1.1 In evaluating the air quality impacts of a proposed project upon air sensitive receivers, contributions from three classes of emission sources depending on their distance from the site should be considered. These are:

Primary contributions: project induced

Secondary contributions: pollutant-emitting activities in the immediate neighbourhood

Other contributions: pollution not accounted for by the previous two
(Background contributions)

2. Nature of Emissions**2.1 Primary contributions**

In most cases, the project-induced emissions are fairly well defined and quite often (but not necessarily) the major contributor to local air quality impacts. Examples include those due to traffic network, building or road construction projects.

2.2 Secondary contributions

Within the immediate neighbourhood of the project site, there are usually pollutant emitting activities contributing further to local air quality impacts. For most local scale projects, any emission sources in an area within 500m radius of the project site with notable impacts should be identified and included in an air quality assessment to cover the short-range contributions. In the exceptional cases where there is one or more significant sources nearby, the study area may have to be extended or alternative estimation approach employed to ensure these impacts are reasonably accounted for.

2.3 Background contributions

The above two types of emission contributions should account for, to a great extent, the air quality impacts upon local air sensitive receivers, which are often amenable to estimation by the 'Gaussian Dispersion' type of models. However, a background air quality level should be prescribed to indicate the baseline air quality in the region of the project site, which would account for any pollution not covered by the two preceding contributions. The emission sources contributing to the background air quality would be located further afield and not easy to identify. In addition, the

transport mechanism by which pollutants are carried over long distances (ranging from 1km up to tens or hundreds of kms) is rather complex and cannot be adequately estimated by the 'Gaussian' type of models.

3. Background Air Quality - Estimation Approach

3.1 The approach

In view of the difficulties in estimating background air quality using the air quality models currently available, an alternative approach based on monitored data is suggested. The essence of this approach is to adopt the long-term (5-year) averages of the most recent monitored air quality data obtained by EPD. These background data would be reviewed yearly or biennially depending on the availability of the monitored data. The approach is a first attempt to provide a reasonable estimate of the background air quality level for use in conjunction with EIA air quality assessment to address the cumulative impacts upon a locality. This approach may be replaced or supplemented by superior modelling efforts such as that entailed in PATH (Pollutants in the Atmosphere and their Transport over Hong Kong), a comprehensive territory-wide air quality modelling system currently being developed for Hong Kong. Notwithstanding this, the present approach is based on measured data and their long term regional averages; the background values so derived should therefore be indicative of the present background air quality. In the absence of any other meaningful way to estimate a background air quality for the future, this present background estimate should also be applied to future projects as a first attempt at a comprehensive estimate until a better approach is formulated.

3.2 Categorisation

The monitored air quality data, by 'district-averaging' are further divided into three categories, viz, Urban, Industrial and Rural/New Development. The background pollutant concentrations to be adopted for a project site would depend on the geographical constituency to which the site belongs. The categorisation of these constituencies is given in Section 3.4. The monitoring stations suggested for the 'district-averaging'(arithmetic means) to derive averages for the three background air quality categories are listed as follows:

Urban: Kwun Tong, Sham Shui Po, Tsim Sha Tsui and Central/Western

Industrial: Kwun Tong, Tsuen Wan and Kwai Chung

Rural/New Development: Sha Tin, Tai Po, Junk Bay, Hong Kong South and Yuen Long

The averaging would make use of data from the above stations wherever available. The majority of the monitoring stations are located some 20m above ground.

3.3 Background pollutant values

Based on the above approach, background values for the 3 categories have been

obtained for a few major air pollutants as follows:

POLLUTANT	URBAN	INDUSTRIAL	RURAL / NEW DEVELOPMENT
NO ₂	59	57	39
SO ₂	21	26	13
O ₃	62	68	57
TSP	98	96	87
RSP	60	58	51

All units are in micrograms per cubic metre. The above values are derived from 1992 to 1996 annual averages with the exception of ozone which represent annual average of daily hourly maximum values for year 1996.

In cases where suitable air quality monitoring data representative of the study site such as those obtained from a nearby monitoring station or on-site sampling are not available for the prescription of background air pollution levels, the above tabulated values can be adopted instead. Strictly speaking, the suggested values are only appropriate for long term assessment. However, as an interim measure and until a better approach is formulated, the same values can also be used for short term assessment. This implies that the short term background values will be somewhat under-estimated, which compensates for the fact that some of the monitoring data are inherently influenced by secondary sources because of the monitoring station location.

Indeed, if good quality on-site sampling data which cover at least one year period are available, these can be used to derive both the long term (annual) and short term (daily / hourly) background values, the latter are usually applied on an hour to hour, day to day basis.

3.4 Site categories

The categories to which the 19 geographical constituencies belong are listed as follows:

DISTRICT	AIR QUALITY CATEGORY
Islands	Rural / New Development
Southern	Rural / New Development
Eastern	Urban
Wan Chai	Urban
Central & Western	Urban
Sai Kung	Rural / New Development
Kwun Tong	Industrial
Wong Tai Sin	Urban
Kowloon City	Urban
Yau Tsim	Urban
Mong Kok	Urban
Sham Shui Po	Urban

Kwai Tsing	Industrial
Sha Tin	Rural / New Development
Tsuen Wan	Industrial
Tuen Mun	Rural / New Development
Tai Po	Rural / New Development
Yuen Long	Rural / New Development
Northern	Rural / New Development

3.5 Provisions for 'double-counting'

The current approach is, by no means, a rigorous treatment of background air quality but aims to provide an as-realistic-as-possible approximation based on limited field data. 'Double-counting' of 'secondary contributions' may be apparent through the use of such 'monitoring-based' background data as some of the monitoring stations are of close proximity to existing emission sources. 'Primary contributions' due to a proposed project (which is yet to be realized) will not be double-counted by such an approach. In order to avoid over-estimation of background pollutant concentrations, an adjustment to the values given in Section 3.3 is possible and optional by multiplying the following factor:

$$(1.0 - E_{\text{Secondary contributions}}/E_{\text{Territory}})$$

where E stands for emission.

The significance of this factor is to eliminate the fractional contribution to background pollutant level of emissions due to 'secondary contributions' out of those from the entire territory. In most cases, this fractional contribution to background pollutant levels by the secondary contributions is minimal.

4. Conclusions

- 4.1 The above described approach to estimating the total air quality impacts of a proposed project, in particular the background pollutant concentrations for air quality assessment, should be adopted with immediate effect. Use of short term monitoring data to prescribe the background concentrations is no longer acceptable.

Appendix B-3**Guidelines on the Use of Alternative Computer Models in Air Quality Assessment**

[The information contained in this Appendix is only meant to assist the Applicant in performing the air quality assessment. The Applicant must exercise professional judgment in applying this general information for the Project.]

1. Background

- 1.1 In Hong Kong, a number of Gaussian plume models are commonly employed in regulatory applications such as application for specified process licences and environmental impact assessments (EIAs). These frequently used models (as listed in Schedule 1 attached; hereafter referred to as Schedule 1 models) have no regulatory status but form the basic set of tools for local-scale air quality assessment in Hong Kong.
- 1.2 However, no single model is sufficient to cover all situations encountered in regulatory applications. In order to ensure that the best model available is used for each regulatory application and that a model is not arbitrarily applied, the project proponent (and/or its environmental consultants) should assess the capabilities of various models available and adopt one that is most suitable for the project concerned.
- 1.3 Examples of situations where the use of an alternative model is warranted include:
 - (i) the complexity of the situation to be modelled far exceeds the capability of the Schedule 1 models; and
 - (ii) the performance of an alternative model is comparable or better than the Schedule 1 models.
- 1.4 This paper outlines the demonstration / submission required in order to support the use of an alternative air quality model for regulatory applications for Hong Kong.

2. Required Demonstration / Submission

- 2.1 Any model that is proposed for air quality applications and not listed amongst the Schedule 1 models will be considered by EPD on a case-by-case basis. In such cases, the proponent will have to provide the followings for EPD's review:
 - (i) Technical details of the proposed model; and
 - (ii) Performance evaluation of the proposed model

Based on the above information, EPD will determine the acceptability of the proposed model for a specific or general applications. The onus of providing adequate supporting materials rests entirely with the proponent.

- 2.2 To provide technical details of the proposed model, the proponent should submit documents containing at least the following information:
 - (i) mathematical formulation and data requirements of the model;

- (ii) any previous performance evaluation of the model; and
 - (iii) a complete set of model input and output file(s) in commonly used electronic format.
- 2.3 On performance evaluation, the required approach and extent of demonstration varies depending on whether a Schedule 1 model is already available and suitable in simulating the situation under consideration. In cases where no Schedule 1 model is found applicable, the proponent must demonstrate that the proposed model passes the screening test as set out in USEPA Document "Protocol for Determining the Best Performing Model" (Ref. 1).
- Ref.(1): William M. Cox, 'Protocol for Determining the Best Performing Model'; Publication No. EPA-454/R-92-025; U.S. Environmental Protection Agency, Research Triangle Park, NC.*
- 2.4 For cases where a Schedule 1 model is applicable to the project under consideration but an alternative model is proposed for use instead, the proponent must demonstrate either that
- (i) the highest and second highest concentrations predicted by the proposed model are within 2 percent of the estimates obtained from an applicable Schedule 1 model (with appropriate options chosen) for all receptors for the project under consideration; or
 - (ii) the proposed model has superior performance against an applicable Schedule 1 model based on the evaluation procedure set out in USEPA Document "Protocol for Determining the Best Performing Model" (Ref. 1).
- 2.5 Should EPD find the information on technical details alone sufficient to indicate the acceptability of the proposed model, information on further performance evaluation as specified in Sections 2.3 and 2.4 above would not be necessary.
- 2.6 If the proposed model is an older version of one of the Schedule 1 models or was previously included in Schedule 1, the technical documents mentioned in Section 2.2 are normally not required. However, a performance demonstration of equivalence as stated in Section 2.4 (i) would become necessary.
- 2.7 If EPD is already in possession of some of the documents that describe the technical details of the proposed model, submission of the same by the proponent is not necessary. The proponent may check with EPD to avoid sending in duplicate information.

Schedule 1

Air Quality Models Generally Accepted by Hong Kong Environmental Protection Department for Regulatory Applications as at 1 July 1998 : *

Industrial Source Complex Dispersion Model - Short Term Version 3 (ISCST3) or the latest

version developed by U.S. Environmental Protection Agency

California Line Source Dispersion Model Version 4 (CALINE4) or the latest version developed by Department of Transportation, State of California, U.S.A.

Fugitive Dust Model (FDM) or the latest version developed by U.S. Environmental Protection Agency

* EPD is continually reviewing the latest development in air quality models and will update this Schedule accordingly.

Appendix B-4**Guidelines on Estimating Height Restriction and Position of Fresh Air Intake Using Gaussian Plume Models**

[The information contained in this Appendix is only meant to assist the Applicant in performing the air quality assessment. The Applicant must exercise professional judgment in applying this general information for the Project.]

1. Introduction

- 1.1 Two situations in Hong Kong call for an assessment of ambient pollution concentration as a function of height, namely, the determination of
- (i) height restriction for new buildings in areas subject to poor air quality aloft as a result of elevated emission sources nearby; and
 - (ii) optimum / acceptable location of fresh-air intakes for centrally air-conditioned buildings.
- 1.2 Simple Gaussian plume models like the Industrial Source Complex Dispersion Model - Short Term Version 3 (ISCST3) have been commonly used in Hong Kong for predicting air quality with a view to addressing the two situations above. This guideline provides a practical approach to applying the ISCST3 model to these two situations in order to safeguard air quality. The application limits of the ISCST3 model must, however, be observed (refer to its User's Guide). Suitable alternatives such as wind tunnel modelling or more sophisticated numerical modelling may have to be used instead if the situation warrants.

2. Approach

- 2.1 The concentration pattern at sensitive receivers produced by emissions from a single stack is different from that produced by multiple stacks. However, in most cases, the emission characteristics of one particular stack can be used to approximate the concentration pattern at sensitive receivers due to its dominance. An exception to this generalisation occurs when there exist a number of stacks concentrating in a small area but having large differences in emission characteristics such as emission height, stack dimensions, efflux velocity and temperature.

General Situation

- 2.2 A case can be considered general if it belongs to one of the following categories:
- (i) Vertical concentration profile at receptors is contributed solely by emissions from one stack with diameter less than or equal to 1m;
 - (ii) Vertical concentration profile at receptors is dominated by emissions from one stack with none of the contributing stacks having tip diameter larger than 1m and the stacks are not clustered in space (i.e. not of similar distance nor in the same direction from the receptor);

- (iii) Vertical concentration profile at receptors is dominated by emissions from more than one stack with no contributing stack(s) having tip diameter larger than 1m and the stacks are not clustered horizontally; and
 - (iv) Vertical concentration profile at receptors is dominated by emissions from more than one stack with no contributing stack(s) having tip diameter larger than 1m and the dominant stacks clustered horizontally, but the stack gas characteristics and emission heights of these dominant stacks are not significantly different.
- 2.3 Since only fewer than 3% of stacks registered in Hong Kong have tip diameter larger than 1m, these "large" stacks are treated individually as suggested in section 2.5.
- 2.4 For the general case, we have performed a sensitivity study (Annex 1) based on a single stack to determine the uncertainty associated with plume heights arising from input data of limited accuracy. On the basis of these findings, we recommend the followings:
- (i) Conduct an air quality modelling exercise using the stack emission characteristics dictated by the situation.
 - (ii) The restricted height range will be the region of unacceptable air quality with a 10m safety margin added to both ends. The modelling exercise should therefore address the full receptor height range and 10m beyond.

Special Situation

- 2.5 For all other situations not covered by those in Section 2.2 above, the following procedures are recommended:
- (i) Conduct an air quality modelling exercise using the minimum values of stack gas exit velocity and stack gas temperature (i.e. 6ms-1 and 373K, respectively).
 - (ii) Conduct a second modelling exercise based on the maximum (or calculated, whichever is higher) values of stack gas exit velocity and stack gas temperature of the respective ranges (Table 1).
 - (iii) The results from the first and second runs above are then used to delimit the upper and lower end of the range of unacceptable air quality, respectively.
- 2.6 In conducting the air quality modelling exercise, background pollutant concentrations should also be allowed for. The "Guidelines on Assessing the "TOTAL" Air Quality Impacts" can be referred to.

Annex I**Sensitivity Study on the Height of Maximum Impact at a Receptor****A. Approach**

- A.1 In assessing the impact of emission from a point source using ISCST3, the following parameters would affect the plume rise :
- a. stack height;
 - b. stack diameter;
 - c. stack gas temperature;
 - d. stack gas exit velocity;
 - e. ambient temperature; and
 - f. stack tip wind velocity.
- A.2 The first two parameters above are clearly specified and not subject to change. The last two parameters are part of the meteorological input independent of plume characteristics. Uncertainty in the plume rise calculation is introduced through:
- a. the limited ability of the plume rise algorithm to replicate nature; and
 - b. the uncertainty in the effluent's characteristics as represented by the stack gas temperature and stack gas exit velocity.
- A.3 The first type of uncertainty attends all mathematical representation of complex reality. Users of model results will have to come to terms with this limitation. However, in modelling air quality for general environmental assessment (e.g. ground level concentration, safe set-back distance, ..., etc.), attempts are usually made to produce a 'conservative' estimate. Though this conservative estimate does not address the accuracy of the algorithm, which varies from case to case and cannot be determined without an unrealistic amount of monitoring in most cases, it is generally practiced and accepted as sufficient to safeguard the air quality at sensitive receivers.
- A.4 In the same vein, we are attempting to specify procedures that would produce 'conservative' results to safeguard air quality at air sensitive receptors that are dependent on the vertical position of the plume. The complication in this attempt is the definition of 'conservative' results. For the case of height restriction, estimation based on a lower plume rise would be conservative. For determining the optimum locations of fresh-air intakes, enough margin would have to be allowed for at both the upper and lower ends of the acceptable locations.
- A.5 Since the values of the stack gas temperature and stack gas exit velocity affect the plume rise, a sensitivity test was conducted to delimit the uncertainty in plume rise due to these two parameters.

B. Sensitivity Study

- B.1 The base case of the sensitivity test is selected such that the plume rise due to buoyancy (represented by the stack gas temperature) and momentum (represented by the stack gas exit velocity) is at a minimum. This corresponds to choosing the minimum values of the stack gas exit velocity and temperature in the respective ranges. Performing sensitivity tests on this base case would amplify the resulting deviation, thus producing conservative results.
- B.2 By studying the emission characteristics of the industrial stacks in Hong Kong, it is found that exit velocities and stack gas temperatures for most industrial stacks vary between 6 - 10 ms⁻¹ and 373 - 573K. For the sensitivity tests, the values of the exit gas velocity and exit gas temperature are varied within these ranges to determine the maximum uncertainty in plume rise. The details of the parameters used in the base case are given in Table 1.
- B.3 The same procedure was repeated for different values of the stack tip diameter (between 0.1 and 1m) and for different ambient temperatures (between 0 and 40°C).

C. Results

- C.1 Within a horizontal distance of 20 to 1,000m from the stack, the sensitivity tests' results show that the plume centre line height will not differ by more than 10m from that of the base case for the specified ranges of parameter values. Also, within the ranges tested, this plume centre line height is not significantly affected by the ambient temperature and stack tip diameter. Furthermore, the maximum concentration at a certain distance from the stack is not sensitive to the changes in the stack gas exit velocity and stack gas temperature.
- C.2 Further tests show that some plume rise values resulting from the specified ranges of parameters may deviate from the base case plume rise by more than 10m if the stack tip diameter is larger than 1m.

Table 1

Input Parameters in the Base Case

Chimney Characteristics	Rationale
height of emission - 100m	the height was chosen to represent the typical height of emission for chimneys in industrial areas
stack tip diameter - 1m	approximate 97% of the stacks have diameters less than 1m according to EPD's Enforcement Management System (EMS)
exit velocity - 6 ms ⁻¹	the minimum exit velocity required by the licence
exit gas temperature - 373K	the minimum of the range typical of those stacks servicing industrial boilers
emission strength - 1gs ⁻¹	a reference emission strength

Meteorological Conditions	Rationale
	follows the USEPA's meteorological conditions for screening procedure, i.e.
	A: 1, 2, 3 ms ⁻¹ B: 1, 2, 3, 4, 5 ms ⁻¹ C: 1, 2, 3, 4, 5, 8, 10 ms ⁻¹ D: 1, 2, 3, 4, 5, 8, 10, 15, 20 ms ⁻¹ E: 1, 2, 3, 4, 5 ms ⁻¹ F: 1, 2, 3, 4 ms ⁻¹
mixing height - 500m	as the emission height of the source is at 100m, the predicted concentration and the height of maximum impact are insensitive to this value
ambient temperature - 298K	a typical ambient temperature used in Hong Kong

Receptor

receptor distance

- 20, 40, 60, 80, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000m
downwind from the source

receptor height

Appendix C**Guidelines for Cultural Heritage Impact Assessment**

(as at April 2011)

Introduction

The purpose of the guidelines is to assist the understanding of the requirements in assessing impact on archaeological and built heritage. The guidelines which will be revised by the Antiquities and Monuments Office (AMO) of the Leisure and Cultural Services Department from time to time, where appropriate, and when required should be followed in the interest of professional practice.

A comprehensive Cultural Heritage Impact Assessment (CHIA) includes a baseline study, an impact assessment study associated with the appropriate mitigation measures proposed and to be implemented by project proponents.

(1) Baseline Study

1.1 A baseline study shall be conducted:

- a. to compile a comprehensive inventory of heritage sites within the proposed project area, which include:
 - (i) all sites of archaeological interest (both terrestrial and marine);
 - (ii) all pre-1950 buildings and structures;
 - (iii) selected post-1950 buildings and structures of high architectural and historical significance and interest; and
 - (iv) cultural landscapes include places associated with historic event, activity, or person or exhibiting other cultural or aesthetic values, such as sacred religious sites, battlefields, a setting for buildings or structures of architectural or archaeological importance, historic field patterns, clan graves, old tracks, *fung shui* woodlands and ponds, and etc.
- b. to identify the direct and indirect impacts on the heritage sites at the planning stage in order to avoid causing any negative effects. The impacts include the direct loss, destruction or disturbance of an element of cultural heritage, impact on its settings or impinging on its character through inappropriate sitting or design, potential damage to the physical fabric of archaeological remains, historic buildings or historic landscapes through air pollution, change of ground water level, vibration, ecological damage, new recreation or other daily needs to be caused by the new development. The impacts listed are merely to illustrate the range of potential impacts and not intended to be exhaustive.

1.2 The baseline study shall also include a desk-top research and a field evaluation.

1.3. Desk-top Research

- 1.3.1 Desk-top research should be conducted to analyse, collect and collate the best available information. It shall include (if applicable) but not limited to:

- a. List of declared monuments protected by the Antiquities and Monuments Ordinance (Chapter 53).
- b. Graded historic buildings and sites.
- c. Government historic sites identified by AMO.
- d. Lists and archives kept in the Reference Library of AMO including sites of archaeological interest, declared monuments, proposed monuments, deemed monuments and recorded historical building & structures identified by AMO.
- e. Publications on local historical, architectural, anthropological, archaeological and other cultural studies, such as, Journals of the Royal Asiatic Society (Hong Kong Branch), Journals of the Hong Kong Archaeological Society, AMO Monograph Series and so forth.
- f. Other unpublished papers, records, archival and historical documents through public libraries, archives, and the tertiary institutions, such as the Hong Kong Collection and libraries of the Department of Architecture of the University of Hong Kong and the Chinese University of Hong Kong, Public Records Office, photographic library of the Information Services Department and so forth.
- g. Any other unpublished archaeological investigation and excavation reports kept by AMO.
- h. Relevant information from AMO's website.
- i. Historical documents in the Public Records Office, the Land Registry, District Lands Office, District Office and the Hong Kong Museum of History and so forth.
- j. Cartographic and pictorial documents. Old and recent maps and aerial photos searched in the Map and Aerial Photo Library of the Lands Department.
- k. Existing geological and topographic information (for archaeological desk-top research).
- l. Discussion with local informants.

1.4 Field Evaluation

1.4.1 General

The potential value of the project area with regard the cultural heritage could be established easily where the area is well-documented. However, it does not mean that the area is devoid of interest if it lacks information. In these instances, site inspections and consultations with appropriate individuals or organisations should be conducted by those with expertise in local heritage to clarify the situation.

1.4.2 Field survey on historic buildings and structures

- a. Field scan of all the historic buildings and structures within the project area.
- b. Photographic recording of each historic building or structure including the exterior (the elevations of all faces of the building premises, the roof, close up for the special architectural details) and the interior (special architectural details), if possible, as well as the surroundings, the associated cultural landscape features and the associated intangible cultural heritage (if any) of each historic building or structure.
- c. Interview with local elders and other informants on local historical,

architectural, anthropological and other cultural information related to the historic buildings and structures.

- d. Historical and architectural appraisal of the historic buildings and structures, their associated cultural landscape and intangible cultural elements.

1.4.3 Archaeological Survey

- a. Appropriate methods for pricing and valuation of the archaeological survey, including by means of a Bill of Quantities or a Schedule of Rates should be adopted when appropriate in preparing specifications and relevant documents for calling tenders to carry out the archaeological survey. The specifications and relevant documents should be sent to AMO for agreement prior to calling tenders to conduct the archaeological survey.
- b. For archaeologists involved in contract archaeological works, they should adhere to recognized standards for professional practice and ethical conduct in undertaking commissioned archaeological works under contracts. They should make themselves fully understand recognized principles and guidelines regarding contract archaeological works, such as those of the Institute for Archaeologists, European Associations of Archaeologists and in Mainland China.
- c. A licence shall be obtained from the Antiquities Authority for conducting archaeological field work. It takes at least two months to process an application.
- d. An archaeological brief/proposal, as an outline framework of the proposed archaeological works, should be prepared. The brief/proposal should clearly state the project and archaeological background, address necessary archaeological works required, elaborate the strategy and methodology adopted, including what particular research question(s) will be resolved, how the archaeological data will be collected and recorded, how the evidence will be analysed and interpreted and how the archaeological finds and results will be organized and made available. Effective field techniques including method and sampling details are required to be demonstrated clearly in the brief/proposal. Monitoring arrangement, reporting, contingency plan for field and post-excavation works and archive deposition (including finds, field and laboratory records, etc.) should also be addressed in the brief/proposal. The brief/proposal should be submitted to AMO for agreement prior to applying for a licence. Prior site visit to the project site before the submission of the brief/proposal is required so as to ascertain the feasibility of the proposed strategy and methodology as well as the availability of the proposed locations for auger survey and test pitting.
- e. The following methods of archaeological survey (but not limited to) should be applied to assess the archaeological potential of the project area:
 - (i) Definition of areas of natural land undisturbed in the recent past.
 - (ii) Field scan of the natural land undisturbed in the recent past in detail with special attention paid to areas of exposed soil which were searched for artifacts.

- (iii) Conduct systematic auger survey and test pitting. The data collected from auger survey and test pitting should be able to establish the horizontal spread of cultural materials deposits.
 - (iv) Excavation of test pits to establish the vertical sequence of cultural materials. The hand digging of 1 x 1 m or 1.5 x 1.5 m test pits to determine the presence or absence of deeper archaeological deposits and their cultural history.
 - (v) The quantity and location of auger holes and test pits should be agreed with AMO prior to applying for a licence. Additional auger holes and test pits may be required to ascertain and demarcate the extent of archaeological deposits and remains.
 - (vi) A qualified land surveyor should be engaged to record reduced levels and coordinates as well as set base points and reference lines in the course of the field survey.
 - (vii) All archaeological works should be properly completed and recorded to agreed standards.
- f. Archaeologists should adhere to all the agreed professional and ethical standards for archaeological works, such as the standards and guidelines of the Institute for Archaeologists, English Heritage, European Associations of Archaeologists, Society for American Archaeology and in Mainland China.
- g. A Marine Archaeological Investigation (MAI) following *Guidelines for MAI* may be required for projects involving disturbance of seabed.
- 1.4.4 If the field evaluation identifies any additional heritage sites within the study area which are of potential historic or archaeological importance/interest and not recorded by AMO, the findings should be reported to AMO as soon as possible.

1.5 The Report of Baseline Study

- 1.5.1 The study report should unequivocally include all the direct and concrete evidence to show that the process of the above desk-top and field survey has been satisfactorily completed. This should take the form of a detailed inventory of the heritage sites supported by full description of their significance. The description should contain detailed geographical, historical, archaeological, architectural, anthropological, ethnographic and other relevant data supplemented with illustrations below and photographic and cartographic records, if required.
- 1.5.2 A master layout plan showing all the identified archaeological and built heritage within the study area should be provided in the report. All the identified heritage sites should be properly numbered with their locations indicated on the master layout plan.
- 1.5.3 Historic Buildings/ Structures/ Sites
- a. A map in 1:1000 scale showing the boundary of each historic item.
 - b. Photographic records of each historic item.
 - c. Detailed recording form of each historic item including its construction year, previous and present uses, architectural characteristics, as well as legends,

historic persons and events, cultural landscape features and cultural activities associated with the structure.

- d. A cross-referenced checklist including the reference number of each historical item, their photo and drawing reference, as well as the page number of the detailed recording form of each identified historical item for easy cross-checking of individual records.

1.5.4 Sites of Archaeological Interest

- a. A map showing the boundary of each site of archaeological interest as supported and delineated by field walking, augering and test-pitting.
- b. Drawing of stratigraphic section of test-pits excavated which shows the cultural sequence of a site.
- c. Reduced levels, coordinates, base points and reference lines should be clearly defined and certified by a qualified land surveyor.
- d. *Guidelines for Archaeological Reports* should be followed (Annex 1).

- 1.5.5 A full bibliography and the source of information consulted should be provided to assist the evaluation of the quality of the evidence, including the title of the relevant material, its author(s), publisher, publication place and date. To facilitate verification of the accuracy, AMO will reserve the right to examine the full details of the research materials collected under the baseline study.

1.6 Finds and Archives

- 1.6.1 Archaeological finds and archives should be handled following *Guidelines for Handling of Archaeological Finds and Archives* (Annex 2).

1.7 Safety Issue

- 1.7.1 During the course of the CHIA Study, all participants shall comply with all Ordinances, Regulations and By-laws which may be relevant or applicable in safety aspect in connection with the carrying out of the CHIA Study, such as site safety, insurance for personal injuries, death and property damage as well as personal safety apparatuses, etc.
- 1.7.2 A Risk Assessment for the fieldwork shall be carried out with full consideration to all relevant Ordinances, Regulations and By-laws.

1.8 Information Disclosure

- 1.8.1 For releasing any information on the CHIA Study, the archaeologist/expert involved should strictly comply with the terms and conditions set in the contract/agreement and avoid conflict of interest.

(2) Impact Assessment Study

2.1 Identification of impact on heritage

- 2.1.1 The impact assessment study must be undertaken to identify the impacts on the

heritage sites which will be affected by the proposed development subject to the result of desktop research and field evaluation. The prediction of impacts and an evaluation of their significance must be undertaken by expert(s) in local heritage.

- 2.1.2 During the assessment, both the direct impacts such as loss or damage of important features as well as indirect impacts should be clearly stated, such as adverse visual impact on heritage sites, landscape change to the associated cultural landscape features of the heritage sites, temporary change of access to the heritage sites during the work period, change of ground level or water level which may affect the preservation of the archaeological and built heritage *in situ* during the implementation stage of the project.
- 2.1.3 The evaluation of cultural heritage impact assessment may be classified into five levels of significance based on type and extent of the effects concluded in the CHIA study:
 - a. Beneficial impact: the impact is beneficial if the project will enhance the preservation of the heritage site(s) such as improving the flooding problem of the historic building after the sewerage project of the area;
 - b. Acceptable impact: if the assessment indicates that there will be no significant effects on the heritage site(s);
 - c. Acceptable impact with mitigation measures: if there will be some adverse effects, but these can be eliminated, reduced or offset to a large extent by specific measures, such as conduct a follow-up Conservation Proposal or Conservation Management Plan for the affected heritage site(s) before commencement of work in order to avoid any inappropriate and unnecessary interventions to the building;
 - d. Unacceptable impact: if the adverse effects are considered to be too excessive and are unable to mitigate practically;
 - e. Undetermined impact: if the 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.
- 2.1.4 Preservation in totality must be taken as the first priority as it will be a beneficial impact and will enhance the cultural and socio-economical environment if suitable measures to integrate the heritage site into the proposed project are carried out.
- 2.1.5 If, due to site constraints and other factors, only preservation in part is possible, this must be fully justified with alternative proposals or layout designs which confirm the impracticability of total preservation.
- 2.1.6 Total destruction must be taken as the very last resort in all cases and shall only be recommended with a meticulous and careful analysis balancing the interest of preserving local heritage as against that of the community as a whole. Assessment of impacts on heritage sites shall also take full account of, and follow where appropriate, paragraph 4.3.1(c), item 2 of Annex 10, items 2.6 to 2.9 of Annex 19 and other relevant parts of the Technical Memorandum on Environmental Impact Assessment Process.

2.2 Mitigation Measures

- 2.2.1 It is always a good practice to recognize the heritage site early in the planning stage and site selection process, and to avoid it, i.e. preserve it *in-situ*, or leaving a buffer zone around the site with full justifications demonstrating the best practice of heritage conservation.
- 2.2.2 Mitigation is not only concerned with minimizing adverse impact on the heritage site but also should give consideration of potential enhancement if possible (such as to improve the access to the heritage site or enhance the landscape and visual quality of the heritage site).
- 2.2.3 Mitigation measures shall not be recommended or taken as *de facto* means to avoid preservation of heritage sites. They must be proved beyond all possibilities to be the only practical course of action. Heritage sites are to be in favour of preservation unless it can be demonstrated that there is a need for a particular development which is of paramount importance and outweighs the significance of a heritage site.
- 2.2.4 If avoidance of the heritage site is not possible, amelioration can be achieved by minimizing the potential impacts and the preservation of the heritage site, such as physically relocating it. Measures like amendments of the sitting, screening and revision of the detailed design of the development are required to lessen its degree of exposure if it causes visual intrusion to the heritage site and affects the character and integrity of the heritage site.
- 2.2.5 A rescue programme, when required, may involve preservation of the historic building or structure together with the relics inside, and its historic environment through relocation, detailed cartographic and photographic survey or preservation of site of archaeological interest “by record”, i.e. through excavation to extract the maximum data as the very last resort.

2.3 The Impact Assessment Report

- 2.3.1 A detailed description and plans should be provided to elaborate on the heritage site(s) to be affected. Besides, please also refer to paragraph 4.3.1(d), items 2.10 to 2.14 of Annex 19 and other relevant parts of the Technical Memorandum, other appropriate presentation methods for mitigation proposals like elevations, landscape plan and photomontage shall be used in the report extensively for illustrating the effectiveness of the measures.
- 2.3.2 To illustrate the landscape and visual impacts on heritage sites, as well as effects of the mitigation measures, choice of appropriate presentation methods is important. These methods include perspective drawings, plans and section/elevation diagrams, photographs on scaled physical models, photo-retouching and photomontage. These methods shall be used extensively to facilitate communication among the concerned parties.
- 2.3.3 The implementation programme for the agreed mitigation measures should be able to be executed and should be clearly set out in the report together with the

funding proposal. These shall form an integral part of the overall redevelopment project programme and financing of the proposed redevelopment project. Competent professionals must be engaged to design and carry out the mitigation measures.

- 2.3.4 For contents of the implementation programme, reference can be made to Annex 20 of the Technical Memorandum on Environmental Impact Assessment Process. In particular, item 6.7 of Annex 20 requires to define and list out clearly the proposed mitigation measures to be implemented, by whom, when, where, to what requirements and the various implementation responsibilities. A comprehensive plan and programme for the protection and conservation of the preserved heritage site, if any, during the planning and design stage of the proposed project must be addressed in details.
- 2.3.5 Supplementary information to facilitate the verification of the findings shall be provided in the report including but not limited to:
- a. layout plan(s) in a proper scale illustrating the location of all heritage sites within the study area, the extent of the work area together with brief description of the proposed works;
 - b. all the heritage sites within the study area should be properly numbered, cross-reference to the relevant drawings and plans.
 - c. an impact assessment cross-referenced checklist of all the heritage sites within the study area including heritage site reference, distance between the heritage site and work area, summary of the possible impact(s), impact level, summary of the proposed mitigation measure(s), as well as references of the relevant plans, drawings and photos; and
 - d. a full implementation programme of the mitigation measures for all affected heritage sites to be implemented with details, such as by whom, when, where, to what requirements and the various implementation responsibilities of individual parties.

* *This Guidelines for Cultural Heritage Impact Assessment was first set out in August 2008 based on the Criteria for Cultural Heritage Impact Assessment and revised subsequently in December 2008, July 2010, October 2010, March 2011 and April 2011.*

Annex 1**Guidelines for Archaeological Reports****(As at April 2011)****I. General**

1. All reports should be written in a clear, concise and logical style.
2. All the constituent parts (text, figures, photos and specialist reports (if any)) should provide full cross-reference. Readers should be able to find their way around the report without difficulty.
3. The reports should be submitted in A4 size and accompanying drawings of convenient sizes.
4. Draft reports should be submitted to the Antiquities and Monuments Office (AMO) for comments within two months after completion of archaeological work unless otherwise approved by AMO.
5. The draft reports should be revised as required by AMO and relevant parties. The revised reports should be submitted to AMO within three weeks after receiving comments from AMO and relevant parties.
6. At least 5 hard copies of the final reports should be submitted to AMO for record purpose.
7. At least 2 digital copies of the final reports in both Microsoft Word format and Acrobat (.PDF) format without loss of data and change of appearance compared with the corresponding hard copy should be submitted to AMO. The digital copies should be saved in a convenient medium, such as compact discs with clear label on the surface and kept in protective pockets.
8. Errors are the responsibilities of the author(s) and should so far as possible be identified and rectified before submission to AMO.
9. The guidelines which will be revised by the AMO of the Leisure and Cultural Services Department from time to time, where appropriate, and when required should be followed in the interest of professional practice.

II. Suggested Format of Reports

1. Front page:
 - Project/Site name
 - Nature of the report
 - e.g. (Draft/Final)
 - Archaeological Investigation/Survey Report
 - Archaeological Impact Assessment Report
 - Watching Brief Report
 - Rescue Excavation Report
 - Post-excavation Report
 - Organization
 - Date of report
2. Contents list
Page number of each section should be given.
3. Non-technical summary (both in English and Chinese with approximate 150 - 300 words each)

This should outline in plain, non-technical language, the principal reasons for the archaeological work, its aims and main results, and should include reference to authorship and commissioning body.

4. Introduction

This should set out background leading to the commission of the reports. The location, area, scope and date of conducting the archaeological work must be given. The location of archaeological work should be shown on maps in appropriate scales and with proper legends.

5. Aims of archaeological work

These should reflect the aims set in the project design.

6. Archaeological, historical, geological and topographical background of the site

Supporting aerial photos and maps (both old and present) in appropriate scales, with proper legends and with the site locations clearly marked on should be provided.

7. Methodology

The methods used including any variation to the agreed project design should be set out clearly and explained as appropriate.

8. Results

- The results should outline the findings, known and potential archaeological interests by period and/or type. Their significance and value with reference/inclusion of supporting evidence should be indicated. If more than one interpretation is possible, the alternatives should also be presented, at least in summary.
- The results should be amplified by the use of drawings and photographs.
- Tables summarizing features and artifacts by trench/grid/test pit together with their interpretation should be included.
- The method, sampling details, results and interpretation as well as appropriate supporting data of the analysis for the environmental materials, e.g. ecofacts identified and/or collected during the fieldwork should be included.
- For impact assessment, the likely effect of the proposed development on the known or potential archaeological resource should be outlined.

9. Conclusion

This should include summarization and interpretation of the result.

10. Recommendation

Recommendations on further work and the responsible party as well as a brief planning framework should be outlined.

11. Reference and bibliography

A list of all primary and secondary sources including electronic sources used should be given in full detail, including the title of the relevant material, its author(s), publisher, publication place and date.

12. **Archaeological team**
The director and members of the archaeological team and the author(s) of the report should be clearly specified.
13. **Copyright and dissemination**
The copyright of the report should be clearly identified. To facilitate future research studies, please specify that the report can be made available to the public in the Reference Library of the Heritage Discovery Centre.
14. **Supporting illustrations**
They should be clearly numbered and easily referenced to the text. They should be scanned and saved in TIFF or JPEG formats.

A. **Maps**

A location plan of the project site should be included. Archaeological work locations, such as auger hole and test pit locations (with relevant coordinates certified by a qualified land surveyor), should be clearly shown on maps in appropriate scales, with proper legends, grid references (in 8 digits) and captions.

B. **Drawings of test pits, archaeological features, special finds¹, selected representative samples from general finds**

Drawings of all excavated test pits (at least one cross section of each test pit), all excavated archaeological features (both plan and cross section of each archaeological feature), all special finds identified in the excavation and selected representative samples from general finds (at least front view and section of each finds) should be included. All drawings should be clearly numbered and easily referenced to the text. The drawing scales stipulated below should be followed:

Cross section and profile drawings of test pits	1:20
Archaeological feature drawings	1:10
Finds drawings	1:1

If drawings of the above stated scales are not appropriate to be incorporated into the report under certain occasions, reduced copy of the drawings with the same scales are acceptable. Proper captions, legends and indication of reduced size should be given.

C. **Photos of project site and the surrounding area, test pits, archaeological features, special finds, selected representative samples from general finds**

Photos of project site and the surrounding area, all excavated test pits (at least one cross section of each test pit), all excavated archaeological features (both plan and cross section of each archaeological feature), all special finds identified in the excavation and selected representative samples from general finds (at least front view of each of the finds) should be included. All photos should be at least in 3R size with proper

¹ Special finds are sometimes known as small finds (小物件) in Chinese or registered finds. Drawings and photos of the special/small/registered finds should be included in the archaeological report.

captions and scales. They should be clearly numbered and easily referenced to the text. They should be scanned and saved in TIFF or JPEG formats.

15. **Supporting data in appendices**
These should consist of essential technical details to support the result. These may include stratigraphic record of test pits and auger holes, records of general and special finds as well as ecofacts discovered with description, quantity and context number/stratigraphic sequence, result of laboratory testing, index of field archives.
16. **Other professional views/comments**
This can reflect any issues/difficulties regarding the archaeological project observed/encountered by the archaeological team.
17. **Comment and response**
All comments and responses from AMO and relevant parties should be attached in full.

III. Green Measures

1. All reports should be of single line spacing and printed on both sides of the paper.
2. Excessive page margins should be avoided. A top/bottom margin of 2 cm and left/right margin of 2.5 cm are sufficient.
3. Use of blank paper should be avoided as far as possible.
4. Suitable font type of font size 12 should be used generally in balancing legibility and waste reduction objective.

Annex 2**Guidelines for Handling of Archaeological Finds and Archives****(As at November 2011)****I. General Remark**

1. The guidelines which will be revised by the Antiquities and Monuments Office (AMO) of the Leisure and Cultural Services Department from time to time, where appropriate, and when required should be followed in the interest of professional practice.
2. Please use the site code (_____)** for the archaeological project, namely _____. Licensee must use this unique site code for the whole project.

** If an archaeological project covers more than one archaeological site/location, licensee should contact the Central Archaeological Repository (CAR) at 2384 5446 or aciamoar@lcsd.gov.hk to obtain relevant site codes.

3. Licensee should contact the CAR at 2384 5446 or aciamoar@lcsd.gov.hk regarding the handover of archaeological finds and archives when post-excavation research and excavation report have been completed and accepted by the AMO.
4. If a huge quantity of similar general finds was discovered from a single archaeological project, licensee is advised to consult the AMO regarding the collecting strategy as early as possible.
5. For the preparation of archaeological finds and archives for long-term curation by the CAR, the guidelines as set out below should be followed.
6. If the licensee does not handle the finds and archives in accordance with this guidelines, the AMO may inform the project proponent to revise the relevant data. The arrangement of handover may subsequently be deferred.

II. Archaeological Finds**7. Cleaning**

The excavated finds should be properly cleaned with water, except: (i) the finds are identified for scientific analysis; (ii) metal & organic objects (e.g. bone, wood, leather, textile objects and etc.) should not be cleaned with water. Licensee is advised to consult the AMO if in doubt.

8. Marking

- The excavated finds should be cleaned before marking object number.
- “Sandwich” technique¹ should be adopted for marking permanent object

¹ *Steps for “Sandwich” technique*

1. First of all, the find number should be marked in appropriate area and size that does not impact important diagnostic or aesthetic parts of the find.

number.

- Each special find should be marked with site code, context number and SF number, etc.
- Any representative samples selected from the general finds for discussion on the excavation report should be marked with site code, context number, sample number and bagged separately.
- The general finds should be marked with site code and context number.
- For the finds which are too small, organic objects (e.g. bone, wood, leather, textile objects and etc.) or have unstable surface, object number should not be marked on the object directly. These finds should be bagged separately and attached with a label containing information about the site code, context number, find number and description of find.

9. Labeling and bagging

- Two labels should be provided for each bag which contains finds, one is adhered on the surface of the bag while the other is kept inside the bag for easy reference.
- The label inside the bag should be kept separately with a smaller plastic bag so that the label can be kept much longer.
- Information about the site code, context number, test-pit number, object number (or bag number) and description of finds should be written clearly on the label.
- Finds under the same context should be bagged together. If those finds, however, have been categorized according to their typology, materials or characteristics, separate bagging is required.

10. Conservation

- To refit and reconstruct pottery vessels with appropriate adhesive. A heat and waterproof adhesive, e.g. product of H. Marcel Guest Ltd., is recommended.
- Any adhesives which are not reversible or would damage the finds should not be applied on the finds. Archaeologist is advised to consult the AMO if in doubt.

11. Finds register

A standard finds register, for both special finds and general finds, with information about the find's number, name, description, quantity, type, weight, dimensions and field data should be duly filled in. Licensee should contact the CAR at 2384 5446 or aciamaoar@lcsd.gov.hk to obtain the standard finds register (in Excel format). Special finds and general finds should be inputted in individual register. Both hard & soft copies (in Excel format) of the duly completed register should be handed over.

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2. Clean the area to be marked.
 3. Apply a thin coat of clear reversible lacquer on the area. Use white lacquer if the object is dark in colour. Let the base coat dry completely.
 4. Use a permanent water-based ink to write the find number on top of the base coat. Let ink dry completely.
 5. Apply a top coat of clear varnish.
 6. Let the marking dry completely before packing.

12. Sample register of eco-facts

A clear sample register with information about the description of the sample, quantity, type and weight should be prepared for handover.

III. Field Records and Finds Processing Records

13. Field records include field diary, site record for individual test pit/trench/square, context recording sheet, special finds recording sheet, soil sample & eco-facts sample recording sheet, map, survey sheet, photograph/ audio-visual records, etc.

14. Finds processing records include conservation record, measured drawings and photographs, laboratory reports, etc.

15. Measured drawing, both hard & soft copies (in pdf format), and photograph (in jpg format) of each special find should be handed over.

16. All the aforesaid records stated in paragraphs 12 to 14 should be handed over to the CAR when post-excavation research and excavation report have been completed.

Please note:

- all the field records should be submitted together with indexes.
- the video footage should be submitted together with index describing the content of the video footage.
- all the slides, colour/ black & white negatives or digital photographs should be submitted together with photo register.

IV. Handover of Finds

17. Packing

- Each special find should be packed and protected with tissue paper, bubble sheet or P.E. foam to avoid shocking when transporting to the repository. No packing material other than the aforesaid items should be used.
- The general finds should be protected with bubble sheet or P.E. foam and packed in heavy duty plastic container.
- The heavy duty plastic container, e.g. product of the Star Industrial Co., Ltd. (No. 1849 or 1852), is recommended.
- For oversized finds, prior advice on packing method should be sought from the AMO.

18. Handover procedure

- The licensee should make an appointment with the CAR for the handover and arrange to transport the finds and archives to the repository.
- Prior to handover, licensee is required to supply with the aforesaid finds register, field records register and associated records to the CAR for checking at least three working days in advance. Exact date of handover will be arranged subsequently.
- Handover forms for finds and archives should be signed by the representatives of the licensee and the AMO.

