

**Environmental Impact Assessment Ordinance (Cap. 499), Section 5 (7)****Environmental Impact Assessment Study Brief No. ESB-261/2013**

**Project Title: Tai Shue Wan Development at Ocean Park  
(hereinafter known as the "Project")**

**Name of Applicant: Ocean Park Corporation  
(hereafter known as the "Applicant")**

**1. BACKGROUND**

- 1.1 An application (No. ESB-261/2013) 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 10 May 2013 with a project profile (No. PP-486/2013) (the Project Profile).
- 1.2 The Ocean Park is classified as a designated project (DP) under Part I, Schedule 2, Item O.8 of the EIAO and exempted under section 9(2) of the EIAO. As the Project involves physical addition and alteration resulting in adverse environmental impacts, it constitutes a material change to an exempted designated project.
- 1.3 The Project is to redevelop the existing theme park areas at Tai Shue Wan (TSW), which had been operated as Middle Kingdom, Aviary, Flamingo Pond, and Bird Paradise till January 2011, and the existing shrubland in the periphery into a Water Park. The site area of the Project is approximately 6 hectares. The location of the Project is shown in Figure 1. The Project includes construction and operation of the following facilities:
- (i) an indoor zone – water park with a wave pool; sandy beach, lazy river, various water slides, food and beverage facilities, premium zone with cabanas; associated facilities; and an underground car-park;
  - (ii) an outdoor zone – water park with various pools, lazy river, water slides, natural stream and pools; and some small-scale food and beverage facilities; and
  - (iii) general approach area – coach and taxi drop-off point and emergency vehicular access (EVA) road.
- 1.4 Pursuant to section 5(7)(a) of the EIAO, the Director of Environmental Protection (the Director) issues this EIA study brief to the Applicant to carry out an EIA study.
- 1.5 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 Project and associated works that will 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 staged implementation;
  - (ii) the conditions and requirements for the detailed design, construction and operation of

the Project to mitigate against adverse environmental consequences; and

- (iii) the acceptability of residual impacts after the 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 and associated works together with the requirements and environmental benefits for carrying out the Project;
- (ii) to identify and describe the elements of the community and environment likely to be affected by the Project, and/or likely to cause adverse impacts to the Project, including both the natural and man-made environment and the associated environmental constraints;
- (iii) to identify and quantify emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;
- (iv) to identify and quantify any potential losses or damage to flora, fauna and natural habitats;
- (v) to propose the provision of infrastructure or mitigation measures to minimize pollution, environmental disturbance and nuisance during construction and operation of the Project;
- (vi) to investigate the feasibility, effectiveness and implications of the proposed mitigation measures;
- (vii) to identify, predict and evaluate the residual (i.e. after practicable mitigation) environmental impacts and the cumulative effects expected to arise during the construction and operation phases of the Project in relation to the sensitive receivers and potential affected uses;
- (viii) to identify, assess and specify methods, measures and standards, to be included in the detailed design, construction and operation of the Project which are necessary to mitigate these residual environmental impacts and cumulative effects and reduce them to acceptable levels;
- (ix) to design and specify the environmental monitoring and audit requirements; and
- (x) to identify any additional studies necessary to implement the mitigation measures or monitoring and proposals recommended in the EIA report.

## **3. DETAILED REQUIREMENTS OF THE EIA STUDY**

### **3.1 The Purpose**

The purpose of this EIA 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 study. The Applicant has to demonstrate in the EIA report whether the criteria in the relevant sections of

the Technical Memorandum on the Environmental Impact Assessment Process of the Environmental Impact Assessment Ordinance (hereinafter referred to as “the TM”) are complied with.

### **3.2 The Scope**

3.2.1 The scope of this EIA study shall cover the Project and associated works mentioned in sub-sections 1.2-1.3 above. The EIA study shall cover the combined impacts of the whole Project and the cumulative impacts of the existing, committed and planned developments in the vicinity of the Project in accordance with the requirements laid down in section 3.4 of the TM. The environmental impacts of on-site and off-site works and facilities associated with the Project shall be addressed. 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) potential air quality impacts on sensitive receivers due to the construction activities of the Project and potential air quality impacts on sensitive receivers due to operation of the Project, if there are any gaseous emissions from the water sterilization system, as well as induced traffic;
- (ii) potential noise impacts on sensitive receivers due to the construction and operation of the Project, as well as induced traffic;
- (iii) potential water quality impacts and sewerage infrastructure impacts due to the construction and operation of the Project, including the discharges of surface runoff during construction stage; sewage generated from visitor attraction facilities, discharges, if any, containing disinfectants/residue chemicals from the Project pools, surface runoff from landscape areas potentially containing pesticides or fertilizer residues, backwash water produced from water filtration systems, thermal and chemical discharge, if any, from cooling systems, possible sewage overflow and/or emergency bypass, if any, from sewage treatment and disposal within the Project during the operation stage;
- (iv) potential waste management and land contamination implications arising from the Project;
- (v) potential terrestrial and marine/aquatic ecological impacts due to the construction and operation of the Project, including the loss of habitats, removal of vegetation and disturbance to wildlife, in particular the site clearance for providing land for new developments and construction of EVA road;
- (vi) potential landscape and visual impacts caused by the removal of trees and vegetation, the form and appearance of the Project, as well as night time visual impact during night time operation and due to lighting of the Project; and
- (vii) potential cumulative environmental impacts of the Project and associated works, through interaction or in combination with other existing, committed and planned projects in the vicinity of the Project, and that the impacts of these projects may have a bearing on the environmental acceptability of the Project.

### **3.3 Need of the Project and Consideration of Alternatives**

#### **3.3.1 Need of the Project**

The Applicant shall provide information on the need of the Project, including the purpose, objectives and environmental benefits of the Project, and describe the scenarios with and without the Project.

#### **3.3.2 Consideration of Alternative Development Options**

The Applicant shall provide background information on the consideration of alternative development options including alternative design, scale, extent, layout, and mode of operation for the Project within the existing Ocean Park, provide justifications regarding how the proposed development option is arrived at, including the descriptions of the environmental factors considered in the option selection. A comparison of the environmental benefits and dis-benefits of alternative development options shall be made with a view to recommending the preferred option to avoid and minimize adverse environmental effects.

#### **3.3.3 Consideration of Alternative Construction Methods and Sequences of Works**

Taking into consideration the combined effect with respect to the severity and duration of the construction impacts to the affected sensitive receivers, the EIA study shall explore alternative construction methods and sequences of works for the Project, with a view to avoiding or minimizing prolonged adverse environmental impacts. A comparison of the environmental benefits and dis-benefits of applying different construction methods and sequence of works shall be made.

#### **3.3.4 Selection of Preferred Scenario**

Taking into consideration of the findings in sub-sections 3.3.2 and 3.3.3 above, the Applicant shall recommend/justify the adoption of the preferred scenario that will maximize environmental benefits and avoid or minimize adverse environmental effects arising from the Project, and adequately describe the part that environmental factors played in arriving at the final selection.

### **3.4 Technical Requirements**

3.4.1 The Applicant shall conduct the EIA study to address the environmental aspects of the activities as described in section 3.2 above. The assessment shall be based on the best and latest information available during the course of the EIA study. The Applicant shall include in the EIA report details of the construction and operational programme as well as approaches and methodologies for assessing environmental impacts of the Project. The Applicant shall clearly state in the EIA report the time frame, implementation programme and works programme of the Project and other concurrent projects, and assess the cumulative environmental impacts from the Project and interacting projects as identified in the EIA study.

3.4.2 The EIA study shall follow the technical requirements specified below and in the Appendices of this EIA study brief.

#### **3.4.3 Air Quality Impact**

- 3.4.3.1 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.
- 3.4.3.2 The study area for the air quality impact assessment shall be defined by a distance of 500 metres from the boundary of the Project site, with consideration to be extended to include major existing, planned and committed air pollutant emission sources that may have a bearing on the environmental acceptability of the Project. The assessment shall include the existing, committed and planned sensitive receivers within the study area as well as areas where air quality may be potentially affected by the Project. The sensitive receivers shall include those at Victoria Shanghai Academy, HK Juvenile Care Centre, Po Chong Wan Industrial Area as well as the existing Ocean Park etc. The Applicant shall assess the air quality impact arising from the construction activities at the Project site. The Applicant shall also state clearly the transportation routings and the frequency of the construction trucks involved and propose appropriate measures to reduce potential nuisance caused by construction truck movements.
- 3.4.3.3 The Applicant shall justify in the EIA report the decision on the need for an air quality impact assessment on any potential air emission sources arising from the operation of the Project and the road traffic induced by operation of the Project. If an air quality impact assessment of road traffic induced by operation of the Project is needed, the sensitive receivers shall also include those at Broadview Court, Nam Long Hospital, South Wave Court, the planned development on Wong Chuk Hang Station Depot and Pao Yue Kong Swimming Pool etc. The assessment shall also take into account the impacts of emission sources from nearby concurrent projects, if any. The assessment shall be based on the best available information at the time of the assessment.
- 3.4.3.4 The air quality impact assessment shall follow the detailed technical requirements given in Appendix A.
- 3.4.4 **Hazard to Life**
- 3.4.4.1 If the Project involves any overnight storage of explosives and/or potentially hazardous installation (PHI) as defined in Section 4, Chapter 12 of Hong Kong Planning Standards and Guidelines (HKPSG) or the Project site falls within the consultation zone of any PHI, then the Applicant shall follow the criteria for evaluating hazard to life as stated in section 2 of Annex 4 of the TM.
- 3.4.4.2 The hazard to life assessment, if needed, shall follow the detailed technical requirements given in Appendix B.
- 3.4.5 **Noise Impact**
- 3.4.5.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing noise impact as stated in Annexes 5 and 13 of the TM.
- 3.4.5.2 The study area for the noise impact assessment shall generally include areas within 300 metres from the boundary of the Project site. Subject to the agreement of the Director, the study area can be reduced accordingly if the first layer of noise sensitive receivers (NSRs), closer than 300 metres from the outer Project limit, provides acoustic shielding to those receivers at distances further away from the Project. The study area shall be expanded to include NSRs at distances over 300 metres from the Project, e.g. Victoria Shanghai

Academy and HK Juvenile Care Centre, if those NSRs are also affected by the construction and operation of the Project. The Applicant shall assess the construction and operational noise impacts, in particular the use of powered mechanical equipment (PME) during construction phase and noise generated from fixed plant and open-air entertainment activities which employ sound amplification systems during the operation phase. The Applicant shall also state clearly the transportation routings and the frequency of the construction trucks involved and propose appropriate measures to reduce potential nuisance caused by construction truck movements.

3.4.5.3 The Applicant shall justify in the EIA report the decision on the need for a noise impact assessment associated with the road traffic noise induced by the operation of the Project. If such a noise impact assessment is needed, the sensitive receivers shall also include those at Broadview Court, South Wave Court and the planned development on Wong Chuk Hang Station Depot etc.

3.4.5.4 The noise impact assessment shall follow the detailed technical requirements given in Appendix C.

### 3.4.6 Water Quality Impact

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

3.4.6.2 The study area for the water quality impact assessment shall include areas within 500 metres from the boundary of the Project site and shall cover the Western and Southern Buffer Water Control Zones as designated under Water Pollution Control Ordinance and the water sensitive receivers in the vicinity of the Project, such as streams and ponds located within or close to the Project; existing seawater intake for pumping station at Ocean Park; Aberdeen South Typhoon Shelter; secondary contact recreational waters to the south of Ocean Park (The nearest bathing beach is Deep Water Bay, which is approximately 0.8 km from the existing jetty at the Lowland Area); and corals at some sites around the headland. The study area can be extended to include other areas such as stream courses, existing and new drainage system, and the associated water system(s) in the vicinity if they are found also being affected by the Project during the EIA study and have a bearing on the environmental acceptability of the Project.

3.4.6.3 The water quality impact assessment shall follow the detailed technical requirements given in Appendix D1.

### 3.4.7 Sewerage and Sewage Treatment Implication

3.4.7.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing impacts on the downstream 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 to the sewerage systems in the area served by Aberdeen Preliminary Treatment Works (APTW), including but not limited to sewage generated from water filtration systems, water parks and visitor attraction facilities.

3.4.7.3 The assessment of the sewerage and sewage treatment implication arising from the operation of the Project shall follow the detailed technical requirements given in Appendix D2.

### 3.4.8 **Waste Management Implication**

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.

3.4.8.2 The assessment of the waste management implication shall follow the detailed technical requirements given in Appendix E1.

### 3.4.9 **Land Contamination**

3.4.9.1 If any previous contaminating land uses with the potential to cause land contamination as stated in Sections 3.1 and 3.2 of Annex 19 in the TM is identified, the Applicant shall follow the guidelines for evaluating and assessing potential land contamination issue as stated in sections 3.1 and 3.2 of Annex 19 of the TM.

3.4.9.2 The assessment of the potential land contamination issue of the Project, if needed, shall follow the detailed requirements given in Appendix E2.

### 3.4.10 **Ecological Impact [Terrestrial and Marine/Aquatic]**

3.4.10.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing ecological impact as stated in Annexes 8 and 16 of the TM.

3.4.10.2 The study area for the purpose of the terrestrial and marine/aquatic ecological impact assessment shall include areas within 500 metres distance from the boundary of the Project site and any other areas likely to be impacted by the Project. The Applicant shall address the potential ecological impacts, including but not limited to the potential ecological impacts on habitats such as shrubland, woodland, ponds, streams and coral communities located within or close to the Project, in particular the potential impacts on the roosting and breeding grounds for ardeids caused by the clearance of shrubland, woodland and vegetation areas for accommodating the Project and the potential impacts caused by the re-provision of streams as proposed under the Project.

3.4.10.3 The ecological impact assessment shall follow the detailed technical requirements given in Appendix F.

### 3.4.11 **Fisheries Impact**

3.4.11.1 The Applicant shall justify in the EIA report the decision on the need for a fisheries impact assessment associated with the construction and operation of the Project. If a fisheries impact assessment is needed, then the Applicant shall follow the criteria and guidelines for evaluating and assessing fisheries impact as stated in Annexes 9 and 17 of the TM.

3.4.11.2 The fisheries impact assessment, if needed, shall follow the detailed technical requirements given in Appendix G.

### 3.4.12 **Landscape and Visual Impacts**

3.4.12.1 The Applicant shall follow the criteria and guidelines as stated in Annexes 10 and 18 of

the TM, the EIAO Guidance Note No. 8/2010 on “Preparation of Landscape and Visual Impact Assessment under the Environmental Impact Assessment Ordinance” and the report of “Landscape Value Mapping of Hong Kong” for evaluating and assessing the landscape and visual impacts caused by the removal of trees and vegetation, the form and appearance of the Project, as well as night-time visual impact during night time operation and due to lighting of the Project.

3.4.12.2 The study area for the landscape impact assessment shall include areas within 500 metres distance from the boundary of the Project site. The study area for the visual impact assessment shall be defined by the visual envelope of the Project.

3.4.12.3 The landscape and visual impact assessments shall follow the detailed technical requirements given in Appendix H.

### 3.4.13 **Environmental Monitoring and Audit (EM&A) Requirements**

3.4.13.1 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, if affirmative, to define the scope of EM&A requirements for the Project in the EIA study.

3.4.13.2 Subject to the confirmation of the EIA study findings, the Applicant shall comply with the requirements as stipulated in Annex 21 of the TM.

3.4.13.3 The Applicant shall prepare a Project Implementation Schedule (in the form of a checklist as shown in Appendix I) containing the EIA study recommendations and mitigation measures with reference to the implementation programme.

## 3.5 **Presentation of Summary Information**

### 3.5.1 Summary of Environmental Outcomes

The EIA report shall contain a summary of key environmental outcomes arising from the EIA study, including estimated population protected from various environmental impacts, environmentally sensitive areas protected, environmentally friendly options considered and incorporated in the preferred option, environmental designs recommended, key environmental problems avoided, minimisation of environmental impacts, compensation areas included and the environmental benefits of environmental protection measures recommended.

### 3.5.2 Summary of Environmental Impacts

To facilitate effective retrieval of pertinent key information, the EIA report shall contain a summary table of environmental impacts showing the assessment points, results of impact predictions, relevant standards or criteria, extents of exceedances predicted, impact avoidance measures considered, mitigation measures proposed and residual impacts (after mitigation). This summary shall cover each individual impact assessment under sub-section 3.4 above and shall also form an essential part of the executive summary of the EIA report.

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

The EIA report shall contain a summary including the assessment methodologies and key

assessment assumptions adopted in the EIA study, the limitations of these assessment(s) methodologies/assumptions, if any, plus all relevant prior agreement(s) with the Director or other Authorities on individual environmental media assessment components. 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) before seeking the Director's agreement. The supporting documents shall be provided in the EIA report.

#### **4. DURATION OF VALIDITY**

- 4.1 The Applicant shall notify the Director of the commencement of the EIA study. If the EIA study does not commence within 36 months after the date of issue of the EIA study brief, the Applicant shall apply to the Director for a fresh EIA study brief before commencement of the EIA study.

#### **5. REPORTING 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 accompany with the submission of the EIA report a summary, pointing out where in the EIA report the respective requirements of this EIA study have been addressed and fulfilled.
- 5.2 The Applicant shall supply the Director with hard and electronic copies of the EIA report and the executive summary in accordance with the requirements given in Appendix I of this EIA study brief. 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.

#### **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 sub-section 1.2 to 1.3 of this EIA study brief and in Project Profile (No. PP-486/2013), 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 Project fundamentally alter the key scope of the EIA study brief, the Applicant shall apply to the Director for a fresh EIA study brief.

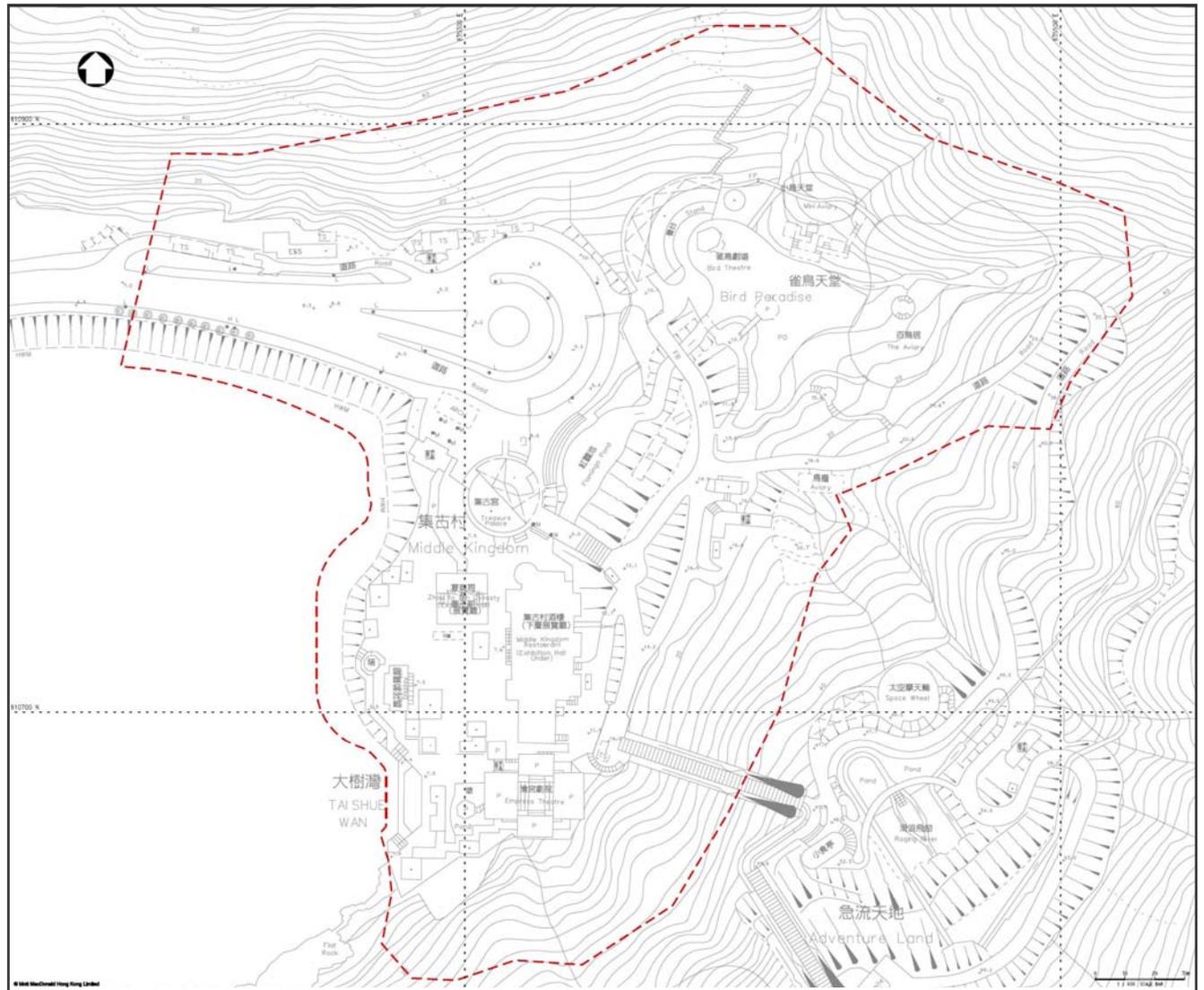
## **7. LIST OF FIGURE AND APPENDICES**

7.1 This EIA study brief includes the following figure and appendices:

- Figure 1 – Project Location Plan
- Appendix A – Requirements for Air Quality Impact Assessment
- Appendix B – Requirements for Hazard to Life Assessment
- Appendix C – Requirements for Noise Impact Assessment
- Appendix D1 – Requirements for Water Quality Impact Assessment
- Appendix D2 – Requirements for Assessment of Sewerage and Sewage Treatment Implication
- Appendix E1 – Requirements for Assessment of Waste Management Implication
- Appendix E2 – Requirements for Land Contamination Assessment
- Appendix F – Requirements for Ecological Impact Assessment
- Appendix G – Requirements for Fisheries Impact Assessment
- Appendix H – Requirements for Landscape and Visual Impact Assessment
- Appendix I – Implementation Schedule
- Appendix J – Requirements for EIA Report Documents

--- END OF EIA STUDY BRIEF ---

June 2013  
Environmental Assessment Division  
Environmental Protection Department



**Legend**  
- - - PROJECT AREA 項目範圍

Tai Shue Wan Development at Ocean Park (海洋公園大樹灣發展計劃)

Figure 1

附圖 1

Location Plan of the Project - 工程項目的位置圖

This figure was prepared based on Figure 1 of the Project Profile (No.: PP-486/2013)

本圖是根據工程項目簡介(編號：PP-486/2013) 圖 1 編制

EIA Study Brief No.  
ESB-261/2013

環評研究概要編號  
ESB-261/2013



**Appendix A****Requirements for Air Quality Impact Assessment**

The air quality impact assessment shall include the following:

**1. Background and Analysis of Activities**

- (i) Provision of background information relating to air quality issues relevant to the Project, e.g. description of the types of activities of the Project that may affect air quality during construction and operation stages of the Project.
- (ii) Giving an account, where appropriate, of the consideration/measures that had been taken into consideration in the planning of the Project to abate the air pollution impact. The Applicant shall consider alternative construction methods/phasing programmes, and alternative operation modes to minimize the air quality impact during construction and operation stages of the Project.
- (iii) Presentation of background air quality levels in the study area for the purpose of evaluating cumulative air quality impacts during construction and operation stages of the Project. If PATH (Pollutants in the Atmosphere and their Transport over Hong Kong) model is used to estimate the background air quality, details for the estimation of the emission sources to be adopted in the model runs should be clearly presented.

**2. Identification of Air Sensitive Receivers (ASRs) and Examination of Emission / Dispersion Characteristics**

- (i) Identification and description of existing, planned and committed ASRs that would likely be affected by the Project, including those earmarked on the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans and Layout Plans and other relevant published land use plans, including plans and drawings published by Lands Department and any land use and development applications approved by the Town Planning Board. The Applicant shall select the assessment points of the identified ASRs that represent the worst impact point of these ASRs. A map clearly showing the location and description such as name of buildings, their uses and height of the selected assessment points shall be given. The separation distances of these ASRs from the nearest emission sources shall also be given.
- (ii) Provision of a list of air pollution emission sources, including any nearby emission sources which are likely to have impact on the Project based on the analysis of the constructional and operational activities in section 1 above. Examples of constructional stage emission sources include stock piling, vehicular movements on unpaved haul roads on site, etc. Examples of operational stage emission sources include exhaust emissions from vehicles and odour emissions from drainage channels, etc. Confirmation regarding the validity of the assumptions adopted and the magnitude of the activities (e.g. volume of construction material handled, etc.) shall be obtained from the relevant government departments / authorities and documented.
- (iii) Identification of chimneys and obtainment of 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 may be invalidated.

- (iv) The emissions 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 impact as affecting the existing, committed and planned ASRs within the study area shall be assessed, based on the best information available at the time of assessment.

### 3. Construction Phase Air Quality Impact

- (i) 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.
- (ii) If the Applicant anticipates that the Project will give rise to significant construction dust impacts likely to exceed recommended limits in the TM at the ASRs despite the incorporation of the dust control measures proposed, a quantitative assessment should be carried out to evaluate the construction dust impact at the identified ASRs. The Applicant shall follow the methodology set out in section 5 below when carrying out the quantitative assessment.
- (iii) A monitoring and audit programme for the construction phase of the Project shall be devised to verify the effectiveness of the control measures proposed so as to ensure proper construction dust control.

### 4. Operational Phase Air Quality Impact

- (i) The Applicant shall assess the expected air pollutant impacts at the identified ASRs based on an assumed reasonably worst-case scenario under normal operating conditions. If the assessment indicates likely exceedances of the recommended limits in the TM at the development and the nearby ASRs, a quantitative assessment should be carried out to evaluate the operational phase air quality impacts at the identified ASRs. The Applicant shall follow the methodology set out in section 5 below when carrying out the quantitative assessment.
- (ii) The air pollution impacts of future road traffic induced by the operation of the Project shall be calculated based on the highest emission strength from the road within the next 15 years upon commissioning of the proposed 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 Fleet Average Emission Factors for assessing vehicle emissions. If necessary, the Fleet Average Emission Factors shall be derived by a motor vehicle emission model such as EMFAC-HK model and documented in the EIA report. The Fleet Average Emission Factors used in the assessment shall be agreed with the Director. 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).
- (iii) If vehicle tunnels and/or full enclosures are proposed in the Project, it is the

responsibility of the Applicant to ensure that the air quality inside these proposed structures shall comply with 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 ventilation design engineer over the amount and the types/kinds of pollutants emitted from these full enclosures; and such assumptions shall be clearly and properly documented in the EIA report.

- (iv) The Applicant shall assess the potential odour impact if there is any odour sources identified from the Project/activities in the Project during the operation phase based on assumed reasonably worst-case scenario under normal operating conditions.
- (v) A monitoring and audit programme for the operational phase of the Project, if necessary, shall be devised to verify the effectiveness of the control measures proposed so as to ensure proper control of operational air quality impacts.

## 5. Quantitative Assessment Methodology

- (i) The Applicant shall conduct the quantitative assessment by applying the general principles enunciated in the modelling guidelines in Appendices A-1 to A-3 while making allowance for the specific characteristic of the Project. This specific methodology must be documented in such level of details, preferably assisted 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 under study without referring to the model input files. Detailed calculations of air pollutants emission rates for input to the modelling 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. In case of doubt, the Applicant shall seek prior agreement from the Director on the specific modelling details.
- (ii) The Applicant shall identify the key/representative air pollution parameters (types of pollutants and averaging time concentrations) to be evaluated and provide explanation for selecting such parameters for assessing the impact of the Project. Ozone Limiting Method (OLM) or Discrete Parcel Method (DPM) or other method to be agreed with the Director shall be used to estimate the conversion ratio of  $\text{NO}_x$  to  $\text{NO}_2$  if  $\text{NO}_2$  has been identified as a key air pollutant.
- (iii) The Applicant shall calculate the overall cumulative air quality impact at the ASRs identified under section 2 above 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.
- (iv) If there are any direct technical noise remedies recommended in the study, the air quality implication due to these technical remedies 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. The Applicant shall highlight clearly the locations and types of agreed noise mitigating measures (where applicable), be they noise barriers and affected ASRs, on contour maps for easy

reference.

6. 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 documented. The Applicant shall demonstrate quantitatively that the residual impacts after incorporation of the proposed mitigating measures will comply with the criteria stipulated in Section 1 of Annex 4 in the TM.

7. 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.

**Appendix A-1****Guidelines on Choice of Models and Model Parameters**

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

**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 exercises 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.

<b><u>Model</u></b>	<b><u>Applications</u></b>
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'.

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 the 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,  $\sigma_{\theta}$ , needs to be provided as input to the CALINE4 model. Typical values of  $\sigma_{\theta}$  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/m<sup>2</sup>) 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, 5<sup>th</sup> 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 classed 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 classed as rural.

### 3.4 Surface Roughness Height

This parameter is closely related to 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 the 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 µgm) and RSP (< 10 µgm) compositions should be used.

### 3.7 NO<sub>2</sub> to NO<sub>x</sub> Ratio

The conversion of NO<sub>x</sub> to NO<sub>2</sub> is a result of a series of complex photochemical reactions and has implications on prediction of near field impacts of traffic emissions. Until further data are available, three approaches are currently acceptable in the determination of NO<sub>2</sub>:

- (a) Ambient Ratio Method (ARM) - assuming 20% of NO<sub>x</sub> to be NO<sub>2</sub>; or
- (b) Discrete Parcel Method (DPM, available in the CALINE4 model); or
- (c) Ozone Limiting Method (OLM) - assuming the tailpipe NO<sub>2</sub> emission to be 7.5% of NO<sub>x</sub> and the background ozone concentration to be in the range of 57 to 68 µg/m<sup>3</sup> depending on the land use type (see also EPD reference paper 'Guidelines on Assessing the 'TOTAL' Air Quality Impacts').

### 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:

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

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.

*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. Refer to EPD reference paper 'Guidelines on Assessing the 'TOTAL' Air Quality Impacts' 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.

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#### 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 (USEPA)

**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 USEPA.

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

**Appendix A-2****Guidelines on Assessing the “Total” Air Quality Impacts**

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

**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 <sub>2</sub>	59	57	39
SO <sub>2</sub>	21	26	13
O <sub>3</sub>	62	68	57
TSP	98	96	87

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 realised) 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 A-3****Guidelines on the Use of Alternative Computer Models in Air Quality Assessment**

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

**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) complexity of situation to be modelled far exceeds capability of Schedule 1 models; and
  - (ii) 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"

- 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"
- 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.
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**Schedule 1 - Air Quality Models Generally Accepted by Hong Kong Environmental Protection Department For Regulatory Applications as at 1 July 1998\***

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**Fugitive Dust Model (FDM)** or the latest version developed by USEPA.

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

**Appendix B****Requirements for Hazard to Life Assessment****If there is Potentially Hazardous Installation (PHI) for the operation of the Project**

1. The Applicant shall investigate methods to avoid and/or minimize chlorine risks. The Applicant shall carry out hazard assessment to evaluate potential hazard to life during construction and operational stages of the Project due to the Potentially Hazardous Installation (PHI). The hazard assessment shall include the following:
  - (i) identify hazardous scenarios associated with the on-site transport, storage and use of chlorine at the PHI with a view to determining a set of relevant scenarios (including possible damage scenarios associated with construction activities) 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.
2. The methodology to be used in the hazard assessment shall be consistent with previous studies having similar issues.

**If there is use of explosives for the construction of the Project**

1. 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(s), the Applicant shall carry out hazard assessment as follows:
  - (i) identify hazardous scenarios associated with the transport and storage of explosives with a view to determining 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.
2. The methodology to be used in the hazard assessment shall be consistent with previous studies having similar issues.

**Appendix C****Requirements for Noise Impact Assessment**

The noise impact assessment shall include the following:

**1. Provision of Background Information and Existing Noise Levels**

The Applicant shall provide background information relevant to the Project, e.g. relevant previous or current studies. Unless required for determining the planning standards, e.g. those for planning of fixed noise sources, no existing noise levels are particularly required.

**2. Identification of Noise Sensitive Receivers**

- (i) The Applicant shall refer to Annex 13 of the TM when identifying the NSRs. The NSRs shall include existing NSRs and planned/committed noise sensitive developments and uses earmarked on the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land use plans, including plans and drawings published by Lands Department and any land use and development applications approved by the Town Planning Board. Photographs of existing NSRs shall be appended to the EIA report.
- (ii) The Applicant shall select assessment points to represent identified NSRs for carrying out quantitative noise assessment described below. The assessment points shall be agreed by the Director prior to the quantitative noise assessment and may be varied subject to the best and latest information available during the course of the EIA study. 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 should use the relevant planning parameters to work out representative site layouts for operational noise assessment purpose. However, such assumptions together with any constraints identified, such as setback of building, building orientation, extended podium, shall be agreed by the relevant responsible parties including Planning Department and Lands Department in accordance with section 6.3 of Annex 13 of the TM.

**3. 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, and traffic flow/fixed plant equipment, as appropriate, for operational noise assessment. Confirmation of the validity of the inventory shall be obtained from the relevant government departments/authorities and documented in the EIA report.

**4. Construction Noise Assessment**

- (i) The assessment shall cover the cumulative noise impacts due to the construction works of the Project and other concurrent projects identified during the course of the EIA study.
- (ii) The Applicant shall carry out assessment of noise impact from construction (excluding percussive piling) of the Project during daytime, i.e. 7am to 7pm, on weekdays other than general holidays in accordance with methodology in paragraphs 5.3 and 5.4 of Annex 13 of the TM. The criteria in Table 1B of Annex 5 of TM shall be adopted in

the assessment.

- (iii) To minimize the construction noise impact, alternative construction methods to replace percussive piling and blasting shall be proposed as far as practicable.
- (iv) 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 tasks) to minimize the impact. If the mitigated noise levels still exceed the relevant criteria, the duration of the noise exceedance shall be given.
- (v) The Applicant shall, as far as practicable, formulate a reasonable construction programme so that no work will be required in 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 relevant technical memoranda issued under the NCO. Regardless of the results of construction noise impact assessment for restricted hours, the Noise Control Authority will process 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 EIA report.

## 5. Operational Noise Assessment

### (i) Road Traffic Noise

The Applicant shall assess any adverse traffic noise impact induced by the operation of the Project. The following assessment requirements shall be followed.

#### (a) Calculation of Noise Levels

The Applicant shall identify road sections for the purpose of traffic noise impact assessment. In determining whether the traffic noise impact due to road traffic induced by the project is considered significant, detailed information with respect to factors including change of nature of road, change of traffic capacity or traffic composition etc. shall be assessed. Figures showing extents of the affected road sections (including existing, planned and new/altered road sections) 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 (including existing, planned and new/altered road sections) at the NSRs.

The EIA shall contain sample calculations and input parameters as considered necessary and requested by the Director, and drawings (i.e.

road-plots of the traffic noise model) of appropriate scale to show the road segments, topographic barriers (if any), and assessment points input into the traffic noise model. The Applicant shall provide the input data sets of traffic noise prediction model in the format of electronic files adopted in the EIA study as requested by the Director for the following scenarios:

- (1) scenario without the Project at the design year;
- (2) unmitigated scenario at assessment year;
- (3) mitigated scenario at assessment year; and
- (4) prevailing scenario for indirect technical remedies eligibility assessment, if applicable.

The data shall be in electronic text, file (ASCII format) containing road segments, barriers (if any) and NSRs' information. The data structure of the above file shall be agreed with the Director. CD-ROM(s) containing the above data shall be attached in the EIA report.

(b) Presentation of Noise Levels

The Applicant shall present the noise levels in  $L_{10}$  (1 hour) 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 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.

(c) 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 in accordance with section 6 of Annex 13 of the TM direct technical remedies in all situations where the predicted traffic noise level exceeds the criteria set in Table 1A of Annex 5 of the TM by 1.0 dB(A) or more and at the same time is greater than that without the Project at the design year by 1.0 dB(A) or more. 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 technical remedies 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 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 (ie. existing NSRs as distinct from planned NSRs) to be protected by different barrier sections 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 elements that will be benefited from, and be protected by the provision noise mitigation measures should be provided. In order to clearly present the extents/locations of the recommended noise mitigation measures, plans prepared from 1:1000 or 1:2000 survey maps showing the mitigation measures (e.g., enclosures/barriers, low noise road surfacing, etc.) should be included in the EIA report.

The Applicant shall provide, in the EIA report information of recommended noise mitigation measures (such as barrier types, nominal dimensions at different cross-sections, extents/locations, lengths and mPD levels of barriers) in an appropriate format (including electronic format).

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 technical remedies shall be quantified.

In case where a number of 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 costs and any implications for such implementation. For the purpose of determining 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 road sections and 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 educational institutions and places of public worship, all in  $L_{10}$  (1hour));
- (2) the predicted overall noise level at the NSR is at least 1.0 dB(A) more than the prevailing traffic noise level, i.e. the total traffic noise level existing before the commencement of works to construct the road; and
- (3) the contribution from the road sections to the increase in predicted overall noise level from the new road at the NSR must be at least 1.0dB(A).

(ii) Fixed Noise Sources

(a) Assessment of Fixed Source Noise Levels

The Applicant shall identify any fixed noise sources including but not limited to plant, chiller plant, pumps, public announcement (PA) system, and ventilation louvers for the Indoor Water Park enclosure that may have a bearing on the environmental acceptability of the Project and those caused by the Project. The Applicant shall calculate expected noise using standard acoustics principles. Calculations for expected noise shall be based on assumed plant inventories and utilization schedule for worst-case scenario.

The Applicant shall calculate noise levels taking into account correction of tonality, impulsiveness and intermittency in accordance with Technical Memorandum for Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites issued under NCO.

(b) 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 m P.D.) on tables and plans of suitable scale. A quantitative assessment at the NSRs for the proposed 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 listed in Table 1A of Annex 5 of the TM, the criteria and assessment methodology shall be agreed by the Director (with reference to section 4.4.2(c) of the TM) prior to the commencement of the assessment.

(c) Proposals for Noise Mitigation Measures

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

6. 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 technical remedies.

7. Evaluation of Constraints on Planned Noise Sensitive Developments/Land uses

For planned noise sensitive uses which will still be affected even with practicable direct technical remedies in place, the Applicant shall propose, evaluate and confirm the practicability 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 relevant parties. The Applicant shall take into account agreed environmental requirements / constraints identified in the EIA study to assess the development potential of concerned sites which shall be made known to the relevant parties.

**Appendix D1****Requirements for Water Quality Impact Assessment**

1. The Applicant shall identify and analyse physical, chemical and biological disruptions of the water system(s) arising from the construction and operation of the Project.
2. The Applicant shall predict, quantify and assess any water quality impacts arising from the construction and operation of the Project by appropriate mathematical modelling and/or other techniques proposed by the Applicant and approved by the Director. The mathematical modelling requirements are set out in Appendix D1-1. Possible impacts due to the marine works activities, effluent discharge, thermal/cooling water and biocide, pesticide and fertilizer residual bearing discharges, overflow of sewage pumping stations and site runoff shall include changes in hydrology, flow regime, sediment erosion and deposition patterns, morphological change of seabed profile, water quality and sediment quality. The prediction shall include possible different construction stages or sequences of the Project. Affected sensitive receivers shall be identified by the assessment tool with indications of degree of severity.
3. The assessment shall include, but not be limited to the following:
  - (i) the water quality impacts of the site run-off generated during the construction stage such as the effluents generated from dewatering associated with piling and excavation activities, grouting and concrete washing and those specified in the ProPECC Practice Note 1/94;
  - (ii) the water quality impacts of the road runoff containing oil/grease and suspended solids during the operational stage;
  - (iii) the water quality impacts of surface runoff that may bear biocide, pesticide and fertilizer and their residuals during the operational stage;
  - (iv) the water quality impacts on seawater intake points, streams, ponds, drainages and identified water sensitive receivers around the work sites.
4. The Applicant shall address water quality impacts due to the construction phase and operational phase of the Project. Essentially, the assessment shall address the following :
  - (i) collect and review background information on affected existing and planned water systems, their respective catchments and sensitive receivers which might be affected by the Project;
  - (ii) characterize water quality of the water systems and sensitive receivers, which might be affected by the Project based on existing best available information or through appropriate site survey and tests;
  - (iii) identify and analyse relevant existing and planned future activities, beneficial uses and water sensitive receivers related to the affected water system(s). The Applicant should refer to, *inter alia*, those developments and uses earmarked on the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans and Layout Plans, and any other relevant published landuse plans;

- (iv) identify pertinent water quality objectives and establish other appropriate water quality criteria or standards for the water system(s) and the sensitive receivers identified in (i), (ii) & (iii) above;
- (v) review the specific construction methods and configurations, and operation of the Project to identify and predict the likely water quality impacts arising from the Project;
- (vi) identify any alternation of any water courses, natural streams, ponds, change of water holding/flow regimes of water bodies, change of catchment types or areas, erosion or sedimentation due to the Project and any other hydrological changes in the study area;
- (vii) identify and quantify existing and likely future water pollution sources, including point discharges and non-point sources to surface water runoff, sewage from workforce and polluted discharge generated from the Project, contaminant release from works on marine sediment and sediment release or re-suspension from works into water bodies;
- (viii) provide an emission inventory on the quantities and characteristics of those existing and future pollution sources in the study area. Field investigation and laboratory test, shall be conducted as appropriate to fill relevant information gaps;
- (ix) report the adequacy of the existing, committed and planned sewerage and sewage treatment facilities for the handling, treatment and disposal of wastewater arising from the Project as required in section 3.4.7;
- (x) identify and quantify the water quality impacts based on the findings and recommendations from the Sewerage and Sewage Treatment Implications Assessment under section 3.4.7. The water quality concerns shall include, but not limited to, possible sewage overflow or emergency discharge due to capacity constraints of the sewerage system, and emergencies arising from the Project;
- (xi) predict and quantify the impacts on the water system(s) include change in hydrology, flow regime, water quality and the effects on the sensitive receivers brought about by those alternations and changes identified in (vi) to (x) above. The prediction shall take into account and include possible different construction and operation stages of the Project;
- (xii) assess the cumulative impacts due to other related concurrent and planned projects, activities or pollution sources within the study area that may have a bearing on the environmental acceptability of the Project;
- (xiii) analyze the provision and adequacy of existing and planned future facilities to reduce pollution arising from the point and non-point sources identified in (vii) above;

- (xiv) develop effective infrastructure upgrading or provision, contingency plan, water pollution prevention and mitigation measures to be implemented during construction and operation stages, including emergency sewage discharge in the case of sewage treatment works and sewage pumping stations, so as to reduce the water quality impacts to within standards. Requirements to be incorporated in the Project contract document shall also be proposed;
- (xv) investigate and develop best management practices to reduce storm water and non-point source pollution as appropriate; and
- (xvi) evaluate and quantify residual impacts on water system(s) and the sensitive receivers with regard to the appropriate water quality objectives, criteria, standards or guidelines.

5. The Applicant shall address and assess water quality impacts arising from the following concerns :

#### Waste Water and Non-point Sources Pollution

- (i) Proposal for upgrading or providing any effective infrastructure, water pollution prevention and mitigation measures to be implemented during the construction and operation stages so as to handle any wastewater generated including inter alia wastewater discharge from the surface runoff, if any, due to the Project and associated works, construction site runoff, drainage diversion, sewage effluent from the workforce and accidental spillage of chemicals and wastes during construction stage; sewage generated from visitor attraction facilities, discharges, if any, which may or may not containing disinfectants/residue chemicals from the Project including but not limited to water park with a wave pool, sandy beach, lazy river, various water slides, food and beverage facilities, premium zone with cabanas; water sterilization system, marine life keeping systems, aquariums and associated facilities, pools, surface runoff from landscape areas potentially containing pesticides, or fertilizer residues, backwash water produced from water filtration systems, thermal and chemical discharge, if any, from cooling systems, possible sewage overflow and/or emergency bypass, if any, from sewage treatment and disposal within the Project during the operation stage and to reduce the water quality impacts to within standards. Requirements to be incorporated in the Project contract document shall also be proposed;
- (ii) Investigation of and proposal for, as appropriate, best management practices to reduce storm water and non-point source pollution and the determination of the optimum location of discharge points; and
- (iii) <sup>3</sup>Evaluation and quantification of residual impacts on the water systems(s) and the sensitive receivers with regard to appropriate water quality objectives, criteria, standards or guidelines.

**Appendix D1-1****Hydrodynamic and Water Quality Modelling Requirements****Modelling Software General**

1. The modelling software shall be fully 3-dimensional capable of accurately simulating the stratified condition, salinity transport, and effects of wind and tide on the water body within the model area.
2. The modelling software shall consist of hydrodynamic, water quality, sediment transport, thermal and particle dispersion modules. All modules shall have been proven with successful applications locally and overseas.
3. The hydrodynamic, water quality, sediment transport and thermal modules shall be strictly mass conserved at all levels.
4. An initial dilution model shall be used to characterize the initial mixing of the effluent discharge, and to feed the terminal level and size of the plume into the far field water quality modules where necessary. The initial dilution model shall have been proven with successful applications locally and overseas.

**Model Details – Calibration and Validation**

1. The models shall be properly calibrated and validated against applicable existing and/or newly collected field data before their use in this study in the Hong Kong waters, the Pearl Estuary and the Dangan (Lema) Channel. The field data set for calibration and validation shall be agreed with EPD.
2. Tidal data shall be calibrated and validated in both frequency and time domain manner.
3. For the purpose of calibration and validation, the model shall run for not less than 15 days of real sequence of tide (excluding model spin up) in both dry and wet seasons with due consideration of the time required to establish initial conditions.
4. In general the hydrodynamic models shall be calibrated to the following criteria:

**Criteria**

<u>Criteria</u>	<u>Level of fitness with field data</u>
• tidal elevation (@)	< 8 %
• maximum phase error at high water and low water	< 20 minutes
• maximum current speed deviation	< 30 %
• maximum phase error at peak speed	< 20 minutes
• maximum direction error at peak speed	< 15 degrees
• maximum salinity deviation	< 2.5 ppt

@ Root mean square of the error including the mean and fluctuating components shall meet the criteria at no less than 80% of the monitoring stations in the model domain

5. The consultants shall be responsible for acquiring/developing and calibration of the models for use in this study themselves. They may make reference to the models developed under the Update on Cumulative Water Quality and Hydrological Effect of Coastal Developments and Upgrading of Assessment Tool (Agreement No. CE 42/97). They may also propose to

use other models subject to agreement with EPD.

### Model Details – Simulation

1. The water quality modelling results shall be qualitatively explainable, and any identifiable trend and variations in water quality shall be reproduced by the model. The water quality model shall be able to simulate and take account of the interaction of dissolved oxygen, phytoplankton, organic and inorganic nitrogen, phosphorus, silicate, BOD, temperature, suspended solids, contaminants release of dredged and disposed material, air-water exchange, *E. coli* and benthic processes. It shall also simulate salinity. Salinity results simulated by hydrodynamic models and water quality models shall be demonstrated to be consistent.
2. The sediment transport module for assessing impacts of sediment loss due to marine works shall include the processes of settling, deposition and re-erosion. The values of the modelling parameters shall be agreed with EPD. Contaminants release and DO depletion during dredging and dumping shall be simulated by the model.
3. The thermal model shall be based on the flow field produced by the hydrodynamic model. It shall incorporate the physical processes of thermal / cooled water discharge and abstraction flow, buoyancy effect of the thermal plume, and surface heat exchange. Dispersion of biocides in the discharge shall also be simulated with appropriate decay rates.
4. The models shall at least cover the Hong Kong waters, the Pearl Estuary and the Dangan Channel to incorporate all major influences on hydrodynamic and water quality. A fine grid model may be used for detailed assessment of this study. It shall either be linked to a far field model or form part of a larger model by gradual grid refinement. The coverage of the fine grid model shall be properly designed such that it is remote enough so that the boundary conditions will not be affected by the project. The model coverage area shall be agreed with EPD.
5. In general, grid size at the area affected by the project shall be less than 400 m in open waters and less than 75 m around sensitive receivers. The grid shall also be able to reasonably represent coastal features existing and proposed in the project. The grid schematization shall be agreed with EPD.

### Modelling Assessment

1. The assessment shall include the construction and operational phase of the project. Where appropriate, the assessment shall also include maintenance dredging. Scenarios to be assessed shall cover the baseline condition and scenarios with various different options proposed by the Applicant in order to quantify the environmental impacts and improvements that will be brought about by these options. Corresponding pollution load, bathymetry and coastline shall be adopted in the model set up.
2. Hydrodynamic, water quality, sediment transport and thermal modules, where appropriate, shall be run for (with proper model spin up) at least a real sequence of 15 days spring-neap tidal cycle in both the dry season and the wet season.
3. For assessing temporary discharges via the emergency outfall, the Applicant shall estimate discharge loading, pattern and duration. The worst case scenario shall include discharge near slack water of neap tide. A period of at least 15 days spring-neap cycle in wet season,

but long enough for recovery of the receiving water, shall be simulated. Detailed methodology shall be agreed with EPD.

4. The results shall be assessed for compliance of Water Quality Objectives. Any changes in hydrodynamic regime shall be assessed. Daily erosion / sedimentation rate shall be computed and its ecological impact shall be assessed.
5. The impact on all sensitive receivers shall be assessed.
6. Cumulative impacts due to other projects, activities or pollution sources within a boundary to the agreement of EPD shall also be predicted and quantified.

**Appendix D2****Requirements for Assessment of Sewerage and Sewage Treatment Implication**

1. The Applicant shall study and assess the need and impacts of discharging sewage to the existing/planning sewerage systems in the area served by Aberdeen Preliminary Treatment Works (APTW). The assessment shall include the following:
  - (i) review and confirm whether the existing, committed and planned sewerage and sewage treatment facilities in the area served by APTW will provide adequate capacity for the Project.;
  - (ii) take into account any additional sewage flows from other existing/planned developments connected or to be connected to the existing, committed and planned sewerage and sewage treatment facilities in the area served by APTW.;
  - (iii) propose and undertake all required measures to mitigate any forecast shortfalls in the sewerage system as a result of the Project under different development phases and demonstrate the proposed measures would be adequate for the Maximum Development Flows under different development phases. Any proposed sewerage system and/or on-site sewage treatment facility should be designed to meet the current government standards and requirements. InfoWorks compatible computerized analysis techniques may be used in the preliminary design if necessary;
  - (iv) identify and quantify the water quality and ecological impacts due to the emergency discharge from on-site sewage treatment plant/pumping stations, if any, and sewer bursting discharge, and to propose measures to mitigate these impacts;
  - (v) identify the appropriate alignment and layouts of the new sewerage to connect to the existing/planned/future sewerage systems in the area served by APTW and investigate and assess the technical feasibility of connection (eg. technical feasibility and details for connection to public sewer and sewage pumping station); and
  - (vi) set out the design, operation and maintenance requirements and identify the party responsible for the construction and maintenance of any proposed sewerage and sewage treatment facilities, such as pumping station(s) and sewage treatment plant, including electrical and mechanical components to eliminate the problem of septicity incurred in long rising main(s) during low flows and to facilitate maintenance. The above shall be agreed by DSD and EPD (Twin rising mains for each pumping station should be provided to make sure that the proposed sewage rising mains are maintainable without shutting down and discharging untreated sewage into the natural stream/drainage channel directly).

**Appendix E1****Requirements for Assessment of Waste Management Implication**

The assessment of waste management implications shall cover the following:

**1. Analysis of Activities and Waste Generation**

- (i) 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 based on the sequence and duration of these activities, e.g. construction and demolition materials (C&DM) and other wastes which will be generated during construction and operational stages.
- (ii) The Applicant shall adopt appropriate design, general layout, construction methods and programme to minimize the generation of public fill/inert C&DM and maximize the use of public fill/inert C&DM for other construction works.

The Applicant shall consider alternative project designs/ measures to avoid/ minimize floating refuse accumulation/ entrapment and measures/ proposals for the potential floating refuse problem, e.g. regular collection of the floating refuse along the coast. Regarding the potential trapping of floating refuse along the shoreline of the Project, the Applicant shall estimate as far as practicable the amount of floating refuse to be found/trapped along the shoreline of the Project in construction stage and after the completion of the Project (if any). The Applicant shall develop an effective plan / design to avoid/ minimize the trapping of floating refuse. If floating refuse problem is identified and needs to be dealt with, the Applicant shall propose appropriate measures to deal with this floating refuse in a proper and acceptable manner e.g. to collect, recycle, reuse, store, transport and dispose of.

**2. Proposal for Waste Management**

- (i) 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 planning and design stages e.g. by modifying the design approach and in the construction stage for maximizing waste reduction shall be separately considered.
- (ii) After considering 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 methods/options for each type of wastes shall be described in detail. The disposal methods/options recommended for each type of wastes shall take into account of the result of the assessment in (iv) below.
- (iii) The EIA report shall also state clearly the transportation routings and the frequency of the trucks/vessels involved, any barging point or conveyor system to be used, the stockpiling areas and the disposal outlets for the waste identified.
- (iv) The impact caused by handling (including stockpiling, labelling, packaging and storage), collection, transportation and re-use/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;
- ecology; and
- public transport.

**Appendix E2****Requirements for Land Contamination Assessment**

1. The Applicant shall identify all land lots and sites within the Project boundary, which, due to their past or present land uses, are potential contaminated sites. A detailed account of the present activities and past land use history in relation to possible land contamination shall be provided.
2. If any potential contaminated land lots/sites are identified, the Applicant shall carry out the land contamination assessment in accordance with sections 3.1 and 3.2 of Annex 19 of the TM accordingly.
3. The list of potential contaminants which are anticipated to be found in these potential contaminated sites shall be provided and the relevant remediation options shall be discussed.

**Appendix F****Requirements for Ecological Impact Assessment (Terrestrial, Marine/Aquatic)**

1. In the ecological impact assessment, the Applicant shall examine the flora, fauna and other components of the ecological habitats within the study area. The aim shall be to protect, maintain or rehabilitate the natural environment. In particular, the Project shall avoid as far as possible impacts on recognized sites of conservation importance (e.g. Sites of Special Scientific Interest, Country Park, conservation areas) and other ecological sensitive areas (e.g. shrubland, woodland, ponds and natural streams located within or close to the Project, as well as intertidal, subtidal and benthic marine habitats and marine mammals habitats). The assessment shall identify and quantify as far as possible the potential ecological impacts associated with the Project, both directly by physical disturbance and indirectly by changes of water quality and hydrodynamic regime to the natural environment and the associated wildlife groups and habitats / species arising from the Project including its construction phases as well as the subsequent management and maintenance of the proposals.
2. The assessment shall include the following:
  - (i) review the findings of relevant studies / surveys and collate the available information regarding the ecological characters of the study area;
  - (ii) evaluate the information collected, identify any information gap relating to the assessment of potential ecological impacts to terrestrial and marine/aquatic environment;
  - (iii) carry out any necessary ecological field surveys with a duration of at least six months covering the wet season, and investigations to verify the information collected, fill in the information gaps as identified and to fulfil the objectives of the EIA study;
  - (iv) establish the general ecological profile of the study area based on information collected in the tasks mentioned in sub-section (i) to (iii) above, 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 and assessment of whether these sites will be affected by the Project or not;
    - (b) habitat maps of suitable scale (1:1000 to 1:5000) showing the types and locations of habitats and species of conservation interest in the study area;
    - (c) ecological characteristics of each habitat type such as size, vegetation and/or substrate type, species present, dominant species found, species diversity and abundance, inter-dependence of the habitats and species, and presence of any features of ecological importance;
    - (d) representative colour photos 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 with conservation interest, including but not limited to the following :

- (a) woodlands and plantations;
  - (b) shrublands;
  - (c) natural stream courses;
  - (d) vertebrates (e.g. fish, herpetofauna, mammals including bats);
  - (e) macroinvertebrates (e.g. butterflies, odonates and crustaceans);
  - (f) avifauna (including raptors, woodland and wetland dependent migratory bird species, and roosting and breeding ardeids);
  - (g) coral communities; and
  - (h) any other habitats and wildlife groups identified as having special conservation interests by this EIA study.
- (vi) using suitable methodology, identification and quantification as far as possible of 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 grounds, reduction of ecological carrying capacity and habitat fragmentation, bird collision to new building structures and in particular the following :
- (a) habitat loss and disturbance to wildlife during construction stage;;
  - (b) deterioration of environmental qualities (e.g. water qualities) and the subsequent impacts to the biological communities, in particular the egret and roosting of ardeids near Flamingo Pond and Bird Paradise during and after construction stage; and
  - (c) evaluation of the significance and acceptability of the ecological impacts identified using well-defined criteria.
- (vii) recommend feasible alternatives, such as modifications of layout, design and alignment of the Project and modification / change of construction methods, and practicable mitigation measures to avoid, minimize and/or compensate for the adverse ecological impacts identified during construction and operation of the Project;
- (viii) evaluate feasibility and effectiveness of the recommended mitigation measures and definition of the scope, type, location, implementation arrangement, resources requirement, subsequent management and maintenance of such measures;
- (ix) determine and quantify as far as possible of the residual ecological impacts after implementation of the proposed mitigation measures;
- (x) evaluate the severity and acceptability of the residual ecological impacts using well-defined criteria in Annex 8 of the TM and determine if off-site mitigation measures are necessary to mitigate the residual impacts and if affirmative, guidelines and requirements laid down in Annex 16 of the TM should be followed; and
- (xi) review the need for and recommend any ecological monitoring programme required.

**Appendix G****Requirements for Fisheries Impact Assessment**

1. Existing information regarding the study area shall be reviewed. Based on the review results, the assessment shall identify data gap and determine if there is any need for field surveys to collect adequate baseline information. If field surveys are considered necessary, the assessment shall recommend appropriate methodology, duration and timing for such surveys.
2. The fisheries impact assessment shall cover any potential short-term and long-term impacts on capture and culture fisheries during the construction and operation phases of the Project.
3. The fisheries impact assessment shall provide the following information:-
  - (i) description of the physical environmental background;
  - (ii) description and quantification of the existing capture and culture fisheries activities;
  - (iii) description and quantification of the existing fisheries resources;
  - (iv) identification of parameters (e.g. water quality parameters) and areas of fisheries importance;
  - (v) identification and evaluation of any direct/indirect impacts and on-site/off-site impacts to fisheries, such as loss or disturbance of fishing, spawning and nursery grounds, disruption of fishing activities and water quality deterioration in fish culture zone ;
  - (vi) evaluation of cumulative impacts on fisheries arising from interacting projects as identified in the EIA study;
  - (vii) proposals for environmental mitigation measures with details on justification, feasibility, scope and programme, as well as staff and financial implications including those related to subsequent management and maintenance requirements of such measures; and
  - (viii) review for the need of monitoring during the construction and operation phases of the Project and, if necessary, proposal for a monitoring and audit programme.

**Appendix H****Requirements for Landscape and Visual Impact Assessments**

1. The Applicant shall review relevant outline development plan(s), outline zoning plan(s), layout plan(s) or planning briefs and studies which may identify areas of high landscape value, e.g. green belt and woodland areas with sensitive landscape designations and visually sensitive areas/receivers. Any guidelines on landscape strategy, landscape framework, urban design concept, building height profiles, designated view corridors, open space network and landscape link that may affect the appreciation of the Project shall also be reviewed. The aim is to gain an insight to the future outlook of the area affected so as to assess whether the Project can fit into the surrounding setting. Any conflict with statutory town plan(s) shall be highlighted and appropriate follow-up action shall be recommended.
2. The Applicant shall describe, appraise, analyze and evaluate the existing and planned landscape resources and character of the study area. e.g. vegetation, woodland, streams and topography, etc. A system shall be derived for judging landscape impact significance as required under the TM. Annotated oblique aerial photographs and plans of suitable scale showing the baseline landscape resources and landscape character areas and mapping of impact assessment shall be extensively used to present the findings of impact assessment. Descriptive text shall provide a concise and reasoned judgment from a landscape and visual point of view. The assessment shall be particularly focused on the sensitivity of the landscape framework and its ability to accommodate change. The Applicant shall identify the degree of compatibility of the Project with the existing and planned landscape settings. The landscape impact assessment shall quantify potential landscape impact as far as possible, so as to illustrate the significance of such impact arising from the Project. Clear mapping of the landscape impact is required. A broad brush tree survey to identify dominant tree species, maturity, rarity and any plant species of conservation interest, etc. should be conducted within the study area to provide baseline information on the landscape resources and landscape character areas and the impacts on existing trees shall be summarized. Cumulative landscape and visual impacts of the Project with other existing, committed and planned developments in the study area shall be assessed.
3. The Applicant shall assess the visual impacts, including night-time visual impact, of the proposed Project. Clear illustration 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 existing and planned sensitive receivers within the visual envelope and their views at both ground level and elevated vantage points. Among other receivers, sensitive receivers shall include, but not limited to, nearby residents and villagers. Both long distance view and short distance view shall be covered in the assessment;
  - (iii) assessment for evaluating visual impacts, by taking into account the factors affecting the sensitivity of receivers (including value and quality of existing views, availability and amenity alternative views, type and estimated number of receiver population, duration of view and degree of visibility) and the magnitude of change of view (including compatibility of the project with the surrounding landscape and planned setting, duration of impacts under construction and operation phases, scale of development, reversibility of change, viewing distance and potential blockage of view).

The visual impacts of the Project with and without mitigation measures shall also be included so as to demonstrate the effectiveness of the proposed mitigation measures; and

- (iv) clear evaluations and explanation with supportive arguments of all relevant factors considered in arriving the significance thresholds of visual impacts.
4. The Applicant shall evaluate the merit and demerit of preservation in totality, in parts or total destruction of existing landscape and the establishment of a new landscape character area. Alternative location, site layout, development options, design and construction method that would avoid or reduce the identified landscape and visuals impacts shall first be considered and 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 the existing landscape and visual quality. The Applicant shall recommend mitigation measures to minimize the adverse effects identified above, including provision of a master landscape design.
  5. The mitigation measures shall also include the preservation of vegetation, transplanting of trees of good amenity value, provision of screen planting, re-vegetation of disturbed lands, compensatory planting, re-provisioning of amenity areas and open spaces, design of structure, provision of finishes to structure, colour scheme and texture of material used and any measures to mitigate the disturbance of the existing land use. Parties shall be identified for the on-going management and maintenance of the proposed mitigation works to ensure their effectiveness throughout the operation phase of the Project. A practical programme and funding proposal for the implementation of the recommended measures shall be provided.
  6. Annotated illustration such as coloured perspective drawings, plans and section/elevation diagrams, oblique aerial photographs, photographs taken at vantage points and computer-generated photomontage, particularly from but not limited to the most severely affected vantage points shall be adopted to illustrate the significance of the landscape and visual impacts of the Project in four stages i.e. existing conditions, unmitigated impacts at Operation Day 1, mitigated impacts at Operation Day 1 and residual impacts at Year 10. Options of design schemes should be illustrated with photomontages to show the visual impact on the surrounding areas. True colour samples may be requested if found necessary and appropriate. Technical details in preparing the illustration, which may need to be submitted for verification of accuracy of the illustration shall be recorded. Computer graphics shall be compatible with Microstation DGN file format.



**Appendix J****Requirements for EIA Report Documents**

1. The Applicant shall supply the Director with the following number of copies of the EIA report and the executive summary:
  - (i) 30 copies of the EIA report and 30 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 in item (i) above 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 and 20 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.
2. In addition, to facilitate public inspection of EIA report via EIAO Internet Website, the Applicant shall provide electronic copies of both the EIA report and 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 executive summary shall be included in the beginning of the document. Hyperlinks to figures, drawings and tables in the EIA report and executive summary shall be provided in the main text from where respective references are made. Graphics in the report shall be in interlaced GIF format unless otherwise agreed by the Director.
3. 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.
4. 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. 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 and their format shall be agreed by the Director.