

## **ENVIRONMENTAL IMPACT ASSESSMENT ORDINANCE (CAP. 499), SECTION 5(7)**

**ENVIRONMENTAL IMPACT ASSESSMENT STUDY BRIEF NO. ESB-184/2008**

**PROJECT TITLE:**

**DEVELOPMENT OF THE INTEGRATED WASTE MANAGEMENT FACILITIES PHASE I**  
**(hereinafter known as the "Project")**

**NAME OF APPLICANT:**

**Environmental Infrastructure Division, Environmental Protection Department**  
**(hereinafter known as the "Applicant")**

### **1. BACKGROUND**

- 1.1 An application (No. ESB-184/2008) for an Environmental Impact Assessment (EIA) study brief under section 5(1) of the Environmental Impact Assessment Ordinance (EIAO) was submitted by the Applicant on 31 March 2008 with a Project Profile (No. PP- 348/2008) (the Project Profile).
- 1.2 The Project is to construct and operate the Integrated Waste Management Facilities (IWMF) at either the Tsang Tsui Ash Lagoon site or the Shek Kwu Chau site, as shown in Figures 1 to 3 respectively in Appendix A. The proposed IWMF, occupying an area of 10 ha, would have a total treatment capacity for about 3,000 tonnes per day (tpd) of mixed municipal solid waste (MSW) which comprises: (a) a thermal incineration plant of about 2,800 tpd capacity; and (b) a sorting and recycling plant of a demonstration scale of about 200 tpd capacity. The mixed MSW would be delivered from various existing Refuse Transfer Stations in Hong Kong to the site by marine vessels.
- 1.3 The Project mainly involves the following components:

#### **For both Tsang Tsui Ash Lagoon and Shek Kwu Chau Sites**

##### **Thermal Incineration Plant**

- (a) Waste reception, storage and feeding system
- (b) Mass burn incinerator (combustion chamber)
- (c) Waste heat recovery (boiler), turbine generation and cooling systems
- (d) Boiler feedwater treatment system
- (e) Flue gas treatment system
- (f) Flue gas discharge system with stack
- (g) Fly ash storage and treatment system
- (h) Residues and bottom ash storage and handling system
- (i) Bulky waste storage and handling system
- (j) Reagent reception and storage system
- (k) Process control and monitoring system

### Sorting and Recycling Plant

- (a) Waste reception provisions
- (b) Mechanical sorting and shredding systems for recyclables recovery
- (c) Biological treatment systems based on anaerobic digestion and composting processes
- (d) Biogas storage system
- (e) Biogas electricity generation system

### Ancillary and Supporting Facilities

- (a) Weighbridge
- (b) Security system
- (c) Administration building
- (d) Visitor and education centre
- (e) Vehicle and container washing facilities
- (f) Maintenance workshop and utility yard
- (g) Fuel storage tanks
- (h) Drainage and sewerage system
- (i) Water supply and waste water treatment systems
- (j) Berthing for marine vessels that transport MSW to the site
- (k) Refuse container storage facilities

### For Tsang Tsui Ash Lagoon Site

#### Decommissioning of Pulverized Fuel Ash Lagoon at Tsang Tsui

Works associated with the decommissioning of the Pulverized Fuel Ash Lagoon at Tsang Tsui, including diversion of pipes.

#### Foundation Works of the Project at Pulverized Fuel Ash Lagoon at Tsang Tsui

### For Shek Kwu Chau Site

#### Reclamation of 10ha of land

- 1.4 The following elements of the Project are classified as Designated Projects under the *Environmental Impact Assessment Ordinance (Cap. 499) (EIAO)*:

For both Tsang Tsui Ash Lagoon and Shek Kwu Chau sites:

- An incinerator with an installed capacity of more than 50 tonnes per day (under Item G.3 of Part I, Schedule 2 of the EIAO)
- A waste disposal facility for refuse (under Item G.4 of Part I, Schedule 2 of the EIAO)
- A waste disposal facility for pulverized fuel ash or furnace bottom ash (under Item G.6 of Part I, Schedule 2 of the EIAO)
- Public utility electricity power plant (under Item D.1 of Part I, Schedule 2 of the EIAO)

For Tsang Tsui Ash Lagoon site:

- A waste disposal facility for pulverized fuel ash, furnace bottom ash or gypsum (under Item 8 of Part II, Schedule 2 of the EIAO).

For Shek Kwu Chau site:

- Reclamation works (including associated dredging works) of more than 5 ha in size (under Item C.1 of Part I, Schedule 2 of the EIAO)
- A dredging operation exceeding 500,000m<sup>3</sup> (under Item C.12 of Part I, Schedule 2 of the EIAO)

1.5 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.

1.6 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 related activities that take place concurrently. This information will contribute to decisions by the Director on:

- (i) the overall acceptability of any adverse environmental consequences that is to arise as a result of the Project and the associated activities of the Project;
- (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 for carrying out the Project;
- (ii) to identify and describe the elements of the community and environment likely to be affected by the Project, including any loss of natural coastline, landscape, and/or to cause adverse impacts to the Project, including both the natural and man-made environment and the associated environmental constraints;
- (iii) to consider alternatives including, but not limited to, location, designs (including updated technology to be adopted for incineration), size of reclamation, design layout and construction methods, with a view to avoiding and minimizing the potential environmental impacts; to compare the environmental benefits and dis-benefits of each of the alternatives; to provide reasons for selecting the preferred option(s) and to describe the part of environmental factors played in the selection;
- (iv) to identify and quantify emission sources and determine the significance of impacts on sensitive receivers and potential affected uses and to propose measures to mitigate these impacts;
- (v) to identify and quantify any potential impacts from point and non-point pollution sources on the identified water systems and sensitive receivers and to propose measures to mitigate these impacts;
- (vi) to identify and quantify waste management requirements and land contamination prevention requirements, and to propose measures to mitigate or prevent impacts;

- (vii) to identify and quantify any potential losses or damage to flora, fauna and natural habitats and to propose measures to mitigate these impacts;
- (viii) to identify any negative impacts on Chinese White Dolphin and Finless Porpoise and to propose measures to mitigate these impacts;
- (ix) to identify any negative impacts on fisheries and to propose measures to mitigate these impacts;
- (x) to identify any potential landscape and visual impacts and to propose measures to mitigate these impacts;
- (xi) to identify and quantify any health impacts and to propose measures to mitigate these impacts;
- (xii) to identify any potential risks of landfill gas and to propose measures to mitigate these risks;
- (xiii) to identify any negative impacts on sites of cultural heritage and to propose measures to mitigate these impacts;
- (xiv) to compare the environmental merits and demerits of the Tsang Tsui Ash Lagoon and/or Shek Kwu Chau sites with other possible sites;
- (xv) to propose the provision of mitigation measures to minimize pollution, environmental disturbance and nuisance during construction and operation of the Project;
- (xvi) to investigate the feasibility, practicability, effectiveness and implications of the proposed mitigation measures;
- (xvii) to identify, predict and evaluate the residual environmental impacts (i.e. after practicable mitigation) and the cumulative effects expected to arise during construction and operational phases of the Project in relation to the sensitive receivers and potential affected uses;
- (xviii) 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 any risks, environmental impacts and cumulative effects and reduce them to acceptable levels;
- (xix) to investigate the extent of the secondary environmental impacts that may arise from the proposed mitigation measures and to identify constraints associated with the mitigation measures recommended in the EIA study, as well as the provision of any necessary modification; and
- (xx) to design and specify the environmental monitoring and audit requirements to ensure the effective implementation of the recommended environmental protection and pollution control measures.

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

#### **3.1 The Purpose**

The purpose of this study brief is to scope the key issues of the EIA study and to specify the environmental issues that are required to be reviewed and assessed in the EIA report. The Applicant shall refer to Sections 3.2 to 3.4 for the scope and study requirements of the Tsang Tsui Ash Lagoon site and Sections 3.5 to 3.7 for those of the Shek Kwu Chau site. The Applicant has to demonstrate in the EIA

report that 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 fully complied with.

### **3.2 The Scope for the Tsang Tsui Ash Lagoon Site**

The scope for the Tsang Tsui Ash Lagoon site of this EIA study shall cover the Project scope for the Tsang Tsui Ash Lagoon site as proposed in the Project Profile and shall include the relevant works and facilities mentioned in Section 1.3 above. The EIA study shall address the key issues described below, together with any other key issues identified during the course of the EIA study and the cumulative environmental impacts of the Project, through interaction or in combination with other existing, committed, planned and known potential developments in the vicinity of the Project:

- (i) the potential air quality impacts during construction and operation of the Project including odour impacts at the sensitive receivers;
- (ii) the potential health impacts during construction and operation of the Project, including radon emissions from pulverized fuel ash (PFA) within the Ash Lagoon at Tsang Tsui, aerial emissions, fugitive emissions, biogas production and storage and other accidental events;
- (iii) the potential water quality impacts during construction and operation of the Project, including the impacts arising from effluent and cooling water discharge/intake;
- (iv) the potential ecological impacts from construction and operation of the Project, including loss of habitats, disturbance to wildlife and any indirect impacts to habitats and associated fauna adjacent to the site;
- (v) the potential fisheries impacts during construction and operation of the Project;
- (vi) the potential impacts of various types of wastes to be generated from construction and operation of the Project;
- (vii) the potential noise impacts during construction and operation of the Project;
- (viii) the potential landscape and visual impacts during construction and operation of the Project to sensitive receivers;
- (ix) the potential risks of landfill gas on the Project during construction and operation of the Project;
- (x) the potential impacts on sites of cultural heritage during construction of the Project; and
- (xi) the potential cumulative environmental impacts of the Project, through interaction or in combination with other existing, committed and planned developments in the vicinity of the Project, such as the existing Black Point and Castle Peak Power Stations, the planned Sludge Treatment Facilities, the West New Territories (WENT) Landfill and its planned extension, as well as tentative proposals for regional roadworks and other environmental infrastructures near the Project site (e.g. the Hong Kong-Zhuhai-Macao Bridge project), and that those impacts may have a bearing on the environmental acceptability of the Project.

### **3.3 Consideration of Alternative Location, Layout and Construction Methods for the Tsang Tsui Ash Lagoon Site**

#### **3.3.1 Need for the Project**

The Applicant shall study and review the need for the Project and provide information to justify the need. The Applicant shall explain clearly the purpose and objectives of the Project and describe the scenarios with and without the Project.

#### **3.3.2 Consideration of Different Technologies for Mixed Municipal Solid Waste (MSW)**

The EIA study shall review the international mixed MSW management practices and take into consideration, with clear and objective comparison of the environmental benefits and disbenefits, of different technologies for mixed MSW treatment. The technologies to be considered shall include, but not limited to landfilling, incineration, heat drying and composting.

#### **3.3.3 Consideration of Alternative Options**

The EIA study shall take into consideration, with clear and objective comparison of the environmental benefits and disbenefits, of alternative options for the Project, including alternative site locations, layouts and designs. The Applicant shall compare the main environmental impacts and provide reasons for selecting the preferred options and the part environmental factors played in the selection shall be described.

#### **3.3.4 Consideration of Alternative Construction Methods and Sequence of Works**

Taking into consideration of the combined effects 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 adverse environmental impacts to the maximum practicable extent. A comparison of the environmental benefits and dis-benefits of applying different construction methods and sequence of works shall be made.

#### **3.3.5 Selection of Preferred Scenario**

Taking into consideration of the findings in Sections 3.3.2 to 3.3.4 above, the Applicant shall recommend with full justifications 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 for the Tsang Tsui Ash Lagoon Site**

The Applicant shall conduct the EIA study to address the environmental aspects as described in Sections 3.1 to 3.3 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 programme and methodologies. The Applicant shall clearly state in the EIA report the time frame

and work programmes of the Project and other concurrent projects, and assess the cumulative environmental impacts from the Project with all interacting projects as identified in the EIA study, including any phased implementation of the Project and the associated works.

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

### **3.4.1 Air Quality Impact**

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

3.4.1.2 The study area for air quality impact assessment shall generally be defined by a distance of 500 metres from the boundary of the Project site, and it shall be extended to include major existing and planned/committed air pollutant emission sources such as Castle Peak Power Station, Black Point Power Station, large industrial uses in Tuen Mun, planned Sludge Treatment Facilities and WENT Landfill and Extension, etc. (with their individual aerial emission rate showing in a table), that may have a bearing on the environmental acceptability of the Project. For this Project, the assessment shall include the existing and planned/ committed air sensitive receivers within the study area (e.g. premises of the Castle Peak Power Company Limited) as well as areas where the air quality may be potentially affected by the Project. In particular, the affected zone of air pollution impact due to stack emissions of the incinerator, which depends on the chimney height and air pollutant emission rates, may be extended over many kilometers. Such assessment shall be based on the best available information at the time of the assessment.

3.4.1.3 The Applicant shall assess the air pollutant concentrations with reference to the relevant sections of the guidelines in Appendices B1 to B3 attached to this study brief, or other methodology as agreed by the Director.

3.4.1.4 The air quality impact assessment shall include the following:

(i) Background and Analysis of Activities

(a) Provide 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 both construction and operational stages.

(b) Present background air quality levels in the assessment area for the purpose of evaluating cumulative construction and operational air quality impacts.

(c) Consider alternative construction methods/phasing programmes and alternative modes of operation to minimize the construction and operational air quality impact.

- (ii) Identification of Air Sensitive Receivers (ASRs) and Examination of Emission/ Dispersion Characteristics
- (a) Identify and describe existing and planned/committed ASRs that would be affected by the Project, including those indicated 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 the Lands Department, 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 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. The Applicant shall also review the development programme against the different construction stages to assess whether the occupiers of the early phases could become ASRs to be affected by the construction works of later phases.
- (b) Provide a list of air pollutant emission sources, which are to have impact related to the Project based on the analysis of construction and operational activities in Section 3.4.1.4(i) above. Besides, if the concurrent projects within the study area are identified relevant, its possible emissions shall also be taken into account in the air quality impact assessment. Examples of construction stage emission sources include stockpiling, material handling and vehicular movements on unpaved haul roads on site. Examples of operational stage emission sources include stack emissions from the incinerator and biogas electricity generation system of the Project, marine vessel emissions and odour emissions from transportation, storage and handling of mixed MSW, biological treatment processes of the sorting/recycling plant and the proposed wastewater treatment plant. Confirmation of validity of the assumptions and magnitude of the activities (e.g. volume of construction material handled, odour emission strength.) shall be obtained from the relevant government departments/authorities and documented.
- (c) The Applicant shall identify chimneys and obtain relevant chimney emission data in the study area by carrying out a survey for assessing the cumulative air quality impact of air pollutants through chimneys. The Applicant shall ensure and confirm that the chimney emission data used in their assessment have been validated and updated by their own survey. If there are any errors subsequently found in their chimney emission data used, the Applicant shall be fully responsible and the submission might be invalidated.
- (iii) Construction Phase Air Quality Impact
- (a) The Applicant shall follow the requirements stipulated under the Air Pollution Control (Construction Dust) Regulation to ensure that construction dust which may arise as a result of the works are controlled within the relevant standards as stipulated in Section 1 of Annex 4 of the



TM. A monitoring and audit programme for the construction phase shall be devised to verify the effectiveness of the control measures and to ensure that the construction dust levels are brought under control.

- (b) 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 in accordance with Section 3.4.1.4(iii)(a) above, 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 3.4.1.4(v) below when carrying out the quantitative assessment.

(iv) Operational Phase Air Quality Impact

- (a) Apart from preparing a list of emission sources required in Section 3.4.1.4(ii)(b) above, the Applicant shall state the target emission levels for the incinerator, and compare them with the standards specified in the Guidance Note on the Best Practicable Means for Incinerators (Municipal Waste Incineration) issued by EPD, and other relevant overseas standards. The target emission levels for the incinerator shall be agreed with the Director prior to the execution of the quantitative assessment on operational air quality impact.
- (b) The Applicant shall calculate the expected air pollutant concentrations, including toxic air pollutants such as heavy metals, dioxins and odour, at the identified ASRs based on an assumed reasonably worst-case scenario. The evaluation shall be based on the strength of the emission sources identified in Sections 3.4.1.4(ii)(b) and 3.4.1.4(iv)(a) above. The Applicant shall follow Section 3.4.1.4(v) below when carrying out the quantitative assessment.

(v) Quantitative Assessment Methodology

- (a) The Applicant shall conduct the quantitative assessment with reference to relevant sections of the modelling guidelines in Appendices B1 to B3 or any other methodology as agreed with the Director. The specific methodology must be documented in such level of details (preferably with tables and diagrams) to allow the readers of the assessment report to grasp how the model is set up to simulate the situation at hand without referring to the model input files. Details of the calculation of the emission rates of air pollutants for input to the modelling shall be presented in the report. The Applicant must ensure consistency between the text description and the model files. In case of doubt, prior agreement between the Applicant and the Director on the specific modelling details should be sought.
- (b) The Applicant shall identify the key/representative air pollutant parameters (types of pollutants such as dioxins and furans and the averaging time concentration) to be evaluated and provide explanation for choosing these parameters for the assessment of the impact of the Project.

(c) The Applicant shall calculate the overall cumulative air quality impact at the identified ASRs identified under Section 3.4.1.4(ii) 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 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 contour to allow buffer distance requirements to be determined properly.

(vi) 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. If these measures will result in any constraints on future land use planning outside the Project site, the Applicant shall liaise with the relevant government departments/authorities and document the agreement in the EIA Report in order to demonstrate that the proposed measures are feasible and practicable. The Applicant shall demonstrate quantitatively that the residual impacts after incorporation of the proposed mitigating measures will comply with the criteria stipulated in the TM.

(vii) Submission of Model Files

Input and output file(s) of the model run(s) shall be submitted to the Director in electronic format.

### **3.4.2 Noise Impact**

3.4.2.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing noise impact as stated in Annexes 5 and 13 of the TM respectively.

3.4.2.2 The noise impact assessment shall include the following:

(i) Determination of Assessment Area

The study area for the noise impact assessment shall include all areas within 300m from the Project boundary. Subject to the agreement of the Director, the study area could be reduced accordingly if the first layer of noise sensitive receivers (NSRs), closer than 300m from the outer Project limit, provides acoustic shielding to those receivers at distances further away from the Project. Similarly, subject to the agreement of the Director, the study area shall be expanded to include NSRs at distance greater than 300m from the Project which would be affected by construction and operation of the Project.

(ii) Provision of Background Information and Existing Noise Levels

The Applicant shall provide all background information relevant to the Project including relevant previous and 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.

(iii) Identification of Noise Sensitive Receivers

- (a) The Applicant shall refer to Annex 13 of the TM when identifying the NSRs. The NSRs shall include existing NSRs and planned or 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. Photographs of existing NSRs shall be appended to the EIA report.
- (b) The Applicant shall select assessment points to represent identified NSRs for carrying out quantitative noise assessment described below. The assessment points shall be agreed with the Director prior to the quantitative noise assessment. 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.

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

The Applicant shall provide an inventory of noise sources including representative construction equipment for construction noise assessment; and 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.

(v) Construction Noise Assessment

- (a) 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.
- (b) The Applicant shall carry out assessment of noise impact from construction (excluding percussive piling) of the Project during day time, i.e. 7 a.m. to 7 p.m., on weekdays other than general holidays in accordance with the methodology stipulated in paragraphs 5.3 and 5.4 of Annex 13 of the TM. The criteria in Table 1B of Annex 5 of the TM shall be adopted in the assessment.
- (c) To minimize the construction noise impact, alternative construction methods to replace percussive piling shall be proposed as far as practicable.
- (d) If the unmitigated construction noise levels are found to exceed 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.

- (e) The Applicant shall, as far as practicable, formulate a reasonable construction programme so that no work will be required in the restricted hours as defined under the Noise Control Ordinance (NCO). In case the Applicant needs to evaluate whether construction works in restricted hours as defined under the NCO are feasible or not in the context of programming construction works, reference should be made to the relevant technical memoranda issued under the NCO. Regardless of the results of the construction noise impact assessment for restricted hours, the Noise Control Authority will process the Construction Noise Permit (CNP) application, if necessary, based on the NCO, the relevant technical memoranda issued under the NCO, and the contemporary conditions/situations. This aspect should be explicitly stated in the noise chapter and the conclusions and recommendations chapter in the EIA report.

(vi) Operational Noise Impact Assessment

- (a) The Applicant shall analyze the scope of the proposed system to identify noise sources for the purpose of noise impact assessment.
- (b) The Applicant shall calculate the expected noise using standard acoustic principles. Calculations for the expected noise shall be based on assumed plant inventories and utilization schedule for the worst case scenario. The Applicant shall calculate the noise levels taking into account of correction of tonality, impulsiveness and intermittency in accordance with the Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites.
- (c) The Applicant shall present the relevant noise levels in Leq (30 mins) at the NSRs at various representative floor levels (in mPD) in tables and plans of suitable scales. Quantitative assessment at the NSRs for 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.
- (d) Proposals for Noise Mitigation Measures: The Applicant shall propose direct technical remedies in 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. Specific reasons for not adopting certain direct technical remedies in the design to reduce the noise to a level meeting the criteria in the TM or to maximize the protection for the NSRs should be clearly quantified and laid down.

(vii) Assessment of Side Effects and Constraints

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

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

- (a) For planned noise sensitive uses which will still be affected even with all

practicable direct technical remedies in place, the Applicant shall propose, evaluate and confirm the practicality of additional measures within the planned noise sensitive uses and shall make recommendations on how these noise sensitive uses will be designed for the information of relevant parties.

- (b) The Applicant shall take into account the agreed environmental requirements/constraints identified by the EIA study to assess the development potential of concerned sites which shall be made known to the relevant parties.

### **3.4.3 Water Quality Impact**

- 3.4.3.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing water pollution as stated in Annexes 6 and 14 of the TM respectively.
- 3.4.3.2 The study area for the purpose of water quality impact assessment shall cover an area within 300 metres of the Project site boundary, and all relevant water sensitive receivers, including existing cooling water system of the Black Point Power Station. This study area could be extended to include other areas such as nearby watercourses and the associated water systems in the Deep Bay and North Western Water Control Zones as designated under the Water Pollution Control Ordinance (Cap.358, WPCO), if they are found also being impacted during the course of the EIA study and have a bearing on the environmental acceptability of the Project.
- 3.4.3.3 The Applicant shall identify and analyze in the assessment all physical, chemical and biological disruptions of marine, estuarine, or fresh water system(s) arising from construction and operation of the Project (including impacts arising from effluent and seawater intake/discharge outfall).
- 3.4.3.4 The Applicant shall predict, quantify and assess any water quality impacts arising from the Project on the water system(s) and the sensitive receivers by appropriate techniques proposed by the Applicant and approved by the Director. The prediction shall include possible different construction stages or sequences and different operational stages of the Project. Affected sensitive receivers shall be identified by the assessment tool with indications of degree of severity.
- 3.4.3.5 The water quality impact assessment shall cover the following, but not limited to, major areas of concern:
  - (i) dredging of marine sediment for construction and maintenance of navigation channel, turning circle and berthing area;
  - (ii) construction impacts of any marine works that may be identified during the course of the EIA study due to the Project, such as construction of seawater intake/discharge outfall;
  - (iii) impacts of any disposal of industrial wastewater on the receiving environmental waters due to operation of the Project, such as any discharge of concentrate and backwash water from desalination plant and blowdown from cooling water system; and
  - (iv) impacts of potential on-site sewage treatment and disposal facilities and other wastewater treatment facilities.

3.4.3.6 The Applicant shall include the following in the water quality assessment:

- (i) collection and review of background information on the existing water system(s) and the respective catchment(s);
- (ii) characterization of water and sediment quality based on existing information or site surveys/tests as appropriate;
- (iii) identification and analysis of all existing and planned future activities and beneficial uses related to the water system(s) and identification of all water sensitive receivers;
- (iv) establishment of pertinent water and sediment quality objectives, criteria or standards for the water system(s) and all the sensitive receivers to be affected by the Project;
- (v) review of construction sequences and methods, and operation of the Project to identify any change of existing water courses, shoreline or bathymetry, flow regimes and catchment types or areas;
- (vi) identification, analysis and quantification of all existing and likely future water and sediment pollution sources, including point discharges and non-point sources to surface water runoff, solid and liquid wastes that may contain Toxic Pollutants including Persistent Organic Pollutants (POPs) especially dioxins and dioxin-like substances, as well as heavy metals and other contaminants, sewage and spent industrial wastewater due to construction and operation of the Project. Field investigation and laboratory tests shall be conducted as appropriate. An emission inventory on the quantities and characteristics of these pollution sources in the study area shall also be provided;
- (vii) prediction and quantification of impacts on the water system(s) and the sensitive receivers that would likely be affected by the alternations and changes identified in Sections 3.4.3.6(v) above and the pollution sources identified in Section 3.4.3.6(vi) above. Both the local and regional effects on erosion, sedimentation pattern, sediment dispersion, flow regime and water quality due to any dredging of marine sediment shall be assessed. The location, nature, extent and rate of such works for the Project shall be clearly identified and evaluated. The assessment shall also take into account the additional pollution loading and oxygen demand exerted by sediment disturbed;
- (viii) identification and quantification of all dredging, mud/sediment transportation and disposal activities and requirements. Potential dumping ground to be involved shall also be identified. Field investigation, sampling and chemical and biological laboratory tests to characterize the sediment/mud concerned shall be conducted as appropriate. The potential for the release of contaminants during dredging and any other marine works shall be addressed using the chemical testing results derived from sediment and marine water samples collected on site and relevant historic data. Appropriate laboratory tests such as elutriate tests in accordance with the USACE method and sediment pore water (interstitial water) analyses shall be performed on the sediment samples to simulate and quantify the degree of mobilization of various contaminants such as metals, ammonia, nutrients, trace organic contaminants (including PCBs, PAHs, TBT and chlorinated pesticides) into the water column during dredging. The ranges of parameters to be analyzed;

the number, location, depth of sediment, type and methods of sampling; sample preservation; and chemical and biological laboratory test methods to be used shall be subject to the approval of the Director. The Applicant shall also address the pattern of the sediment deposition and the potential increase in turbidity and suspended solid levels in the water column and at the sensitive receivers due to the disturbance of sediments during dredging. The prediction and quantification of impacts caused by sediment re-suspension and contaminants release shall be carried out by techniques to be approved by the Director;

- (ix) assessment and quantification of all existing and future waste water generation activities and analysis on the adequacy of existing and future sewerage infrastructure (including the proposed wastewater treatment plant);
- (x) assessment of the cumulative impacts due to other related concurrent and planned projects, activities or pollution sources along the identified water system(s) and sensitive receivers that may have a bearing on the environmental acceptability of the Project. This shall include the potential cumulative construction and operation water quality impacts arising from, inter alia, the associated works of the Project, the activities and planned projects to be approved by the Director when the programme of the Project and associated works are confirmed during the course of the EIA study;
- (xi) proposal for upgrading or providing any effective sewerage infrastructure (including the proposed wastewater treatment plant), water pollution prevention and mitigation measures to be implemented during construction, operational stages so as to reduce the water and sediment quality impacts to within standards. Requirements to be incorporated in the Project contract document shall also be proposed;
- (xii) best management practices to reduce storm water and non-point source pollution shall be investigated and proposed as appropriate; and
- (xiii) evaluation and quantification of residual impacts on the water system(s) and the sensitive receivers with regard to the appropriate water quality objectives, criteria, standards or guidelines.

#### **3.4.4 Waste Management Implications**

3.4.4.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing waste management implications as stated in Annexes 7 and 15 of the TM respectively.

3.4.4.2 The assessment of waste management implications shall cover the following:

(i) Analysis of Activities and Waste Generation

The Applicant shall identify the quantity, quality and timing of the waste arising as a result of construction and operational activities of the Project, based on the sequence and duration of these activities. The Applicant shall adopt the design, general layout, construction methods and programme that will minimize the generation of public fill/inert construction and demolition (C&D) materials and maximise the use of public fill/inert C&D materials for other construction works.

(ii) Proposal for Waste Management

- (a) Prior to considering the disposal options for various types of wastes, opportunities for reducing waste generation, on-site or off-site re-use and recycling shall be fully evaluated. Measures that can be taken in the planning and design stages e.g. by modifying the design approach and in the construction stage for maximizing waste reduction shall be separately considered.
- (b) After considering 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 the wastes shall be described in detail. The disposal methods/options recommended for each type of wastes shall take into account the result of the assessment in item (c) below. The EIA report shall also state clearly the transportation routings and the frequency of the trucks/vessels involved, any barging point, the stockpiling areas and the disposal outlets for the wastes identified; and
- (c) The impact caused by handling (including stockpiling, labelling, packaging & 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; and
  - public transport.

(iii) Dredging and Dumping

- (a) Identification and quantification as far as practicable of all dredging (including maintenance dredging)/excavation, sediment/mud transportation and disposal activities and requirements shall be conducted. Potential dumping ground to be involved shall also be identified. Field investigation, sampling and chemical and biological laboratory tests to characterize the sediment/mud concerned shall be conducted as appropriate. The ranges of parameters to be analyzed; the number, type and methods of sampling; sample preservation; chemical and biological laboratory test methods to be used shall be agreed with the Director (with reference to Section 4.4.2(c) of the TM) prior to the commencement of the tests. The categories of sediment/mud which are to be disposed of in accordance with a permit granted under the Dumping at Sea Ordinance (DASO) shall be identified by both chemical and biological tests and their quantities shall be estimated. If the presence of any serious contamination of sediment/mud which requires special treatment/disposal is confirmed, the Applicant shall identify the most appropriate treatment and/or disposal arrangement and demonstrate its feasibility;
- (b) Identification and evaluation of the best practicable dredging/excavation methods, treatment methods, in-situ/ex-situ arrangements, reuse/



recycling options and construction programme to minimize dredging/excavation and dumping requirements based on the criterion that existing sediment/mud shall be left in place and not to be disturbed as far as possible and the inert C&D materials shall be used to maximum practicable extent for other construction works.

- 3.4.4.3 To prevent potential contamination problems during operational phase of the Project, the Applicant shall:
- (i) identify the possible sources of contamination associated with the operation of the Project; and
  - (ii) formulate appropriate operational practices, waste management strategies and precautionary measures for prevention of contamination problems.

### **3.4.5 Ecological Impact (Both Terrestrial and Aquatic)**

- 3.4.5.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing ecological impact as stated in Annexes 8 and 16 of the TM respectively.
- 3.4.5.2 The study area for the purpose of terrestrial ecological assessment shall include all areas within 500 metres from the site boundary of the land based works areas or the area likely to be impacted by the Project. For aquatic ecology, the study area shall be the same as the water quality impact assessment as stipulated in Section 3.4.3.2 or the area likely to be impacted by the Project.
- 3.4.5.3 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 impacts on recognized sites of conservation importance and other ecological sensitive areas. The assessment shall identify and quantify as far as possible the potential ecological impacts arising from construction and operation of the Project and in combination with those cumulative impacts from associated works of the Project.
- 3.4.5.4 The assessment shall include the following major tasks:
- (i) review and incorporate the findings of relevant previous studies/surveys and collate all available information on the ecological characters of the study area;
  - (ii) carry out necessary field surveys, the duration of which shall be at least six months (covering wet and dry seasons), and investigation to verify the information collected, fill the information gaps identified in Section 3.4.5.4(i) above and fulfill the objectives of the EIA study. The field surveys shall include, but not limited to a dive survey for coral communities;
  - (iii) evaluate the information collected from Sections 3.4.5.4 (i) and (ii) above, and determine whether further ecological survey is required under the following Section 3.4.5.4 (v);
  - (iv) present the findings of all relevant studies together with surveys carried out under this Study;

- (v) establish an ecological profile of the study area based on data of relevant previous studies/surveys and results of additional ecological field surveys, and describe the characteristics of each habitat found. Major information to be provided shall include:
- (a) description of the physical environment, including all recognized sites of conservation importance and ecologically sensitive areas, and assess whether these sites will be affected by the Project or not;
  - (b) habitats maps of suitable scale (1:1000 to 1:5000) showing the types and locations of habitats in the study area;
  - (c) ecological characteristics of each habitat type such as size, vegetation type, species present, dominant species found, species diversity and abundance, community structure, seasonal patterns, inter-dependence of the habitats and species, and presence of any features of ecological importance;
  - (d) representative colour photographs of each habitat type and any important ecological features identified;
  - (e) species found that are rare, endangered and/or listed under local legislation, international conventions for conservation of wildlife/habitats or Red Data Books;
  - (f) investigate and describe the existing wildlife uses of the various habitats with special attention to those wildlife groups and habitats with conservation interests, including but not limited to the following:
    - woodlands
    - wetlands
    - natural stream courses and rivers
    - vertebrates (e.g. avifauna, mammals including bats, Chinese white dolphin, fish, herpetofauna)
    - macroinvertebrates (e.g. horseshoe crabs, butterflies, odonates, crustaceans)
    - coral communities (including all hard corals, octocorals and black corals)
    - any other habitats and wildlife groups including but not limited to uncommon plants such as *Zeuxine sp.*, and potential breeding habitats of Little Grebe, Little Ringed Plovers and White-breasted Kingfishers in the ash lagoons identified as having special conservation interests by this EIA study;
  - (g) using suitable methodology to identify and quantify as far as possible any direct, indirect (such as contaminants in water bodies of the Ash Lagoons due to the re-suspension and dispersion of PFA during construction), on-site, off-site, primary, secondary and cumulative ecological impacts on the wildlife groups and habitats mentioned in Section 3.4.5.4 (v)(f) above, such as destruction of habitats, reduction of species abundance/diversity, loss of feeding grounds, reduction of ecological carrying capacity, habitat fragmentation and disturbance due to maintenance dredging;
- (vi) demonstrate that the ecological impacts due to construction and operation of the Project are avoided by design to the maximum practicable extent;

- (vii) evaluate the significance and acceptability of the ecological impacts identified using well-defined criteria. The evaluation shall include, but not limited to, the potential impacts of POPs, heavy metals and other contaminants due to construction and operation of the Project, if any, on Chinese White Dolphins and their prey species together with the oyster culture area in Deep Bay;
- (viii) recommend all possible alternatives options (such as minimizing the footprint of the proposed development, different extension area and/or using other construction methods and sequences) and practicable mitigation measures to avoid, minimize and/or compensate for the adverse ecological impacts identified;
- (ix) evaluate the feasibility and effectiveness of the recommended mitigation measures and define the scope, type, location, implementation arrangement, subsequent management and maintenance of such measures;
- (x) determine and quantify as far as possible the residual ecological impacts after implementation of the proposed mitigation measures;
- (xi) evaluate the severity and acceptability of the residual ecological impacts using well-defined criteria; and
- (xii) review the need for and recommend any ecological monitoring programme required.

### **3.4.6 Fisheries Impact**

- 3.4.6.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing fisheries impact as stated in Annexes 9 and 17 of the TM.
- 3.4.6.2 The study area for fisheries impact assessment shall cover the North Western and Deep Bay Water Control Zones as designated under the Water Pollution Control Ordinance (Cap. 358, WPCO). Special attention shall be given to the potential impacts on spawning and nursery grounds of fisheries species.
- 3.4.6.3 The assessment shall cover potential impact on capture fisheries during construction and operation of the Project and in combination with those cumulative impacts from associated works of the Project. Different options of the cooling system shall be evaluated for minimizing fisheries impacts. For any water cooling systems to be adopted, impacts associated with entrainment and impingement of marine organisms (including eggs and larvae of fisheries species) as well as adverse effect of anti-fouling agents shall be assessed.
- 3.4.6.4 Existing information regarding the study area shall be reviewed. Based on the review results, the study shall identify data gap and determine if there is any need for field surveys. If field surveys are considered necessary, the study shall recommend appropriate methodology, duration and timing for the field surveys.
- 3.4.6.5 The fisheries impact assessment shall include the following:-
  - (i) description of the physical environmental background;
  - (ii) description and quantification of existing capture fisheries activities;
  - (iii) description and quantification of existing capture fisheries resources (e.g. major fisheries products and stocks);

- (iv) identification of parameters (e.g. water quality parameters) and areas that are important to fisheries and will be affected by the Project;
- (v) identification and quantification any direct/indirect and on-site/off-site impacts to fisheries; and
- (vi) evaluation of impacts and make recommendations for any environmental mitigation measures with details on justification, description of scope and programme, feasibility as well as manpower and financial implications including those related to subsequent management and maintenance requirements of the proposals.

### **3.4.7 Landscape and Visual Impact**

- 3.4.7.1 The Applicant shall follow the criteria and guidelines as stated in Annexes 10 and 18 of the TM on the preparation of Landscape and Visual Impact Assessment under the EIAO. Landscape and visual impacts during both construction and operational phases within the study area and the related works area shall be assessed.
- 3.4.7.2 The study area for the landscape impact assessment shall include all areas within a 500 metres distance from the site boundary of the works areas while the assessment area for the visual impact assessment shall be defined by the visual envelope of the Project.
- 3.4.7.3 The Applicant shall review relevant outline zoning plans, outline development plans, layout plans, planning briefs and studies which may identify areas of high landscape value and recommend country park, coastal protection area, green belt and conservation area designations. Any guidelines on landscape strategies, landscape frameworks, designated view corridors, open space networks, landscape links and urban design concepts 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 so as to assess whether the Project can fit into surrounding setting. Any conflict with statutory town plan(s) and any published land use plans shall be highlighted and appropriate follow-up action shall be recommended.
- 3.4.7.4 The Applicant shall describe, appraise, analyse and evaluate the existing and planned landscape resources and character of the study area. A system shall be derived for judging landscape and visual impact significance as required under the TM. Annotated oblique aerial photographs and plans of suitable scale showing the baseline landscape character areas and landscape resources and mapping of impact assessment shall be extensively used to present the findings of impact assessment. Descriptive text shall provide a concise and reasoned judgement from a landscape and visual point of view. The sensitivity of the landscape framework and its ability to accommodate change shall be particularly focused on. The Applicant shall identify the degree of compatibility of the Project with the existing and planned landscape settings. The landscape impact assessment shall quantify the potential landscape impact as far as possible so as to illustrate the significance of such impacts arising from the proposed development. Clear mapping of the landscape impact is required. A broad brush tree survey shall be carried out and the impacts on existing trees shall be addressed.
- 3.4.7.5 The Applicant shall assess the visual impacts of the Project. A system shall be derived for judging visual impact significance as required under the TM. Clear

illustrations including mapping of visual impact are required. The assessment shall include the following:

- (i) identification and plotting of visual envelope of the Project;
- (ii) identification of the key groups of sensitive receivers within the visual envelope with regard to views from ground level, sea level and elevated vantage points;
- (iii) description of the visual compatibility of the Project with the surrounding, the existing and the planned setting, and its obstruction and interference with the key views within the visual envelope;
- (iv) description of the severity of visual impacts in terms of distance, nature and number of sensitive receivers. 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
- (v) clear evaluations and explanations of all the factors considered in arriving the significance thresholds of visual impact.

3.4.7.6 The Applicant shall evaluate the merits of preservation in totality, in parts or total destruction of existing landscape and the establishment of a new landscape character area if it will be affected by the Project. In addition, alternative location, site layout, design and construction methods that would avoid or reduce the identified landscape and visual impacts shall be evaluated for comparison before adopting other mitigation or compensatory measures to alleviate the impacts. The mitigation measures proposed shall not only be concerned with damage reduction but shall also include consideration of potential enhancement of existing landscape and visual quality. The Applicant shall recommend mitigation measures to minimize the adverse effects identified above, including provision of a landscape design.

3.4.7.7 The mitigation measures shall include preservation of vegetation, transplanting of mature trees, provision of screen planting, re-vegetation of disturbed lands, compensatory planting, woodland restoration, design of structure, provision of finishes to structure, colour scheme and texture of materials used and any measures to mitigate the impact on existing and planned land uses and visually sensitive receivers. Parties shall be identified for the ongoing management and maintenance of the proposed mitigation works to ensure their effectiveness throughout the operational phase of the Project. A practical programme and funding proposal for the implementation of the recommended measures shall be provided.

3.4.7.8 Annotated illustration materials such as coloured perspective drawings, plans and section/elevation diagrams, annotated oblique aerial photographs, photographs particularly taken at vantage points and computer-generated photomontage shall be adopted to fully illustrate the landscape and visual impacts of the Project to the satisfaction of Director. The landscape and visual impacts of the Project with and without mitigation measures from representative viewpoints, particularly from views of the most severely affected visually sensitive receivers (i.e. worst case scenario), shall be properly illustrated in existing and planned setting at four stages (existing condition, Day 1 with no mitigation measures, Day 1 with mitigation measures and Year 10 with mitigation measures) by computer-generated photomontage so as to demonstrate the effectiveness of the proposed mitigation

measures. Computer graphics shall be compatible with Microstation DGN file format. The Applicant shall record the technical details such as system set-up, software, data files and function in preparing the illustration that may need to be submitted for verification of the accuracy of the illustrations.

### **3.4.8 Health Impact**

- 3.4.8.1 A health risk assessment shall be conducted to assess the potential health impact associated with construction and operation of the Project. Particular attention should be paid to assess any radon emissions from PFA within the Tsang Tsui Ash Lagoon during construction and operation of the IWMF, aerial emissions from the IWMF, biogas from the sorting and recycling plant; fugitive emissions during transportation, storage and handling of the waste and ash; and any other potential accidental events.
- 3.4.8.2 The health risk assessment shall include the following key steps:
- (i) a systematic identification of the risks from the handling, storage, transport and disposal (including accidental or disastrous release) of solid and liquid wastes that may contain Toxic Pollutants including POPs, especially dioxin and dioxin-like substances as incineration by-products; and the risks, especially from the radon emissions, of the excavation, filling, handling, storage, transport and disposal of PFA arising from construction and operation of IWMF;
  - (ii) an assessment of the likelihood and consequences of exposure to aerial emissions and solid and liquid wastes that may contain Toxic Pollutants including POPs, especially dioxin and dioxin-like substances;
  - (iii) an identification of means by which the risks could be further reduced; and
  - (iv) recommendation of all reasonably practicable measures to reduce risks during the operation of the Project.
- 3.4.8.3 The health risk assessment shall be based on established practices in countries around the world. A literature search shall be carried out to determine the best approach for the risk assessment, including any codes of practices, guidelines etc. applied locally in Hong Kong and elsewhere in the world. The approach shall be agreed by the Director prior to the commencement of assessment. For toxic air pollutants, the review list shall follow the criteria in Section 1.1(d) in Annex 4 of the TM.
- 3.4.8.4 The environmental health risk assessment on Toxic Pollutants including POPs, especially dioxins and dioxin-like substances, shall include all pathways by which the Toxic Pollutants including POPs may enter the human body, including inhalation, direct dermal contact as well as consumption of food and water which may be contaminated by the Toxic Pollutants including POPs emitted from IWMF and all relevant existing, committed and planned sources.
- 3.4.8.5 It is also necessary to perform a quantitative environmental health risk assessment for the risk of exposure to and the potential impacts from the release of Toxic Pollutants including POPs, especially dioxins and dioxin-like substances, from the operation of the Project. The assessment shall also include risk of exposure to and the potential impacts from release of Toxic Pollutants including POPs through

stack emissions, as well as the handling, storage, transport and disposal of any solid or liquid wastes that may contain Toxic Pollutants including POPs during operation of the Project. Any mitigation measures recommended should be aimed to minimize the environmental health risks from the release of Toxic Pollutants including POPs during operation of the Project.

### **3.4.9 Landfill Gas Hazards Assessment**

3.4.9.1 The Applicant shall assess the potential risks of landfill gas during construction and operation of the Project. The Applicant shall follow the guidelines as stated respectively in Annex 7 and Annex 19 of the TM and the Landfill Gas Hazard Assessment Guidance Note issued by the Director for evaluating and assessing landfill gas hazards.

3.4.9.2 The landfill gas hazards assessment shall entail two main components, which are qualitative risk assessment and landfill gas precautionary/protection design. Specifically, the assessment shall include the following technical tasks:

- (i) review of background information and studies related to the West New Territories Landfill Extensions;
- (ii) identification of the nature and extent of the sources, including the likely concentrations/amounts of hazardous emissions which might have the potential for causing impacts on the Project;
- (iii) identification of possible pathways through the ground, underground cavities, utilities or groundwater and the nature of these pathways through which hazardous emissions must traverse if they were to reach the facilities within the Project site;
- (iv) identification of the potential targets associated with the proposed facilities which are sensitive to the impacts of the hazardous emissions;
- (v) qualitative assessment on the degrees of risk which the hazardous emissions may pose to the target for each of the source-pathway-target combinations;
- (vi) design of suitable level of precautionary measures and the types of protection measures for construction and operation of the Project; and
- (vii) identification of monitoring requirement for assessing the adequacy and performance of the implemented protection measures.

### **3.4.10 Impact on Cultural Heritage**

3.4.10.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing the cultural heritage impacts as stated in Annexes 10 and 19 of the TM respectively, Criteria for Cultural Heritage Impact Assessment (Appendix C1), Guidelines for Archaeological Reports (Appendix C2) and Guidelines for Handling of Archaeological Finds and Archives (Appendix C3) to conduct a Cultural Heritage Impact Assessment (CHIA).

3.4.10.2 The CHIA shall comprise an Archaeological Impact Assessment (AIA) and a Built Heritage Impact Assessment (BHIA) as follows:

(i) Archaeological Impact Assessment (AIA)

The Applicant shall engage a qualified archaeologist to conduct the AIA in accordance with relevant sections of the Criteria for Cultural Heritage Assessment. If existing information is insufficient to ascertain the archaeological potential of the Project area, further field investigation shall be conducted to obtain archaeological data. The archaeologist shall obtain a licence from the Antiquities Authority before undertaking field investigation under the provision of the Antiquities and Monuments Ordinance (Cap. 53).

The Applicant shall identify all the archaeological sites that might be adversely affected by construction of the Project. A plan of proper scale showing the location of the proposed works and all archaeological sites identified is required. A check list including all affected archaeological sites, impacts identified, recommended mitigation measures as well as the implementation agent and period shall also be included in the EIA.

The Applicant shall assess the extent to which those archaeological sites might be directly and indirectly affected and recommend possible alternatives (such as modification of the Project design) and practicable monitoring and mitigation measures to avoid or keep the adverse impact on the archaeological sites to the minimum.

(ii) Built Heritage Impact Assessment (BHIA)

The Applicant shall draw necessary reference to relevant sections of the *Criteria for Cultural Heritage Impact Assessment* to conduct the BHIA to identify known and unknown built heritage items within the assessment area that may be affected by the Project and its associated works and to assess the direct and indirect impacts on built heritage items. Appropriate mitigation measures shall be recommended in the BHIA.

**3.4.11 Summary of Environmental Outcomes**

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

**3.4.12 Summary of Environmental Performance Comparison**

- 3.4.12.1 The EIA report shall contain a summary table comparing the environmental performance of the Tsang Tsui Ash Lagoon Site and other possible sites. The table shall compare the key design parameters; the key sensitive receivers and the environmental impacts.

**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 construction and operational phases of the Project and, if affirmative, to define the scope of EM&A requirements for the Project.



- 3.4.13.2 Subject to confirmation of EIA findings, the Applicant shall comply with requirements as stipulated in Annex 21 of the TM. The Applicant shall also propose real-time reporting of monitoring data for the Project in the EIA study.
- 3.4.13.3 The Applicant shall prepare a project implementation schedule (in the form of a checklist as shown in Appendix F to this EIA study brief) containing all the EIA study recommendations and mitigation measures with reference to the implementation programme. The Project Implementation Schedule shall include the explicit agreement reached between the Applicant and relevant parties on the responsibility for implementation of mitigation measures together with the relevant legislation and guidelines. Alternatively, the Project Implementation Schedule shall include an undertaking from the Applicant to assume the responsibility of those mitigation measures until an agreement is reached between the Applicant and relevant parties on the implementation of mitigation measures.

### **3.5 The Scope for the Shek Kwu Chau Site**

The scope for the Shek Kwu Chau site of this EIA study shall cover the Project scope for the Shek Kwu Chau site as proposed in the Project Profile and shall include the relevant works and facilities mentioned in Section 1.3 above. The EIA study shall address the key issues described below, together with any other key issues identified during the course of the EIA study and the cumulative environmental impacts of the Project, through interaction or in combination with other existing, committed, planned and known potential developments in the vicinity of the Project:

- (i) the potential air quality impacts from construction and operation of the Project including odour impacts at the sensitive receivers;
- (ii) the potential health impacts during construction and operation of the Project, including aerial emissions, fugitive emissions, biogas production and storage and other accidental events;
- (iii) the potential water quality impacts from dredging, reclamation and any other marine works activities during construction and the discharges during operation, in particular the potential impacts to the ecological resources due to increases in suspended sediment concentrations and potential decrease in dissolved oxygen; and the effluent and cooling water discharge/intake;
- (iv) the potential ecological impacts from construction and operation of the Project, including loss of habitats, disturbance to wildlife and any indirect impacts to habitats and associated fauna adjacent to the site;
- (v) the potential impact to the ecological sensitive areas, including the vicinities along the marine portion of the Project which are frequented by the Chinese White Dolphins and Finless Porpoise;
- (vi) the potential fisheries impacts during construction and operation of the Project, including the potential loss of fishing grounds, spawning and nursery grounds of fisheries species;
- (vii) the potential impacts of various types of wastes to be generated from construction and operation of the Project;
- (viii) the potential waste management issue associated with the use of filling materials such as marine sand and inert construction and demolition (C&D) materials for reclamation during construction of the Project;

- (ix) the potential noise impacts during construction and operation of the Project;
- (x) the potential landscape and visual impacts during construction and operation of the Project;
- (xi) the potential impact on sites of cultural heritage during construction of the Project; and
- (xii) the potential cumulative environmental impacts of the Project, through interaction or in combination with other existing, committed and planned developments in the vicinity of the Project, and those impacts that may have a bearing on the environmental acceptability of the Project.

### **3.6 Consideration of Alternative Location, Layout and Construction Methods for the Shek Kwu Chau Site**

#### **3.6.1 Need for the Project**

The Applicant shall study and review the need for the Project and provide information to justify the need. The Applicant shall explain clearly the purpose and objectives of the Project and describe the scenarios with and without the Project.

#### **3.6.2 Consideration of Different Technologies for Mixed Municipal Solid Waste (MSW)**

The EIA study shall review the international mixed MSW management practices and take into consideration, with clear and objective comparison of the environmental benefits and disbenefits, of different technologies for mixed MSW treatment. The technologies to be considered shall include, but not limited to landfilling, incineration, heat drying and composting.

#### **3.6.3 Consideration of Alternative Options**

The EIA study shall take into consideration, with clear and objective comparison of the environmental benefits and disbenefits, of alternative options for the Project, including alternative site locations, layouts and designs. The Applicant shall compare the main environmental impacts and provide reasons for selecting the preferred option and the part environmental factors played in the selection shall be described.

#### **3.6.4 Consideration of Alternative Construction Methods and Sequence of Works**

Taking into consideration of the combined effects 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 adverse environmental impacts to the maximum practicable extent. A comparison of the environmental benefits and dis-benefits of applying different construction methods and sequence of works shall be made.

#### **3.6.5 Selection of Preferred Scenario**

Taking into consideration of the findings in Sections 3.6.2 to 3.6.4 above, the Applicant shall recommend with full justifications 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.

### **3.7 Technical Requirements for the Shek Kwu Chau Site**

The Applicant shall conduct the EIA study to address the environmental aspects as described in Sections 3.1, 3.5 and 3.6 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 programme and methodologies. The Applicant shall clearly state in the EIA report the time frame and work programmes of the Project and other concurrent projects, and assess the cumulative environmental impacts from the Project with all interacting projects as identified in the EIA study, including any phased implementation of the Project and the associated works.

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

#### **3.7.1 Air Quality Impact**

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

3.7.1.2 The study area for air quality impact assessment shall generally be defined by a distance of 500 metres from the boundary of the Project site, and it shall be extended to include major existing and planned/committed air pollutant emission sources such as Lamma Power Station, etc. (with their individual aerial emission rate showing in a table) that may have a bearing on the environmental acceptability of the Project. For this Project, the assessment shall include the existing and planned/committed air sensitive receivers within the study area as well as areas where the air quality may be potentially affected by the Project. In particular, the affected zone of air pollution impact due to stack emissions of the incinerator, which depends on the chimney height and air pollutant emission rates, may be extended over many kilometres. Such assessment shall be based on the best available information at the time of the assessment.

3.7.1.3 The Applicant shall assess the air pollutant concentrations with reference to the relevant sections of the guidelines in Appendices B1 to B3 attached to this study brief, or other methodology as agreed by the Director.

3.7.1.4 The air quality impact assessment shall include the following:

(i) Background and Analysis of Activities

- (a) Provide 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 both construction and operational stages.
- (b) Present background air quality levels in the assessment area for the purpose of evaluating cumulative construction and operational air quality impacts.

- (c) Consider alternative construction methods/phasing programmes and alternative modes of operation to minimize the construction and operational air quality impact;
- (ii) Identification of Air Sensitive Receivers (ASRs) and Examination of Emission/ Dispersion Characteristics
- (a) Identify and describe existing and planned/committed ASRs that would be affected by the Project, including those indicated 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 the Lands Department, 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 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. The Applicant shall also review the development programme against the different construction stages to assess whether the occupiers of the early phases could become ASRs to be affected by the construction works of later phases.
  - (b) Provide a list of air pollutant emission sources, which are to have impact related to the Project based on the analysis of construction and operational activities in Section 3.7.1.4(i) above. Besides, if the concurrent projects within the study area are identified relevant, its possible emissions shall also be taken into account in the air quality impact assessment. Examples of construction stage emission sources include stockpiling, blasting, concrete batching, marine construction plant and vehicular movements on unpaved haul roads on site. Examples of operational stage emission sources include stack emissions from the incinerator and biogas electricity generation system of the Project, marine vessel emissions and odour emissions from transportation, storage and handling of mixed MSW, biological treatment processes of the sorting/recycling plant and the proposed wastewater treatment plant. Confirmation of validity of the assumptions and magnitude of the activities (e.g. volume of construction material handled, odour emission strength.) shall be obtained from the relevant government departments/authorities and documented.
  - (c) The Applicant shall identify chimneys and obtain relevant chimney emission data in the study area by carrying out a survey for assessing the cumulative air quality impact of air pollutants through chimneys. The Applicant shall ensure and confirm that the chimney emission data used in their assessment have been validated and updated by their own survey. If there are any errors subsequently found in their chimney emission data used, the Applicant shall be fully responsible and the submission might be invalidated.

(iii) Construction Phase Air Quality Impact

- (a) The Applicant shall follow the requirements stipulated under the Air Pollution Control (Construction Dust) Regulation to ensure that construction dust which may arise as a result of the works are controlled within the relevant standards as stipulated in Section 1 of Annex 4 of the TM. A monitoring and audit programme for the construction phase shall be devised to verify the effectiveness of the control measures and to ensure that the construction dust levels are brought under control.
- (b) 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 in accordance with Section 3.7.1.4(iii)(a) above, 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 3.7.1.4(v) below when carrying out the quantitative assessment.

(iv) Operational Phase Air Quality Impact

- (a) Apart from preparing a list of emission sources required in Section 3.7.1.4(ii)(b) above, the Applicant shall state the target emission levels for the incinerator, and compare them with the standards specified in the Guidance Note on the Best Practicable Means for Incinerators (Municipal Waste Incineration) issued by EPD, and other relevant overseas standards. The target emission levels for the incinerator shall be agreed with the Director prior to the execution of the quantitative assessment on operational air quality impact.
- (b) The Applicant shall calculate the expected air pollutant concentrations, including toxic air pollutants such as heavy metals, dioxins and odour, at the identified ASRs based on an assumed reasonably worst-case scenario. The evaluation shall be based on the strength of the emission sources identified in Sections 3.7.1.4(ii)(b) and 3.7.1.4(iv)(a) above. The Applicant shall follow Section 3.7.1.4(v) below when carrying out the quantitative assessment.

(v) Quantitative Assessment Methodology

- (a) The Applicant shall conduct the quantitative assessment with reference to relevant sections of the modelling guidelines in Appendices B1 to B3 or any other methodology as agreed with the Director. The specific methodology must be documented in such level of details (preferably with tables and diagrams) to allow the readers of the assessment report to grasp how the model is set up to simulate the situation at hand without referring to the model input files. Details of the calculation of the emission rates of air pollutants for input to the modelling shall be presented in the report. The Applicant must ensure consistency between the text description and the model files. In case of doubt, prior agreement between the Applicant and the Director on the specific modelling details should be sought.

- (b) The Applicant shall identify the key/representative air pollutant parameters (types of pollutants such as dioxins and furans and the averaging time concentration) to be evaluated and provide explanation for choosing these parameters for the assessment of the impact of the Project.
- (c) The Applicant shall calculate the overall cumulative air quality impact at the identified ASRs identified under Section 3.7.1.4(ii) 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 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 contour to allow buffer distance requirements to be determined properly.

(vi) 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. If these measures will result in any constraints on future land use planning outside the Project site, the Applicant shall liaise with the relevant government departments/authorities and document the agreement in the EIA Report in order to demonstrate that the proposed measures are feasible and practicable. The Applicant shall demonstrate quantitatively that the residual impacts after incorporation of the proposed mitigating measures will comply with the criteria stipulated in the TM.

(vii) Submission of Model Files

Input and output file(s) of the model run(s) shall be submitted to the Director in electronic format.

### **3.7.2 Noise Impact**

3.7.2.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing noise impact as stated in Annexes 5 and 13 of the TM respectively.

3.7.2.2 The noise impact assessment shall include the following:

(i) Determination of Assessment Area

The study area for the noise impact assessment shall include all areas within 300m from the Project boundary. Subject to the agreement of the Director, the study area could be reduced accordingly if the first layer of noise sensitive receivers (NSRs), closer than 300m from the outer Project limit, provides acoustic shielding to those receivers at distances further away from the Project. Similarly, subject to the agreement of the Director, the study area shall be expanded to include NSRs at distance greater than 300m from the Project which would be affected by construction and operation of the Project.

(ii) Provision of Background Information and Existing Noise Levels

The Applicant shall provide all background information relevant to the Project including relevant previous and 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.

(iii) Identification of Noise Sensitive Receivers

(a) The Applicant shall refer to Annex 13 of the TM when identifying the NSRs. The NSRs shall include existing NSRs and planned or 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. Photographs of the existing NSRs shall be appended to the EIA report.

(b) The Applicant shall select assessment points to represent identified NSRs for carrying out quantitative noise assessment described below. The assessment points shall be agreed with the Director prior to the quantitative noise assessment. 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.

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

The Applicant shall provide an inventory of noise sources including representative construction equipment for construction noise assessment; and 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.

(v) Construction Noise Assessment

(a) 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.

(b) The Applicant shall carry out assessment of noise impact from construction (excluding percussive piling) of the Project during day time, i.e. 7 a.m. to 7 p.m., on weekdays other than general holidays in accordance with the methodology stipulated in paragraphs 5.3 and 5.4 of Annex 13 of the TM. The criteria in Table 1B of Annex 5 of the TM shall be adopted in the assessment.

(c) To minimize the construction noise impact, alternative construction methods to replace percussive piling shall be proposed as far as practicable.

- (d) If the unmitigated construction noise levels are found to exceed 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.
  - (e) The Applicant shall, as far as practicable, formulate a reasonable construction programme so that no work will be required in the restricted hours as defined under the Noise Control Ordinance (NCO). In case the Applicant needs to evaluate whether construction works in restricted hours as defined under the NCO are feasible or not in the context of programming construction works, reference should be made to the relevant technical memoranda issued under the NCO. Regardless of the results of the construction noise impact assessment for restricted hours, the Noise Control Authority will process the Construction Noise Permit (CNP) application, if necessary, based on the NCO, the relevant technical memoranda issued under the NCO, and the contemporary conditions/situations. This aspect should be explicitly stated in the noise chapter and the conclusions and recommendations chapter in the EIA report.
- (vi) Operational Noise Impact Assessment
- (a) The Applicant shall analyze the scope of the proposed system to identify noise sources for the purpose of noise impact assessment.
  - (b) The Applicant shall calculate the expected noise using standard acoustic principles. Calculations for the expected noise shall be based on assumed plant inventories and utilization schedule for the worst case scenario. The Applicant shall calculate the noise levels taking into account of correction of tonality, impulsiveness and intermittency in accordance with the Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites.
  - (c) The Applicant shall present the relevant noise levels in Leq (30 mins) at the NSRs at various representative floor levels (in mPD) in tables and plans of suitable scales. Quantitative assessment at the NSRs for 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.
  - (d) Proposals for Noise Mitigation Measures: The Applicant shall propose direct technical remedies 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. Specific reasons for not adopting certain direct technical remedies in the design to reduce the noise to a level meeting the criteria in the TM or to maximize the protection for the NSRs should be clearly quantified and laid down.
- (vii) Assessment of Side Effects and Constraints

The Applicant shall identify, assess and propose means to minimize any side



effects and to resolve any potential constraints due to the inclusion of any recommended direct technical remedies.

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

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

(b) The Applicant shall take into account the agreed environmental requirements/constraints identified by the EIA study to assess the development potential of concerned sites which shall be made known to the relevant parties.

### **3.7.3 Water Quality Impact**

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

3.7.3.2 The study area for the purpose of water quality impact assessment shall cover the Southern, Southern Supplementary, Second Southern Supplementary, North Western, North Western Supplementary, and Western Buffer Water Control Zones as designated under the Water Pollution Control Ordinance (Cap. 358, WPCO). This study area could be extended to cover other areas such as estuaries, coastal, marine and fresh water, groundwater system; and the associated catchment area(s) being impacted and to be identified during the course of the EIA study.

3.7.3.3 The Applicant shall identify and analyze in the assessment all physical, chemical and biological disruptions of marine, estuarine, fresh water, ground water system(s) and the associated catchment area(s) arising during construction and operation of the Project (including impacts arising from effluent and seawater discharge/intake outfall).

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

- (i) construction and operational impacts arising from the proposed reclamation and berthing facilities;
- (ii) dredging of marine sediment for construction and maintenance of navigation channel, turning circle and berthing area;
- (iii) construction impacts of any proposed submarine power cable and other marine works that may be identified during the course of the EIA study due to the Project, such as construction of seawater intake/discharge outfall;
- (iv) impacts of any disposal of industrial wastewater on the receiving environmental waters due to operation of the Project, such as any discharge of concentrate and backwash water from desalination plant and blowdown from cooling water system; and

- (v) impacts of potential on-site sewage treatment and disposal facilities and other wastewater treatment facilities.

3.7.3.5 The Applicant shall include the following in the water quality assessment:

- (i) collection and review of background information on the existing water system(s) and the respective catchment(s);
- (ii) characterization of water and sediment quality based on existing information or site surveys/tests as appropriate;
- (iii) identification and analysis of all existing and planned future activities and beneficial uses related to the water system(s) and identification of all water sensitive receivers;
- (iv) establishment of pertinent water and sediment quality objectives, criteria or standards for the water system(s) and all the sensitive receivers to be affected by the Project;
- (v) identification of any change of shoreline or bathymetry, change of flow regimes, change of ground water levels, change of catchment types or areas;
- (vi) review the specific construction methods and configurations of the Project, such as, but are not limited to, the reclamation sides and configuration, and design and configurations of the berthing facilities; and
- (vii) identification, analysis and quantification of all existing and likely future water and sediment pollution sources, including point discharges and non-point sources to surface water runoff, solid and liquid wastes that may contain Toxic Pollutants including Persistent Organic Pollutants (POPs) especially dioxins and dioxin-like substances, as well as heavy metals and other contaminants, sewage and spent industrial wastewater due to construction and operation of the Project. Field investigation and laboratory tests shall be conducted as appropriate. An emission inventory on the quantities and characteristics of these pollution sources in the study area shall also be provided.

Impact Prediction

- (viii) Prediction and quantification, by mathematical modelling or other technique to be approved by the Director, of the impacts on the water system(s) and the sensitive receivers due to construction and operation of the Project. The mathematical modelling requirements are set out in Appendix D of this study brief. Possible impacts include change in hydrology, flow regime, sediment erosion or deposition, water and sediment quality and the effects on the aquatic organism due to such changes in the affected water bodies. The prediction shall take into account and include possible different construction stages or sequences, and different operational stages.
- (ix) Assessment of the cumulative impacts due to other related concurrent and planned projects, activities or pollution sources within a boundary around the study area to be agreed by the Director that may have a bearing on the environmental acceptability of the Project through mathematical modelling. This shall include the potential cumulative construction and operational water quality impacts arising from, inter alia, the associated works of the Project, the activities and planned projects to be approved by the Director when the

programme of the Project and associated works is confirmed during the course of the EIA study.

#### Wastewater and Non-point Sources Pollution

- (x) Assessment and quantification on the adequacy of existing and future sewerage infrastructure to treat and dispose of the wastewater identified above. In general all waste water generated shall have to meet effluent discharge standards set out in the TM stipulated under the WPCO prior to discharge.
- (xi) Assessment and quantification of all existing and future water pollutants from non-point sources and analysis on the provision and adequacy of existing and future facilities to reduce such pollution.

#### Dredging, Submarine Trenching Works, Filling and Dumping

- (xii) Identification and quantification of all dredging, submarine trenching, fill extraction, back filling, reclamation, mud/sediment transportation and disposal activities and requirements. Potential fill source and dumping ground to be involved shall also be identified. Field investigation, sampling and laboratory tests to characterize the sediment/mud concerned shall be conducted as appropriate. The potential for the release of contaminants during dredging and any other marine works shall be addressed using the chemical testing results derived from sediment and marine water samples collected on site and relevant historic data. Appropriate laboratory tests such as elutriate tests in accordance with the USACE method and sediment pore water (interstitial water) analyses shall be performed on the sediment samples to simulate and quantify the degree of mobilization of various contaminants such as metals, ammonia, nutrients, trace organic contaminants (including PCBs, PAHs, TBT and chlorinated pesticides) into the water column during dredging. The ranges of parameters to be analyzed; the number, location, depth of sediment, type and methods of sampling; sample preservation; and laboratory test methods to be used shall be subject to the approval of the Director. The Applicant shall also address the pattern of the sediment deposition and the potential increase in turbidity and suspended solid levels in the water column and at the sensitive receivers due to the disturbance of sediments during dredging and back filling, dumping and submarine trenching.
- (xiii) Prediction, quantification and assessment of impacts on the hydrodynamic regime, water and sediment quality of the water system(s) and the sensitive receivers due to the activities identified above. The prediction and quantification of impacts caused by, amongst others, sediment re-suspension and contaminants release shall be carried out by mathematical modelling (see modelling requirements set out in Appendix D of this study brief) or other techniques to be approved by the Director.
- (xiv) Recommendation of appropriate mitigation measures to avoid or minimize the impacts identified above, in particular suitable mud dredging and disposal, submarine trenching and backfilling method(s). The residual impacts on the water system(s) and the sensitive receivers with regard to the relevant water and sediment quality objective, criteria, standards or guidelines shall be

assessed and quantified by mathematical modelling as set out in Appendix D in this study brief or other techniques to be approved by the Director.

- (xv) Identification and evaluation of the best practicable dredging, submarine trenching, backfilling, marine mud disposal and reclamation methods to minimize marine mud disturbance and dumping requirements and demand for fill sources based on the criterion that existing marine mud shall be left in place and not be disturbed as far as possible.
- (xvi) Prediction and quantification of cumulative impacts due to other dredging, filling or dumping activities within a boundary around the study area to be agreed by the Director shall also be predicted and quantified.

### Mitigation

- (xvii) Proposal of effective infrastructure upgrading or provision, water pollution prevention and mitigation measures to be implemented during construction and operational stages so as to avoid and reduce the water and sediment quality impacts to within acceptable levels of standards. Requirements to be incorporated in the Project contract document shall also be proposed.
- (xviii) Best management practices to reduce storm water and non-point source pollution shall be investigated and proposed as appropriate. Attention shall be made to the water quality control and mitigation measures recommended in the Practice Note for Authorized Persons and Registered Structural Engineers on construction site drainage.
- (xix) Evaluation and quantification of residual impacts on the water system(s) and the sensitive receivers with regard to the appropriate water and sediment quality objectives, criteria, standards or guidelines using appropriate mathematical models as set out in Appendix D in this study brief or other techniques approved by the Director.

## **3.7.4 Waste Management Implications**

3.7.4.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing waste management implications as stated in Annexes 7 and 15 of the TM respectively.

3.7.4.2 The assessment of waste management implications shall cover the following:

(i) Analysis of Activities and Waste Generation

- (a) The Applicant shall identify the quantity, quality and timing of the waste arising as a result of construction and operational activities of the Project, based on the sequence and duration of these activities. The Applicant shall adopt the design, general layout, construction methods and programme that will minimize the generation of public fill/inert construction and demolition (C&D) materials and maximise the use of public fill/inert C&D materials for the reclamation works.
- (b) 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. streamlining the shoreline design; measures to improve the tidal flushing capacity; alternative seawall design to facilitate floating refuse collection; and regular collection of the floating refuse along the shoreline. 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 completion of the Project. 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.

(ii) Proposal for Waste Management

- (a) Prior to considering the disposal options for various types of wastes, opportunities for reducing waste generation, on-site or off-site re-use and recycling shall be fully evaluated. Measures that can be taken in the planning and design stages e.g. by modifying the design approach and in the construction stage for maximizing waste reduction shall be separately considered.
- (b) After considering 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 the wastes shall be described in detail. The disposal methods/options recommended for each type of wastes shall take into account the result of the assessment in item (c) below. 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 wastes identified; and
- (c) The impact caused by handling (including stockpiling, labelling, packaging & 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; and
  - public transport.

(iii) Dredging, Filling and Dumping

- (a) Identification and quantification as far as practicable of all dredging/excavation, fill extraction, filling, reclamation, sediment/mud transportation and disposal activities and requirements shall be conducted. Potential fill source and dumping ground to be involved shall also be identified. Field investigation, sampling and chemical and biological laboratory tests to characterize the sediment/mud concerned

shall be conducted as appropriate. The ranges of parameters to be analyzed; the number, type and methods of sampling; sample preservation; chemical and biological laboratory test methods to be used shall be agreed with the Director (with reference to Section 4.4.2(c) of the TM) prior to the commencement of the tests. The categories of sediment/mud which are to be disposed of in accordance with a permit granted under the Dumping at Sea Ordinance (DASO) shall be identified by both chemical and biological tests and their quantities shall be estimated. If the presence of any serious contamination of sediment/mud which requires special treatment/disposal is confirmed, the Applicant shall identify the most appropriate treatment and/or disposal arrangement and demonstrate its feasibility;

- (b) Identification and evaluation of the best practicable dredging/excavation methods, treatment methods, in-situ/ex-situ arrangements, reuse/recycling options and construction programme to minimize dredging/excavation and dumping requirements and demand for fill sources based on the criterion that existing sediment/mud shall be left in place and not to be disturbed as far as possible and the inert C&D materials shall be used to maximum practicable extent for reclamation works.

(iv) Potential Biogas Problem

Investigation of the potential biogas problem shall be conducted if there is reclamation area adopting a design of leaving sediment/mud in place (i.e. "not fully dredged" approach). The investigation, if found necessary, shall include:

- (a) a proposal on collection and analysis of representative samples at various depths or on the use of previously obtained information for the agreement of the Director;
- (b) carrying out the actual sampling and testing or review of previously obtained information as agreed by the Director; and
- (c) a proposal, with justification, on monitoring, mitigation and precautionary measures for the Project, if found necessary.

3.7.4.3 To prevent potential contamination problems during operational phase of the Project, the Applicant shall:

- (i) identify the possible sources of contamination associated with the operation of the Project; and
- (ii) formulate appropriate operational practices, waste management strategies and precautionary measures for prevention of contamination problems.

**3.7.5 Ecological Impact (Both Terrestrial and Aquatic)**

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

- 3.7.5.2 The study area for the purpose of terrestrial ecological assessment shall include all areas within 500 metres from the site boundary of the land based works areas or the area likely to be impacted by the Project. For aquatic ecology, the study area shall be the same as the water quality impact assessment as stipulated in Section 3.7.3.2 or the area likely to be impacted by the Project.
- 3.7.5.3 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 impacts on recognized sites of conservation importance and other ecological sensitive areas. The assessment shall identify and quantify as far as possible the potential ecological impacts arising from construction and operation of the Project and in combination with those cumulative impacts from the associated works of the Project, both directly by physical disturbance and indirectly by changes of water quality, sedimentation patterns and hydrodynamic regime. Details of specific requirements on the assessment of impacts on the Finless Porpoise and the Chinese White Dolphin are stipulated in Section 3.7.5.5 below.
- 3.7.5.4 The assessment shall include the following major tasks:
- (i) review and incorporate the findings of relevant previous studies/surveys and collate all available information on the ecological characters of the study area;
  - (ii) carry out necessary field surveys, the duration of which shall be at least six months (covering wet and dry seasons), and investigation to verify the information collected, fill the information gaps identified in Section 3.7.5.4(i) above and fulfill the objectives of the EIA study. The field surveys shall include, but not limited to a dive survey for coral communities;
  - (iii) present the findings of all relevant studies together with surveys carried out under this Study;
  - (iv) establish an ecological profile of the study area based on data of relevant previous studies/surveys and results of additional ecological field surveys, and describe the characteristics of each habitat found. Major information to be provided shall include:
    - (a) description of the physical environment, including all recognized sites of conservation importance and ecologically sensitive areas, and assess whether these sites will be affected by the Project or not;
    - (b) habitats maps of suitable scale (1:1000 to 1:5000) showing the types and locations of habitats in the study area;
    - (c) ecological characteristics of each habitat type such as size, vegetation type, species present, dominant species found, species diversity and abundance, community structure, seasonal patterns, inter-dependence of the habitats and species, and presence of any features of ecological importance;
    - (d) representative colour photographs of each habitat type and any important ecological features identified;
    - (e) species found that are rare, endangered and/or listed under local legislation, international conventions for conservation of wildlife/habitats or Red Data Books;
    - (f) investigate and describe the existing wildlife uses of the various habitats with special attention to those wildlife groups and habitats with

conservation interests, including but not limited to the following:

- woodlands;
- shrublands;
- natural stream courses and rivers;
- vertebrates (e.g. avifauna, mammal, fish and herpetofauna in particular *Dibamus bogadeki*);
- macroinvertebrates (e.g. aquatic macroinvertebrates, lepidoptera and odonata in particular *Cercion calamorum dyeri* and *Cercion melanotum*);
- coral communities (including all hard corals, octocorals and black corals);
- inter-tidal and sub-tidal benthic faunal communities; and
- any other habitats and wildlife groups identified as having special conservation interests by this EIA study.

(g) using suitable methodology to identify and quantify as far as possible any direct, indirect (e.g. changes in water qualities, hydrodynamics properties, sedimentation rates and patterns, hydrology), 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, habitat fragmentation; and in particular the following:

- habitat loss and disturbance to wildlife during construction stage;
- potential impacts associated with reclamation, dredging, spoil disposal, extraction and placement of fill materials during construction, and in particular to the benthic communities;
- potential impacts to the fish spawning and nursery area in the southern waters;
- deterioration of environmental quality (e.g. water quality) and the subsequent impacts to the biological communities during operational stage (e.g. impact from maintenance dredging);
- potential impacts to flora and fauna due to introduction of pest to the island during operational stage involving transportation of waste;
- potential impacts to the avifauna during operational stage due to the increase in noise, air pollution, lighting and physical barrier; and
- potential loss and disturbance to natural shoreline, inter-tidal habitats and coral communities during construction and operational stages of the Project.

(v) demonstrate that the ecological impacts due to construction and operation of the Project are avoided by design to the maximum practicable extent;

(vi) evaluate the significance and acceptability of the ecological impacts identified using well-defined criteria;

(vii) recommend all possible alternatives options (such as minimizing the footprint of the proposed development, different extension area and/or using other construction methods and sequences) and practicable mitigation measures to avoid, minimize and/or compensate for the adverse ecological impacts identified, such as :

(a) measures to recreate the natural inter-tidal and sub-tidal habitats lost;

(b) reinstatement of habitats temporarily affected by the Project to its original



state and if possible with some enhancement features; and

- (c) reducing the size of reclamation.
- (viii) evaluate the feasibility and effectiveness of the recommended mitigation measures and define the scope, type, location, implementation arrangement, subsequent management and maintenance of such measures;
- (ix) determine and quantify as far as possible 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; and
- (xi) review the need for and recommend any ecological monitoring programme required.

3.7.5.5 The assessment of impacts on Finless Porpoise (*Neophocaena phocaenoides*) and Chinese White Dolphins (*Sousa chinensis*) shall include the following tasks:

- (i) review and incorporate the findings of relevant studies including the previous Finless Porpoise and Chinese White Dolphin studies, in particular the “Monitoring of Chinese White Dolphin in Hong Kong Waters – Data Collection” commissioned by Agricultural, Fisheries and Conservation Department (AFCD), and collate all available information regarding the ecological characters of the study area;
- (ii) carry out a boat survey of at least six months covering the period from December to May (both inclusive) for the Chinese White Dolphin and Finless Porpoise in waters adjacent to Shek Kwu Chau area. The methodology of the boat survey shall be consistent with the previous related studies identified in (i) above;
- (iii) present all relevant survey findings including previous surveys conducted in relevant studies together with surveys carried out under this study;
- (iv) assess the direct and indirect impacts, including water quality changes, release of toxic contaminants from sediments and their consequential ecological effects on the Finless Porpoise and Chinese White Dolphins, during construction and operational stages of the Project. The assessment shall include:
  - (a) impacts and disturbance to the Finless Porpoise and Chinese White Dolphins associated with reclamation, dredging (including maintenance dredging), fill extraction, filling, transportation and disposal of dredged sediment;
  - (b) impacts on the Finless Porpoise and Chinese White Dolphins of the possible use of underwater blasting and underwater percussive piling during construction stage, due to shock wave and underwater noise generated;
  - (c) predicted water quality changes and consequential ecological impacts on the Finless Porpoise and Chinese White Dolphins. Parameters to be assessed should include suspended solids, dissolved oxygen and contaminants present in disturbed or dredged sediment. The significance and acceptability of the predicted changes shall be evaluated using well-defined criteria;

- (d) ecological impacts on the Finless Porpoise and Chinese White Dolphins associated with potential bioaccumulation of toxic contaminants such as POPs and heavy metals, from the disturbed or dredged sediment or other potential sources. The significance and acceptability of the predicted impacts shall be evaluated using well-defined criteria;
  - (e) potential risk on the Finless Porpoise and Chinese White Dolphins colliding with marine vessels during construction;
  - (f) change in marine traffic volume, distribution and pattern during operational stage, and the consequential increase or decrease in risk of Finless Porpoise and Chinese White Dolphins colliding with marine vessels; and
  - (g) potential risk on the Finless Porpoise and Chinese White Dolphins due to chemical spillages arising from vehicle accident during operation of the Project.
- (v) assess the overall cumulative ecological impacts on the Finless Porpoise and Chinese White Dolphins due to this Project, any associated works of the Project, and any nearby development;
  - (vi) identify precautionary and mitigatory measures for protection of the Finless Porpoise and Chinese White Dolphins. The proposed measures may include, but need not be limited to, those recommended in previous EIA studies and Finless Porpoise/Chinese White Dolphin studies;
  - (vii) review the need for and recommend any Finless Porpoise and Chinese White Dolphin monitoring programme; and
  - (viii) assess and determine the acceptability of the overall residual ecological impact on the Finless Porpoise and Chinese White Dolphin, after implementation of the precautionary and mitigatory measures as identified under Section 3.7.5.5 (vi) above.

### **3.7.6 Fisheries Impact**

- 3.7.6.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing fisheries impact as stated in Annexes 9 and 17 of the TM.
- 3.7.6.2 The study area for fisheries impact assessment shall be the same as for marine water quality impact assessment as set out in Section 3.7.3.2 above and any areas likely to be impacted by the Project. Special attention shall be given to the potential loss of fishing grounds, spawning and nursery grounds of fisheries species; adverse impacts on the Cheung Sha Wan Fish Culture Zone and other areas of fisheries importance.
- 3.7.6.3 The assessment shall cover potential impact on capture and culture fisheries during construction and operation of the Project and in combination with those cumulative impacts from associated works of the Project. Different options of the cooling system shall be assessed to minimize impacts. For any water cooling systems to be adopted, impacts associated with entrainment and impingement of marine organisms (including eggs and larvae) shall be assessed. Different options of the cooling system shall be evaluated for minimizing fisheries impacts. For any water cooling systems to be adopted, impacts associated with entrainment and impingement of marine organisms (including eggs and larvae of fisheries species) as well as adverse effect of anti-fouling agents shall be assessed.

- 3.7.6.4 Existing information regarding the study area shall be reviewed. Based on the review results, the study shall identify data gap and determine if there is any need for field surveys. If field surveys are considered necessary, the study shall recommend appropriate methodology, duration and timing for the field surveys.
- 3.7.6.5 The fisheries impact assessment shall include the following:
- (i) description of the physical environmental background;
  - (ii) description and quantification of existing capture and culture fisheries activities;
  - (iii) description and quantification of existing capture and culture fisheries resources (e.g. major fisheries products and stocks);
  - (iv) identification of parameters (e.g. water quality parameters), including any potential toxic contaminants released from the dredged sediment and areas that are important to fisheries and will be affected;
  - (v) identification and quantification any direct/indirect and on-site/off-site impacts to fisheries; and
  - (vi) evaluation of impacts and make recommendations for any environmental mitigation measures with details on justification, description of scope and programme, feasibility as well as manpower and financial implications including those related to subsequent management and maintenance requirements of the proposals.

### **3.7.7 Landscape and Visual Impact**

- 3.7.7.1 The Applicant shall follow the criteria and guidelines as stated in Annexes 10 and 18 of the TM on the preparation of Landscape and Visual Impact Assessment under the EIAO. Landscape and visual impacts during both construction and operational phases within the study area and the related works area shall be assessed.
- 3.7.7.2 The study area for the landscape impact assessment shall include all areas within a 500 metres distance from the site boundary of the works area while the assessment area for the visual impact assessment shall be defined by the visual envelope of the Project.
- 3.7.7.3 The Applicant shall review relevant outline zoning plans, outline development plans, layout plans, planning briefs and studies which may identify areas of high landscape value. Any guidelines on landscape strategies, landscape frameworks, designated view corridors, open space networks, landscape links and urban design concepts 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 so as to assess whether the Project can fit into surrounding setting. Any conflict with statutory town plan(s) and any published land use plans shall be highlighted and appropriate follow-up action shall be recommended.
- 3.7.7.4 The Applicant shall describe, appraise, analyse and evaluate the existing and planned landscape resources and character of the study area. A system shall be derived for judging landscape and visual impact significance as required under the TM. Annotated oblique aerial photographs and plans of suitable scale showing the baseline landscape character areas and landscape resources and mapping of impact assessment shall be extensively used to present the findings of impact assessment. Descriptive text shall provide a concise and reasoned judgement from a landscape

and visual point of view. The sensitivity of the landscape framework and its ability to accommodate change shall be particularly focused on. The Applicant shall identify the degree of compatibility of the Project with the existing and planned landscape settings. The landscape impact assessment shall quantify the potential landscape impact as far as possible so as to illustrate the significance of such impacts arising from the proposed development. Clear mapping of the landscape impact is required. A broad brush tree survey shall be carried out and the impacts on existing trees shall be addressed.

- 3.7.7.5 The Applicant shall assess the visual impacts of the Project. A system shall be derived for judging visual impact significance as required under the TM. Clear illustrations including mapping of visual impact are required. The assessment shall include the following:
- (i) identification and plotting of visual envelope of the Project;
  - (ii) identification of the key groups of sensitive receivers within the visual envelope with regard to views from ground level, sea level and elevated vantage points;
  - (iii) description of the visual compatibility of the Project with the surrounding, the existing and the planned setting, and its obstruction and interference with the key views within the visual envelope;
  - (iv) description of the severity of visual impacts in terms of distance, nature and number of sensitive receivers. 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
  - (v) clear evaluations and explanations of all the factors considered in arriving the significance thresholds of visual impact.
- 3.7.7.6 The Applicant shall evaluate the merits of preservation in totality, in parts or total destruction of existing landscape and the establishment of a new landscape character area if it will be affected by the Project. In addition, alternative location, site layout, design and construction methods that would avoid or reduce the identified landscape and visual impacts shall be evaluated for comparison before adopting other mitigation or compensatory measures to alleviate the impacts. The mitigation measures proposed shall not only be concerned with damage reduction but shall also include consideration of potential enhancement of existing landscape and visual quality. The Applicant shall recommend mitigation measures to minimize the adverse effects identified above, including provision of a landscape design.
- 3.7.7.7 The mitigation measures shall include preservation of vegetation and natural coastline, provision of screen planting, amenity areas and open spaces, re-vegetation of disturbed lands, compensatory planting, sensitive design of structures, colour scheme and texture of materials used and any measures to mitigate the impact on existing and planned land uses and visually sensitive receivers. Parties shall be identified for the on going management and maintenance of the proposed mitigation works to ensure their effectiveness throughout the operational phase of the Project. A practical programme and funding proposal for the implementation of the recommended measures shall be provided.
- 3.7.7.8 Annotated illustration materials such as coloured perspective drawings, plans and section/elevation diagrams, annotated oblique aerial photographs, photographs

particularly taken at vantage points and computer-generated photomontage shall be adopted to fully illustrate the landscape and visual impacts of the Project to the satisfaction of Director. The landscape and visual impacts of the Project with and without mitigation measures from representative viewpoints, particularly from views of the most severely affected visually sensitive receivers (i.e. worst case scenario), shall be properly illustrated in existing and planned setting at four stages (existing condition, Day 1 with no mitigation measures, Day 1 with mitigation measures and Year 10 with mitigation measures) by computer-generated photomontage so as to demonstrate the effectiveness of the proposed mitigation measures. Computer graphics shall be compatible with Microstation DGN file format. The Applicant shall record the technical details such as system set-up, software, data files and function in preparing the illustration that may need to be submitted for verification of the accuracy of the illustrations.

### **3.7.8 Health Impact**

- 3.7.8.1 A health risk assessment shall be conducted to assess the potential health impact associated with construction and operation of the Project. Particular attention should be paid to assess aerial emissions from the IWMF, biogas from the sorting and recycling plant, fugitive emissions during transportation, storage and handling of the waste and ash; and any other potential accidental events.
- 3.7.8.2 The health risk assessment shall include the following key steps:
- (i) a systematic identification of the risks from the handling, storage, transport and disposal (including accidental or disastrous release) of solid and liquid wastes that may contain Toxic Pollutants including POPs, especially dioxin and dioxin-like substances as incineration by-products;
  - (ii) an assessment of the likelihood and consequences of exposure to aerial emissions and solid and liquid wastes that may contain Toxic Pollutants including POPs, especially dioxin and dioxin-like substances;
  - (iii) an identification of means by which the risks could be further reduced; and
  - (iv) recommendation of all reasonably practicable measures to reduce risks during the operation of the Project.
- 3.7.8.3 The health risk assessment shall be based on established practices in countries around the world. A literature search shall be carried out to determine the best approach for the risk assessment, including any codes of practices, guidelines etc. applied locally in Hong Kong and elsewhere in the world. The approach shall be agreed by the Director prior to the commencement of assessment. For toxic air pollutants, the review list shall follow the criteria in Section 1.1(d) in Annex 4 of the TM.
- 3.7.8.4 The environmental health risk assessment on Toxic Pollutants including POPs especially dioxins and dioxin-like substances, shall include all pathways by which the Toxic Pollutants including POPs may enter the human body, including inhalation, direct dermal contact as well as consumption of food and water which may be contaminated by the Toxic Pollutants including POPs emitted from IWMF and all relevant existing, committed and planned sources.
- 3.7.8.5 It is also necessary to perform a quantitative environmental health risk assessment for the risk of exposure to and the potential impacts from the release of Toxic Pollutants including POPs, especially dioxins and dioxin-like substances, from the operation of

the Project. The assessment shall also include risk of exposure to and the potential impacts from release of Toxic Pollutants including POPs through stack emissions, as well as the handling, storage, transport and disposal of any solid or liquid wastes that may contain Toxic Pollutants including POPs during the operation of the Project. Any mitigation measures recommended should be aimed to minimize the environmental health risks from the release of Toxic Pollutants including POPs during operation of the Project.

### **3.7.9 Impact on Cultural Heritage**

3.7.9.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing the cultural heritage impacts as stated in Annexes 10 and 19 of the TM.

3.7.9.2 The cultural heritage impact assessment shall include Marine Archaeological Investigation (MAI). The Applicant shall refer to Appendix E of this EIA study brief for the detailed requirements.

#### Marine Archaeological Investigation (MAI)

The Applicant shall engage a qualified marine archaeologist to review available information to identify whether there is any possible existence of sites or objects of cultural heritage, for example shipwreck, within seabed that will be affected by the marine and dredging works of the Project. The information shall include the information as stipulated in Task 1 – Baseline Review and Task 2 – Geophysical Survey according to the Guidelines for Marine Archaeological Investigation at Appendix E of this study brief. The result of the review shall be presented as a written report and charts. If sites or objects of cultural heritage are found, a MAI is required within the said area. The MAI shall be carried out by a qualified marine archaeologist who shall obtain a Licence from the Antiquities Authority under the provision of the Antiquities and Monuments Ordinance (Cap.53).

3.7.9.3 The Applicant shall demonstrate that the disturbance, including access, to those sites of cultural heritage are avoided to the maximum practicable extent by modification of the layout and design of the Project. For those sites of cultural heritage that might still be directly and indirectly affected by the Project, the Applicant shall recommend practicable mitigation measures and monitoring to avoid or keep the adverse impacts on the site of cultural heritage to the minimum. A checklist including the affected sites of cultural heritage, impacts identified, recommended mitigation measures as well as the implementation agent and period shall also be included in the EIA report.

### **3.7.10 Summary of Environmental Outcomes**

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

### **3.7.11 Summary of Environmental Performance Comparison**

3.7.11.1 The EIA report shall contain a summary table comparing the environmental performance of the Shek Kwu Chau Site and other possible sites. The table shall compare the key design parameters (including size of reclamation, reclamation method, dredging volume, waste generation, etc); the key sensitive receivers and the environmental impacts.

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

3.7.12.1 The Applicant shall identify and justify in the EIA study whether there is any need for EM&A activities during construction and operational phases of the Project and, if affirmative, to define the scope of EM&A requirements for the Project.

3.7.12.2 Subject to confirmation of EIA findings, the Applicant shall comply with requirements as stipulated in Annex 21 of the TM. The Applicant shall also propose real-time reporting of monitoring data for the Project in the EIA study.

3.7.12.3 The Applicant shall prepare a project implementation schedule (in the form of a checklist as shown in Appendix F to this EIA study brief) containing all the EIA study recommendations and mitigation measures with reference to the implementation programme. The Project Implementation Schedule shall include the explicit agreement reached between the Applicant and relevant parties on the responsibility for implementation of mitigation measures together with the relevant legislation and guidelines. Alternatively, the Project Implementation Schedule shall include an undertaking from the Applicant to assume the responsibility of those mitigation measures until an agreement is reached between the Applicant and relevant parties on the implementation of mitigation measures.

## **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 this EIA study brief, the Applicant shall apply to the Director for a fresh EIA study brief before commencement of the EIA study.

## **5. REPORT REQUIREMENTS**

5.1 In preparing the EIA report, the Applicant shall refer to Annex 11 of the TM for the contents of an EIA report. The Applicant shall also refer to Annex 20 of the TM, which stipulates the guidelines for the review of an EIA report.

5.2 The Applicant shall supply the Director with the following number of copies of the EIA report and the executive summary:

- (i) 50 copies of the EIA report in English and 80 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 Section 5.2 (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 in English and 50 copies of the executive summary (each bilingual in both English and Chinese) with or without Addendum as required under section 7(5) of the EIAO, to be supplied upon advice by the Director for consultation with the Advisory Council on the Environment.
- 5.3 The Applicant shall, upon request, make additional copies of above documents available to the public, subject to payment by the interested parties of full costs of printing.
- 5.4 In addition, to facilitate public inspection of the EIA report via the EIAO Internet Website, the Applicant shall provide electronic copies of both the EIA report and the executive summary prepared in HyperText Markup Language (HTML) (version 4.0 or later) and in Portable Document Format (PDF version 1.3 or later), unless otherwise agreed by the Director. For the HTML version, a content page capable of providing hyperlink to each section and sub-section of the EIA report and the executive summary shall be included in the beginning of the document. Hyperlinks to all figures, drawings and tables in the EIA report and executive summary shall be provided in the main text from where the respective references are made. All graphics in the report shall be in interlaced GIF format unless otherwise agreed by the Director.
- 5.5 The electronic copies of the EIA report and the executive summary shall be submitted to the Director at the time of application for approval of the EIA report.
- 5.6 When the EIA report and the executive summary are made available for public inspection under section 7(1) of the EIAO, the content of the electronic copies of the EIA report and the executive summary must be the same as the hard copies and the Director shall be provided with the most updated electronic copies.
- 5.7 To promote environmentally friendly and efficient dissemination of information, both hardcopies and electronic copies of future EM&A reports recommended by the EIA study shall be required and their format shall be agreed by the Director.

## **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 Sections 1.2 and 1.3 of this EIA study brief and in Project Profile (No. PP- 348/2008), 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.

--- END OF EIA STUDY BRIEF ---



## Appendix B1

### Guidelines on Choice of Models and Model Parameters

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

#### **1. Introduction**

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

#### **2. Choice of Models**

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

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

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

- 2.2 Note that both FDM and CALINE4 have a height limit on elevated sources (20 m and 10m, respectively). Source of elevation above these limits will have to be modelled using the ISCST3 model or suitable alternative models. In using the latter, reference should be made to the 'Guidelines on the Use of Alternative Computer Models in Air Quality Assessment' in Appendix B3.
- 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 following 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, 5th Edition, United States Environmental Protection Agency, January 1995.*

### 3.3 Urban/Rural Classification

Emission sources may be located in a variety of settings. For modelling purposes these are 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 the land use characteristics of a study area and associated with the roughness element height. As a first approximation, the surface roughness can be estimated as 3 to 10 percent of the average height of physical structures. Typical values used for urban and new development areas are 370 cm and 100 cm, respectively.

### 3.5 Receptors

These include discrete receptors representing all 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 µm) and RSP (< 10 µm) 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 the 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 the EPD reference paper 'Guidelines on Assessing the 'TOTAL' Air Quality Impacts' in Appendix B2).

### 3.8 Odour Impact

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

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

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

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

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

### 3.9 Plume Rise Options

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

However, the 'Final Plume Rise' option may still be used for assessing the impacts of distant sources.

### 3.10 Portal Emissions

These include traffic emissions from tunnel portals and any other similar openings and are generally modelled as volume sources according to the PIARC 91 (or more up-to-date version) recommendations (Ref. 5, section III.2). For emissions arising from underpasses or any horizontal openings of the like, these are treated as area or point sources depending on the source physical dimensions. In all these situations, the ISCST3 model or more sophisticated models will have to be used instead of the CALINE4 model. In the case of portal emissions with significant horizontal exit velocity which cannot be handled by the ISCST3 model, the impacts may be estimated by the TOP model (Ref. 6) or any other suitable models subject to prior agreement with EPD. The EPD's 'Guidelines on the Use of Alternative Computer Models in Air Quality Assessment' should also be referred to in Appendix B3.

*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.*

### 3.10 Background Concentrations

Background concentrations are required to account for far-field sources which cannot be estimated by the model. These values, to be used in conjunction with model results for assessing the total impacts, should be based on long term average of monitoring data at location representative of the study site. Please make reference to the paper 'Guidelines on Assessing the 'TOTAL' Air Quality Impacts' in Appendix B2 for further information.

### 3.11 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

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

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

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

## **Appendix B2**

### **Guidelines on Assessing the 'TOTAL' Air Quality Impacts**

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

#### **1. Total Impacts - 3 Major Contributions**

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

Primary contributions:	project induced
Secondary contributions:	pollutant-emitting activities in the immediate neighbourhood
Other contributions: (Background contributions)	pollution not accounted for by the previous two

#### **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:

<b>POLLUTANT</b>	<b>URBAN</b>	<b>INDUSTRIAL</b>	<b>RURAL / NEW DEVELOPMENT</b>
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



<b>POLLUTANT</b>	<b>URBAN</b>	<b>INDUSTRIAL</b>	<b>RURAL / NEW DEVELOPMENT</b>
RSP	60	58	51

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

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

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

### 3.4 Site categories

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

<b>DISTRICT</b>	<b>AIR QUALITY CATEGORY</b>
Islands	Rural / New Development
Southern	Rural / New Development
Eastern	Urban
Wan Chai	Urban
Central & Western	Urban
Sai Kung	Rural / New Development
Kwun Tong	Industrial
Wong Tai Sin	Urban
Kowloon City	Urban
Yau Tsim	Urban
Mong Kok	Urban
Sham Shui Po	Urban
Kwai Tsing	Industrial
Sha Tin	Rural / New Development
Tsuen Wan	Industrial
Tuen Mun	Rural / New Development
Tai Po	Rural / New Development
Yuen Long	Rural / New Development
Northern	Rural / New Development

### 3.5 Provisions for 'double-counting'

The current approach is, by no means, a rigorous treatment of background air quality but aims to provide an as-realistic-as-possible approximation based on limited field data.

'Double-counting' of 'secondary contributions' may be apparent through the use of such 'monitoring-based' background data as some of the monitoring stations are of close proximity to existing emission sources. 'Primary contributions' due to a proposed project (which is yet to be realized) will not be double-counted by such an approach. In order to avoid over-estimation of background pollutant concentrations, an adjustment to the values given in Section 3.3 is possible and optional by multiplying the following factor:

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

where E stands for emission.

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

#### **4. Conclusions**

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

## **Appendix B3**

### **Guidelines on the Use of Alternative Computer Models in Air Quality Assessment**

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

#### **1. Background**

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

#### **2. Required Demonstration / Submission**

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

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

- 2.2 To provide technical details of the proposed model, the proponent should submit documents containing at least the following information:

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

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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

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

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

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

## **Appendix C1**

### **Criteria for Cultural Heritage Impact Assessment**

#### **(1) Baseline Study**

##### 1.1 A baseline study shall be conducted:

- a. to compile a comprehensive inventory of archaeological sites (including marine archaeological sites), historic buildings and structures within the proposed project area, which include:
  - (i) all sites of archaeological interest (including marine archaeological sites);
  - (ii) all pre-1950 buildings and structures;
  - (iii) selected post-1950 buildings and structures of high architectural and historical significance and interest; and
  - (iv) landscape features include sites of historical events or providing a significant historical record or a setting for buildings or monuments of architectural or archaeological importance, historic field patterns, tracks and fish ponds and cultural element such as *fung shui* woodlands and clan grave.
- b. to identify the direct and indirect impacts on the site of cultural heritage at the planning stage in order to avoid causing any negative effects. The impacts include the direct loss, destruction or disturbance of an element of cultural heritage, impact in its settings causing impinge on its character through inappropriate sitting or design, potential damage to the physical fabric of archaeological remains, historic buildings or historic landscapes through air pollution, change of ground water level, vibration, recreation pressure and ecological damage by the development. The impacts listed are merely to illustrate the range of potential impacts and not intended to be exhaustive.

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

##### 1.3. Desk-top Study

- 1.3.1 Desk-top searches should be conducted to analyse, collect and collate extant information. They include but not limited to:
  - a. Search of the list of declared monuments protected by the Antiquities and Monuments Ordinance (Chapter 53).
  - b. Search of the list of deemed monuments through the Antiquities and Monuments Office (AMO) of the Leisure and Cultural Services Department.
  - c. Search of the list of sites of cultural heritage identified by the AMO.
  - d. Search of publications on local historical, architectural, anthropological, archaeological and other cultural studies, such as, Journals of the Royal Asiatic Society (Hong Kong Branch), Journals of the Hong Kong Archaeological society, Antiquities and Monuments Office Monograph Series and so forth.
  - e. Search of other unpublished papers, records, archival and historical documents through public libraries, archives, and the tertiary institutions, such as the

Hong Kong Collection and libraries of the Department of Architecture of the University of Hong Kong and the Chinese University of Hong Kong, Public Records Office, photographic library of the Information Services Department and so forth.

- f. Search of any other unpublished archaeological investigation and excavation reports kept by the AMO.
- g. Search of historical documents in the Public Records Office, the Land Registry, District Lands Office, District Office and the Hong Kong Museum of History and so forth.
- h. Search of cartographic and pictorial documents. Old and recent maps and aerial photos searched in the Maps and Aerial Photo Library of the Lands Department.
- i. Study of existing geological information (for archaeological desk-top research).
- j. Discussion with local informants.

#### 1.4 Field Evaluation

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

#### 1.4.2 Historic buildings and structures survey

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

#### 1.4.3 Archaeological Survey

- a. A licence shall be obtained from the Antiquities Authority for conducting an archaeological survey. It takes at least two months to process the application.
- b. A detailed archaeological survey programme should be designed to assess the archaeological potential of the project area. The programme should clearly elaborate the strategy and methodology adopted, including what particular question(s) can be resolved, how the archaeological data will be collected and recorded, how the evidence will be analyzed and interpreted and how the archaeological finds and results will be organized and made available. Effective field techniques should also be demonstrated in the programme. The

programme should be submitted to the Antiquities and Monuments Office for agreement prior to applying for a licence.

- c. The following methods of archaeological survey (but not limited to) should be applied to assess the archaeological potential of the project area:
  - (i) Definition of areas of natural land undisturbed in the recent past.
  - (ii) Field scan of the natural land undisturbed in the recent past in detail with special attention paid to areas of exposed soil which were searched for artifacts.
  - (iii) Conduct systematic auger survey and test pitting. The data collected from auger survey and test pitting should be able to establish the horizontal spread of cultural materials deposits.
  - (iv) Excavation of test pits to establish the vertical sequence of cultural materials. The hand digging of 1 x 1 m or 1.5 x 1.5 m test pits to determine the presence or absence of deeper archaeological deposits and their cultural history.
  - (v) The quantity and location of auger holes and test pits should be agreed with the AMO prior to applying for a licence.
  - (vi) A qualified land surveyor should be engaged to record reduced levels and coordinates as well as setting base points and reference lines in the course of the field survey.

1.4.4 If the field evaluation identifies any additional sites of cultural heritage within the study area which are of potential historic or archaeological importance and not recorded by the AMO, the office should be reported as soon as possible.

## 1.5 The Report of Baseline Study

1.5.1 The study report should have concrete evidence to show that the process of the above desk-top and field survey has been satisfactorily completed. This should take the form of a detailed inventory of the sites of cultural heritage supported by full description of their cultural significance. The description should contain detailed geographical, historical, archaeological, architectural, anthropological, ethnographic and other cultural data supplemented with illustrations below and photographic and cartographic records.

### 1.5.2 Historic Buildings and Structures

- a. A map in 1:1000 scale showing the boundary of each historic building or structure.
- b. Photographic records of each historic building or structure.
- c. Detailed record of each historic building or structure including its construction year, previous and present uses, architectural characteristics, as well as legends, historic persons and events, and cultural activities associated with the structure.

### 1.5.3 Archaeological Sites

- a. A map showing the boundary of each archaeological site as supported and delineated by field walking, augering and test-pitting;



- b. Drawing of stratigraphic section of test-pits excavated which shows the cultural sequence of a site.
- c. Reduced levels, coordinates, base points and reference lines should be clearly defined and certified by a qualified land surveyor.
- d. *Guidelines for Archaeological Reports* should be followed (Appendix C2).

1.5.4 A full bibliography and the source of information consulted should be provided to assist the evaluation of the quality of the evidence. To facilitate verification of the accuracy, the AMO will reserve the right to examine the full details of the research materials collected under the baseline study.

## 1.6 Finds and Archives

1.6.1 Archaeological finds and archives should be handled following *Guidelines for Handling of Archaeological Finds and Archives* (Appendix C3).

## (2) Impact Assessment

2.1 Culture heritage impact assessment must be undertaken to identify the impacts of the sites of cultural heritage which will be affected by the proposed development subject to the result of desktop research and field evaluation. The prediction of impacts and an evaluation of their significance must be undertaken by an expert in cultural heritage. During the assessment, both the direct impacts such as loss or damage of important features as well as indirect impacts such as change of ground water level which may affect the preservation of the archaeological and built heritage in situ should be stated. A detailed description and plans should be provided to elaborate to what extent the site of cultural heritage will be affected.

2.2 Preservation in totality must be taken as the first priority. Please refer to paragraph 4.3.1(c), item 2 of Annex 10, items 2.6 to 2.9 of Annex 19 and other relevant parts of the Technical Memorandum on Environmental Impact Assessment Process for the detailed requirements of the impact assessment.

## (3) Mitigation Measures

3.1 It is always a good practice to recognise the site or monument early in the planning stage and site selection process, and to avoid it, i.e. preserve it in-situ, or leaving a buffer zone around the site. Built heritage, sites and landscapes are to be in favour of preservation unless it can be shown that there is a need for a particular development which is of paramount importance and outweighs the significance of the heritage feature.

3.2 If avoidance of the cultural heritage is not possible, amelioration can be achieved by reduction of the potential impacts and the preservation of heritage features, such as physically relocating it. Measures like amendments of the sitting, screening and revision of the detailed design of the development are required to lessen its degree of exposure if it causes visual intrusion to the cultural heritage and affecting its character.

3.3 All the assessments should be conducted by an expert in cultural heritage and further evaluated and endorsed by the AMO and the Antiquities Advisory Board.

3.4 Please refer to paragraph 4.3.1(d), items 2.10 to 2.14 of Annex 19 and other relevant parts of the Technical Memorandum. Proposals for mitigation measures should be

accompanied with a master layout plan together with all detailed treatment, elevations, and landscape plan. A rescue programme, when required, may involve preservation of the historic building or structure together with the relics inside, and its historic environment through relocation, detailed cartographic and photographic survey or preservation of an archaeological site “by record”, i.e. through excavation to extract the maximum data as the very last resort.

- 3.5 The programme for implementation of agreed mitigation measures should be able to be implemented. It is to be clearly stated in the EIA report, as required in Annex 20 of the Technical Memorandum. In particular, item 6.7 of Annex 20 requires to define and list out clearly the proposed mitigation measures to be implemented, by whom, when, where, to what requirements and the various implementation responsibilities. A comprehensive plan and programme for the protection and conservation of the partially preserved Site of Cultural Heritage, if any, during the planning and design stage of the proposed project must be detailed.

## Appendix C2

### Guidelines for Archaeological Reports

#### **I. General**

1. All reports should be written in a clear, concise and logical style.
2. The reports should be submitted in A4 size and accompanying drawings of convenient sizes.
3. Draft reports should be submitted to the Antiquities and Monuments Office (AMO) for comments within two months after completion of archaeological work unless otherwise approved by AMO.
4. The draft reports should be revised as required by AMO and relevant parties. The revised reports should be submitted to AMO within three weeks after receiving comments from AMO and relevant parties.
5. At least 3 hard copies of the final reports should be submitted to AMO for record purpose.
6. At least 2 digital copies of the final reports in both Microsoft Word format and Acrobat (.PDF) format without loss of data and change of appearance compared with the corresponding hard copy should be submitted to AMO. The digital copies should be saved in a convenient medium, such as compact discs with clear label on the surface and kept in protective pockets.

#### **II. Suggested Format of Reports**

1. Front page:
  - Project/Site name
  - Nature of the report  
e.g. (Draft/Final)  
Archaeological Investigation/Survey Report  
Archaeological Impact Assessment Report  
Watching Brief Report  
Rescue Excavation Report  
Post-excavation Report
  - Organization
  - Date of report
2. Contents list  
Page number of each section should be given.
3. Non-technical summary (both in English and Chinese with not less than 300 words each)  
This should outline in plain, non-technical language, the principal reasons for the archaeological work, its aims and main results, and should include reference to authorship and commissioning body.
4. Introduction  
This should set out background leading to the commission of the reports. The location, area, scope and date of conducting the archaeological work must be given. The location of archaeological work should be shown on maps in appropriate scales and with proper legends.

5. Aims of archaeological work  
These should reflect the aims set in the project design.
6. Archaeological, historical, geological and topographical background of the site  
Supporting aerial photos and maps (both old and present) in appropriate scales, with proper legends and with the site locations clearly marked on should be provided.
7. Methodology  
The methods used including any variation to the agreed project design should be set out clearly and explained as appropriate.
8. Result  
This should outline the findings, known and potential archaeological interests by period and/or type. Their significance and value with reference/inclusion of supporting evidence should be indicated. For impact assessment, the likely effect of the proposed development on the known or potential archaeological resource should be outlined.
9. Conclusion  
This should include summarization and interpretation of the result.
10. Recommendation  
Recommendations on further work and the responsible party as well as a brief planning framework should be outlined.
11. Reference and bibliography  
A list of all primary and secondary sources used should be given. Director and members of the archaeological team and author of the report should be listed.
12. Supporting illustrations  
They should be clearly numbered and easily referenced to the text. They should be scanned and saved in TIFF or JPEG formats.
  - A. Maps  
Archaeological work locations, such as auger hole and test pit locations (with relevant coordinates certified by a qualified surveyor), should be clearly shown on maps in appropriate scales, with proper legends, grid references (in 8 digits) and captions.
  - B. Drawings of test pits, archaeological features and finds  
The below scales should be followed:

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

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

C. Photos of site and finds

All photos should be at least in 3R size with proper captions and scales. They should be clearly numbered and easily referenced to the text. They should be scanned and saved in TIFF or JPEG formats.

13. Supporting data in appendices

These should consist of essential technical details to support the result. These may include stratigraphy record of test pits and auger holes, record of general and special finds discovered with description, quantity and context number/stratigraphical sequence, index of field archives.

14. Comment and Response

All comments and responses from AMO and relevant parties should be attached.

### **III. Green Measures**

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

## **Appendix C3**

### **Guidelines for Handling of Archaeological Finds and Archives**

#### **I. General**

##### 1. Site Code

The Licensee should contact the Central Archaeological Repository (CAR) of the Antiquities and Monuments Office (AMO) [Contact Person: Mr. Michael TANG, Tel: 2384 5446; Email: mkstang@lcsd.gov.hk] about the allocation of site code before the commencement of the project to avoid duplicate of site code assignment.

#### **II. Archaeological Finds**

##### 2. Cleaning

Every excavated finds should be properly cleaned before handing over to the CAR of the AMO.

##### 3. Marking

- All the excavated finds should be cleaned before marking object number.
- “Sandwich” technique<sup>1</sup> should be adopted for marking permanent identification number on an object.
- Every special finds should be marked with site code, context number and object number, etc.
- All representative samples collected from general finds should be marked.
- For the finds which is too small, has unstable surface, or leather, textiles or wood, it should not be marked/labeled directly and should be bagged separately or attached with tags by tying. The tag should contain information about the object number, context number and site code, etc.

##### 4. Labeling and bagging

- A label should be attached on each bag.
- Information about the object number, context number, test-pit number, site code and bag number should be stated clearly on the label.
- Finds excavated within the same context should be bagged together.

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#### <sup>1</sup> *Steps for “Sandwich” technique*

1. First of all, the object should be marked in appropriate area and size that does not impact important diagnostic or aesthetic parts of the object.
2. Clean the area to be marked.
3. Apply a thin coat of clear reversible lacquer on the area. Use white lacquer if the object is dark in colour. Let the base coat dry completely.
4. Use a permanent water-based ink to write the object number on top of the base coat. Let ink dry completely.
5. Apply a top coat of clear varnish.
6. Let the marking dry completely before packing.

However, if they have been categorized according to their types, materials or characteristics, separate bagging is required.

5. Conservation
  - To refit and reconstruct pottery vessels by appropriate adhesive. A heat and waterproof adhesive, e.g. product of H. Marcel Guest Ltd., is recommended.
  - Any adhesives which are not reversible or will damage artefacts, e.g. the pottery vessel should not be applied on the finds.
6. Finds register

A clear finds register with information about the finds description, quantity, form, weight, dimensions and field data should be prepared for handover to the CAR.

### **III. Field Archives and Laboratory Records**

7. Field archives include field dairy, context recording sheet, special finds recording sheet, soil sample/sample recording sheet, map, survey sheet and video/visual records etc. Laboratory records also form part of the archaeological archives, which include finds processing record, conservation record, finds drawings and photos, records of typological analysis and objects card etc.
8. All the aforesaid archives should be handed over to the CAR after the compilation of the excavation report. Attention should be drawn to the following:
  - All the field archives should be submitted together with their indexes.
  - The video footage should be submitted together with a detailed script introducing the content of the video record.
  - All the slides, colour/black & white negatives and digital photographs should be submitted together with their contact prints and indexes.

#### ***Handover of Finds***

9. Packing
  - Every special finds should be protected with tissue paper, bubble sheet or P.E. foam with shock-proofed packing. No packing material other than the aforesaid items should be used.
  - All the general finds should be stored in heavy duty plastic container with shock-proofed packing.
  - The heavy duty plastic container, e.g. product of the Star Industrial Co., Ltd. (No. 1849 or 1852), is recommended.
  - For oversized finds, prior advice on packing method should be sought from the AMO.
10. Handover procedure
  - The Licensee should arrange to transport the finds and archives to the CAR upon the completion of the finalized excavation report.
  - Separate handover forms for finds and archives should be signed by the representatives of the Licensee and the AMO.

**Appendix D**

**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 & Validation

1. The models shall be properly calibrated and validated before its use in this study in the Hong Kong waters, the Pearl Estuary and the Dangan (Lema) Channel, with the field data collected by:
  - Hydraulic and Water Quality Studies in Victoria Harbour (1987)
  - Port and Airport Development Strategy - Enhancement of WAHMO Mathematical Models (1990)
  - Strategic Sewage Disposal Scheme Stage II - Oceanic Outfall, Oceanographic Surveys and Modelling (1992)
  - Update on Cumulative Water Quality and Hydrological Effect of Coastal Developments and Upgrading of Assessment Tool (1998)
  - Environmental Protection Department (EPD)'s routine monitoring data
  - Tidal data from Hong Kong Observatory, Macau and relevant Mainland Authorities
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:

<u>Criteria</u>	<u>Level of fitness with field data</u>
• tidal elevation (rms)	< 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

### 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 would not be affected by the waterway and the proposed disposal ground. 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 phases 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, 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. Water quality module shall run for a complete year incorporating monthly variations in

Pearl River discharges, solar radiation, water temperature and wind velocity in the operational stage. Construction stage impacts, cooling water discharge and floating refuse and debris entrapment may be assessed by simulating typical spring-neap cycles in the dry and wet seasons.

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 E****Guidelines for Marine Archaeological Investigation (MAI)**

The standard practice for MAI should consist of four separate tasks, i.e. (1) Baseline Review, (2) Geophysical Survey, (3) Establishing Archaeological Potential and (4) Remote Operated Vehicle (ROV)/Visual Diver Survey/Watching Brief.

**(1) Baseline Review**

- 1.1 A baseline review should be conducted to collate the existing information in order to identify the potential for archaeological resources and, if identified, their likely character, extent, quality and value.
- 1.2 The baseline review will focus on known sources of archive data. It will include:
  - a. Geotechnical Engineering Office (GEO) – the Department holds extensive seabed survey data collected from previous geological research.
  - b. Marine Department, Hydrographic Office - the Department holds a substantial archive of hydrographic data and charts.
  - c. The Royal Naval Hydrographic Department in the UK - the Department maintains an archive of all survey data collected by naval hydrographers.
- 1.3 The above data sources will provide historical records and more detailed geological analysis of submarine features which may have been subsequently masked by more recent sediment deposits and accumulated debris.

**(2) Geophysical Survey**

- 2.1 Extensive geophysical survey of the study area should deploy high resolution boomer, side scan sonar, an echo sounder and high resolution multi beam sonar. The multi beam data must be presented as processed digital terrain models to facilitate the archaeological analysis. The data received from the survey would be analysed in detail to provide:
  - a. Exact definition of the areas of greatest archaeological potential.
  - b. Assessment of the depth and nature of the seabed sediments to define which areas consist of suitable material to bury and preserve archaeological material.
  - c. Detailed examination of the boomer and side scan sonar records to map anomalies in and on the seabed which may be archaeological material.
  - d. Detailed examination of the multi beam sonar data to assess the archaeological potential of the sonar contacts.

**(3) Establishing Archaeological Potential**

- 3.1 The data examined during Tasks 1 and 2 will be analysed to provide an indication of the likely character and extent of archaeological resources within the study area. This would facilitate formulation of a strategy for investigation.

- 3.2 The results would be presented as a written report and charts. If there is no indication of archaeological material there would be no need for further work.
- 3.3 Charts should be presented at 1:500 scale and show each survey contact. Its dimensions and exact location should also be shown.

**(4) Remote Operated Vehicle (ROV)/Visual Diver Survey/Watching Brief**

- 4.1 Subject to the outcome of Tasks 1, 2 and 3, accepted marine archaeological practice would be to plan a field evaluation programme to acquire more detailed data on areas identified as having archaeological potential. The areas of archaeological interest can be inspected by ROV or divers. ROV or a team of divers with both still and video cameras would be used to record all seabed features of archaeological interest.
- 4.2 Owing to the heavy marine traffic in Hong Kong, the ROV/visual diver survey may not be feasible to achieve the target. If that is the case, an archaeological watching brief is the most appropriate way to monitor the dredging operations in areas of identified high potential to obtain physical archaeological information.
- 4.3 A sampling strategy for an archaeological watching brief would be prepared based on the results of Tasks 1, 2 and 3 to focus work on the areas of greatest archaeological potential. Careful monitoring of the dredging operations would enable immediate identification and salvage of archaeological material. If archaeological material is found, the AMO should be contacted immediately to seek guidance on its significance and appropriate mitigation measures would be prepared.
- 4.4 If Task 4 is undertaken, the results would be presented in a written report with charts.

**Report**

Three copies of the final report should be submitted to the AMO for record.

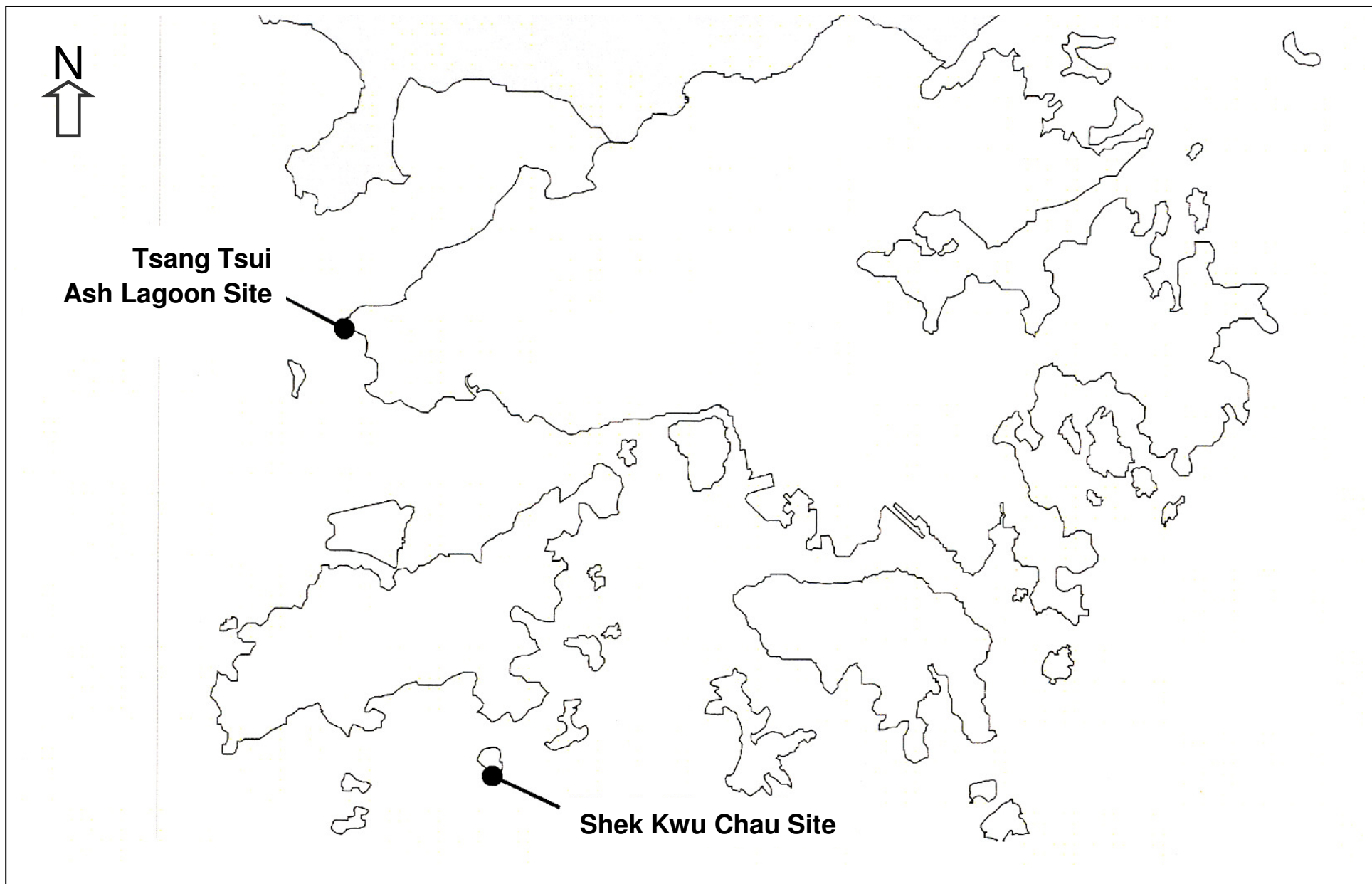
**Appendix F**

**IMPLEMENTATION SCHEDULE**

EIA* Ref.	EM&A Log Ref.	Environmental Protection Measures*	Implementation Agent	Implementation Stage **				Relevant Legislation & Guidelines
				Des	C	O	Dec	

\* All recommendations and requirements resulted during the course of EIA Process, including ACE and/or accepted public comment to the proposed project.

\*\* Des=Design; C=Construction; O=Operation; Dec=Decommissioning



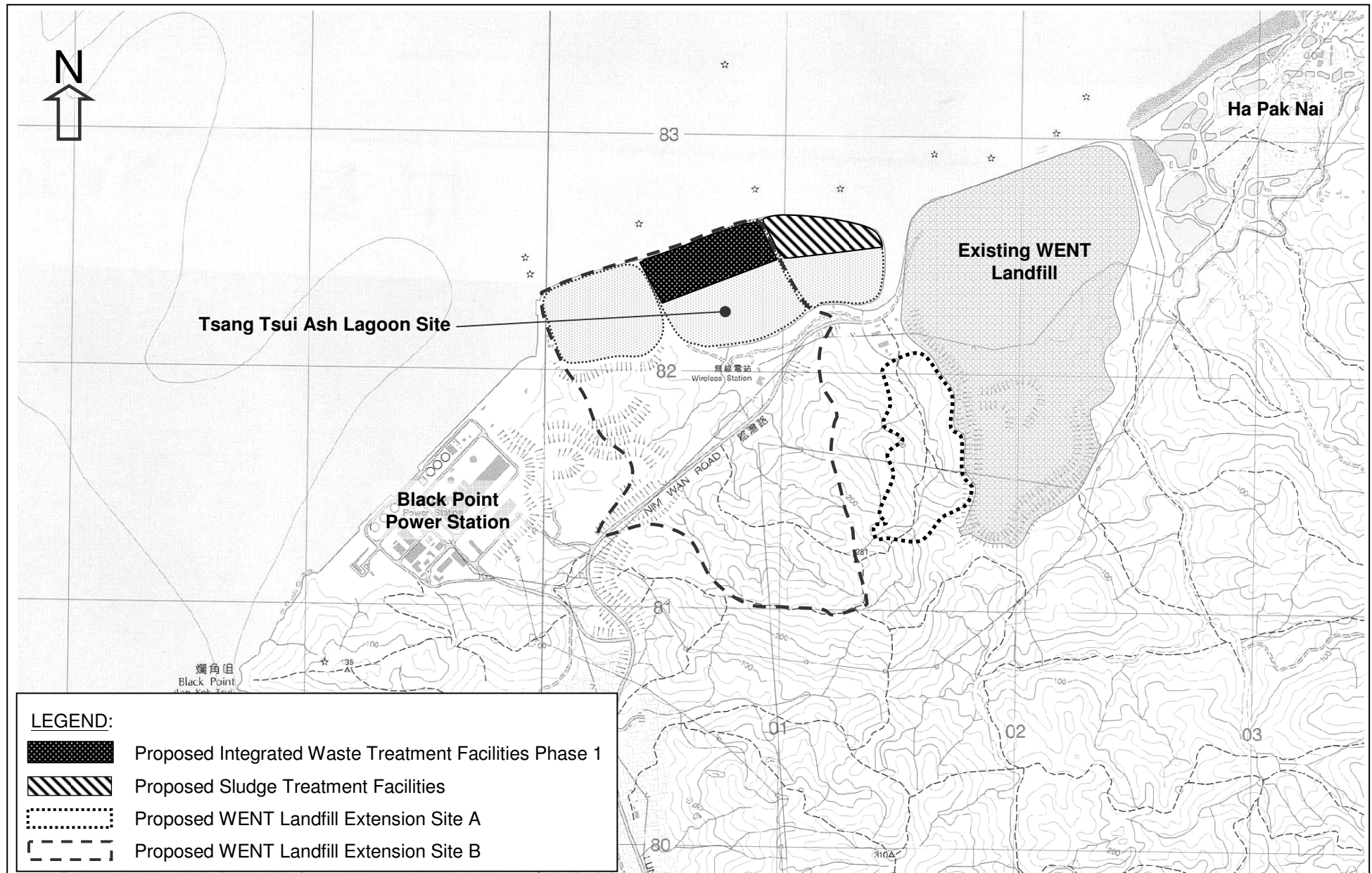
Development of the Integrated Waste Management Facilities Phase 1 –  
Locations of Two Potential Sites

EIA Study Brief No.: EIA-184/2008

Appendix A

Figure 1





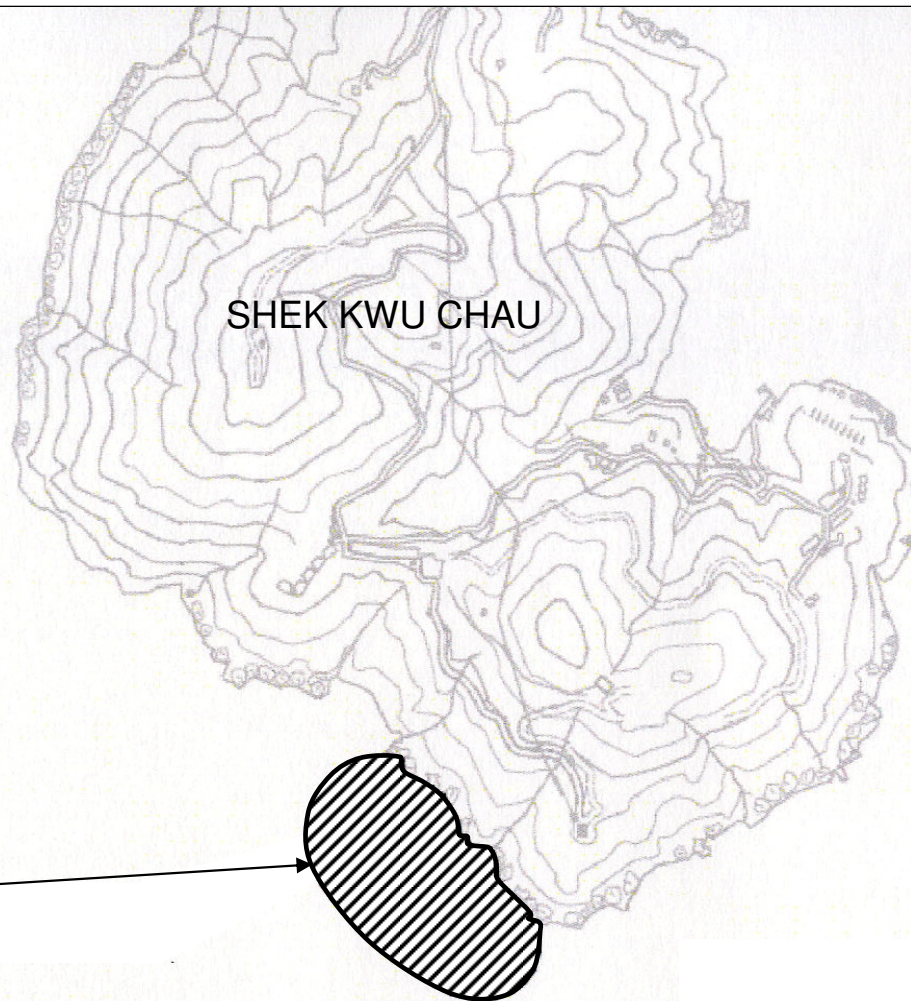
Development of the Integrated Waste Management Facilities Phase 1 –  
Tsang Tsui Ash Lagoon Site

EIA Study Brief No.: EIA-184/2008

Appendix A

Figure 2





Shek Kwu Chau Site

