

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

Environmental Impact Assessment Study Brief No. ESB-208/2009

Project Title : Black Point Gas Supply Project
(hereinafter known as the "Project")

Name of Applicant : Castle Peak Power Company Limited
(hereinafter known as the "Applicant")

1. BACKGROUND

- 1.1 An application (No. ESB-208/2009) 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 23 June 2009 with a Project Profile (No. PP-388/2009) (the Project Profile).
- 1.2 The Project will involve the construction and operation of two submarine natural gas pipelines within the Hong Kong waters for connecting Black Point Power Station (BPPS) with gas export facilities on the mainland. Two Gas Receiving Stations (GRSs) will be constructed and operated at the BPPS. The gas from the two GRSs will connect with BPPS via a short onshore pipeline within the boundaries of the BPPS.
- 1.3 The proposed GRSs will be built on newly reclaimed land to the north of Black Point Power Station (BPPS), with a land footprint of about 2 hectares (ha) and a seabed footprint of less than 4.5 ha. Dredging, seawall construction and sand-filling works will be involved for land formation.
- 1.4 The layout plan for the proposed Project facilities, namely the GRSs and the two submarine gas pipelines, are presented in Appendix A.
- 1.5 The following elements of the Project addressed in this Project Profile are classified as Designated Projects under the Environmental Impact Assessment Ordinance (Cap. 499) (EIAO):
 - *"Installation of submarine gas pipelines connecting the proposed Gas Receiving Stations at the Black Point Power Station (BPPS) and gas export facilities on the mainland, (Item H.2 of Part I of Schedule 2 of EIAO)"*
 - *"A dredging operation exceeding 500,000 m³ for the reclamation and pipeline trenches, (Item C.12 of Part I of Schedule 2 of EIAO)"*
- 1.6 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.
- 1.7 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 wherever practicable; 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 the types of Designated Projects under Part I Schedule 2 of the EIAO to be covered in the Project;
- iii. to identify and describe the elements of the community and environment likely to be affected by the Project,
- iv. to review and to ascertain whether the findings and recommendations of relevant approved EIA reports have adequately addressed the environmental impacts arising from this Project; and where necessary, to identify and carry out the assessment on the outstanding issues that need to be addressed in this EIA study;
- v. to identify and quantify all environmental receivers, emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;
- vi. to identify and quantify any potential losses or damage to natural habitats and to propose measures to mitigate these impacts;
- vii. to identify any marine ecological impacts on intertidal and subtidal habitats and species and to propose measures to mitigate these impacts;
- viii. to identify any negative impacts on Chinese White Dolphin 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 any negative impacts on sites of cultural heritage and to propose measures to mitigate these impacts;
- xii. to propose the provision of infrastructure or mitigation measures to minimize pollution, environmental disturbance and nuisance during construction and operation of the Project;
- xiii. to investigate the feasibility, practicability, effectiveness and implications of the proposed mitigation measures;
- xiv. to identify, predict and evaluate the residual environmental impacts (i.e. after practicable mitigation) and the cumulative effects expected to arise during the construction and operation phases of the Project in relation to the sensitive receivers and potential affected uses;
- xv. to identify, assess and specify methods, measures and standards, to be included in

- the detailed design, construction and operation of the Project which are necessary to mitigate these environmental impacts and cumulative effects and reduce them to acceptable levels;
- xvi. 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;
- xvii. 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 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 met.

3.2 The Scope

The scope of this EIA study shall cover the Project scope proposed in the Project Profile and shall include the relevant works and facilities mentioned in Section 1 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.

- i) the potential water quality impact caused by dredging, reclamation, pipeline laying 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;
- ii) The potential marine ecological impacts arising from dredging, reclamation, pipeline laying and any other marine works of the project to the marine ecological sensitive receivers including but not limited to the intertidal and subtidal habitats, benthic communities, hard corals, octocorals and black corals;
- iii) the potential impact to the ecological sensitive areas, including the vicinity of the Project which are frequented by the Chinese White Dolphins;
- iv) The potential ecological impacts arising from the construction and operation of the Project, including loss of habitats and pollution, if any, caused by run-off;
- v) The potential fisheries impacts during the construction and operation of the Project, including the potential loss of fishing grounds, spawning and nursery grounds of fish and shrimp;
- vi) The potential noise and air pollution impacts to sensitive receivers during the construction and operation of the Project;

- vii) The potential landscape and visual impacts caused by reclamation, GRSs and associated facilities on existing and planned sensitive receivers, during operation of the Project;
- viii) The potential impacts of various types of wastes to be generated from the construction and operation of the Project, in particular the dredged sediment;
- ix) The potential waste management issue associated with the use of filling materials such as marine sand and inert construction and demolition material (C&DM) for reclamation during construction of the Project;
- x) The potential hazard to life on the general public and the workers of the Project due to the natural gas transfer and the operation of the GRSs within HKSAR;
- 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, and those impacts may have a bearing on the environmental acceptability of the Project. Consideration shall be given to account for the impacts from likely concurrent projects; and
- xii) The potential impact on site of cultural heritage during the construction of the Project.

3.3 Consideration of Alternative

3.3.1 Consideration of Alternative Construction Methods and Sequence of Works

Having regard to the cumulative effects of the construction period and the severity of the construction impacts to the affected sensitive receivers, the EIA study shall explore alternative construction methods and sequences of works for the Project (including various construction methods for the pipeline installation), 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 with a view to recommending the preferred option to avoid adverse on-site and off-site environmental impact to the maximum practicable extent. In this principle, the Applicant shall reduce the extent of seabed reclamation to the maximum practicable extent and provide the detailed explanation in the EIA report. Similarly, the Applicant shall also explore sharing the administration buildings and associated facilities (if any) with those of the existing BPPS to minimize seabed reclamation, and provide such details in the EIA report.

3.4 Technical Requirements

The Applicant shall conduct the EIA study to address the environmental aspects as described in Sections 3.1, 3.2 and 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 assess the cumulative environmental impacts from the Project with other interacting projects. The Applicant shall include in the EIA report details of the construction programme and methodologies.

The Applicant shall review the validity of the findings and recommendations in the previous approved EIA report(s), such as the approved EIA report no. (EIA 125/2006) *Liquefied Natural Gas Receiving Terminal and Associated Facilities*, prior to carry out assessment in this EIA Study. Taking on board the findings and recommendations of previous approved EIA report, the Applicant shall conduct supplementary assessment in this EIA Study, if

necessary, in order to fulfil the following technical requirements:

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 for evaluating and assessing the air quality impact due to the construction and operation of the Project, as stipulated in Sections 1.2 and 1.3 above. The Applicant shall follow the criteria and guidelines for evaluating and assessing air quality impact as stated in section 1 of Annex 4 and Annex 12 of the TM respectively. The assessment shall be based on the best available information at the time of the assessment.

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 emission sources such as power station and large industrial establishment that may have a bearing on the environmental acceptability of the Project.

3.4.1.3 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 constructional and operational stages.
- b) Present background air quality levels in the assessment area for the purpose of evaluating cumulative constructional and operational air quality impacts.
- c) Consider alternative construction methods/phasing programmes and alternative modes of operation to minimize the constructional 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 landuse plans. 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.
- (b) Provide a list of air pollutant emission sources, which are to have impact related to the Project based on the analysis of constructional and operational activities in Section 3.4.1.3(i) above. Examples of construction stage emission sources include odour emission arising from dredging works and emission of dust from construction activities. Besides, if the likely concurrent projects are identified relevant, their possible emissions shall also be taken into account in the air quality impact assessment. Confirmation of validity of the assumptions and

magnitude of the activities (e.g. volume of construction material handled) shall be obtained from the relevant government departments/authorities and documented.

(iii) Constructional Phase Air Quality Impact

- a) The Applicant shall follow the requirements stipulated under the Air Pollution Control (Construction Dust) Regulation to ensure that construction dust impacts 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 constructional phase shall be devised to verify the effectiveness of the control measures and to ensure that the construction dust levels be brought under proper control.
- b) If the Applicant anticipates that the Project will give rise to significant construction dust impacts likely to exceed the recommended limits in the TM at the ASRs despite the incorporation of the dust control measures proposed in accordance with Section 3.4.1.3(iii)(a) above, a quantitative assessment shall be carried out to evaluate construction dust impact at the identified ASRs. The Applicant shall follow the methodology set out in Section 3.4.1.3(v) below when carrying out the quantitative assessment.

(iv) Operational Phase Air Quality Impact

The Applicant shall assess the expected air pollutant impacts at the identified ASRs based on an assumed reasonably worst-case scenario under normal operating conditions. If the assessment indicates likely exceedances of the recommended limits in the TM at the nearby ASRs, a quantitative impact evaluation following the methodology in Section 3.4.1.3 (v) shall be carried out.

(v) Quantitative Assessment Methodology

- (a) The Applicant shall apply the general principles enunciated in the modelling guidelines in Appendices B-1 to B-3 while making allowance for the specific characteristics of the Project. This 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 and the averaging time concentrations) 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 cumulative air quality impact at the ASRs identified under Section 3.4.1.3(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 landuse implications. Plans of a suitable scale should be used to present pollution contour to allow proper determination of buffer distance requirements.

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

(vii) Submission of Model Files

All 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 noise impact assessment shall include all areas within 300m from the project boundary.

Provision of Background Information

The Applicant shall provide all background information relevant to the project including relevant previous and current studies. Unless involved in the planning standards, no existing noise levels are particularly required.

ii) Identification of Noise Sensitive Receivers

a) The Applicant shall refer to Annex 13 of the TM when identifying the noise sensitive receivers (NSRs). The NSRs shall include all existing ones and all planned or committed noise sensitive developments and uses earmarked on the relevant Outline Zoning Plans, Outline Development Plans, Layout Plans and other relevant published land use plans.

b) 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.

iii) Provision of an Emission Inventory of the Noise Sources

The Applicant shall provide an inventory of noise sources including construction equipment for construction noise assessment; fixed plant equipment for operational noise assessment. Confirmation of the validity of the inventory shall be obtained from the relevant government departments/authorities and documented.

iv) Construction Noise Assessment

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

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 the North Western, North Western Supplementary, Deep Bay 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 stream courses and the associated water system, existing and new drainage system, wetland, 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.

3.4.3.3 The Applicant shall identify and analyse all physical, chemical and biological disruptions of marine, estuarine, fresh water, ground water system(s) and the associated catchment area(s) arising during the construction and operation of the Project.

3.4.3.4 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 reclamation;
- ii) Dredging of marine sediment for the construction and maintenance of submarine natural gas pipelines and associated GRSSs;
- iii) Impacts arising from the laying, submarine trenching (such as, but not limited to, by means of dredging, ploughing and jetting), testing and commissioning, operation and maintenance of submarine gas pipelines;
- iv) Cumulative impact from any concurrent project, which may result in adverse water quality impact to the sensitive receivers.

3.4.3.5 Essentially the assessment shall address the following:

- 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 and standards for the water system(s) and all the sensitive receivers.
- v) Identification of any change of shoreline or bathometry, change of flow regimes.
- vi) Review the specific construction methods and configurations of the Project, such as, but are not limited to, the reclamation sides and configuration; the submarine natural gas pipelines alignment and its laying and submarine trenching method.
- 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, sewage and spent hydrostatic testing effluent. Field investigation and laboratory tests shall be conducted as appropriate. Establishment and provision of an emission inventory on the quantities and characteristics of all these pollution sources.

Impact Prediction

- viii) Prediction and quantification, by mathematical modelling or other technique to be approved by EPD, of the impacts on the water system(s) and the sensitive receivers due to the construction and operation of the Project. The mathematical modeling

requirements are set out in Appendix C 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 operation 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.

Dredging, Submarine Trenching Works, Filling and Dumping

- x) 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 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 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.
- xi) 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 modeling (see modeling requirements set out in Appendix C of this Study Brief) or other techniques to be approved by the Director.
- xii) 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 modeling as set out in Appendix C in this Study Brief

or other techniques to be approved by the Director.

- xiii) 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.
- xiv) 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

- xv) Proposal of effective infrastructure upgrading or provision, water pollution prevention and mitigation measures to be implemented during the 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.
- xvi) 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.
- xvii) 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 C in this Study Brief or other techniques approved by the Director.

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 the construction and operation 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 to minimize the generation of wastes (including public fill/inert construction and demolition (C&D) materials and dredged/excavated sediment/mud) and maximise the use of public fill/inert C&DM for the reclamation and 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 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 reuse/disposal of wastes shall be addressed in detail and appropriate mitigation measures shall be proposed. This assessment shall cover the following areas :
 - potential hazard;
 - air and odour emissions;
 - noise;
 - wastewater discharge;
 - public transport; and
 - landscape and visual impacts, if any.

(iii) Dredging/Excavation, 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. The Applicant shall provide supporting document, such as agreement by the relevant facilities management authorities, to demonstrate the viability of any treatment/disposal plan; and

- b) Identification and evaluation of the best practicable construction 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.

3.4.5 Ecological Impact (Aquatic)

- 3.4.5.1 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 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 The assessment shall identify and quantify as far as possible the potential ecological impacts arising from the construction (including dredging, reclamation, pipeline laying and any other marine works activities) 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.
- 3.4.5.4 The assessment shall include the following major tasks:
- i) review the findings of relevant previous studies/surveys and collate all available information on the ecological characters of the study area;
 - ii) evaluate the information collected from sub-section 3.4.5.4 (i) above, and identify any information gap relating to the assessment of potential ecological impacts to the aquatic environment in the vicinity of the Project area;
 - iii) carrying out of necessary ecological field surveys and investigation of 4 months (covering the wet season) to verify the information gaps identified in (ii) above and to fulfil the objectives of the EIA study. The field surveys shall include but not limited to corals, marine benthic communities and inter-tidal habitats;
 - 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) habitat maps of suitable scale showing the types and locations of habitats/species in the Study Area with special attention to those with coral communities (including all hard corals, octocorals and black corals); Horseshoe Crabs and any other notable marine benthic or littoral communities; seagrass bed; avifauna, in particular migratory birds; and any other habitats/ species identified as having special conservation interest by this EIA study;
 - c) ecological characteristics of each habitat type such as size, species present, dominant species found, species diversity and abundance, community structure, seasonal patterns, inter-dependence of the habitats and species, and

- d) presence of any features of ecological importance;
- d) representative colour photographs of each habitat type and any important ecological features identified in both the works area, its nearby waters and along the alignment of the submarine gas pipeline;
- e) using water quality modelling to address the impacts of the sediment deposition and the potential increase in turbidity and suspended solid levels and decrease in oxygen level in the water column and their effects on marine ecological sensitive receivers such as coral communities etc. due to the disturbance of sediments during dredging and back filling, dumping and submarine trenching; and
- f) using suitable methodology to identify and quantify any primary, secondary and cumulative direct and indirect ecological impacts on the habitats, 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 including both intertidal and subtidal habitats 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 Chinese White Dolphin;
 - potential loss and disturbance to shoreline, inter-tidal habitats and coral communities during the construction and operation stages of the project.
- v) demonstrate that the ecological impacts due to the 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 (such as different alignment, built-form and/or using other construction methods and sequences) and practicable mitigation measures to avoid, minimize and/or compensate for the adverse ecological impacts identified;
- viii) evaluate the feasibility and effectiveness of the recommended mitigation measures and define the scope, type, location, implementation arrangement;
- 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.

3.4.5.5 Impacts on Chinese White Dolphins

The assessment of impacts on Chinese White Dolphins (*Sousa chinensis*) shall include the following tasks:

- (i) review and incorporate the findings of relevant studies including the previous dolphins studies and collate available information regarding the ecological characters of the study area;
- (ii) evaluate the information collected and identify any information gap relating to the assessment of potential impacts on the Chinese White Dolphins;

- (iii) carry out necessary field surveys and investigations to verify the information collected, fill the information gaps identified, if any, and to fulfil the objectives of the EIA study;
- (iv) present relevant survey findings including previous survey conducted in relevant studies together with surveys carried out under this study, including the habitat maps as mentioned in Section 3.4.5.4 (iv) (b);
- (v) assess the direct and indirect impacts, including loss of habitat, water quality changes, release of toxic contaminants from sediments, underwater noise disturbance and their consequential ecological effects on the Chinese White Dolphins, during the construction and operational stages of the Project. The assessment shall include:
 - (a) impacts and disturbance to the Chinese White Dolphins associated with the pipe laying, reclamation, dredging, fill extraction, filling, transportation and disposal of dredged sediments;
 - (b) impacts on the 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 Chinese White Dolphins. Parameters to be assessed should include suspended solids, dissolved oxygen and contaminants present in disturbed or dredged sediments;
 - (d) ecological impacts on the Chinese White Dolphins associated with potential bioaccumulation of toxic contaminants released from the disturbed or dredged sediment;
 - (e) potential risk on the Chinese White Dolphins colliding with marine vessels during construction;
 - (f) potential risk on the Chinese White Dolphins due to the natural gas leakage during operation of the Project.
- (vi) assess the overall cumulative ecological impacts on the Chinese White Dolphins due to this Project, any associated works of the Project, and any nearby development;
- (vii) identify mitigation measures for protection of the Chinese White Dolphins. The proposed measures may include, but need not be limited to, those recommended in previous EIA studies and dolphin studies;
- (viii) review the need for and recommend any dolphin monitoring programme; and
- (ix) assess and determine the acceptability of the overall residual ecological impact on the Chinese White Dolphins, after implementation of the mitigation measures as identified under Section 3.4.5.5 (vii) above.

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 be the same as for marine water quality impact assessment as set out in sub-section 3.4.3.2 above and any areas likely to be impacted by the Project. Special attention shall be given to potential loss of fishing grounds and spawning and nursery grounds, the artificial reefs located in the Sha Chau and Lung Kwu Chau Marine Park and the oyster culture area in Deep Bay.
- 3.4.6.3 The assessment shall cover any potential impact on capture and culture fisheries, during the construction and operation of the Project and in combination with those cumulative impacts from associated works of the Project.

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, mariculture and oyster farming activities, if any;
- iii) description and quantification of the existing as far as possible the existing fisheries resources (e.g. major fisheries products and stocks);
- iv) identification of parameters (e.g. water quality parameters), including any potential toxic contaminates released from the dredged sediment identified in sub-section 3.4.3.5 (xi) above and areas that are important to fisheries and will be affected;
- v) identification and quantification of any direct/indirect and on-site/off-site impacts to fisheries;
- 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; and
- vii) review the need for monitoring during the construction and operation phases of the Project and, if necessary, propose a monitoring and audit programme.

3.4.7 Landscape and Visual Impact

3.4.7.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing landscape and visual impacts as stated in Annexes 10 and 18 of the TM respectively.

3.4.7.2 The assessment area for the landscape impact assessment shall include all areas within a 500 metres distance from the boundary of the Project. 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 assess the landscape impacts of the Project. The Applicant shall describe, appraise, analyse and evaluate the existing and future landscape resources and character of the assessment area. A system shall be derived for judging the landscape impact significance as required under the TM. Clear illustrations of the landscape impact assessment are required.

3.4.7.4 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 of visual impact assessment are required. The assessment shall include the following:

- (i) identification and plotting of visibility envelope of the Project within the assessment area;
- (ii) identification of the key groups of sensitive receivers within the visibility contours and their views at both 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 of the adjacent areas; and
- (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.
- 3.4.7.5 Alternative 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 Applicant shall recommend mitigation measures to minimize the adverse effects identified above, including provision of a landscape design. 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.
- 3.4.7.6 The mitigation measures shall include provision of screen planting, sensitive design of structures, colour scheme and texture of materials used and any measures to mitigate the impact on existing land uses.
- 3.4.7.7 Annotated illustration such as coloured perspective drawings, plans and section/elevation diagrams, 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.
- 3.4.7.8 All 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 Impact on Cultural Heritage

- 3.4.8.1 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.
- 3.4.8.2 The Applicant shall refer to Appendix D and Appendix E of this EIA Study Brief for the detailed requirements.

i) Marine Archaeological Investigation

The Applicant shall engage a qualified marine archaeologist to review available information to identify whether there is any possible existence of sites of objects of cultural heritage, for example shipwreck, within any seabed that will be affected by the marine works of the Project. The result of the review shall be presented as a written report and charts. If marine archaeological potential is identified, a Marine Archaeological Investigation (MAI) shall be required. 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). The requirements of the MAI are set out in Appendix E of this EIA Study Brief.

- 3.4.8.3 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.

3.4.9 Hazard To Life

- 3.4.9.1 The risk to life due to the operation of the submarine natural gas pipelines and the associated GRSs within HKSAR shall be assessed. The Applicant shall follow the criteria for evaluating hazard to life as stated in Annexes 4 and 22 of the TM in conducting hazard assessment and include the following in the assessment:
- i) identification of all credible hazardous scenarios which may cause fatalities;
 - ii) execution of a Quantitative Risk Assessment expressing population risks in both individual and societal term;
 - iii) comparison of individual and societal risks with the Criteria for Evaluating Hazard to Life stipulated in Annex 4 of the TM; and
 - iv) identification and assessment of practicable and cost effective risk mitigation measures as appropriate.
- 3.4.9.2 All the fundamental assumptions that might affect the conclusion of the quantitative risk assessment shall be listed out and clearly presented.
- 3.4.9.3 The approach and methodology to be used in the hazard assessment shall take into account relevant previous studies (including any international practices and studies), and to be agreed with the Director.

3.4.10 Summary of Environmental Outcomes

- 3.4.10.1 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.

3.4.11 Summary of Environmental Performance Comparison

- 3.4.11.1 The EIA report shall contain a summary table comparing the Environmental Performance of the possible Options. The table shall compare the key design parameters (including size of reclamation; reclamation method, dredging volume, waste generation, pipeline details etc); the key sensitive receivers and the environmental impacts etc.

3.4.12 Environmental Monitoring and Audit (EM&A) Requirements

- 3.4.12.1 The Applicant shall identify and justify in the EIA study whether there is any need for

EM&A activities during construction and operation phases of the Project and, if affirmative, to define the scope of EM&A requirements for the Project.

- 3.4.12.2 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 through a dedicated internet website.
- 3.4.12.3 The Applicant shall prepare a project implementation schedule (in the form of a checklist as shown in Appendix E to this EIA Study Brief) containing the EIA study recommendations and mitigation measures with reference to the implementation programme.

4. DURATION OF VALIDITY

- 4.1 This EIA Study Brief is valid for 36 months from the date of issue. If the EIA study does not commence within this period, the Applicant shall apply to the Director for a fresh EIA Study Brief before commencement of the EIA study.

5. REPORT REQUIREMENTS

- 5.1 In preparing the EIA report, the Applicant shall refer to Annex 11 of the TM for the contents of an EIA report. The Applicant shall also refer to Annex 20 of the TM, which stipulates the guidelines for 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 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 4.0 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.

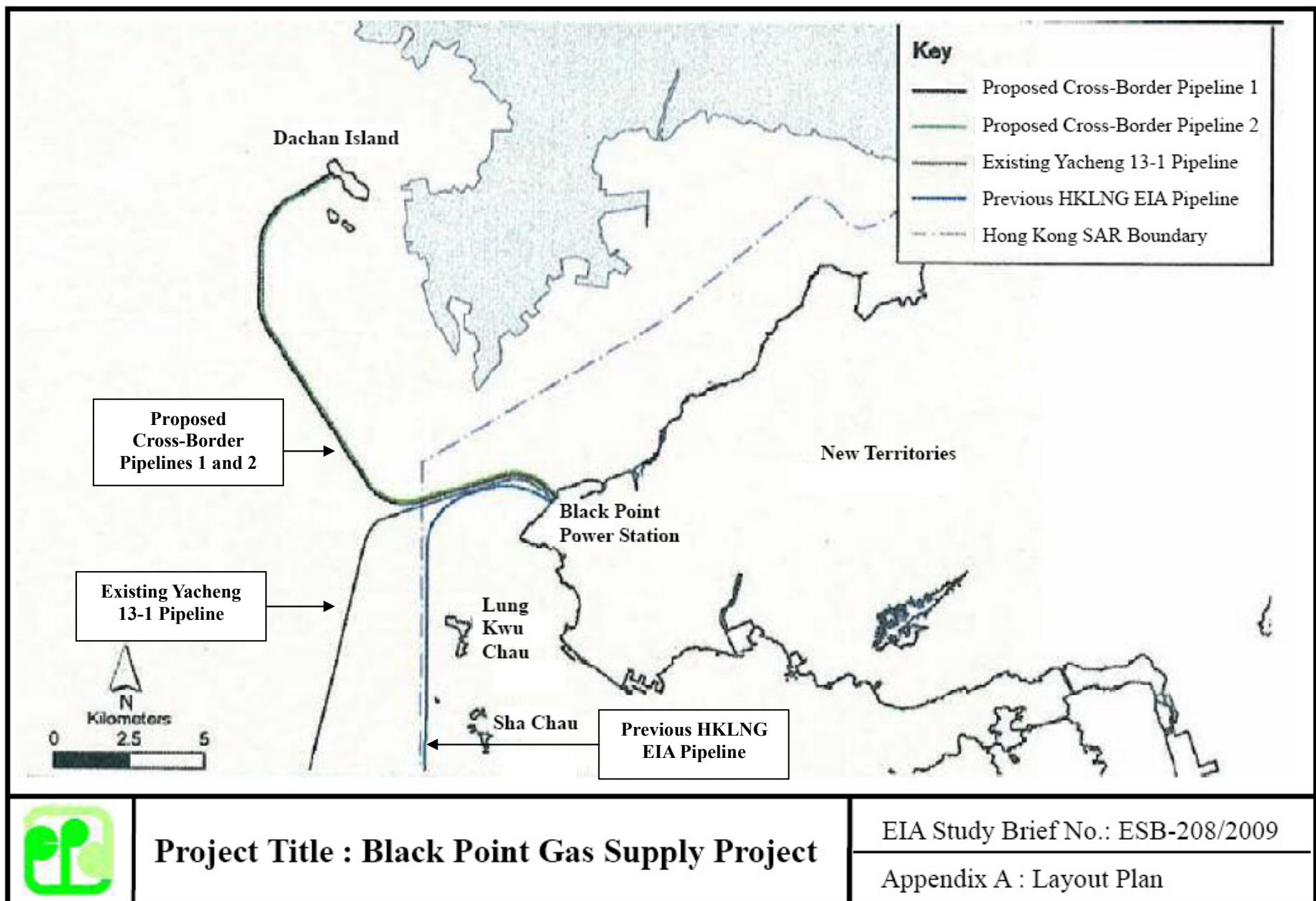
- 5.5 The electronic copies of the EIA report and the executive summary shall be submitted to the Director at the time of application for approval of the EIA report.
- 5.6 When the EIA report and the executive summary are made available for public inspection under s.7(1) of the EIAO, the content of the 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 Section 1.2 and 1.3 of this EIA Study Brief and in Project Profile (No. PP- 388/2009), 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 ---

July 2009
Environmental Assessment Division,
Environmental Protection Department



Appendix B-1

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 B-3.
- 2.3 The models can be used to estimate both short-term (hourly and daily average) and long-term (annual average) ambient concentrations of air pollutants. The model results, obtained using appropriate model parameters (refer to Section 3) and assumptions, allow direct comparison with the relevant air quality standards such as the Air Quality Objectives (AQOs) for the relevant pollutant and time averaging period.

3. Model Input Requirements

3.1 Meteorological Data

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

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

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

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

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

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;

determine the short term hourly impact under all of the identified wind speed, wind direction and stability combinations; and

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/m²) as required by the model should be clearly stated for verification. The physical dimensions, location, release height and any other emission characteristics such as efflux conditions and emission pattern of the sources input to the model should also correspond to site data.

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

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

3.3 Urban/Rural Classification

Emission sources may be located in a variety of settings. For modelling purposes these are 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 NO₂ to NOx Ratio

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

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

3.8 Odour Impact

In assessing odour impacts, a much shorter time-averaging period of 5 seconds is required due to the shorter exposure period tolerable by human receptors. Conversion of model computed hourly average results to 5-second

values is therefore necessary to enable comparison against recommended standard. The hourly concentration is first converted to 3-minute average value according to a power law relationship which is stability dependent (Ref. 3) and a result of the statistical nature of atmospheric turbulence. Another conversion factor (10 for unstable conditions and 5 for neutral to stable conditions) is then applied to convert the 3-minute average to 5-second average (Ref. 4). In summary, to convert the hourly results to 5-second averages, the following factors can be applied:

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

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

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

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

3.9 Plume Rise Options

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

3.10 Portal Emissions

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

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

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

3.11 Background Concentrations

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

3.12 Output

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

Contours of pollutant concentration are also required for indicating the general impacts of emissions over a study area.

Copies of model files in electronic format should also be provided for EPD's reference.

Schedule 1

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

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

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

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

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

Appendix B-2

Guidelines on Assessing the 'TOTAL' Air Quality Impacts

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

1. Total Impacts - 3 Major Contributions

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

Primary contributions: project induced

Secondary contributions: pollutant-emitting activities in the immediate neighbourhood

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

2. Nature of Emissions

2.1 Primary contributions

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

2.2 Secondary contributions

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

nearby, the study area may have to be extended or alternative estimation approach employed to ensure these impacts are reasonably accounted for.

2.3 Background contributions

The above two types of emission contributions should account for, to a great extent, the air quality impacts upon local air sensitive receivers, which are often amenable to estimation by the 'Gaussian Dispersion' type of models. However, a background air quality level should be prescribed to indicate the baseline air quality in the region of the project site, which would account for any pollution not covered by the two preceding contributions. The emission sources contributing to the background air quality would be located further afield and not easy to identify. In addition, the transport mechanism by which pollutants are carried over long distances (ranging from 1km up to tens or hundreds of kms) is rather complex and cannot be adequately estimated by the 'Gaussian' type of models.

3. **Background Air Quality - Estimation Approach**

3.1 The approach

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

estimate should also be applied to future projects as a first attempt at a comprehensive estimate until a better approach is formulated.

3.2 Categorisation

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

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

Industrial : Kwun Tong, Tsuen Wan and Kwai Chung

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

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

3.3 Background pollutant values

Based on the above approach, background values for the 3 categories have been obtained for a few major air pollutants as follows:

POLLUTANT	URBAN	INDUSTRIAL	RURAL / NEW DEVELOPMENT
NO2	59	57	39
SO2	21	26	13
O3	62	68	57
TSP	98	96	87
RSP	60	58	51

All units are in micrograms per cubic metre. The above values are derived from 1992 to 1996 annual averages with the exception of ozone which

represent annual average of daily hourly maximum values for year 1996.

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

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

3.4 Site categories

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

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

Tsuen Wan	Industrial
Tuen Mun	Rural / New Development
Tai Po	Rural / New Development
Yuen Long	Rural / New Development
Northern	Rural / New Development

3.5 Provisions for 'double-counting'

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

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

where E stands for emission.

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

4. Conclusions

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

Appendix B-3

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

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

1. Background

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.

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.

Examples of situations where the use of an alternative model is warranted include:

the complexity of the situation to be modelled far exceeds the capability of the Schedule 1 models; and

(ii) the performance of an alternative model is comparable or better than the Schedule 1 models.

1.4 This paper outlines the demonstration / submission required in order to support the use of an alternative air quality model for regulatory applications for Hong Kong.

2. Required Demonstration / Submission

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

Technical details of the proposed model; and
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:

mathematical formulation and data requirements of the model;
any previous performance evaluation of the model; and
a complete set of model input and output file(s) in commonly used electronic format.

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.

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

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

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).

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.

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.

If EPD is already in possession of some of the documents that describe the technical details of the proposed model, submission of the same by the proponent is not necessary. The proponent may check with EPD to avoid sending in duplicate information.

Schedule 1

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

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

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

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

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

Appendix C

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 and particle dispersion modules. All modules shall have been proven with successful applications locally and overseas.
3. The hydrodynamic, water quality and sediment transport 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 against applicable existing and/or newly collected field data before their use in this study in the Hong Kong waters, the Pearl Estuary and the Dangan (Lema) Channel. The field data set for calibration and validation shall be agreed with EPD.
2. Tidal data shall be calibrated and validated in both frequency and time domain manner.
3. For the purpose of calibration and validation, the model shall run for not less than 15 days of real sequence of tide (excluding model spin up) in both dry and wet seasons with due consideration of the time required to establish initial conditions.

4. In general the hydrodynamic models shall be calibrated to the following criteria:

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

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

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

Model details – Simulation

1. The water quality modelling results shall be qualitatively explainable, and any identifiable trend and variations in water quality shall be reproduced by the model. The water quality model shall be able to simulate and take account of the interaction of dissolved oxygen, phytoplankton, organic and inorganic nitrogen, phosphorus, silicate, BOD, temperature, suspended solids, contaminants release of dredged and disposed material, air-water exchange, *E. coli* and benthic processes. It shall also simulate salinity. Salinity results simulated by hydrodynamic models and water quality models shall be demonstrated to be consistent.
2. The sediment transport module for assessing impacts of sediment loss due to marine works shall include the processes of settling, deposition and re-erosion.

The values of the modelling parameters shall be agreed with EPD. Contaminants release and DO depletion during dredging and dumping shall be simulated by the model.

3. The 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 project. The model coverage area shall be agreed with EPD.
4. 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 all phases of development of the project. Where appropriate, the assessment shall also include maintenance dredging. Scenarios to be assessed shall cover the baseline condition and scenarios with various different options proposed by the Applicant in order to quantify the environmental impacts and improvements that will be brought about by these options. Corresponding pollution load, bathymetry and coastline shall be adopted in the model set up.
2. Hydrodynamic, water quality and sediment transport 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. 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.

4. The impact on identified sensitive receivers shall be assessed.
5. 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 D**Guidelines for Cultural Heritage Impact Assessment**

(as at December 2008)

Introduction

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

A comprehensive Cultural Heritage Impact Assessment (CHIA) includes a baseline study, an impact assessment study associated with the appropriate mitigation measures.

(1) Baseline Study

1.1 A baseline study shall be conducted:

- a. to compile a comprehensive inventory of heritage sites within the proposed project area, which include:
 - (i) all archaeological sites (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) cultural landscapes include places associated with historic event, activity, or person or exhibiting other cultural or aesthetic values, such as sacred religious sites, battlefields, a setting for buildings or structures of architectural or archaeological importance, historic field patterns, clan graves, old tracks, *fung shui* woodlands and ponds, and etc.
- b. to identify the direct and indirect impacts on the heritage sites at the planning stage in order to avoid causing any negative effects. The impacts include the direct loss, destruction or disturbance of an element of cultural heritage, impact on its settings or impinging on its character through

inappropriate siting or design, potential damage to the physical fabric of archaeological remains, historic buildings or historic landscapes through air pollution, change of ground water level, vibration, ecological damage, new recreation or other daily needs to be caused by the new development. The impacts listed are merely to illustrate the range of potential impacts and not intended to be exhaustive.

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

1.3. Desk-top Research

1.3.1 Desk-top research should be conducted to analyse, collect and collate extant information. It shall include but not limited to:

- a. List of declared monuments protected by the Antiquities and Monuments Ordinance (Chapter 53).
- b. Graded historic buildings and sites.
- c. Government historic sites identified by the Antiquities and Monuments Office (AMO).
- d. Lists and archives kept in the Reference Library of the Antiquities and Monuments Office of the Leisure and Cultural Services Department including archaeological sites, declared monuments, proposed monuments, deemed monuments and recorded historical building & structures identified by the AMO.
- e. Publications on local historical, architectural, anthropological, archaeological and other cultural studies, such as, Journals of the Royal Asiatic Society (Hong Kong Branch), Journals of the Hong Kong Archaeological society, Antiquities and Monuments Office Monograph Series and so forth.
- f. Other unpublished papers, records, archival and historical documents through public libraries, archives, and the tertiary institutions, such as the Hong Kong Collection and libraries of the Department of Architecture of the University of Hong Kong and the Chinese University of Hong Kong, Public Records Office, photographic library of the Information Services Department and so forth.
- g. Any other unpublished archaeological investigation and excavation reports kept by the AMO.
- h. 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.

- i. Cartographic and pictorial documents. Old and recent maps and aerial photos searched in the Maps and Aerial Photo Library of the Lands Department.
- j. Existing geological information (for archaeological desk-top research).
- k. Discussion with local informants.

1.4 Field Evaluation

1.4.1 General

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

1.4.2 Field survey on historic buildings and structures

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

1.4.3 Archaeological Survey

- a. Appropriate methods for pricing and valuation of the archaeological survey, including by means of a Bill of Quantities or a Schedule of Rates should be considered in preparing specifications and relevant documents for calling tenders to carry out the archaeological survey. The specifications and relevant documents should be sent to the Antiquities and Monuments Office for agreement prior to calling tenders to conduct the archaeological survey.
- b. A licence shall be obtained from the Antiquities Authority for conducting an archaeological survey. It takes at least two months to process the application.
- c. 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.
- d. 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 Antiquities and Monuments Office 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.
- e. A Marine Archaeological Investigation (MAI) following *Guidelines for MAI* may be required for projects involving disturbance of seabed.
- 1.4.4 If the field evaluation identifies any additional heritage sites within the study area which are of potential historic or archaeological importance and not recorded by AMO, the findings should be reported to the AMO 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 heritage sites supported by full description of their significance. The description should contain detailed geographical, historical, archaeological, architectural, anthropological, ethnographic and other relevant data supplemented with illustrations below and photographic and cartographic records, if required.
- 1.5.2 A master layout plan showing all the identified archaeological and built heritage within the study area should be provided in the report. All the identified heritage sites should be properly numbered with their locations indicated on the master layout plan.

1.5.3 Historic Buildings/ Structures/ Sites

- a. A map in 1:1000 scale showing the boundary of each historic item.
- b. Photographic records of each historic item.

- c. Detailed recording form of each historic item including its construction year, previous and present uses, architectural characteristics, as well as legends, historic persons and events, cultural landscape features and cultural activities associated with the structure.
- d. A cross-referenced checklist including the reference number of each historical item, their photo and drawing reference, as well as the page number of the detailed recording form of each identified historical item for easy cross-checking of individual records.

1.5.4 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 (Annex 1).
- 1.5.5 A full bibliography and the source of information consulted should be provided to assist the evaluation of the quality of the evidence. 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 (Annex 2)*.

1.7 Safety Issue

- 1.7.1 During the course of the CHIA Study, all participants shall comply with all Ordinances, Regulations and By-laws which may be relevant or applicable in safety aspect in connection with the carrying out of the CHIA Study, such as site safety, insurance for personal injuries, death

and property damage as well as personal safety apparatuses, etc.

- 1.7.2 A Risk Assessment for the fieldwork shall be carried out with full consideration to all relevant Ordinances, Regulations and By-laws.

(2) Impact Assessment Study

2.1 Identification of impact on heritage

- 2.1.1 The impact assessment study must be undertaken to identify the impacts on the heritage sites which will be affected by the proposed development subject to the result of desktop research and field evaluation. The prediction of impacts and an evaluation of their significance must be undertaken by expert(s) in local heritage.
- 2.1.2 During the assessment, both the direct impacts such as loss or damage of important features as well as indirect impacts should be clearly stated, such as adverse visual impact on built heritage, landscape change to the associated cultural landscape features of the built heritage, temporary change of access to the heritage sites during the work period, change of ground level or water level which may affect the preservation of the archaeological and built heritage *in situ* during the implementation stage of the project.
- 2.1.3 The evaluation of heritage impact assessment may be classified into five levels of significance based on type and extent of the effects concluded in the CHIA study:
- a. Beneficial impact: the impact is beneficial if the project will enhance the preservation of the heritage site(s) such as improving the flooding problem of the historic building after the sewerage project of the area;
 - b. Acceptable impact: if the assessment indicates that there will be no significant effects on the heritage site(s);
 - c. Acceptable impact with mitigation measures: if there will be some adverse effects, but these can be eliminated, reduced or offset to a large extent by specific measures, such as conduct a follow-up Conservation Proposal or Conservation Management Plan for the

- affected heritage site(s) before commencement of work in order to avoid any inappropriate and unnecessary interventions to the building;
- d. Unacceptable impact: if the adverse effects are considered to be too excessive and are unable to mitigate practically;
 - e. Undetermined impact: if the significant adverse effects are likely, but the extent to which they may occur or may be mitigated cannot be determined from the study. Further detailed study will be required for the specific effects in question.
- 2.1.4 Preservation in totality must be taken as the first priority as it will be a beneficial impact and will enhance the cultural and socio-economical environment if suitable measures to integrate the heritage site into the proposed project are carried out.
- 2.1.5 If, due to site constraints and other factors, only preservation in part is possible, this must be fully justified with alternative proposals or layout designs which confirm the impracticability of total preservation.
- 2.1.6 Total destruction must be taken as the very last resort in all cases and shall only be recommended with a meticulous and careful analysis balancing the interest of preserving local heritage as against that of the community as a whole. Assessment of impacts on heritage sites shall also take full account of, and follow where appropriate, paragraph 4.3.1(c), item 2 of Annex 10, items 2.6 to 2.9 of Annex 19 and other relevant parts of the Technical Memorandum on Environmental Impact Assessment Process.

2.2 Mitigation Measures

- 2.2.1 It is always a good practice to recognize the heritage site early in the planning stage and site selection process, and to avoid it, i.e. preserve it in-situ, or leaving a buffer zone around the site.
- 2.2.2 Mitigation is not only concerned with minimizing adverse impact on the heritage site but also should give consideration of potential enhancement if possible (such as to improve the access to the built heritage or enhance the landscape and visual quality of built heritage).

- 2.2.3 Mitigation measures shall not be recommended or taken as *de facto* means to avoid preservation of heritage sites. They must be proved beyond all possibilities to be the only practical course of action. Heritage sites are to be in favour of preservation unless it can be demonstrated that there is a need for a particular development which is of paramount importance and outweighs the significance of a heritage site.
- 2.2.4 If avoidance of the heritage site is not possible, amelioration can be achieved by minimizing the potential impacts and the preservation of the heritage site, such as physically relocating it. Measures like amendments of the sitting, screening and revision of the detailed design of the development are required to lessen its degree of exposure if it causes visual intrusion to the heritage site and affects the character and integrity of the heritage site.
- 2.2.5 A rescue programme, when required, may involve preservation of the historic building or structure together with the relics inside, and its historic environment through relocation, detailed cartographic and photographic survey or preservation of an archaeological site “by record”, i.e. through excavation to extract the maximum data as the very last resort.

2.3 The Impact Assessment Report

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

used extensively to facilitate communication among the concerned parties.

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

Annex 1**Guidelines for Archaeological Reports**
(As at December 2008)**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 5 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 approximate 150 - 300 words each)
This should outline in plain, non-technical language, the principal reasons for the archaeological work, its aims and main results, and should include reference to authorship and commissioning body.

4. Introduction

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

5. Aims of archaeological work

These should reflect the aims set in the project design.

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

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

7. Methodology

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

8. 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 including electronic sources used should be given in full detail.

12. Archaeological Team

The director and members of the archaeological team and the author of the report should be clearly specified.

13. 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 land surveyor), should be clearly shown on maps in appropriate scales, with proper legends, grid references (in 8 digits) and captions.

- B. Drawings of test pits, archaeological features 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.

14. 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.

15. 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.

Annex 2**Guidelines for Handling of Archaeological Finds and Archives**
(As at Oct 2006)**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.

I. 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” technique¹ 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

¹ *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.

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. 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.

II. 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 followings:
 - 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 E**Guidelines for Marine Archaeological Investigation (MAI)**
(As at August 2008)

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.
 - d. Relevant government departments should be consulted in order to obtain the information of dredging history (if any) on the proposed project area. Area for sand dredging, mud disposal and allocated marine borrow area within Hong Kong should also be considered during the review.
- 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 Task 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 Task 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 Task 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.
- 4.5 If Task 4 is undertaken, the results would be presented in a written report with charts.

Report

Five 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*	Location/Duration of measures/ Timing of completion of 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

---- END OF STUDY BRIEF ----