

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

Environmental Impact Assessment Study Brief No. ESB-186/2008

**Project Title : Sediment Removal at Sha Tau Kok Fish Culture Zone,
Boat Shelter and Approach Channel**
(hereinafter referred as “the Project”)

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

1. BACKGROUND

- 1.1 An application (No. ESB-186/2008) for an Environmental Impact Assessment (EIA) study brief under section 5(1)(a) of the Environmental Impact Assessment Ordinance (EIAO) was submitted by the Applicant on 2 April 2008 with a project profile (No. PP-350/2008) (hereinafter referred as “the Project Profile”).
- 1.2 The Project is to temporarily relocate the fish rafts at the Sha Tau Kok (STK) Fish Culture Zone (FCZ) and to remove sediment at the STK FCZ and the nearby boat shelter and approach channel. The Project site is shown in Appendix A.
- 1.3 The Project is a designated project under Part I, Schedule 2, Item C.12 of the EIAO, which specifies “A dredging operation which is less than 500 m from the nearest boundary of an existing fish culture zone.”
- 1.4 Pursuant to section 5(7)(a) of the EIAO, the Director issues this EIA study brief to the Applicant to carry out an EIA study.
- 1.5 The purpose of this EIA study is to provide information on the nature and extent of environmental impacts arising from the Project; and related activities that would take place concurrently. This information will contribute to decisions by the Director on:
 - (i) the overall acceptability of any adverse environmental consequences that is likely to arise as a result 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 the proposed mitigation measures are implemented.

2. OBJECTIVES OF THE EIA STUDY

- 2.1 The objectives of the EIA study are as follows:
 - (i) to describe the Project and associated works together with the requirements

- and environmental benefits for carrying out the proposed Project;
- (ii) to identify and describe elements of the community and environment likely to be affected by the Project, and/or likely to cause adverse impacts on the Project, including both the natural and man-made environment and associated environmental constraints;
 - (iii) to provide information on the consideration of alternatives to avoid or minimize the potential adverse environmental impacts to environmentally sensitive areas and other sensitive uses; to compare the environmental benefits and dis-benefits of each of different options; to provide reasons, justifications and constraints for selecting the preferred option(s); and to describe the part environmental factors played in the selection of preferred option(s);
 - (iv) to identify and assess air quality impacts, construction noise impacts, water quality impacts, waste management, ecological impacts, fisheries impacts, visual impacts, impacts on sites of cultural heritage, quantify emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;
 - (v) to identify and quantify any potential losses or damage to flora, fauna and natural habitats;
 - (vi) to provide the provision of infrastructure or mitigation measures to minimise pollution, environmental disturbance and nuisance during construction and operation of the Project;
 - (vii) to investigate the feasibility, practicability, effectiveness and implications of the proposed mitigation measures;
 - (viii) to identify, predict and evaluate the residual environmental impacts (i.e. after practicable avoidance or mitigation measures) and the cumulative effects expected to arise during the construction and operation of the Project in relation to the sensitive receivers and potential affected uses;
 - (ix) 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 the acceptable levels;
 - (x) to investigate the extent of the secondary environmental impacts that may arise from the proposed mitigation measures and to identify constraints associated with the mitigation measures recommended in the EIA study, as well as provision of any necessary modification; and
 - (xi) to design and specify environmental monitoring and audit requirements to ensure effective implementation of the recommended environmental protection and pollution control measures.

3. DETAILED REQUIREMENTS OF THE EIA STUDY

3.1 The Purpose

- 3.1.1 The purpose of this study brief is to scope the key issues of the EIA study and to specify the environmental issues that are required to be reviewed and assessed in the

EIA report. The Applicant has to demonstrate in the EIA report that the criteria in the relevant sections of the Technical Memorandum on Environmental Impact Assessment Process of the Environmental Impact Assessment Ordinance (hereinafter referred to as “the TM”) are fully complied with.

3.2 The Scope

3.2.1 The scope of this EIA study shall cover the Project proposed in the Project Profile including that mentioned in section 1.2 of this study brief and any further sediment removal required for maintaining the normal operation of the STK FCZ and STK Pier and boat shelter. The EIA study shall address the key issues 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, and planned and known potential development in the vicinity of the Project:

- (i) the potential air quality impact including odour nuisance on air sensitive receivers in STK area during removal, stockpiling and transportation of sediment;
- (ii) the potential construction noise impact on noise sensitive receivers in STK area arising from removal, stockpiling and transportation of sediment;
- (iii) the potential water quality impact and waste management implications arising from the sediment removal activities under this Project;
- (iv) the potential impact arising from the sediment removal on ecological sensitive areas within and in close proximity to the Project site boundary including A Chau Egretty, Yim Tsoi Ha Egretty, mudflat, intertidal and subtidal habitats within Sha Tau Kok Hoi. Consideration should be given to review the scale of the Project and adopt alternative construction sequence and methods in order to avoid and minimize potential ecological impacts. The potential fisheries impacts on capture and culture fisheries in the vicinity of the Project site shall be considered; and
- (v) the potential impact on marine archaeology and potential visual impact caused by the sediment removal activities shall be considered.

3.3 Consideration of Alternative Options and Description of the Project

The Need of Project

3.3.1 The Applicant shall report on or provide information related to the need and justification for the Project as described in the Project Profile and outlined in section 1.2 of this study brief. The Applicant shall explain clearly the purpose and objectives of the Project and describe the scenarios with and without the Project.

Consideration of Alternative Options

3.3.2 In addition to the proposed layout and design in the Project Profile, the Applicant shall review the scale of the Project and consider other feasible locations and size of the Project to minimize the Project area and volume of sediment to avoid/minimize

any adverse environmental impacts. The Applicant shall provide justification regarding how the proposed scheme is arrived at including the descriptions of the environmental factors considered in the option selection. The Applicant shall also consider and present the consideration given to other possible sediment removal methods including suction dredging, sequence of works and available technology to minimize excessive nuisance to the nearby sensitive receivers. A comparison of the environmental benefits and dis-benefits of possible options, in respect of available technology, sediment removal methods/rates, sequence of works and any lessons learnt from other similar projects, shall be made on the sensitive areas within the assessment areas. The comparison shall assist in the formulation of the recommended preferred option, which shall, in principle, avoid or minimize adverse on-site and off-site environmental impacts to the maximum practicable extent.

Need for Further Sediment Removal

- 3.3.3 The Applicant shall investigate whether there would be any need for further sediment removal for maintaining normal operation of the STK FCZ and the STK Pier and boat shelter. If such a need is identified, the Applicant shall assess and quantify the frequency as well as the likely extent of further sediment removal required, and the associated potential environmental impacts. It is also necessary to assess and quantify (as appropriate) such environmental impacts if the further sediment removal is expected to deploy methods and sequence different from that of the Project.

3.4 Technical Requirements

- 3.4.1 The Applicant shall conduct the EIA study to address all environmental aspects of the Project as described in sections 3.1, 3.2 and 3.3 of this study brief. The assessment shall be based on the best and latest information available during the course of the EIA study.

- 3.4.2 The Applicant shall include in the EIA report details of the construction programme and methodologies. The Applicant shall clearly state in the EIA report the time frame and work programmes of the Project and other concurrent projects, and assess the cumulative environmental impacts from the Project with all interacting projects, including staged implementation of the Project.

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

3.4.4 Air Quality Impact

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

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

(i) Determination of Assessment Area

The area for air quality impact assessment shall generally be defined by a distance of 500 metres expanded from the boundary of the Project within

Hong Kong territory, yet it shall be extended to include major emission sources that may have a bearing on the environmental acceptability of the Project. Such assessment shall be based on the best available information at the time of the assessment.

(ii) Background and Analysis of Activities

- (a) Provide background information relating to air quality issues relevant to the Project, including description of activities of the Project that may affect air quality during the construction stage.
- (b) Give an account, where appropriate, of the consideration/measures that had been taken into consideration in the planning of the Project to abate air pollution impact, including the odour nuisance.
- (c) Present the background air quality in the assessment area for the purpose of evaluating the cumulative air quality impacts, if any, due to the construction stage of the Project.

(iii) Identification of Air Sensitive Receivers (ASRs) and Examination of Emission/Dispersion Characteristics

- (a) Identify and describe the representative existing, committed and planned ASRs likely be affected by the potential adverse air quality impacts (including odour impact) caused by the Project within the assessment area (section 3.4.4.2(i) of this study brief), both on-site and off-site, including those earmarked on the relevant Outline Zoning Plans, Outline Development Plans, Layout Plans, Outline Development Plans and other relevant published land use plans. The Applicant shall select assessment points of the identified ASRs that would represent the worst impact point of these ASRs. A map clearly showing the locations and descriptions, such as names of buildings, uses and heights of the selected assessment points shall be included. The separation distances of these ASRs from the nearest emission sources shall also be given.
- (b) Provide a list of air pollutant emission sources, including any nearby emission sources which are likely to have impact on the Project based on the analysis of the constructional activities of the Project in section 3.4.4.2(ii) of this study brief. Examples of constructional stage emission sources include stockpiling of sediment and construction plant movement etc. Confirmation of the validity of the assumptions and the magnitude of the activities (e.g. number of construction plant; volume of sediment handled) shall be obtained from the relevant government department/authorities and documented.
- (c) The emissions from any concurrent projects identified as relevant during the course of the EIA study, shall be taken into account as contributing towards the overall cumulative air quality impacts. The impact as affecting the existing, planned and committed air sensitive receivers within the assessment area shall be assessed.

(iv) Odour Impact

- (a) The Applicant shall consider the odour impact that may arise from the Project and proposed suitable measures to minimise the odour problem, if any, arising from the sediment removal activities and associated works. If the Applicant anticipates that the Project will give rise to significant odour impacts at the ASRs despite the incorporation of the odour control measures, a quantitative assessment should be carried out to evaluate the odour impact at the identified ASRs.
- (b) If the need of quantitative odour assessment is confirmed, the Applicant shall calculate the expected odour concentrations at the identified ASRs based on an assumed reasonable worst-case scenario under normal operating conditions. The evaluation shall be based on the strength of the emission sources identified in section 3.4.4.2(iii) of the study brief. The Applicant shall follow section 3.4.4.2(v) of the study brief when carrying out the quantitative assessment.

(v) Quantitative Assessment Methodology

If a quantitative assessment is required, the Applicant shall apply the general principles enunciated in the Guidelines for Local-Scale Air Quality Assessment Using Models given in Appendices B1 to B3 while making allowance for the specific characteristics of the Project. The Applicant shall assess the odour impact of the Project at the ASRs identified under section 3.4.4.2(iii) of this study brief and evaluate the significance of the odour impact. The predicted odour impacts (both unmitigated and mitigated) shall be presented in the form of summary table(s) and pollution contours, to be evaluated. Plans of a suitable scale should be used to present pollution contours to allow buffer distance requirements to be determined accurately.

(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 other associated constraints on future land use planning shall be agreed with the relevant government departments/authorities and be clearly documented in the EIA report. The Applicant shall demonstrate that the residual impact after incorporation of the proposed mitigation measures will comply with the relevant guidelines and criteria set out in the main text and Annex 4 of the TM. The Applicant shall also justify the assumptions adopted in the assessment for effectiveness of the proposed mitigation measures.

(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 together with submission of the EIA report.

3.4.5 Construction Noise Impact

3.4.5.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing

the construction noise impacts arising from the sediment removal and associated works as stated in Annexes 5 and 13 of the TM respectively.

3.4.5.2 The noise impact assessment shall include the following :

(i) Determination of Assessment Area

The area for noise impact assessment shall generally include all areas within 300 metres from the boundary of the Project within Hong Kong territory. Subject to the agreement of the Director, the assessment area could be reduced accordingly if the first layer of noise sensitive receivers (NSRs), closer than 300 metres from the boundary of assessment area, provides acoustic shielding to those receivers at further distance behind. Similarly, subject to the agreement of the Director, the assessment area shall be expanded to include NSRs at distance greater than 300 metres from the assessment area boundaries which are noise sensitive if they may be affected by the implementation of the Project.

(ii) Provision of Background Information and Existing Noise Levels

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

(iii) Identification of Noise Sensitive Receivers

(a) The Applicant shall refer to Annex 13 of the TM when identifying the NSRs. The NSRs shall include all existing NSRs and all planned/committed noise sensitive developments and uses earmarked on the relevant Outline Zoning Plans, Outline Development Plans, Recommended Outline Development Plan, Layout Plans and other relevant published land use plans. The photographs of all existing NSRs shall be appended to the EIA report.

(b) The Applicant shall select assessment points to represent all identified NSRs for carrying out quantitative noise assessment described below. The assessment points shall be agreed with the Director prior to the quantitative noise assessment. A map showing the location and description such as name of building, use, and floor of each and every selected assessment point shall be given. For planned noise sensitive land uses without committed site layouts, the Applicant can use the relevant planning parameters to work out representative site layouts for operational noise assessment purpose.

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

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

(v) Construction Noise Assessment

- (a) The assessment shall cover the cumulative noise impacts due to the construction works of the Project and any other relevant concurrent projects identified during the course of the EIA study.
- (b) The Applicant shall carry out assessment of noise impact from construction (excluding percussive piling) of the Project during day time, i.e. 7 a.m. to 7 p.m., on weekdays other than general holidays in accordance with the methodology stipulated in sections 5.3 and 5.4 of Annex 13 of the TM. The criteria in Table 1B of Annex 5 of the TM shall be adopted in the assessment.
- (c) To minimize the construction noise impact, alternative construction methods to replace percussive piling shall be proposed as far as practicable. In case blasting works will be involved, it should be carried out, as far as practicable, outside the sensitive hours of 7 p.m. to 7 a.m. on Monday to Saturday and any time on a general holiday, including Sunday. For blasting that must be carried out during the above-mentioned sensitive hours, the noise impact associated with the removal of debris and rocks should be fully assessed and adequate mitigation measures should be recommended to reduce the noise impact as appropriate.
- (d) If tunneling works will be involved, noise impact (including air-borne noise and ground-borne noise) associated with the operation of powered mechanical equipment, in particular tunnel boring machine or equivalent, shall be assessed. If tunnel boring machine is used and it is likely that ground-borne noise will affect NSRs, the criteria and assessment methodology shall be agreed with the Director (with reference to section 4.4.2(c) of the TM) prior to the commencement of the assessment.
- (e) If the unmitigated construction noise levels are found exceeding the relevant criteria, the Applicant shall propose practicable direct mitigation measures (including movable barriers, enclosures, quieter alternative methods, re-scheduling and restricting hours of operation of noisy task) to minimize the impact. If the mitigated noise levels still exceed the relevant criteria, the duration of the noise exceedance shall be given.
- (f) The Applicant shall formulate a reasonable construction programme as far as practicable such that no work will be required in the restricted hours as defined under the Noise Control Ordinance (NCO). In case the Applicant needs to evaluate whether construction works in restricted hours as defined under the NCO are feasible or not in the context of programming construction works, reference should be made to the relevant technical memoranda issued under the NCO. Regardless of the results of the construction noise impact assessment for restricted hours, the Noise Control Authority will process the Construction Noise Permit (CNP) application, if necessary, based on the NCO, the relevant technical memoranda issued under the NCO, and the contemporary conditions/situations. This aspect should be explicitly stated in the noise chapter and the conclusions and recommendations chapter in the

EIA report.

3.4.6 Water Quality Impact

- 3.4.6.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing water pollution as stated in Annexes 6 and 14 of the TM respectively.
- 3.4.6.2 The assessment area for this water quality impact assessment shall cover the Mirs Bay Water Control Zone as designated under the Water Pollution Control Ordinance (WPCO). Sensitive receivers including, but not limiting to, SSSIs, Coastal Protection Area and Conservation Area, coral communities, fish culture zones, and mudflats and mangrove strands in the above area shall be addressed in the water quality assessment. The assessment areas could be extended to include other areas within Hong Kong territory if they are found also being impacted during the course of the EIA study and have a bearing on the environmental acceptability of the Project.
- 3.4.6.3 The Applicant shall identify and analyse physical, chemical and biological disruptions of marine and coastal water arising from the sediment removal activities.
- 3.4.6.4 The Applicant shall predict, quantify and assess any water quality impacts arising from the Project on the water system(s) and the sensitive receivers by appropriate mathematical modelling and/or other techniques proposed by the Applicant and approved by the Director. The mathematical modelling requirements are set out in Appendix C to this study brief. Possible impacts due to the sediment removal, transportation and disposal of sediments shall include but not be limited to changes in hydrology, flow regime, sediment erosion and deposition patterns, water and sediment quality, fisheries and marine organisms/community. The prediction shall include possible different implementation stages or sequences.
- 3.4.6.5 The Applicant shall address water quality impacts due to the sediment removal and associated works. Essentially the assessment shall address the following:
- (i) Collect and review of background information on the affected existing and planned water system(s), their respective catchments and sensitive receivers which might be affected by the Project;
 - (ii) Characterize water and sediment quality of the water system(s) and sensitive receivers which might be affected by the sediment removal and associated activities based on existing best available information or through appropriate site survey and tests;
 - (iii) Identify and analyse physical, chemical and biological disruptions of marine water, coastal water, existing and planned drainage system arising from the Project;
 - (iv) Identify and analyze relevant existing and planned future activities, beneficial uses and sensitive receivers related to the affected water system(s). The Applicant shall refer to, *inter alia*, those developments and uses specified in the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land

use plans;

- (v) Identify pertinent water and sediment quality objectives and establishment of other appropriate water and sediment quality criteria or standards for the water system(s) and all the sensitive receivers as mentioned in sections 3.4.6.5(i), (ii), (iii) and (iv) of this study brief;
- (vi) Review construction methods (including methods and rates of sediment removal, etc.) and sequence of the construction activities to identify any alteration of existing bathymetry and flow regimes;
- (vii) Identify the potential site for relocating the fish rafts from the STK FCZ temporarily, including such provision for further sediment removal, if found necessary. The impacts arising from the temporary relocation of fish rafts to the water and sediment quality shall be assessed. The relocation site shall be considered as beneficial use sensitive to water pollution if fish culture activities will be carried out within the relocation site during construction.
- (viii) Identify and quantify existing and likely future water and sediment pollution sources and loading. An emission inventory on the quantities and characteristics of these existing and likely future pollution sources in the assessment area shall also be provided. Field investigation and laboratory test, as appropriate, shall be conducted to fill relevant information gaps;
- (ix) Predict, quantify and assess, by mathematical modelling or other technique approved by the Director prior to the commencement of the EIA study, the impacts due to the Project on the water system(s) and their sensitive receivers. The mathematical modelling 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 marine or aquatic organisms due to such changes in the affected water bodies. The prediction shall take into account and include possible different construction stages or sequences of the Project. The assessment shall also take into account the additional pollution loading and oxygen demand exerted by disturbed sediment during sediment removal and shall include possible different construction stages of the Project;
- (x) Identify and quantify all sediment removal, sediment/mud transportation and disposal activities and requirements. Potential dumping ground to be involved shall also be identified. Field investigation, sampling and chemical and biological laboratory tests to characterize the sediment/mud concerned shall be conducted as appropriate. The potential for the release of contaminants during sediment removal shall be addressed using the chemical testing results derived from sediment samples collected on site and relevant historic data. Appropriate laboratory tests such as elutriate tests shall be performed on the sediment samples to simulate and quantify the degree of mobilization of various contaminants such as metals, ammonia, trace organic contaminants (including PCBs, PAHs, TBT and chlorinated pesticides) into the water column during sediment removal. The ranges of parameters to be analyzed; the number, location, depth of sediment, type and methods of sampling; sample preservation; and chemical and biological laboratory test methods to be used shall be subject to the approval of the Director prior to

field investigation, sampling and laboratory testing. If applicable, the Applicant can make reference to previous studies and investigations and confirm with the Director whether the information and findings of such studies/investigations are still relevant and valid for the EIA study. The Applicant shall also assess 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 sediment removal. The prediction and quantification of impacts caused by sediment re-suspension and contaminants release shall be carried out by mathematical modelling requirements as set out in Appendix C of this study brief or other techniques to be approved by the Director.

- (xi) Assess the cumulative impacts due to other related concurrent and planned projects, activities or pollution sources along the identified water system(s) and sensitive receivers that may have a bearing on the environmental acceptability of the Project;
- (xii) Devise appropriate mitigation measures to avoid or minimize the impacts identified above, in particular suitable sediment/mud removal and disposal methods. Arrangement shall be recommended to mitigate any adverse impacts. The residual impacts on the water system(s) and the sensitive receivers with regard to the relevant water and sediment quality objective(s), criteria, standards, or guidelines shall be assessed and quantified using appropriate mathematical modelling as set out in Appendix C of this study brief or other techniques to be approved by the Director prior to the commencement of the EIA study.
- (xiii) Describe the frequency and rate of further sediment removal for maintaining the normal operation of the STK FCZ and STK Pier and boat shelter, if found necessary, including detailed substantiation of the assumptions adopted. The Applicant shall also assess and evaluate the recurrent water quality impacts due to the further sediment removal and associated works.

3.4.7 Waste Management Implications

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

3.4.7.2 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 sediment removal and associated works, based on the sequence and duration of these activities.

(ii) Proposal for Waste Management

- (a) Prior to considering the disposal options for various types of wastes, opportunities for reducing waste generation, on-site or off-site re-use and recycling shall be fully evaluated. Measures which can be taken

in the planning and design stages (e.g. by modifying the design approach) and in the construction stage for maximizing waste reduction shall be separately considered.

- (b) After considering all the opportunities for reducing waste generation and maximizing re-use, the types and quantities of the wastes required to be disposed of as a consequence shall be estimated and the disposal options for each type of waste shall be described in detail. The disposal method recommended for each type of waste shall take into account the result of the assessment in (c) below.
- (c) The impact caused by handling (including labeling, packaging and storage), collection, and reuse/disposal of wastes shall be addressed in detail and appropriate mitigation measures shall be proposed. This assessment shall cover the following areas :
 - potential hazard;
 - air and odour emissions;
 - noise;
 - wastewater discharge; and
 - public transport.

(iii) Proposal for Waste Management

- (a) Identification and quantification as far as practicable of all sediment removal activities, fill extraction, filling, reclamation, mud/sediment 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. If applicable, the Applicant can make reference to previous studies and investigations and confirm with the Director whether the information and findings of such studies/investigations are still relevant and valid for the EIA Study. The categories of sediments 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 seriously contaminated sediment which requires special treatment/disposal is confirmed, the Applicant shall identify the most appropriate treatment and/or disposal arrangement and demonstrate its feasibility.
- (b) Identification and evaluation of the best practical sediment removal methods to minimise sediment removal and dumping requirements and demand for fill sources based on the criterion that existing marine mud shall be left in place and not to be disturbed as far as possible.

3.4.8 Ecological Impact

- 3.4.8.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing ecological impact as stated in Annexes 8 and 16 of the TM respectively.
- 3.4.8.2 The assessment area for the purpose of terrestrial ecological assessment shall include all areas within 500 metres distance from the Project site boundary within Hong Kong territory and the areas likely to be impacted by the Project. For aquatic ecology, the assessment area shall be the same as that of the water quality assessment or the areas likely to be affected by the Project. The study should also cover the A Chau and Yim Tso Ha Egrettry SSSIs, the mudflat along the coastline of Sha Tau Kok Hoi, coral communities within Sha Tau Kok, Ap Chau and Kat O Hoi and the potential relocation site for fish rafts at Sha Tau Kok (STK) Fish Culture Zone (FCZ), which may be affected by the Project.
- 3.4.8.3 In the ecological impact assessment, the Applicant shall examine the flora, fauna and other components of the ecological habitats including marine benthos, mudflat, intertidal habitats, mangroves and corals within the assessment area. The aim shall be to protect, maintain or rehabilitate the natural environment. In particular, the Project shall avoid impacts on recognized sites of conservation importance and other ecological sensitive habitats and species. The assessment shall identify and quantify as far as possible the potential ecological impacts arising from the Project including both directly by physical disturbance and indirectly by changes of water quality.
- 3.4.8.4 The assessment shall include the following:
- (i) review the findings of relevant studies/surveys and collate all available information on the ecological characters of the assessment area;
 - (ii) evaluate the information collected from section 3.4.8.4(i) of this study brief and identify any information gap relating to the assessment of potential ecological impacts to the aquatic and terrestrial environment; and determine whether ecological surveys are required to bridge any identified information gap for the purpose of establishing a comprehensive and updated ecological profile in accordance with section 3.4.8.4(iv) of this study brief;
 - (iii) carry out necessary field surveys including but not limiting to dive survey, marine benthic and intertidal habitat survey as determined under section 3.4.8.4(ii) of this study brief, the duration of which shall be at least 9 months covering both the wet and dry seasons and investigations to verify the information collected, fill the information gaps identified and fulfill the objectives of the EIA study;
 - (iv) establish an ecological profile of the assessment area based on data of relevant previous studies/surveys and results of additional ecological field surveys, and describe the characteristics of each habitat found. Major information to be provided shall include :
 - (a) description of the physical environment;
 - (b) habitats maps of suitable scale (1:1,000 to 1:5,000) showing the types

- and locations of habitats in the assessment area;
- (c) ecological characteristics of each habitat type such as size, vegetation type, species present, dominant species found, species diversity and abundance, community structure, seasonal patterns, inter-dependence of the habitats and species, and presence of any features of ecological importance (e.g. corals and horseshoe crabs);
 - (d) representative colour photographs of each habitat type and any important ecological features identified; and
 - (e) species found that are rare, endangered and/or listed under local legislation, international conventions for conservation of wildlife/habitats or Red Data Books;
- (v) investigate and describe the existing wildlife uses of the various habitats with special attention to those wildlife groups and habitats with conservation interests, including birds, corals, horseshoe crabs, marine benthic communities, mudflat, intertidal habitats, soft-bottom benthic habitat and any other habitats and wildlife groups identified as having special conservation interests by this EIA study;
- (vi) describe all recognized sites of conservation importance in the proposed development site and its vicinity, including but not limiting to A Chau Egretty SSSI, Yim Tso Ha Egretty SSSI, mudflat, intertidal habitats along shoreline of Sha Tau Kok Hoi and coral communities within Sha Tau Kok, Ap Chau and Kat O Hoi and assess whether these sites will be affected by the Project;
- (vii) describe the potential sites for relocating the fish rafts at STK FCZ temporarily and evaluate and assess the ecological impacts to the potential site due to the relocation of fish rafts at STK FCZ;
- (viii) using suitable methodology to identify and quantify as far as possible any direct, indirect (e.g. changes in water qualities, sediment, hydrodynamics properties, sedimentation rates and patterns, hydrology, etc.), on-site, off-site, primary, secondary and cumulative ecological impacts on the wildlife groups and habitats, reduction of species abundance/diversity, loss of habitats and feeding grounds, reduction of ecological carrying capacity, habitat fragmentation; and in particular the following :
- (a) removal or disruption of benthic communities resulting from marine works and the temporary relocation of fish rafts;
 - (b) removal or disruption of mudflat and intertidal habitats along the shoreline of Sha Tau Kok Hoi resulting from direct habitat loss and indirectly by changes of water quality;
 - (c) deterioration or disturbance to sensitive marine ecological habitats/species, such as coral communities and horseshoe crabs;
 - (d) deterioration of environmental quality (e.g. water quality) during the

sediment removal activities and the subsequent impacts to the marine ecological resources and habitats, such as mudflat, intertidal habitats, coral communities and horseshoe crabs.

- (ix) demonstrate that the ecological impacts arising from the sediment removal activities are avoided to the maximum practicable extent;
- (x) evaluate the significance and acceptability of the ecological impacts identified using well-defined criteria;
- (xi) recommend all practicable alternatives (such as modification of rate and methods for sediment removal and change in layout design and size of Project area) and practicable mitigation measures to avoid, minimize and/or compensate for the adverse ecological impacts identified;
- (xii) evaluate the feasibility and effectiveness of the recommended mitigation measures and define the scope, type, location, implementation arrangement, subsequent management and maintenance of such measures;
- (xiii) determine and quantify as far as possible the residual ecological impacts after implementation of the proposed mitigation measures;
- (xiv) evaluate the severity and acceptability of the residual ecological impacts using well-defined criteria and determine if off-site mitigation measures are necessary to mitigate the residual impacts; and
- (xv) review the need for and recommend any ecological monitoring programme required.

3.4.9 Fisheries Impact

- 3.4.9.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing fisheries impact as stated in Annexes 9 and 17 of the TM.
- 3.4.9.2 The assessment area for fisheries impacts shall in general be the same as that for the water quality impact assessment stated in section 3.4.6.2 in this study brief, and include any areas within Hong Kong territory likely to be affected by the Project. Special attention shall be given to the potential impacts on the fish culture zones, nursery areas and spawning ground of commercial fisheries resources, and clam collection activities in the vicinity of the Project site.
- 3.4.9.3 The assessment shall cover any potential impact on both capture and culture fisheries, during sediment removal and associated works, and further sediment removal, if found necessary.
- 3.4.9.4 Existing information regarding the assessment area shall be reviewed. Based on the review results, the study shall identify data gap and determine if there is any need for field surveys. If field surveys are considered necessary, the study shall recommend appropriate methodology, duration and timing for the field surveys. The proposed field surveys shall be agreed with the Director prior to the commencement of the survey.

3.4.9.5 The fisheries impact assessment shall include the following :

- (i) description of the physical environmental background;
- (ii) description and quantification of existing capture and culture fisheries activities;
- (iii) description and quantification of the existing capture and culture fisheries resources (e.g. major fisheries products and stocks);
- (iv) identification of parameters (e.g. water quality parameters) and areas that are important to fisheries and will be affected by the Project;
- (v) identification and quantification as far as practicable any direct/indirect and on-site/off-site impacts on fisheries (e.g. loss of fishing ground and water quality deterioration in areas of fisheries importance including spawning and nursery grounds of fisheries resources);
- (vi) evaluation of impacts and make recommendations for any practical alternatives or mitigation measures with details on justification, description of scope and programme, feasibility as well as manpower and financial implications including those related to subsequent management and maintenance requirements of such recommendations; and
- (vii) review the need for monitoring during the sediment removal activities and, if necessary, propose a monitoring and audit programme.

3.4.10 Visual Impact

- 3.4.10.1 The Applicant shall follow the criteria and guidelines as stated in Annexes 10 and 18 of the TM and EIAO Guidance Note No. 8/2002 on “*Preparation of Landscape and Visual Impact Assessment under the Environmental Impact Assessment Ordinance*” for evaluating and assessing visual impacts of the Project, such as site hoarding and above ground structures, during sediment removal and associated activities. The assessment shall take into account all existing, committed and planned land uses and sensitive receivers.
- 3.4.10.2 The area for the visual impact assessment shall be defined by the visual envelope of the Project area. The defined visual envelope must be shown on a plan in the EIA report.
- 3.4.10.3 The Applicant shall assess the visual impacts of the Project. A system shall be derived for judging visual impact significance as required under the TM. Clear illustrations including mapping of visual impact is required. The assessment shall include the following:
- (i) Identification and plotting of visual envelope of the Project;
 - (ii) Identification of the key groups of sensitive receivers within the visual envelope with regard to views from ground level, sea level and elevated vantage points;

- (iii) Description of the visual compatibility of the Project with the surrounding and the existing and planned setting, and its obstruction and interference with the key views of the adjacent areas;
 - (iv) Description of the severity of visual impacts in terms of nature, distance and number of sensitive receivers. The visual impact of the Project and associated works with and without mitigation measures shall be assessed.
 - (v) Clear evaluations and explanations with supportive arguments of all factors considered in arriving the significance thresholds of visual impact.
- 3.4.10.4 Alternative design(s) and construction methods that would avoid or reduce the identified visual impacts shall be evaluated for comparison before adopting other mitigation or compensatory measures to alleviate the impacts. The mitigation measures proposed shall not only be concerned with damage reduction but shall also include consideration of potential enhancement of existing visual quality.
- 3.4.10.5 The mitigation measures shall include consideration of any measures to mitigate the impact on existing landscape and visual quality of the area. The relevant responsible parties shall be identified for the on-going management and maintenance of the proposed mitigation works to ensure their effectiveness during the implementation of the Project. A practical programme and funding proposal for the implementation of the recommended measures shall be provided.
- 3.4.10.6 Annotated illustration materials such as colour perspective drawings, plans and section/elevation diagrams, oblique aerial photographs, photographs taken at vantage points, and computer-generated photomontages shall be adopted to fully illustrate the visual impacts of the Project to the satisfaction of the Director.
- 3.4.11 Impact on Cultural Heritage**
- 3.4.11.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing the cultural heritage impact as stated in Annexes 10 and 19 of the TM.
- 3.4.11.2 The assessment area for the potential archaeological impact shall include all areas where sediment removal works will be carried out under this Project.
- 3.4.11.3 The Applicant shall engage a qualified marine archaeologist to conduct a marine archaeological review based on the best available information to identify whether there is any potential existence of sites or objects of cultural heritage within the seabed that will be affected by the marine works of the Project, whether the identified issues can be mitigated and whether there is a need for more detailed investigation. The review should take into account the results of previous marine archaeological investigations, the dredging history and other diving records.
- 3.4.11.4 If marine archaeological potential is identified and the need for further investigation is confirmed, a marine archaeological investigation (MAI) shall be carried out to ascertain the archaeological value of the affected seabed area. The Applicant shall propose a programme of investigation, including the scope of work, methodology and time schedule, etc. for agreement with the Antiquities and Monuments Office (AMO) of Leisure and Cultural Services Department. 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. If significant archaeological remains are discovered, mitigation measures shall be designed and implemented in consultation with the AMO.

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

3.4.11.1 To facilitate efficient retrieval, a summary to include the assessment methodologies and key assessment assumptions adopted in this EIA study, the limitations of these assessment(s) methodologies/assumptions, if any, plus all relevant prior agreement(s) with the Director or other Authorities on individual environmental media assessment components. The proposed use of any alternative assessment tool(s) or assumption(s) have to be justified by the Applicant, with supporting documents based on cogent, scientific and objectively derived reason(s) before seeking the Director's agreement. This summary and all related supporting documents shall be provided in the form of an Appendix to the EIA study report.

3.4.12 Impacts Summary

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

3.4.13 Summary of Environmental Outcomes

3.4.13.1 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.

3.4.14 Environmental Monitoring and Audit (EM&A) Requirements

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

3.4.14.2 Subject to the confirmation of the EIA study findings, the Applicant shall comply with the requirements as stipulated in Annex 21 of the TM. The Applicant shall also propose real-time reporting of construction monitoring data, wherever practicable, for the Project and associated works through a dedicated internet website.

3.4.14.3 The Applicant shall prepare a Project Implementation Schedule (in the form of a

checklist as shown in Appendix D to this EIA study brief) containing all the EIA study recommendations and mitigation measures with reference to the Project implementation programme.

4. DURATION OF VALIDITY

- 4.1 This EIA study brief is valid for 36 months counting from the date of its issuance. 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. The Applicant shall advise the Director the date of commencement of the EIA study.

5. REPORT REQUIREMENTS

- 5.1 In preparing the EIA report, the Applicant shall refer to Annex 11 of the TM for the contents of an EIA report. The Applicant shall also refer to Annex 20 of the TM, which stipulates the guidelines for review of an EIA report.
- 5.2 The Applicant shall supply the Director with the following number of copies of the EIA report and the executive summary:
- (i) 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 under section 5.2(i) of this study brief as required under section 7(1) of the EIAO, to be supplied upon advice by the Director for public inspection.
 - (iii) 20 copies of the EIA report in English and 50 copies of the executive summary (each bilingual in both English and Chinese) with or without Addendum as required under section 7(5) of the EIAO, to be supplied upon advice by the Director for consultation with the Advisory Council on the Environment.
- 5.3 The Applicant shall, upon request, make additional copies of the above documents available to the public, subject to payment by the interested parties of full costs of printing.
- 5.4 In addition, to facilitate the public inspection of the EIA report via the EIAO Internet Website, the applicant shall provide electronic copies of both the EIA report and the executive summary prepared in HyperText Markup Language (HTML) (version 4.0 or later) and in Portable Document Format (PDF version 1.3 or later), unless otherwise agreed by the Director. For the HTML version, a content page capable of providing hyperlink to each section and sub-section of the EIA report and the executive summary shall be included in the beginning of the document. Hyperlinks to all figures, drawings and tables in the EIA report and executive summary shall be provided in the main text from where the respective

references are made. All graphics in the report shall be in interlaced GIF format unless otherwise agreed by the Director.

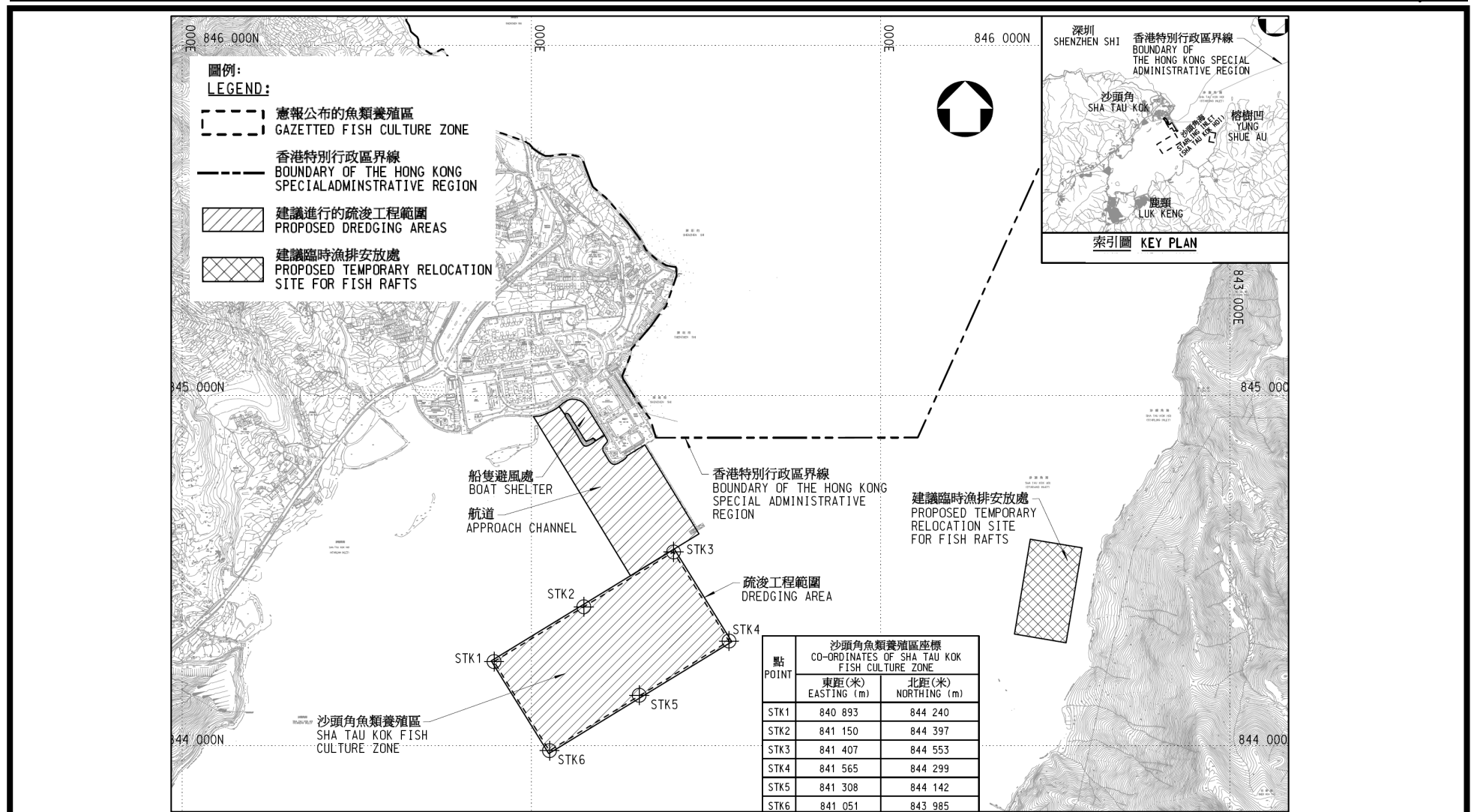
- 5.5 The electronic copies of the EIA report and the executive summary shall be submitted to the Director at the time of application for approval of the EIA report.
- 5.6 When the EIA report and the executive summary are made available for public inspection under section 7(1) of the EIAO, the content of the electronic copies of the EIA report and the executive summary must be the same as the hard copies and the Director shall be provided with the most updated electronic copies.
- 5.7 To promote environmentally friendly and efficient dissemination of information, both hardcopies and electronic copies of future EM&A reports recommended by the EIA study shall be required and their format shall be agreed by the Director.

6. OTHER PROCEDURAL REQUIREMENTS

- 6.1 If there is any change in the Applicant (as representing his or her organisation) for this EIA study brief during the course of the EIA study, the Applicant must notify the Director immediately.
- 6.2 If there are any key changes in the scope of the Project mentioned in section 1.2 of this study brief and in the Project Profile, the Applicant must seek confirmation in writing from the Director on whether or not the scope of this EIA study brief is still applicable to cover the key changes identified, and what additional issues, if any, that the EIA study must also cover to address these key changes. 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 ---

May 2008
Environmental Assessment Division,
Environmental Protection Department



Appendix A 附件 A Sediment Removal at Sha Tau Kok Fish Culture Zone, Boat Shelter and Approach Channel (清除沙頭角魚類養殖區、船隻避風處及航道沉積物工程)

Project Location Plan (工程位置圖)

This figure was prepared based on Drawing no. PW-MS08-008 of Project Profile (No.: PP-350/2008)
本圖是根據工程項目簡介(編號: PP-350/2008)圖 PW-MS08-008 編制

EIA Study Brief No. ESB-186/2008

環評研究概要編號 ESB-186/2008



Appendix B-1

Guidelines on Choice of Models and Model Parameters in Air Quality Assessment

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

1. Introduction

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

2. Choice of Models

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

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

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

- 2.2 Note that both FDM and CALINE4 have a height limit on elevated sources (20 m and 10m, respectively). Source of elevation above these limits will have to be modelled using the ISCST3 model or suitable alternative models. In using the latter, reference should be made to the 'Guidelines on the Use of Alternative Computer Models in Air Quality Assessment' in Appendix B-3.
- 2.3 The models can be used to estimate both short-term (hourly and daily average) and long-term (annual average) ambient concentrations of air pollutants. The model results, obtained using appropriate model parameters (refer to Section 3) and assumptions, allow direct comparison with the relevant air quality standards such as the Air Quality Objectives (AQOs) for the relevant pollutant and time averaging period.

3. Model Input Requirements

3.1 Meteorological Data

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

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

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

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

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

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

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

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

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

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

deviation of wind direction under different stability categories and surface roughness conditions.

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

3.2 Emission Sources

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

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

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

3.3 Urban/Rural Classification

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

3.4 Surface Roughness Height

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

3.5 Receptors

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

3.6 Particle Size Classes

In evaluating the impacts of dust-emitting activities, suitable dust size categories relevant to the dust sources concerned with reasonable breakdown in TSP (< 30 μ m)

and RSP (< 10 μ m) compositions should be used.

3.7 NO₂ to NO_x Ratio

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

- (a) Ambient Ratio Method (ARM) - assuming 20% of NO_x to be NO₂; or
- (b) Discrete Parcel Method (DPM, available in the CALINE4 model); or
- (c) Ozone Limiting Method (OLM) - assuming the tailpipe NO₂ emission to be 7.5% of NO_x and the background ozone concentration to be in the range of 57 to 68 μ g/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 the Director (with reference to Section 4.4.2(c) of the TM). The EPD's 'Guidelines on the Use of Alternative Computer Models in Air Quality Assessment' should also be referred to in Appendix B-3.

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

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

3.11 Background Concentrations

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

3.11 Output

The highest short-term and long-term averages of pollutant concentrations at prescribed receptor locations are output by the model and to be compared against the relevant air quality standards specified for the relevant pollutant. Contours of pollutant concentration are also required for indicating the general impacts of emissions over a study area. Copies of model files in electronic format should also be provided for the Director's reference.

Schedule 1

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

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

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

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

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

Appendix B-2

Guidelines on Assessing the 'TOTAL' Air Quality Impacts

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

1. Total Impacts - 3 Major Contributions

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

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

2. Nature of Emissions

2.1 Primary contributions

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

2.2 Secondary contributions

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

2.3 Background contributions

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

3. Background Air Quality - Estimation Approach

3.1 The approach

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

3.2 Categorisation

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

Urban: Kwun Tong, Sham Shui Po, Tsim Sha Tsui and Central/Western
 Industrial: Kwun Tong, Tsuen Wan and Kwai Chung
 Rural/New Development: Sha Tin, Tai Po, Junk Bay, Hong Kong South and Yuen Long

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

3.3 Background pollutant values

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

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

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

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

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

3.4 Site categories

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

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

3.5 Provisions for 'double-counting'

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

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

where E stands for emission.

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

4. Conclusions

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

Appendix B-3

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

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

1. Background

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

2. Required Demonstration / Submission

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

- (i) Technical details of the proposed model; and
- (ii) Performance evaluation of the proposed model

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

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

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

Model details – Calibration & Validation

1. The models shall be properly calibrated and validated before its use in this study in the Hong Kong waters, the Pearl Estuary and the Dangan (Lema) Channel, with the field data collected by:
 - Strategic Sewage Disposal Scheme Stage II - Oceanic Outfall, Oceanographic Surveys and Modelling (1992)
 - Update on Cumulative Water Quality and Hydrological Effect of Coastal Developments and Upgrading of Assessment Tool (1998)
 - Environmental Protection Department (EPD)'s routine monitoring data
 - Tidal data from Hong Kong Observatory, Macau and relevant Mainland Authorities
2. Tidal data shall be calibrated and validated in both frequency and time domain manner.
3. For the purpose of calibration and validation, the model shall run for not less than 15 days of real sequence of tide (excluding model spin up) in both dry and wet seasons with due consideration of the time required to establish initial conditions.
4. In general the hydrodynamic models shall be calibrated to the following criteria:

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

Model details – Simulation

1. The water quality modelling results shall be qualitatively explainable, and any identifiable trend and variations in water quality shall be reproduced by the model. The water quality model shall be able to simulate and take account of the interaction of dissolved oxygen, phytoplankton, organic and inorganic nitrogen, phosphorus, silicate, BOD, temperature, suspended solids, contaminants release of dredged and disposed material/sediment, 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 sediment removal 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 waterway and the proposed disposal ground. 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 schematization shall be agreed with EPD.

Modelling assessment

1. The assessment shall include the construction phase of the project. Where appropriate, the assessment shall also include the further sediment removal. 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 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 all 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.

- END -

Appendix D

IMPLEMENTATION SCHEDULE

EIA* Ref.	EM&A		Location/Duration of measures/ Timing of completion of measures	Implementation Agent	Implementation Stage **				Relevant Legislation & Guidelines
	Log Ref.	Environmental Protection Measures*			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