

Zen Pacific-Dredging International Joint Venture

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River Trade Terminal at  
Tuen Mun Area 38  
Supplementary EIA for  
Sand Extraction from the  
Brothers' Marine Borrow Area

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EM & A Manual

January 1998

  
Hyder  
Consulting

# Supplementary EIA for Sand Extraction from The Brothers' Marine Borrow Area

## EM&A Manual

January 1998

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# Introduction

## 1. INTRODUCTION

### 1.1 BACKGROUND

Zen Pacific- Dredging International Joint Venture aim to utilise a potential sand borrow area adjacent to The Brothers' islands as a source of sand for reclamation works in the construction of the River Trade Terminal (RTT). An EIA for the RTT was prepared in 1996 but this did not encompass the impacts of sand excavation from within Hong Kong waters. An EM&A Manual for the construction and operation of the RTT was submitted in January 1997.

Hyder Consulting Ltd have been commissioned by Zen Pacific - Dredging International JV to conduct the supplementary EIA and prepare an EM&A Manual for the proposed sand borrowing from the Brothers Area for the construction of the RTT.

### 1.2 PURPOSE OF THE MANUAL

The purpose of this Environmental Monitoring and Audit (EM&A) Manual is to guide the set-up of an EM&A programme to ensure compliance with the Environmental Impact Assessment (EIA) study recommendations, to assess the effectiveness of the recommended mitigation measures and to identify any further need for additional mitigation measures or remedial action. This Manual outlines the monitoring and audit programme to be undertaken during the extraction of sand from The Brothers' MBA. It aims to provide systematic procedures for monitoring, auditing and minimising of the environmental impacts associated with the construction works.

Hong Kong environmental regulations for air and water quality, noise and waste, the Hong Kong Planning Standards and Guidelines, and recommendations in the EIA study final report on the proposed sand borrowing from the Brothers MBA have served as environmental standards and guidelines in the preparation of this Manual.

This Manual contains the following :

1. responsibilities of the Contractor, the Engineer or Engineer's representative (ER), Environmental Team and the Independent Checker (IC(E)) with respect to the environmental monitoring and audit requirements during the course of the project.
2. information on project organisation and programming of construction activities for the project;
3. the hypotheses of potential impacts, the basis for and the description of the broad approach underlying the environmental monitoring and audit programme.
4. requirements with respect to the construction schedule and the necessary environmental monitoring and audit programme to track the varying environmental impact;

5. full details of the methodologies to be adopted, including all field, laboratory and analytical procedures, and details on quality assurance and quality control programme;
6. definition of Action and Limit levels;
7. establishment of Event and Action Plans;
8. requirements of reviewing pollution sources and working procedures required in the event of non-compliance of the environmental criteria and complaints;
9. requirements of presentation of environmental monitoring and appropriate reporting procedures;
10. requirements for review of EIA predictions and effectiveness of the environmental monitoring and audit programme.

### **1.3 PROJECT ORGANISATION**

The project organisation and lines of communication with respect to environmental protection works is shown in Figure 1.1.

The responsibility of respective parties are given in the following sub-sections.

#### **1.3.1 The Contractor:**

- Employ an Environmental Team (ET) to undertake monitoring, laboratory analysis and reporting of environmental monitoring and audit;
- Provide assistance to ET in carrying out monitoring;
- Submit proposals on mitigation measures in case of exceedances of Action and Limit levels in accordance with the Event and Action Plans;
- Implement measures to reduce impact where Action and Limit levels are exceeded.
- Adhere to the procedures for carrying out complaint investigation in accordance with 5.3.

#### **1.3.2 The Engineer or Engineer's Representative:**

- Supervise the Contractor's activities and ensure that the requirements in the EM&A Manual are fully complied with;
- Inform the Contractor when action is required to reduce impacts in accordance with the Event and Action Plans;
- Employ an Independent Checker (Environment)(IC(E)) to audit the results of the EM&A works carried out by the ET.
- Adhere to the procedures for carrying out complaint investigation in accordance with 5.3.

### 1.3.3 The Environmental Team:

- Monitor the various environmental parameters as required in the EM&A Manual;
- Analyse the environmental monitoring and audit data and review the success of EM&A programme to cost effectively confirm the adequacy of mitigatory measures implemented and the validity of the EIA predictions and to identify any adverse environmental impacts arising.
- Carry out site inspection to investigate and audit the Contractor's site practice, equipment and work methodologies with respect to pollution control and environmental mitigation, and anticipate environmental issues for proactive action before problems arise.
- Audit and prepare audit reports on the environmental monitoring data and the site environmental conditions;
- Report on the environmental monitoring and audit results to the IC(E), Contractor, the ER, and the EPD;
- Recommend suitable mitigation measures to the Contractor in the case of exceedance of Action and Limit levels in accordance with the Event and Action Plans.
- Adhere to the procedures for carrying out complaint investigation in accordance with 5.3.

### 1.3.4 Independent Checker (Environment)

- Review the EM&A works performed by the ET;
- Audit the monitoring activities and results;
- Report the audit results to the ER and EPD in parallel;
- Review the EM&A reports submitted by the ET;
- Review the proposal on mitigation measures submitted by the Contractor in accordance with the Event and Action Plans.
- Adhere to the procedures for carrying out complaint investigation in accordance with 5.3.

Suitably qualified professional and technical staff shall be employed by the respective parties to ensure full compliance with their duties and responsibility, as required under the EM&A programme for the duration of the project.

## 1.4 PROJECT DESCRIPTION

The Tuen Mun RTT is strategically located in the mouth of the Pearl River Delta and is intended to act as a port of entry for small river vessels. The RTT will maximise the capacity of the Hong Kong Harbour and discourage utilisation of the Ma Wan Channel by large numbers of small vessels thus reducing the risk of marine traffic accidents in the Ma Wan Fairway. In order to construct the RTT, approximately 10 million m<sup>3</sup> sand for the reclamation and an additional 3 million m<sup>3</sup> for surcharge material are required at the River Trade Terminal (RTT) site. The Supplementary

EIA has investigated the environmental impacts associated with the extraction of 3.5Mm<sup>3</sup> of sand from the Brothers MBA. The EIA found the exploitation of the Brothers MBA to be environmental acceptable provided that recommended mitigation measures are employed throughout the works. The EM&A will ensure that these measures are effectively implemented.

### 1.5 SENSITIVE RECEIVERS

Potential impacts were quantified in the EIA for the following sensitive receivers:

- Gazetted beaches along the coastline extending from Tuen Mun to Tsuen Wan. There are currently six gazetted beaches along the Tuen Mun coastline and 8 within the Tsuen Wan District (including Ma Wan).
- Sea water intakes, for example for the China Light and Power (CLP) Power Station at Castle Peak WSD intakes located at Tsuen Wan, Tuen Mun and Tsing Yi, SRs further afield such as the WSD water intake at Kennedy Town, Queen Mary Hospital, the Wah Fu Housing Estate Intake were also investigated.
- Fisheries and Fish Culture Zones e.g. Ma Wan MFCZ, and Kau Yi Chau Fishery and fisheries in the waters around the Brothers;
- Ecology, particularly the Chinese White Dolphin which is found in the western waters of Hong Kong; fish; and marine conservation areas including Sites of Special Scientific Interest and the Sha Chau and Lung Kwu Cha marine park, which was designated in 1996.

The EIA found that only Ma Wan and the marine park have the potential to be affected by the works and are therefore the key sensitive receivers to be included in this monitoring programme.

### 1.6 PROPOSED WORK PROGRAMME

- Mobilisation of the dredger will commence in February 1998 and will take approximately 4 weeks.
- It is therefore anticipated that works can commence in early March 1998 and will continue throughout the dry season until the end of May 1998. Works will therefore continue over a 24 hour basis for 3 months.
- Optimum working conditions will permit up to 12 dredging cycles to completed a day. Under defined circumstances, the number of permitted dredging cycles undertaken over a 24 hour period may be reduced. This is described below and in the Event Contingency Plan.

### 1.7 ENVIRONMENTAL PROTECTION MEASURES

The EIA identified and assessed a number of mitigation measures which were summarised in Table 8.1 and would ensure that the works would not affect any of the identified sensitive receivers. These measures and appropriate references have been incorporated into an implementation schedule:

Table 1.1 Implementation Schedule of Mitigation Measures

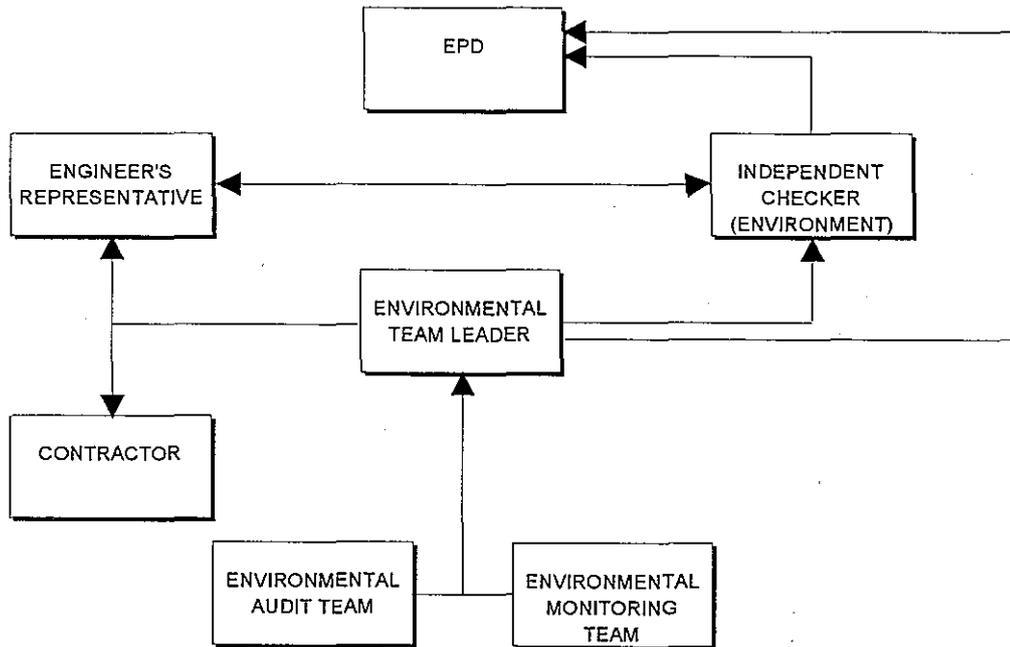
Item No.	EIA Ref.	Activity	Environmental Protection Measure	Responsibilities for implementation	Audit Method	Implementation Status (as of Month X 1998)	Auditor signature
1		Works in general :	To be enforced throughout works period (to end of May 1998):				
1.1	EIA Section 1.2	Dredging.	Works must not extend beyond May 1998. Any further work would require a supplementary EIA.	Records should be kept by contractor of the duration of dredging for each type of material i.e overburden, marine sand, alluvial sand.	1. ET to continue post project EM&A for two weeks in June 1998. 2. ET to check no unauthorised work and ensure mixing zone generated by works returns to pre-project condition.	To be completed during audit....	
1.2	EIA Sec 5.7.2 & Table 8.1 item (8)	Dredging	All staff to have been briefed on the Chinese White Dolphin-	Basic facts and instruction to stop work for 10 minutes if dolphin seen within 500m of dredger to be given to contractors. Engineer to ensure Contractor has been adequately briefed prior to commencement of works.	1.ET to interview key staff and ensure a person has been allocated to monitor dolphin activity around the dredger.		
1.3	EM&A Manual Section 2.2 & 4 EIA: Table 8.1 item (8)	Environmental Monitoring	Monitoring work undertaken within the marine park and close to dolphins should follow the AFD code of practice for dolphin watching. Records of any dolphin sightings and photographs should be taken if possible.	Contractor to employ an Environmental Team responsible for EM&A. Engineer to employ an independent checker to undertake work.	1. ET leader to ensure EM&A team are adequately briefed and to check records of dolphin sightings. 2. Independent Checker to audit records and procedures used by ET.		
1.4	EM&A Manual	Environmental Monitoring	Samples collected for laboratory testing to be analysed using a HOKLAS	Contractor/ET to ensure samples collected are sent to an HOKLAS accredited	IC(E) to check results and laboratory testing		

Item No.	EIA Ref.	Activity	Environmental Protection Measure	Responsibilities for implementation	Audit Method	Implementa-tion Status (as of Month X 1998)	Auditor signature
	Sec.2.5		accredited testing procedures.	laboratory.	procedures		
1.4	EIA Section 4.7 Table 8.1(5)	Commencement of Dredging Cycle	The hopper will, as far as practicable, be empty at the start of the dredging cycle (from a practical point of view approximately 300m <sup>3</sup> of water may remain in the hopper).	Contractor responsible for this at the start of every dredging cycle.	1. ET to audit dredging practice. Inspect hopper prior to dredging and interview staff to ensure that this occurs as standard practice.		
1.5	EIA Section 2.3.2 (1) Table 8.1(6)	Vessel Turning outside of dredging area	The pumps of the dredger should be stopped while turning in order to reduce the amount of sediment released during each loading cycle;	Contractor responsible for implementation.	1. ET to inspect turning activities from the vessel & interview staff to ensure that this occurs as standard practice.		
1.6	EIA Sec 5.7.2 Table 8.1(8)	Dredging and Dumping Activities in General	A 500m boundary will be observed for dolphins. In the unlikely event that the dolphins come within 500m of the stop work zone then work should be stopped for 10 minutes or until the dolphins have moved away.	Contractor responsible for allocating member of staff who will be responsible for monitoring dolphin activity and maintaining records.  Records should be in accordance with section 4 of the EM&A manual and kept on board and copied to Environmental Team. Any problems should be relayed to Engineer/IC(E)	1. ET to audit general work procedure to check member of staff monitors for dolphins.  2. May be possible to audit procedure if dolphin enters stop work zone during site inspection.		

Item No.	EIA Ref.	Activity	Environmental Protection Measure	Responsibilities for implementation	Audit Method	Implementation Status (as of Month X 1998)	Auditor signature
1.7	EIA Sec 8, Table 8.1(9) EM&A Manual Sec 2.7	Releases of sediment cause a non compliance with water quality assessment criteria	Actions to be undertaken to further mitigate the impacts or the number of dredging cycles must be reduced in accordance with the Event Contingency Plan of the EM&A Manual.	Contractor responsible for employing ET. Contractor to review working methods and identify further mitigation measures. Engineer to advise of the need to reduce dredging cycles following consultation with IC(E)..	1. ET to check monitoring works and event contingency plans. 2. ET to report findings to EPD on a monthly basis and to advise of any non compliance. 3. IC(E) to review procedures and monitoring results.		
1.8	EM&A Sec 5.3	General works period	Complaints should be responded to in accordance with the procedure set out in the EM&A Manual	Contractor /Engineer should notify ET Leader of any complaints received. Record of complaints should be maintained by Engineer and ET.	1. ET Leader should liaise with Government Bodies and undertake additional monitoring as required. 2. IC(E) to review response procedure.		
2		<b>Mobilisation</b>	<b>February 1998</b>				
2.1	EIA Sec 2.1 & Table 8.1(1)	Mobilisation and ongoing work.	The trailer will have a 5,000 m <sup>3</sup> capacity.	Engineer/contractor to ensure use of appropriate equipment.	1. ET to check equipment prior to commencement of work.		
2.2	EIA Sec 1.2 Table 8.1(3)	Mobilisation and ongoing work.	The dredger will be a split-hull trailer suction hopper dredger - this will ensure release of fines during dumping of overburden is less than 2.5% as modelled in EIA.	Engineer will ensure contractor uses a split hull TSHD.	1. ET to check during mobilisation of equipment.		

Item No.	EIA Ref.	Activity	Environmental Protection Measure	Responsibilities for implementation	Audit Method	Implementa-tion Status (as of Month X 1998)	Auditor signature
3		Marine Sand Winning	March/April 1998				
3.1	EIA Section 2.3.2 (2) Table 8.1(4)	Extraction of marine sand	Marine Sand will be excavated in its pure form for the minimum amount of time approximately one week to 10 days.	Contractor to minimise dredging of pure marine sand through mixing of sand types. Contractor should keep records which should be copied to Engineer.	1. ET to check dredging practice and records and cross reference with monitoring data at SRs. 2. IC(E) to review ET results as pure marine sand dredging is the only time when works could cause exceedance at SRs		
3.2	EIA Section 5.6.3 Table 8.1(7)	Dredging Marine Sand on Neap Tide	The number of dredging cycles per day should be reduced from 12 to 8 to reduce sediment release over this tidal condition and protect the Marine park. This may extend dredging of marine sand from one week to approx. 10 days.	ET and Contractor to monitor tidal conditions and advise Engineer and IC(E) of approaching neap tide during marine sand extraction. Contractor to reduce dredging cycles accordingly.	1. ET to audit site activities which should be cross referenced with monitoring data at marine park. 2. IC(E) to check results to ensure mitigation is effective and notify EPD.		
4		Extraction of Sand Mixture	April/May 1998				
4.1	EIA Section 2.3.2 (2) Table 8.1(4)	Extraction of a mixture of sand.	Mixture of marine;alluvial sand should be obtained in a ratio of approximately 25:75 after first 7-10 days of sand extraction.	Contractor responsible for extracting this mixture in the quoted ratios. And keeping records as an indication of ratios obtained.	1. ET to audit dredging practice and review records -these are to be cross referenced with monitoring data. 2. IC(E) to review ET results as proposed mixture should not cause any exceedance of the WQOs.		

Figure 1.1 Team Structure and Lines of Communication



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Water Quality Monitoring

## 2. WATER QUALITY MONITORING

### 2.1 INTRODUCTION

The study area and location of the sand borrow area is shown in Figure 2.1. The key impact identified by this EIA has been the increases in suspended solids within the water column arising from the works. Environmental monitoring will therefore focus on collection and analysis of marine water around the work's "mixing zone", and from key sensitive receivers. The mixing zone represents an area where the works may cause the water quality to fail the Water Quality Assessment Criteria (WQAC).

### 2.2 SAMPLE LOCATION

Monitoring stations will be located at:

- (a) the boundary of the mixing zone or area where there is the potential for water quality assessment criteria to be exceeded. The extent of the mixing zones were determined in the EIA final report. These stations have been termed as the impact monitoring stations and are shown in Figure 2.1, prefixed with the letter 'I'. Within the mixing zone there will be six impact monitoring stations; three located for ebb tide monitoring and three for flood tide monitoring.
- (b) Areas unaffected by the works. Control stations are necessary to compare the water quality from potentially impacted sites with the ambient water quality. Control stations will therefore be used to determine the level for non compliance and should be at locations representative of the project site in its undisturbed condition. Control stations should also be located, as far as is practicable, both upstream and downstream of the works area. Figure 2.1 shows the location of the four control stations which will be used during the course of the EM&A. C1 and C2 are located either side of the potential sediment plume and therefore unlikely to be affected by the works. C3 and C4 lie upstream and downstream of the plume and will be used on the flood and ebb tide respectively.
- (c) close to the sensitive receivers which are likely to be affected by the plume. The proposed locations are shown in Figure 2.1. One station will be located at Ma Wan FCZ, another at Sha Chau, within the marine park and the third at Lung Kwu Chau, also within the marine park. Since two of the stations lie within the Marine Park, the AFD code of practice for dolphin watching will be adhered to so that there are no adverse impacts on dolphins during monitoring. These are attached as Appendix 1.

Measurements shall be taken at 3 water depths, namely, 1m below water surface, mid-depth and 1m above sea bed, except where the water depth less than 6m, the mid-depth station may be omitted. Should the water depth be less than 3m, only the mid-depth station will be monitored. The ET Leader shall seek approval from DEP on all the monitoring stations.

## 2.3 BASELINE MONITORING PROGRAMME

The aim of the data set is to establish the suitability of the selected control and impact monitoring stations and to also determine a typical background level at the sensitive receivers.

### 2.3.1 Baseline monitoring at Control and Impact Stations

To determine the suitability of the control stations and impact monitoring stations a simple statistical test is required to test the following hypothesis,

*“prior to commencement of work the water quality at the control station is not significantly different to that at the impact monitoring stations.”*

For this process it is not necessary to sample at each of the impact monitoring stations:

Data will therefore be collected at the following stations:

- Flood Tide: C1, C3, I1 and I3 on day 1 and C2, C3, I2 and I3 on day 2 and so on;
- Ebb tide: C2, C4, I5 and I6 on day 1 and C1, C4, I4 and I5 on day 2 and so on.

Prior to any sampling it will be ensured that there are no marine construction activities in the vicinity of the stations.

Because the data will be used in a statistical test, in order to obtain confidence in the data and have sufficient data on which to perform the test, duplicates of these samples are required. Samples will therefore be collected in duplicate at three depths (surface, middle and bottom), on two tides a day for three days a week for two weeks prior to the commencement of the works.

Parameters to be measured at these stations during the baseline are:

- Suspended Solids (SS, measured in mg/l);
- Turbidity (Tby, expressed as NTU); and
- Dissolved Oxygen (DO, measured in mg/l and % saturation).

The suspended solids data will be used to calibrate the turbidity so that future monitoring at the boundary of the mixing zone can largely focus on collection of field data so that instantaneous assessments of impacts can be made rather than waiting for laboratory analytical data. On each day of the compliance monitoring the calibration will be checked through the collection of 2 samples for suspended solids analysis.

### 2.3.2 Baseline Monitoring at Sensitive Receivers

Data collected during the baseline period at the sensitive receivers will be averaged to determine a typical concentration of suspended solids for the waters. This will be

used in conjunction with the reported water quality assessment criteria to establish level for non compliance at the sensitive receivers:

Non compliance at SR 3 day averaged SS(mg/l) >Average of baseline monitoring data for SS + WQAC for SS reported in EIA (mg/l)

Given the sensitivity of the sites and the need to ensure compliance with the water quality objectives in these areas, it is considered necessary to measure suspended solids throughout the monitoring period, both baseline and compliance. Turbidity will therefore not need to be calibrated against SS at these stations and duplication of samples is not necessary.

In summary the following key parameters will be measured:

- Suspended solids;
- Dissolved Oxygen; and
- Turbidity

In addition to these parameters it will be necessary to measure depth, temperature and salinity of the water column. Monitoring will continue for two weeks.

The data set to be used to calculate the average so as to set action and limit levels for the SRs will be determined after monitoring and in consultation with EPD. Depending on the outcome of the results it may be possible to average the entire data set (S,C and I stations) or, it may be necessary to limit the data set to that collected from the western stations.

## 2.4 COMPLIANCE MONITORING

Monitoring should be undertaken three times a week throughout the works period and for two weeks after completion of dredging. However, due to the need for a flexible programme, the monitoring will be subject to a constant review. The monitoring programme will therefore allow for changes in monitoring stations when the ET and EPD consider it to be necessary.

Table 2.1 shows the parameters and locations to be monitored during compliance monitoring at the control and impact stations. Table 2.2 shows the slightly different programme to be followed for the sensitive receivers.

Field data and analytical results will be recorded on a field record sheet as shown in Figure 2.2. Non compliances will be recorded on a notification form shown in Figure 2.3.

### 2.4.1 Statistical Analysis of data

A simple statistical analysis (e.g Student's t-test) will test to see whether there is a significant difference between the mean of three days impact monitoring stations data and the mean of three days control station monitoring data. The same test will be

performed to determine whether there is a significant difference between the models predicted increases in SS at the sensitive receivers and actual increases recorded in SS. Finally, at the end of the works period, the two weeks post project monitoring should seek to determine whether there is a) a significant difference between the control and impact monitoring stations and b) the baseline data set and the two week post-project data set.

**Table 2.1 Control Station and Impact Stations**

<i>Parameters:</i>	<i>Location<sup>1</sup></i>	<i>Frequency</i>
Turbidity	Flood tide (mid flood) C1, C2, C3 I1, I2 & I3	Three times a week.  All samples to be duplicated.
	Ebb tide (mid ebb) C1, C2, C4, I4, I5, I6.	
Dissolved Oxygen	Flood tide (mid flood) C1, C2, C3 I1, I2 & I3	Three times a week.  All samples to be duplicated.
	Ebb tide (mid ebb) C1, C2, C4, I4, I5, I6.	

*1 The sampling locations will vary with the tide due to the modelled predictions of the extent of the plume under differing tidal conditions. All samples to be collected from surface, middle and bottom layers of water column*

**Table 2.2 Monitoring at Sensitive receivers**

<i>Parameters:</i>	<i>Location<sup>1</sup></i>	<i>Frequency</i>
Suspended solids	Flood tide (mid flood): S1 & S2	Three times a week.
	Ebb tide: (mid ebb) S1 & S3	
Dissolved Oxygen	Flood tide (mid flood): S1 & S2	Three times a week. Or daily <sup>2</sup> if additional monitoring during a non compliance is required.
	Ebb tide: (mid ebb) S1 & S3	
Turbidity	Flood tide (mid flood): S1 & S2	Three times a week. Or daily of additional monitoring during non compliance is required.
	Ebb tide: (mid ebb) S1 & S3	

*1 The sampling locations will vary with the tide due to the modelled predictions of the extent of the plume under differing tidal conditions. All samples to be collected from surface, middle and bottom layers of water column*

*2 See Table 2.4 and 2.5 to determine whether additional monitoring is required. This should be undertaken at the request of the Engineer. If turbidity and not SS is measured during the additional monitoring then it must be correlated using the baseline data for correlation to SS and the values of this additional monitoring converted to SS. Alternatively, SS can be measured rather than DO/Turbidity for this additional monitoring but SS data must be made available from the laboratory within 24 hours.*

## 2.5 MONITORING EQUIPMENT

### 2.5.1 Dissolved oxygen and temperature measuring equipment

- (a) The instrument should be a portable, weatherproof dissolved oxygen measuring instrument complete with cable, sensor, comprehensive operation manuals, and use a DC power source. It should be capable of measuring:-
- a dissolved oxygen level in the range of 0-20 mg/l and 0-200% saturation; and
  - a temperature of 0-45 degree Celsius.
- (b) It should have a membrane electrode with automatic temperature compensation complete with a cable. Sufficient stocks of spare electrodes and cables should be available for replacement where necessary. (e.g. YSI model 59 meter, YSI 5739 probe, YSI 5795A submersible stirrer with reel and cable or an approved similar instrument).

### 2.5.2 Turbidity Measurement Instrument

The instrument should be a portable, weatherproof turbidity-measuring instrument complete with comprehensive operation manual. The equipment should use a DC power source. It should have a photoelectric sensor capable of measuring turbidity between 0-1000 NTU and be complete with a cable (e.g. Hach model 2100P or an approved similar instrument).

### 2.5.3 Suspended Solids

- (a) A water sampler comprises a transparent PVC cylinder, with a capacity of not less than 2 litres, and can be effectively sealed with latex cups at both ends. The sampler should have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth (e.g. Kahlsico Water Sampler or an approved similar instrument).
- (b) Water samples for suspended solids measurement should be collected in high density polythene bottles, packed in ice (cooled to 4°C without being frozen), and delivered to the laboratory as soon as possible after collection.

### 2.5.4 Salinity

A portable salinometer capable of measuring salinity in the range of 0-40 mg/l shall be provided for measuring salinity of the water at each monitoring location.

### 2.5.5 Locating the monitoring site

A hand-held digital Global Positioning System (GPS) or other equivalent instrument of similar accuracy shall be provided and used during monitoring to ensure the monitoring vessel is at the correct location before taking measurements.

All in-situ monitoring instrument shall be checked, calibrated and certified by a laboratory accredited under HOKLAS or any other international accreditation

scheme before use, and subsequently re-calibrated at 3 monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes should be checked with certified standard solutions before each use. Wet bulb calibration for a DO meter shall be carried out before measurement at each monitoring location.

For the on site calibration of field equipment, the BS 127:1993, "Guide to Field and on-site test methods for the analysis of waters" should be observed.

Sufficient stocks of spare parts should be maintained for replacements when necessary. Backup monitoring equipment shall also be made available so that monitoring can proceed uninterrupted even when some equipment some equipment is under maintenance, calibration, etc.

## 2.6 LABORATORY MEASUREMENT / ANALYSIS

Analysis of suspended solids shall be carried out in a HOKLAS or other international accredited laboratory. Water samples of about 500 ml shall be collected at the monitoring stations for carrying out the laboratory SS determination. The SS determination work shall start within 24 hours after collection of the water samples. The SS determination shall follow APHA 17ed 2540D or equivalent methods subject to approval of DEP.

If a site laboratory is set up or a non-HOKLAS and non-international accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment, analytical procedures, and quality control shall be approved by the DEP. All the analysis shall be witnessed by the ER. The ET Leader shall provide the ER with one copy of the relevant chapters of the "Standard Methods for the Examination of Water and Wastewater" updated edition and any other relevant document for his reference.

## 2.7 EVENT AND ACTION PLAN FOR WATER QUALITY

### 2.7.1 Action and Limit Levels

The Action and Limit levels are set out in Table 2.3 below.

### 2.7.2 Event Contingency Plans

The Event Contingency Plans are presented in Table 2.4 below. It should be noted that an exceedance of WQAC at the SRs will not be considered to be a problem if there is no exceedance measured at the impact monitoring stations. The SR exceedance would in that situation be assumed to have arisen as a result of other construction projects which should be identified by the ET or be a result of natural variation within the waters.

In the event of a non compliance, i.e exceedances at the impact monitoring stations on three consecutive days and an exceedance at any of the SR stations, then further mitigative measures should be implemented. In the absence of alternatives it will be necessary to reduce the number of dredging cycles in accordance with Table 2.5. Alternatives may be appropriate. For example, if the stage of the works is such that a mixture of marine and alluvial sand is being dredged then it may be possible to increase the alluvial to marine sand ratio to reduce the amount of fines released into the water column.

**Table 2.3 Action and Limit Levels for Water Quality**

Parameters	Action	Limit
Suspended Solids (Depth Averaged)	Depth average of the pooled data for the impact monitoring stations for three days is significantly greater ( $p < 0.05$ ) than 30% above the control.	Average of 3 days depth averaged data at any SR station is greater than Baseline average + Tidal average WQAC <sup>2</sup> . <b>AND:</b> Depth average of the pooled data for the impact monitoring stations for three days is significantly greater ( $p < 0.05$ ) than 30% above the control
DO <sup>3</sup> in mg/l (Surface Middle & Bottom)	<b>Surface &amp; Middle</b> At SR stations 1%-ile of baseline data for surface and middle layer, or midway between 5%-ile of baseline data and limit levels. <b>Bottom</b> At SR stations 1%-ile of baseline data for bottom layer, or midway between 5%-ile of baseline data and limit levels	<b>Surface &amp; Middle</b> At all stations: 4mg/l except 5 mg/l for Ma Wan FCZ  <b>Bottom</b> 2mg/l
Turbidity in NTU (depth-averaged)	Depth average of the pooled data for the impact monitoring stations for three days is significantly greater ( $p < 0.05$ ) than 30% above the control on three consecutive monitoring occasions.	3 days depth averaged data at any SR station is greater than Baseline average + Tidal average WQAC <sup>1</sup> . <b>AND</b> Depth average of the pooled data for the impact monitoring stations for three days is significantly greater ( $p < 0.05$ ) than 30% above the control

<sup>1</sup> "depth-averaged" is calculated by taking the arithmetic means of reading of all three depths.

<sup>2</sup> The WQAC are based on the tidal and depth averaged data from the WAHMO database collected during the dry season survey (February 1990). Values are as follows for the SRs:

Table to show WQACs to be used:

	SPRING TIDE Tidal and depth averaged WQAC SS(mg/l)	NEAP TIDE Tidal and depth averaged WQAC SS (mg/l)
S1 Lung Kwu Chau	17.3	13.5
S2 Sha Chau	14.7	7.8
S3 Ma Wan	3.8	3.0

<sup>3</sup>-For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.

<sup>4</sup>-All the figures given in the table are used for reference only and the EPD may amend the figures whenever it is considered necessary

**Table 2.4 Event and Action Plan for Water Quality**

Action/ Limit Level	ET Leader	IC(E)	ER	CONTRACTOR
<b>Action level</b> being exceeded on two consecutive sampling days.	<ol style="list-style-type: none"> <li>1. Repeat in-situ measurement on next day of exceedance to confirm findings;</li> <li>2. Identify source(s) of impact;</li> <li>3. Inform IC(E), Contractor and ER;</li> <li>4. Check monitoring data, all plant, equipment and contractor's working methods;</li> </ol>	<ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET and Contractor's working methods;</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing;</li> <li>2. Notify Contractor.</li> </ol>	<ol style="list-style-type: none"> <li>1. Inform the ER and confirm notification of the non-compliance in writing;</li> <li>2. Rectify any unacceptable practice;</li> <li>3. Amend working methods if appropriate.</li> </ol>
<b>Action Level</b> exceeded on three consecutive days at Impact monitoring stations but compliance at SRs	<ol style="list-style-type: none"> <li>1. Repeat measurement on next day of exceedance to confirm findings;</li> <li>2. Identify source(s) of impact;</li> <li>3. Inform IC(E), Contractor, ER and EPD;</li> <li>4. Check monitoring data, all plant, equipment and Contractor's working methods;</li> <li>5. Discuss mitigation measures with IC(E), ER and Contractor</li> <li>6. Ensure mitigation measures are implemented;</li> </ol>	<ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET and Contractor's working method;</li> <li>2. Discuss with ET and Contractor possible remedial actions;</li> <li>3. Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly;</li> <li>4. Supervise the implementation of mitigation measures.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss with IC(E) on the proposed mitigation measures;</li> <li>2. Ensure mitigation measures are properly implemented;</li> <li>3. Assess the effectiveness of the implemented mitigation measures.</li> </ol>	<ol style="list-style-type: none"> <li>1. Inform the Engineer and confirm notification of the non-compliance in writing;</li> <li>2. Rectify unacceptable practice;</li> <li>3. Check all plant and equipment and consider changes of working methods;</li> <li>4. Submit proposal of mitigation measures to ER within 3 working days of notification and discuss with ET, IC(E) and ER;</li> <li>5. Implement the agreed mitigation measures.</li> </ol>
<b>Limit level</b> exceeded on one sampling day	<ol style="list-style-type: none"> <li>1. Identify source(s) of impact;</li> <li>2. Review tidal data;</li> <li>3. Inform IC(E), contractor, ER and EPD;</li> <li>4. Check monitoring data, all plant, equipment and contractor's working method - determine type of material being extracted;</li> <li>5. Discuss mitigation measures with IC(E), Contractor and ER;</li> </ol>	<ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET; review tidal data - determine whether spring or neap tide; review Contractor's working method and type of material being extracted;</li> <li>2. Discuss with ET and Contractor on the possible mitigation measures and likely need to reduce dredging cycles if impacts continue;</li> <li>3. Review any alternative mitigation measures submitted by Contractor and advise the ER accordingly;</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing;</li> <li>2. Discuss with IC(E), ET and Contractor on the proposed mitigation measures;</li> <li>3. Request Contractor to review the working methods;</li> </ol>	<ol style="list-style-type: none"> <li>1. Inform the ER and confirm notification of the non-compliance in writing;</li> <li>2. Rectify unacceptable practice;</li> <li>3. Check all plant and equipment and consider changes of working methods;</li> <li>4. Submit proposal of mitigation measures to ER within 3 working days of notification and discuss with ET, IC(E) and ER.</li> </ol>
<b>Limit level</b> being exceeded on three consecutive sampling days i.e. exceedances at both impact and	<ol style="list-style-type: none"> <li>1. Confirm source(s) of impact;</li> <li>2. Inform IC(E), Contractor, ER and EPD;</li> <li>3. Check monitoring data, tidal data, all plant, equipment and Contractor's working methods;</li> <li>4. Discuss mitigation measures with IC(E), Contractor and ER;</li> <li>5. Ensure mitigation measures are</li> </ol>	<ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET and Contractor's working method;</li> <li>2. Discuss with ET and Contractor remedial actions;</li> <li>3. Supervise the implementation of mitigation measures and ensure</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss with IC(E), ET and Contractor on the proposed mitigation measures;</li> <li>2. Request Contractor to critically review the working methods;</li> <li>3. If no alternatives recommended by contractor, authorise reduction in dredging cycles<sup>1</sup> and ensure this is implemented</li> </ol>	<ol style="list-style-type: none"> <li>1. Take immediate action to avoid further exceedance through reducing number of dredging cycles in the absence of alternative mitigation measures.;</li> <li>2. Submit proposal of alternative mitigation measures to ER within 3 working days of notification and discuss with ET, IC(E) and ER;</li> <li>3. Implement the agreed mitigation measure until</li> </ol>

SR monitoring stations = NON COMPLIANCE <sup>1</sup>	implemented; 6. Monitor water quality - dredging cycles may not be increased until no exceedance of Limit level for three consecutive days. 7. Monitoring may be increased <sup>2</sup> to delay at the request of the Engineer	dredging cycles are reduced if alternative mitigation measures are not found <sup>1</sup> . 4. Ensure dredging cycles not increased until no exceedance of Limit level for 3 consecutive days. 5. Advise further reduction in number of dredging cycles if no improvement in water quality.	4. Determine need for additional monitoring during reduced works period. 5. Authorise further reduction or temporary cessation of works if problem continues.	notified otherwise by ET/IC(E) and ER; 4. As directed by the Engineer, reduce number of dredging cycles further if problem still not under control.; 5. As directed by the Engineer, to slow down or to stop all or part of the construction activities until no exceedance of Limit level.
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- 1 Reduction in dredging cycles should be made in accordance with Table 2.5 in the absence of alternative or further additional mitigation measures. Alternatives may include an increase in the ratio of alluvial sand: marine sand dredged depending on the stage of the works.
- 2 Engineer may wish to increase measurements of Turbidity and Dissolved Oxygen at the Impact and Monitoring Stations to enable quicker resumption of maximum number of dredging cycles per day. Additional monitoring at SR stations is not necessary as no impact within mixing zone indicates that works are not causing an impact.

**Table 2.5 Actions to be undertaken in the event of a “Non compliance”**

Event	ET	IC(E)	ER/Contractor
Non compliance at SR stations is 1-5mg/l above WQAC <sup>1</sup>	Inform IC(E), Contractor, ER and EPD of magnitude of non compliance;	Discuss with ER and Contractor to determine need to reduce dredging cycles	Authorise/undertake a reduction in dredging cycles  In absence of additional mitigation measures, reduce to 10 dredging cycles per day except on neap tide when dredging cycles should not exceed 8.
Non compliance at SR stations is between 5-10mg/l above WQAC.	Inform IC(E), Contractor, ER and EPD of magnitude of non compliance;	Discuss with ER and Contractor to determine need to reduce dredging cycles	Authorise/undertake a reduction in dredging cycles:  In absence of additional mitigation measures, reduce to 8 dredging cycles per day
Non compliance at SR Stations >10mg/l above WQAC	Inform IC(E), Contractor, ER and EPD of magnitude of non compliance;	Discuss with ER and Contractor to determine need to reduce dredging cycles	In absence of additional mitigation measures, reduce to 6 dredging cycles per day i.e. 50% reduction in works.

<sup>1</sup> The WQAC are based on the tidal and depth averaged data from the WAHMO database collected during the dry season survey (February 1990). Values are as follows for the SRs:

Table to show WQACs to be used:

	SPRING TIDE Tidal and depth averaged WQAC SS(mg/l)	NEAP TIDE Tidal and depth averaged WQAC SS (mg/l)
S1 Lung Kwu Chau	17.3	13.5
S2 Sha Chau	14.7	7.8
S3 Ma Wan	3.8	3.0

*N.B Under all scenarios dredging cannot return to 100% until monitoring results indicate a compliance or until it has been agreed with EPD and AFD.*

*Mitigation may only be required during flood or ebb rather than entire tidal cycle depending on results. IC(E) to check ET recommendations.*

*The above criteria may be subject to review in the event that they prove to be impractical.*

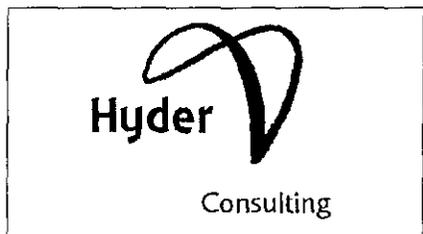
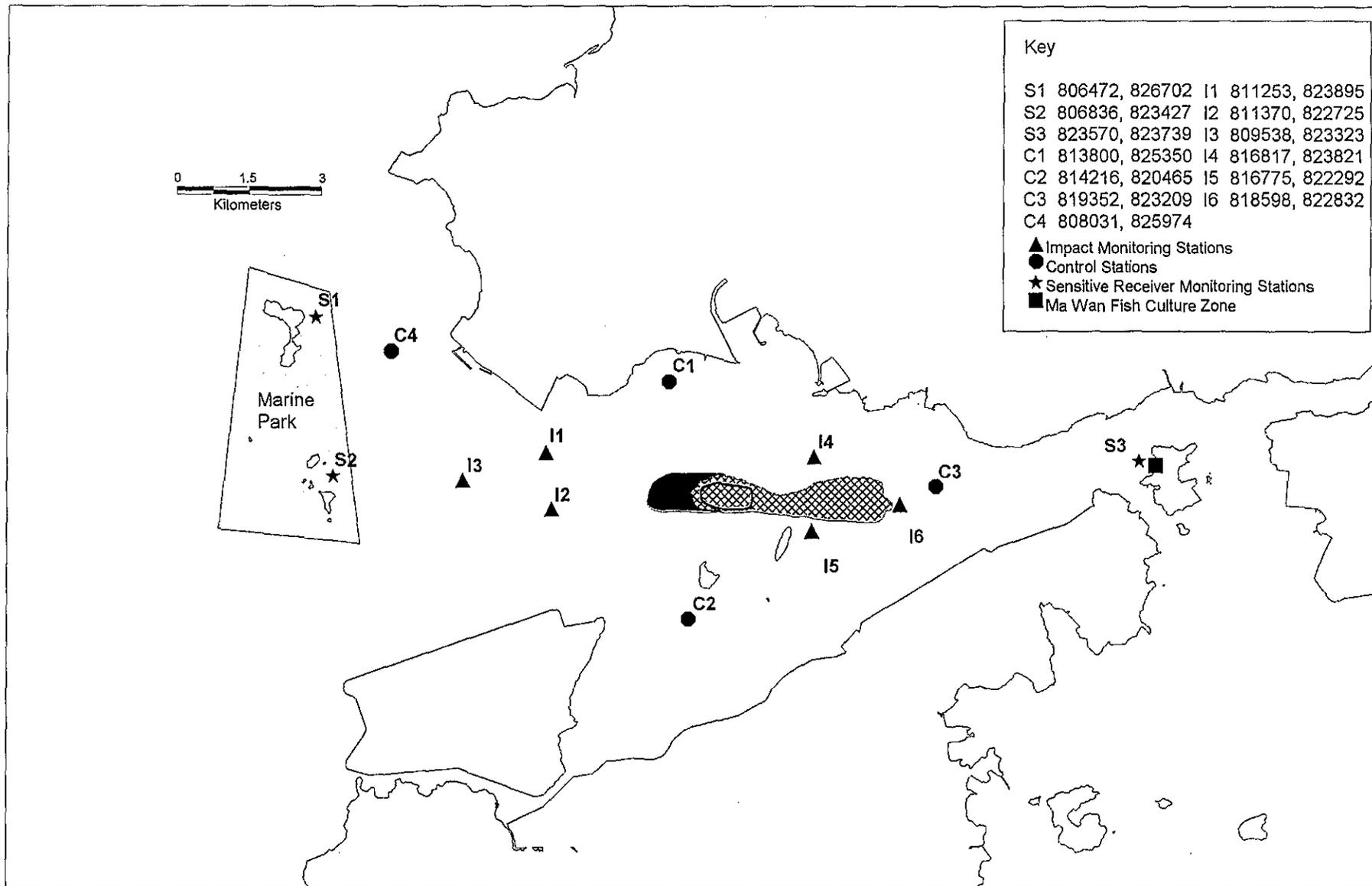


Figure 2.1 Study Area and Water Quality Monitoring Stations

Figure 2.2 Water Quality Monitoring Data Record Sheet

Location				
Date				
Start Time (hh:mm)				
Weather				
Sea Conditions				
Tidal Mode				
Water Depth (m)				
Monitoring Depth		S	M	B
Salinity				
Temperature (°C)				
DO Saturation (%)				
DO (mg/l)				
Turbidity (NTU)				
SS Sample Identification				
SS (mg/l)				
Observed Construction	<100m from location			
Activities	>100m from location			
Other Observations				

Name & Designation

Signature

Date

Recorded By

\_\_\_\_\_

Checked by

\_\_\_\_\_

Note : The SS results are to be filled up once they are available from the laboratory.

**Figure 2.3 Incident Report on Action Level or Limit Level Non-compliance**

Project	
Date	
Time	
Monitoring Location	
Parameter	
Action & Limit Levels	
Measured Level	
Possible reason for Action or Limit Level Non-compliance	
Actions taken / to be taken	
Remarks	

**Location Plan**

Prepared by :

\_\_\_\_\_

Designation :

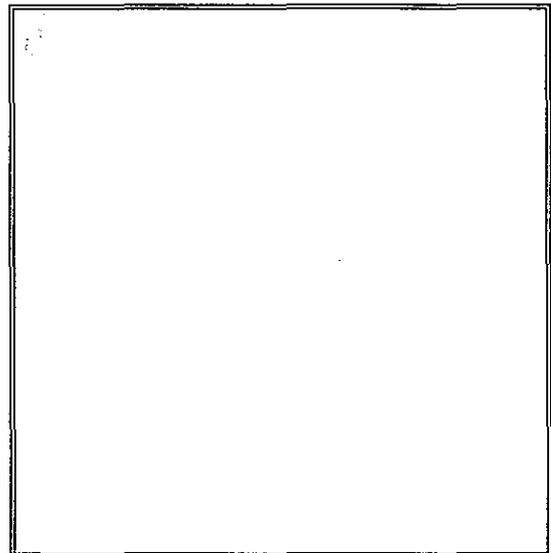
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Signature :

\_\_\_\_\_

Date :

\_\_\_\_\_



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Waste Management

### 3. WASTE MANAGEMENT

The Contractor is responsible for waste control within the construction site, removal of the waste material produced from the site and to implement any mitigation measures to minimise waste or redress problems arising from the waste from the site.

The only waste stream identified in the EIA was mud overburden which will be placed in the adjacent empty borrow pit. The material would be placed in the western pit by bottom dumping from the trailer. This should be done in accordance with the requirements of the Fill Management Committee (FMC allocation conditions for mud disposal and conditions stipulated in EPD's Dumping Permit..

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Ecology

## 4. ECOLOGY

### 4.1 INTRODUCTION

The waters in the vicinity of the proposed works are included in the natural range of the Chinese White Dolphin, *Sousa chinensis*. The EIA did not predict any adverse impacts on the Dolphins or their habitat provided all mitigation measures recommended in the EIA and listed in the Implementation Schedule are implemented. However, there is a need to ensure that disturbance to any dolphins entering the works zone is minimised through a simple process of monitoring.

### 4.2 MONITORING

The Engineer shall ensure that the Contractor has nominated a person on board the vessel who will be responsible for monitoring dolphin activity around the works area during the dredging period. In the event that a dolphin is observed to come within 500m of the dredger then works will stop for 10 minutes after the sighting or until the dolphin is seen to swim away from the works.

Records should be maintained by the Contractor of work stoppages which have arisen from dolphin activity. Information should be recorded as shown in Figure 4.1. Records should be copied to the ET and kept on board the vessel.

The ET team should record dolphin sightings around the works site and monitoring locations to aid research into dolphin activity. Where possible, a photograph should be taken. The ET team should also follow the code of practice for dolphin watching during all monitoring works to ensure that the dolphins are not disturbed (attached as Appendix 1). Records should be kept on a filed record sheet an example of which is attached as Figure 4.2. The IC(E) should check the ET monitoring practice and ensure that records of sightings are kept.

### 4.3 AUDIT

The ET will audit site activities from the vessel and ensure that there is a person allocated to monitoring dolphin activity. Records will also be audited. Any problems with the procedure should be relayed to the IC (E) and the Engineer who will resolve problems and liaise with EPD/AFD as appropriate.

Figure 4.1 Dolphin Record Sheet to be maintained by the Contractor

**RECORD OF DOLPHIN SIGHTINGS**

Date	Time of Sighting	Conditions	Number of Dolphins	Proximity to works	Duration of Work Stoppage	Comments	Signature

**Figure 4.2 Sample of Record Sheet to be Maintained by Environmental Team**

**DOLPHIN RECORDS DURING EM&A OF BROTHERS MBA DREDGING**

Date	
Time	
Weather Conditions	
Tidal Conditions	
Location and number of Dolphins	
Estimated distance from works	
Were any dolphins observed within 500m of the works?	
Was the dolphin spotted by the contractor? Did work cease for a minimum of 10 minutes?	
Photograph taken?	YES/NO
ID No of photograph.	ID No:
Signature	

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Site Environmental Audit

## 5. SITE ENVIRONMENTAL AUDIT

### 5.1 SITE INSPECTIONS

Site Inspections provide a direct means to trigger and enforce the specified environmental protection and pollution control measures listed in Table 1.1, the Implementation Schedule. They shall be undertaken routinely to inspect the construction activities in order to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented. With well defined pollution control and mitigation specifications and a well established site inspection, deficiency and action reporting system, the site inspection is one of the most effective tools to enforce the environmental protection requirements on the construction site.

The ET Leader is responsible for formulation of the environmental site inspection, deficiency and action reporting system, and for carrying out the site inspection works. He shall submit a proposal on the site inspection, deficiency and action reporting procedures within 21 days of the construction contract commencement to the Contractor for agreement and to the ER for approval. The ET's proposal for rectification would be made known to the IC(E).

Regular site inspections shall be carried out at least once per week. The areas of inspection shall not be limited to the environmental situation, pollution control and mitigation measures within the site; it shall also review the environmental situation outside the site area which is likely to be affected, directly or indirectly, by the site activities. The ET Leader shall make reference to the following information in conducting the inspection:

- (a) the EIA recommendations on environmental protection and pollution control mitigation measures;
- (b) works progress and programme;
- (c) individual works methodology proposals (which shall include proposal on associated pollution control measures);
- (d) the contract specifications on environmental protection;
- (e) the relevant environmental protection and pollution control laws; and
- (f) previous site inspection results.

The Contractor shall update the ET Leader with all relevant information of the construction contract for him to carry out the site inspections. The inspection results and its associated recommendations on improvements to the environmental protection and pollution control works shall be submitted to the ER, IC(E) and the Contractor within 24 hours, for reference and for taking immediate action. The implementation schedule will be updated and included in each monthly submission of the EM&A report.

The Contractor shall follow the procedures and time-frame as stipulated in the environmental site inspection, deficiency and action reporting system formulated by the ET Leader to report on any remedial measures subsequent to the site inspections.

Ad hoc site inspections shall also be carried out if significant environmental problems are identified. In particular, the coincidence of marine sand dredging with a neap tide should result in an additional site inspection to ensure that there is the necessary reduction in dredging cycles during this period to protect the marine park.

Inspections may also be required subsequent to receipt of an environmental complaint, or as part of the investigation work, as specified in the Action Plan for environmental monitoring and audit.

## 5.2 COMPLIANCE WITH LEGAL AND CONTRACTUAL REQUIREMENTS

There are contractual environmental protection and pollution control requirements as well as environmental protection and pollution control laws in Hong Kong which the construction activities shall comply with.

In order that the works are in compliance with the contractual requirements, all the works method statements submitted by the Contractor to the ER for approval shall be sent to the ET Leader for vetting to see whether sufficient environmental protection and pollution control measures have been included.

The ET Leader shall also review the progress and programme of the works to check that relevant environmental laws have not been violated, and that any foreseeable potential for violating the laws can be prevented.

The Contractor shall regularly copy relevant documents to the ET Leader so that the checking work can be carried out. The document shall at least include the updated Work Progress Reports, the updated Works Programme, the application letters for different licence/permits under the environmental protection laws, and all the valid licence/permit. The site diary shall also be available for the ET Leader's inspection upon his request.

After reviewing the document, the ET Leader shall advise the IC(E) and the Contractor of any non-compliance with the contractual and legislative requirements on environmental protection and pollution control for them to take follow-up actions. If the ET Leader's review concludes that the current status on licence/permit application and any environmental protection and pollution control preparation works may not cope with the works programme or may result in potential violation of environmental protection and pollution control requirements by the works in due course, he shall also advise the Contractor and the ER accordingly.

Upon receipt of the advice, the Contractor shall undertake immediate action to remedy the situation. The ER shall follow up to ensure that appropriate action has been taken by the Contractor in order that the environmental protection and pollution control requirements are fulfilled.

### 5.3 ENVIRONMENTAL COMPLAINTS

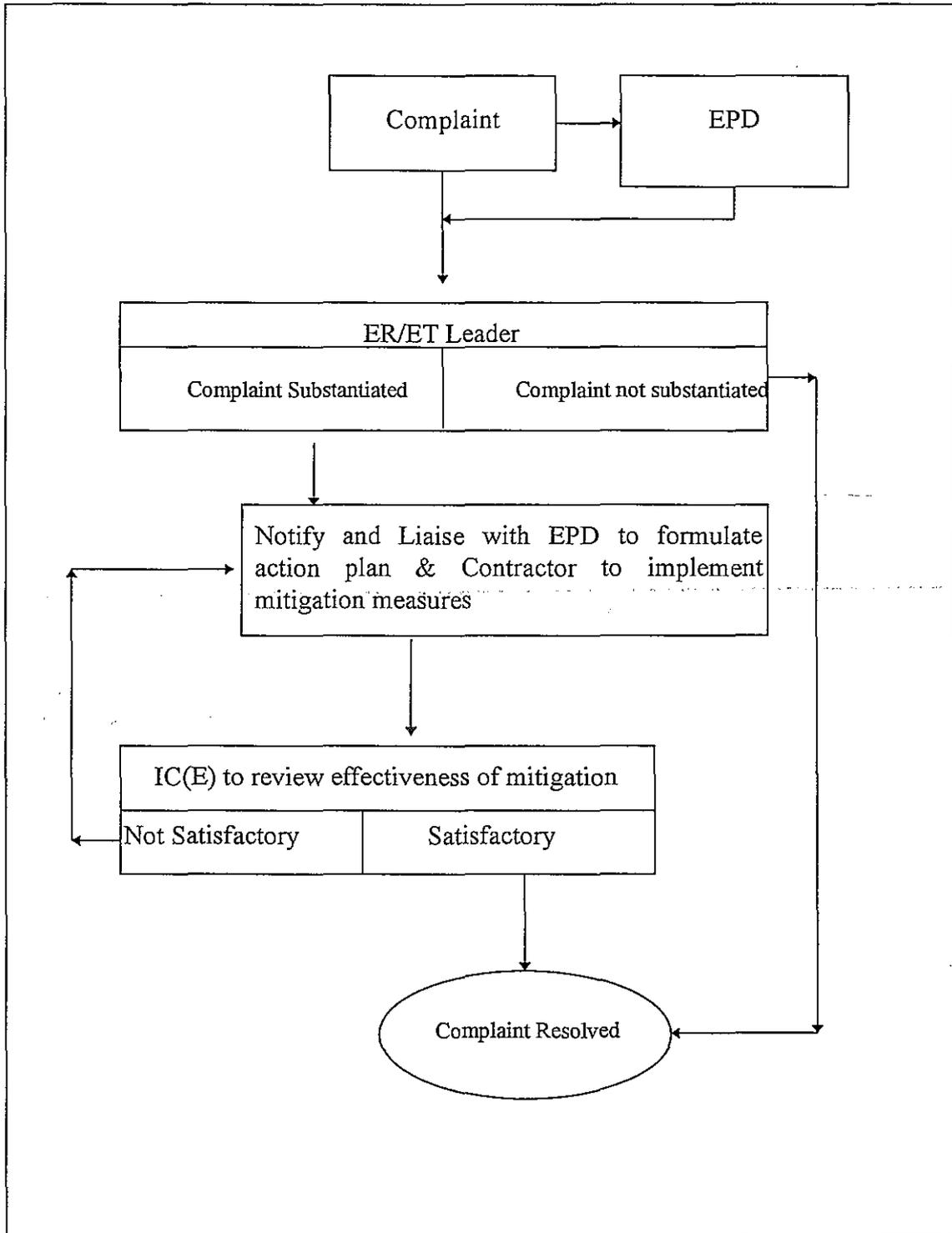
Complaints shall be referred to the ET Leader for carrying out complaint investigation procedures. The ET Leader shall undertake the following procedures upon receipt of the complaints:

- (a) log complaint and date of receipt onto the complaint database and inform the IC(E) immediately;
- (b) investigate the complaint to determine its validity, and to assess whether the source of the problem is due to works activities;
- (c) if a complaint is valid and due to works, identify mitigation measures in consultation with the IC(E);
- (d) if mitigation measures are required, advise the Contractor accordingly;
- (e) review the Contractor's response on the identified mitigation measures, and the updated situation;
- (f) if the complaint is transferred from EPD, submit interim report to EPD on status of the complaint investigation and follow-up action within the time frame assigned by EPD;
- (g) undertake additional monitoring and audit to verify the situation if necessary, and review that any valid reason for complaint does not recur;
- (h) report the investigation results and the subsequent actions to the source of complaint for responding to complainant (If the source of complaint is EPD, the results shall be reported within the time frame assigned by EPD); and
- (i) record the complaint, investigation, the subsequent actions and the results in the monthly EM&A reports.

During the complaint investigation work undertaken by the ET, the Contractor and ER shall co-operate with the ET Leader in providing all the necessary information and assistance for completion of the investigation. If mitigation measures (in consultation with the IC(E), see 6.3.1 (c) above) are identified in the investigation, the Contractor shall promptly carry out the mitigation. The ER shall ensure that the measures have been carried out by the Contractor.

A flow chart of the complaint response procedures is shown in the Figure 5.1

Figure 5.1 Complaint Procedures Flow Chart



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Reporting

## 6. REPORTING

### 6.1 GENERAL

The following reporting requirements are based upon a paper documented approach. However, the same information can be provided in an electronic medium upon agreeing the format with the ER and EPD. All the monitoring data (baseline and impact) shall also be submitted in diskettes in the format shown in Appendix 2.

### 6.2 BASELINE MONITORING REPORT

The ET Leader shall prepare and submit a Baseline Environmental Monitoring Report within 10 working days of completion of the baseline monitoring. Copies of the Baseline Environmental Monitoring Report shall be submitted to each of the four parties: the Contractor, the IC(E), the ER and the EPD. The ET Leader shall liaise with the relevant parties on the exact number of copies they require.

The form and content of the report, and the representation of baseline monitoring data shall be in a format to the satisfaction of EPD and include, but not be limited to the following:

- (a) up to half a page executive summary;
- (b) brief project background information;
- (c) drawings showing locations of the baseline monitoring stations;
- (d) monitoring results (in both hard and diskette copies) together with the following information:
  - monitoring methodology;
  - name of laboratory and types of equipment used and calibration details;
  - parameters monitored;
  - monitoring locations (and depth);
  - monitoring date, time, frequency and duration;
  - QA/QC results and detection limits.
- (e) details on influencing factors, including:
  - major activities, if any, being carried out on the site during the period;
  - weather conditions during the period;
  - other factors which might affect the results;
- (f) determination of the Action and Limit Levels (AL levels) for each monitoring parameter and statistical analysis of the baseline data, the analysis shall conclude if there is any significant difference between control and impact stations for the parameters monitored;

- (g) revisions for inclusion in the EM&A Manual; and
- (h) comments and conclusions.

### 6.3 EM&A REPORTS

The results and findings of all EM&A work required in the Manual shall be recorded in the monthly EM&A reports prepared by the ET Leader. The EM&A report shall be prepared and submitted within 10 working days of the end of each reporting month, with the first report due in the month after construction commences. A maximum of 4 copies of each monthly EM&A report shall be submitted to each of the four parties: the Contractor, the IC(E), the ER and the EPD. Before submission of the first EM&A report, the ET Leader shall liaise with the parties on the exact number of copies and format of the monthly reports in both hard copy and electronic medium requirement. The ET leader shall review the number and location of monitoring stations and parameters to monitor every month or on an as needed basis in order to cater for the changes in surrounding environment and nature of works in progress.

#### 6.3.1 First Monthly EM&A Report

The first monthly EM&A report shall include at least but not be limited to the following :

- (a) Executive Summary (1-2 pages):
  - Breaches of AL levels;
  - Complaint Log;
  - Notifications of any summons and successful prosecutions;
  - Reporting Changes;
  - Future key issues.
- (b) Basic Project Information
  - Project organisation including key personnel contact names and telephone numbers;
  - Programme
  - Management structure; and
  - Works undertaken during the month;
- (c) Environmental Status
  - Works undertaken during the month with illustrations (such as location of works, daily dredging/filling rates, percentage fines in the fill material used); and
  - Drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations.
- (d) Summary of EM&A requirements
  - All monitoring parameters;

- Environmental quality performance limits (Action and Limit levels);
- Event-Action Plans;
- Environmental mitigation measures, as recommended in the project EIA study final report;
- Environmental requirements in contract documents;

(e) Implementation Status

- Advice on the implementation status of environmental protection and pollution control/mitigation measures including measures for ecological and visual impacts, as recommended in the project EIA study report, summarised in the updated implementation schedule.

(f) Monitoring Results

To provide monitoring results (in both hard and diskette copies) together with the following information:

- Monitoring methodology
- Name of laboratory and types of equipment used and calibration details
- Parameters monitored
- Monitoring locations (and depth);
- Monitoring date, time, frequency, and duration;
- Weather conditions during the period; and
- Any other factors which might affect the monitoring results;
- QA/QC results and detection limits.

g) Report on Non-compliance, Complaints, Notifications of Summons and Successful Prosecutions

- Record of all non compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
- Record of all complaints received (written or verbal) for each media, including locations and nature of complaints investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;
- Record of all notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislation, including locations and nature of the breaches, investigation, follow-up actions taken, results and summary;
- Review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures; and
- Description of the actions taken in the event of non compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance;

(a) Others

- An account of the future key issues as reviewed from the works programme and work method statements; and
- Advice on the solid and liquid waste management status.

### 6.3.2 Subsequent Monthly EM&A Reports

The subsequent monthly EM&A reports shall include the following :

(a) Executive Summary (1-2 pages)

- Breaches of AL levels;
- Complaint Log;
- Notifications of any summons and successful prosecutions;
- Reporting Changes;
- Future key issues.

(b) Environmental Status

- Works undertaken during the month with illustrations including key personnel contact names and telephone numbers; and
- Drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations

(c) Implementation Status

Advice on the implementation status of environmental protection and pollution control/mitigation measures including measures for ecological and visual impacts, as recommended in the project EIA study report, summarised in the updated implementation schedule.

d) Monitoring Results

To provide monitoring results (in both hard and diskette copies) together with the following information:

- Monitoring methodology
- Name of laboratory and types of equipment used and calibration details
- Parameters monitored
- Monitoring locations (and depth);
- Monitoring date, time, frequency, and duration;
- Weather conditions during the period; and
- Any other factors which might affect the monitoring results;
- QA/QC results and detection limits.

- e) Report on Non-compliance, Complaints, Notifications of Summons and Successful Prosecutions
  - Record of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
  - Record of all complaints received (written or verbal) for each media, including locations and nature of complaints investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;
  - Record of all notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislation, including locations and nature of the breaches, investigation, follow-up actions taken, results and summary;
  - Review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures; and
  - a description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance;
- (f) Others
  - An account of the future key issues as reviewed from the works programme and work method statements; and
  - Advice on the solid and liquid waste management status.
- (g) Appendix
  - AL levels
  - Graphical plots of trends of monitored parameters at key stations over the past four reporting periods for representative monitoring stations annotated against the following:
    - i) major activities being carried out on site during the period;
    - ii) weather conditions during the period; and
    - iii) any other factors which might affect the monitoring results
  - Monitoring schedule for the present and next reporting period
  - Cumulative statistics on complaints, notifications of summons and successful prosecutions
  - Outstanding issues and deficiencies

### 6.3.3 Final EM&A Review Reports.

The final EM&A report shall be prepared after the completion of works in May 1998 and submitted within 15 days of completion of the post project monitoring (which will proceed for two weeks). The report should contain the following:

- (a) Executive Summary (1-2 pages);

- (b) drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
- (c) basic project information including a synopsis of the project organization, contacts of key management, and a synopsis of work undertaken during the course of the project or past twelve months;
- (d) a brief summary of EM&A requirements including:
  - (i) mitigation measures, as recommended in the EIA report;
  - (ii) environmental impact hypotheses tested;
  - (iii) environmental quality performance limits (Action and Limit Levels);
  - (iv) all monitoring parameters;
  - (v) Event-Action Plans;
- e) a summary of the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the project EIA study report, summarized in the updated implementation schedule;
- f) graphical plots and the statistical analysis of the trends of monitored parameters over the course of the project, including the post-project monitoring (or the past twelve months for annual reports) for all monitoring stations annotated against;
  - the major activities being carried out on site during the period;
  - weather conditions during the period; and
  - any other factors which might affect the monitoring results;
- (g) a summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
- (h) a review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures as appropriate;
- (i) a description of the actions taken in the event of non-compliance;
- (j) a summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;
- (k) a summary record of notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislation, locations and nature of the breaches, investigation, follow-up actions taken and results;
- (l) a review of the validity of EIA predictions and identification of shortcomings in EIA recommendations; and
- (m) a review of the effectiveness and efficiency of the mitigation measures;
- (n) a review of success of the EM&A programme to cost effectively identify deterioration and to initiate prompt effective mitigatory action when necessary.

#### 6.3.4 Data Keeping

The site document such as the monitoring field records, laboratory analysis records, site inspection forms, etc. are not required to be included in the monthly EM&A reports for submission. However, the document shall be well kept by the ET Leader and be ready for inspection upon request.

All relevant information shall be clearly and systematically recorded in the document.

The monitoring data shall also be recorded in magnetic media form, and the software copy can be available upon request.

The water quality data software format shall be agreed with EPD.

All the documents and data shall be kept for at least one year after completion of the construction contract.

#### 6.3.5 Interim Notifications of Environmental Quality Limit Exceedances

With reference to Event and Action Plans in Tables 2.3, 2.4 and 2.5, when the environmental quality limits are exceeded, the ET Leader shall immediately notify the IC(E) & EPD, as appropriate. The notification shall be followed up with advice to IC(E) and EPD on the results of the investigation, proposed action and success of the action taken, with any necessary follow-up proposals. A sample template for the interim notifications is shown in Figure 2.3.

# Appendices

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## Appendix 1

# Information on Chinese White Dolphin and the code of practice for dolphin watching

Locally known as the Chinese white dolphin

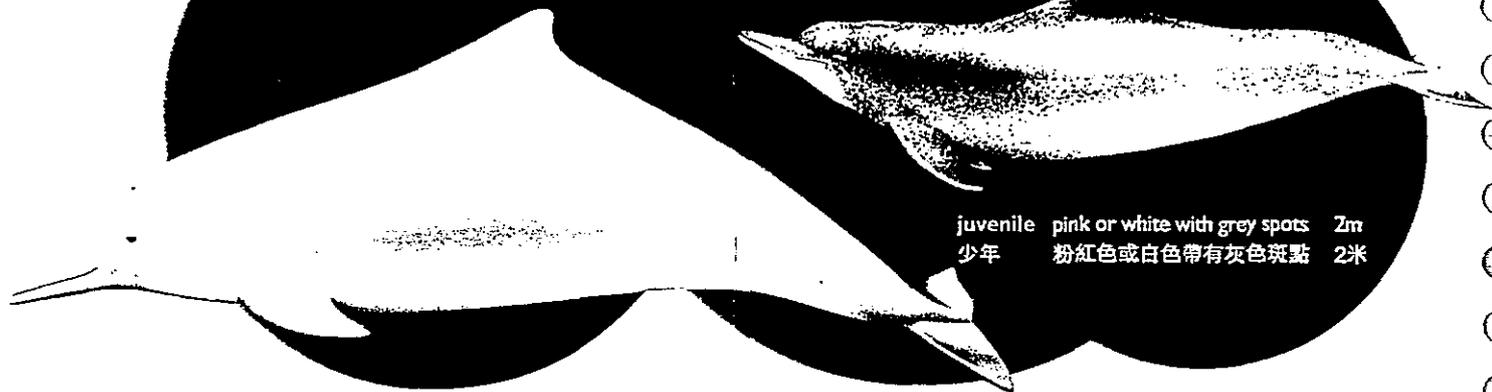
本地稱為中華白海豚

Size, Shape and Colour  
大小、形狀及顏色

adult    pink or white    up to 2.8m  
成年    粉紅色或白色    可達2.8米

newborn    grey    1m  
初生    灰色    1米

juvenile    pink or white with grey spots    2m  
少年    粉紅色或白色帶有灰色斑點    2米



Relationships 分類

They are in the mammalian order Cetacea (whales, dolphins and porpoises). Related to other dolphins and killer and pilot whales, in the family Delphinidae. The stocks in China (including Hong Kong), may possibly be a unique sub-species.

屬於哺乳綱的鯨目(包括鯨、海豚和鼠海豚)。屬於海豚科，與殺人鯨和領航鯨為近親。在中國水域一帶(包括香港)的群落可能為一獨特亞種。



World-wide Distribution  
全球分佈

Indo-Pacific hump-backed dolphins are found from northern Australia and southern China in the east, through Indonesia, and around the coastal rim of the Indian Ocean to southern Africa. They are inhabitants of tropical to warm temperate coastal waters and they enter rivers, estuaries and mangrove swamps.

東面由澳洲北部及華南，伸延至印尼以及沿著印度洋海岸線至南非，均可發現其踪影。牠們棲息於熱帶及溫帶沿岸水域，亦出沒於河流、鹹淡水及沼澤一帶。



Common  
常見

Seasonal  
季節性

Infrequent  
不常見

Local Distribution 本地分佈

They are found year round in Hong Kong, primarily in the waters north and west of Lantau Island. They also occur to the west in China.

全年在香港出現，主要在大嶼山以北及以西水域出沒。牠們也出現於香港以西的中國水域。

Numbers of Dolphins in Hong Kong 本港髯背豚數目

In Hong Kong, depending on season, between 90-155 dolphins are estimated to be in the north Lantau area. So far, 119 individuals (as at September 1997) have been indentified by natural or other markings. It is also estimated that at least 250 individuals use the Hong Kong area at some time. The total size of the breeding population, which extends across the Pearl River, probably numbers several hundred dolphins.

視乎不同季節，估計在香港大嶼山以北的水域有九十至一百五十五條中華白海豚。直至一九九七年九月為止，可由先天或後天特徵認出的海豚有119條。另外，估計有不少於二百五十條海豚在某些時間會使用香港的水域。至於伸延至珠江口的整個繁殖種群，數目可能有數百條。

Feeding 捕食

They feed on a variety of nearshore fishes and occasionally squids and crustaceans. 捕食不同種類的近岸魚類，間中包括魷魚及甲殼類。

Predators 天敵

Hump-backed dolphins in other parts of the world are preyed upon by large sharks and probably also by killer whales, although within Hong Kong there is little evidence that predation is a major factor.

其他地區的髯背豚會成為體形龐大的鯊魚的獵物，亦可能為殺人鯨的獵殺。在本地水域內，海豚遭天敵獵殺的證據不多。

Behaviour and Reproduction 習性及繁殖

- Generally found in small groups of less than ten. In Hong Kong, the dolphins occur as singles and in groups ranging up to 25 members, but the average group size is about four.
- Hump-backed dolphins can be difficult to observe, but are sometimes quite active, performing a variety of jumps and leaps.
- Young are born at different times of the year in different parts of their range, but there appears to be a calving peak in spring and summer in Hong Kong.
- Dolphins of this species are known to live up to 40 years in other parts of the world. The oldest known from Hong Kong so far was over 21 years old.
- 常少於10條一群，在香港，有時海豚只單獨出現，或可多至25條集體出沒，但平均每群約四條。
- 髯背豚不容易觀察但有時卻十分活躍，並做出多種不同的空中翻躍花式。
- 不同地區的海豚有不同時間的生產季節，而香港的群落，其生產季節似乎為春、夏季。
- 在其他地區的同類品種，據悉牠們可活至四十歲。已知香港目前最年長的髯背豚超過二十一歲。

## Conservation Status in Hong Kong

- Protected in Hong Kong under the Wild Animals Protection Ordinance (Cap. 170)
- Import, export and possession of these animals are also regulated under the Animals and Plants (Protection of Endangered Species) Ordinance (Cap. 187).
- The Sha Chau and Lung Kwu Chau Marine Park was designated in November 1996 in accordance with the Marine Parks Ordinance (Cap. 476). This Marine Park, covering a sea area of 1200 hectares is to protect and conserve the general ecology of the area and the Indo-Pacific hump-backed dolphin.



## Code of Conduct for Dolphin Watching Activities

For dolphin-watching, the general rule is:

**LOOK FROM A DISTANCE, AND DO NOT SEEK TO CONTACT, TOUCH, FEED OR HARM DOLPHINS IN THE WILD**

- Maintain forward progress at a slow, steady speed or stop with no sudden course changes. Boat speed should not exceed 10 knots.
- Only one dolphin watching vessel should be within 500 meters of a group of dolphins.
- Always slow down to no-wake speed, or stop if animals appear directly ahead within 100 meters.
- Never approach dolphins head on; approach at an angle.
- Never conduct reverse throttling in the vicinity of dolphins.
- Never chase or cut across the course of dolphins, separate mothers and calves, split up groups or 'corner' dolphins between boats, nets or shore.
- Never attempt to touch, swim with, or feed the dolphins.
- Do not litter or dispose of any fuel, oil or other pollutants in the water.
- Respect the dolphins and let them make the choice to approach or flee. If a group of dolphins is difficult to observe and elusive, leave them alone and try to find a more cooperative group.
- When observing, always parallel the dolphin's course at slow speed.
- When observing dolphins which are following pair trawlers, the following needs to be observed:
  - i. the position of the dolphin watching vessel relative to the marker buoy of the trawl net should change as slowly as possible.
  - ii. after trawlers have hauled up the net, do not move away immediately or at high speed. Move away from the area at low speed very cautiously and ONLY after the dolphins have dispersed.

## 本地存護情況

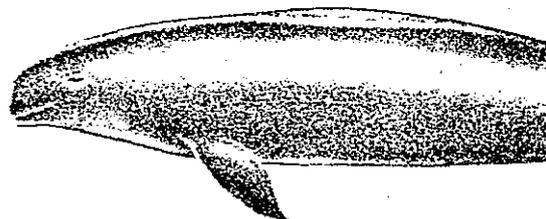
- 受野生動物保護條例(第170章)所保護。
- 這些動物的出口、入口和擁有亦受到動植物(瀕危物種保護)條例(第187章)所限制。
- 在一九九六年十一月,香港政府根據海岸公園條例(第476章)設立了沙洲龍鼓洲海岸公園。它的海域面積為1200公頃。當局會著重保護及存護該處海域的一般生態,以及海岸公園內的中華白海豚。

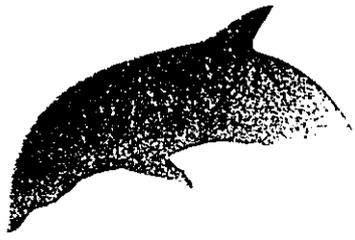
## 觀豚活動守則

觀豚的基本守則是:

離遠觀看,不要試圖接觸、觸摸、餵飼或傷害野生海豚。

- 以緩慢穩定的速度進前或停船,不要突然改變方向。船速不得超過十海里。
- 在被發現的海豚五百米以內,只可有一艘觀豚船。
- 當海豚在船隻前面一百米以內,船隻應減速至減少產生浪花,或應停駛。
- 不可向海豚迎面駛,只能從側面靠近。
- 不可在海豚之近距離「開倒車」。
- 不可追逐或穿越海豚游弋的路線,不可分開海豚母子或群體,不可迫趕海豚游往船隻、魚網及岸邊之間。
- 不可試圖接觸、餵飼海豚或與之游泳。
- 不可拋掉垃圾,不可棄置任何燃料及污染物。
- 尊重海豚,讓牠們選擇接近或離開船隻。如找到的一群海豚難以觀察或逃避觀察,請不要騷擾牠們,應另覓較合作的一群。
- 觀豚時,應以低速與海豚併行。
- 如觀察跟隨雙拖網漁船的海豚,請注意:
  - i. 觀豚船應緩慢地改變方向並隨著拖網末端的浮標行駛。
  - ii. 當拖網漁船收網後,不可即時加速離開,應確定海豚散去後,才小心地以低速離開。





Reports of Dolphin  
or Porpoise Strandings

報告擱淺海豚或鼠海豚

**PLEASE REPORT  
IMMEDIATELY**  
請立即報告

**All Observations (Alive or Dead) of  
Whales, Dolphins and Porpoises**

Be Prepared to Leave the Following:

- Date and time of discovery
- Location (as specific as possible)
- Name and contact number of informant
- For beached animals - state of decomposition (i.e., alive, freshly dead, slightly decomposed, rotten)

**AFD 24 HOUR DOLPHIN HOTLINE**  
2377 1661 (or 7116 3898 #3029)

**所有發現的鯨豚(不論活著與否)**

並請提供以下資料：

- 發現日期及時間
- 發現地點(請盡量明確指出)
- 報告人的姓名及電話號碼
- 若屬擱淺動物，其腐爛程度(是否仍然生存、剛剛死亡、略為腐爛或非常腐爛)

**漁業處24小時海豚熱線電話**

**2377 1661 或 (7116 3898 #3029)**



## Appendix 2 - Data base structure for Water Quality

The data base structure for water quality monitoring is listed below. The ET shall select the related field names to create their own data recording sheet.

Field Name	Type	Width	Dec	Remark
Project/contract ID	C	3		Given by EPD
Work Area ID	C	2		Given by EPD
Sam Stn	C	3		Sampling Station
Latitude	C	10		Latitude of Sampling Station
Longitude	C	10		Longitude of Sampling Station
Easting	C	6		HK Grid (Easting) of Sampling Station
Nothing	C	6		HK Grid (Nothing) of Sampling Station
Date	C	8		Sampling Date
Time	C	5		Sampling Time
Replicate	C	1		1= first sample; 2= duplicated sample; etc.
Stu Purpose	C	1		Purpose of Sampling Station (c= control; I= impacts; s= sensitive receiver; etc.)
Sam Purpose	C	1		Purpose of Sample (B= baseline, I= Impact)
Weather	C	20		(sunshine, precipitation, humidity, air temperature)
Tide Status	C	10		Tidal Status (e.g. mid, ebb; mid-flood)
Water Depth	N	4	1	Depth of water column in meter
Sam Depth M	N	4	1	Depth of sample taken in meter
Sam Depth	C	1		Depth of sample taken (S= surface; M= middle; B= bottom)
Water Temp	N	4	1	Water Temperature
Salinity	N	6	2	
DO	N	6	2	Dissolved Oxygen
DOS	N	6	2	Dissolved Oxygen in % saturation
Trubidity	N	6	2	
SS	N	6	2	Suspended solids
Metal T...	N	6	2	Total metals (approx. 7 parameters, and can be more)
Metals D...	N	6	2	Dissolved metals (approx, 7 parameters, and can be more)
Trace organic...	N	6	2	Trace organic (e.g. PAHs, PCBs etc. can be a lot)
Nutrients	N	6	2	Nutrients (include several parameters such as NO <sub>2</sub> N, NO <sub>3</sub> N, Nhs, N, TP, OP etc.)
BOD	N	6	2	
COD	N	6	2	
Chlorophyll a	N	6	2	
E.coli	N	6	2	
F coliform	N	10	0	Faecal coliform
PARA...	N	10	0	Other parameters not listed above (Confirm with EPD individually)

(Remark: enter 999.99 to any numeric field that have no reading. Please note that "Zero" is also a valid data)

B. Details of water analytical methods and detection limits for different parameters.

Parameter	Limits of detection for WQ parameters	Units of measurement for WQ parameters	Analytical methods
e.g. DO			
e.g. Cd T			
etc.....			

C. Apart from A and B, the following information shall also be provided:

1. Project name, contract number, consultant name and telephone, contractor name, contract person and telephone number, site staffs and telephone.
2. Project commencement data and the proposed completion data, frequency of sampling and project work nature, e.g. dumping, dredging or reclamation.
3. List of site instrument for water quality monitoring.