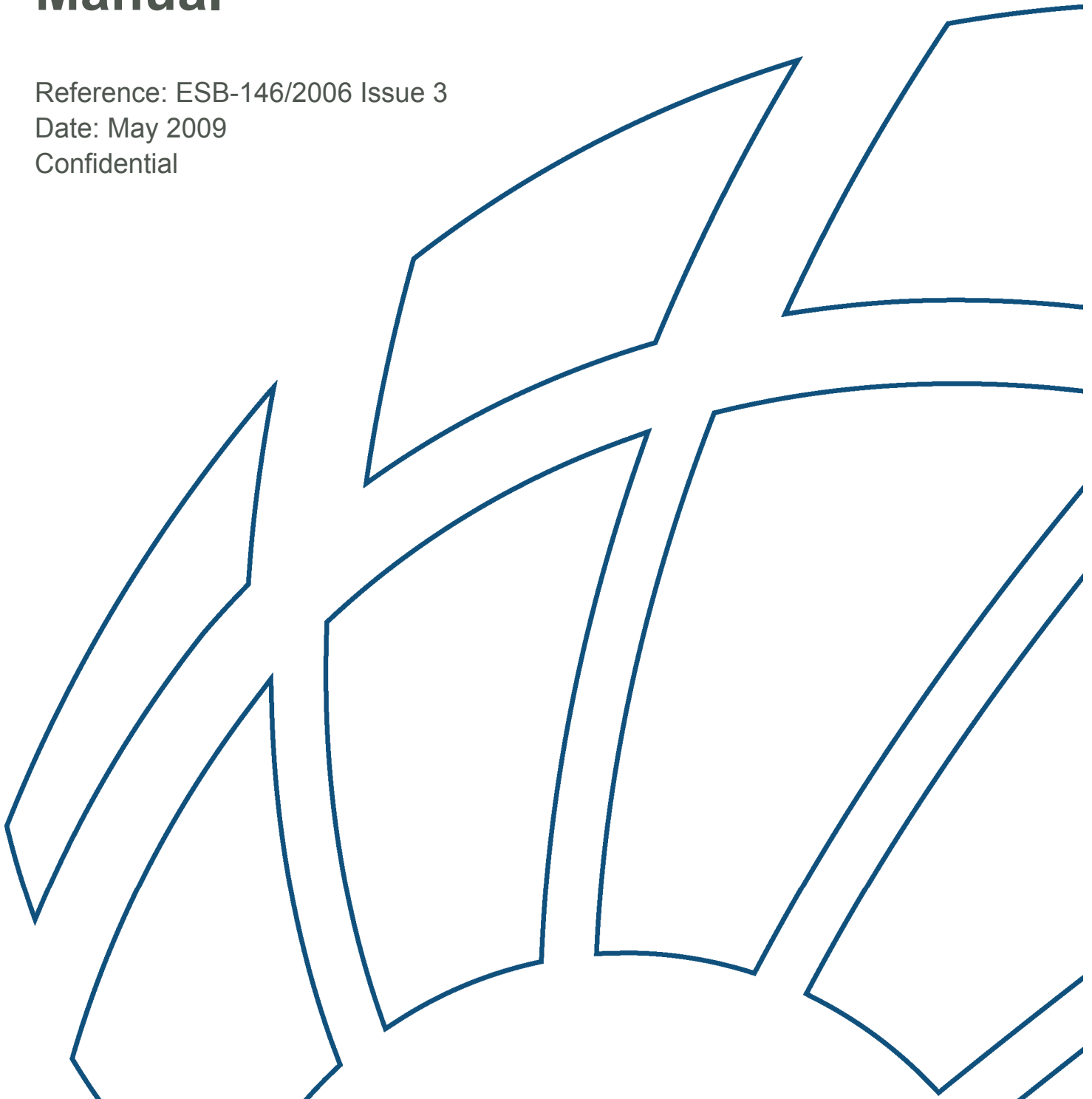


Hong Kong Offshore Wind Farm in Southeastern Waters Environmental Monitoring & Audit Manual

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Date: May 2009

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1 Introduction

1.1 Project Background

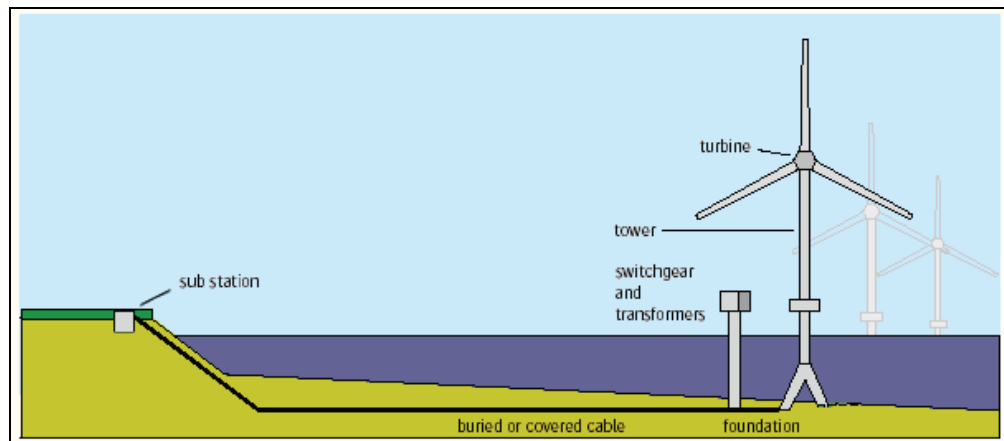
1.1.1.1 “The Project” refers to the development of the proposed Hong Kong Offshore Wind Farm (HKOWF) in Southeastern Waters of the HKSAR. The Project will be capable of producing a maximum output of approximately 200MW of electricity. The annual production would be approximately 1% of HK’s total electricity needs.

1.1.1.2 The Project components shall include:

- Up to 67 wind turbines;
- An offshore transformer platform;
- Sub sea collection and transmission cables;

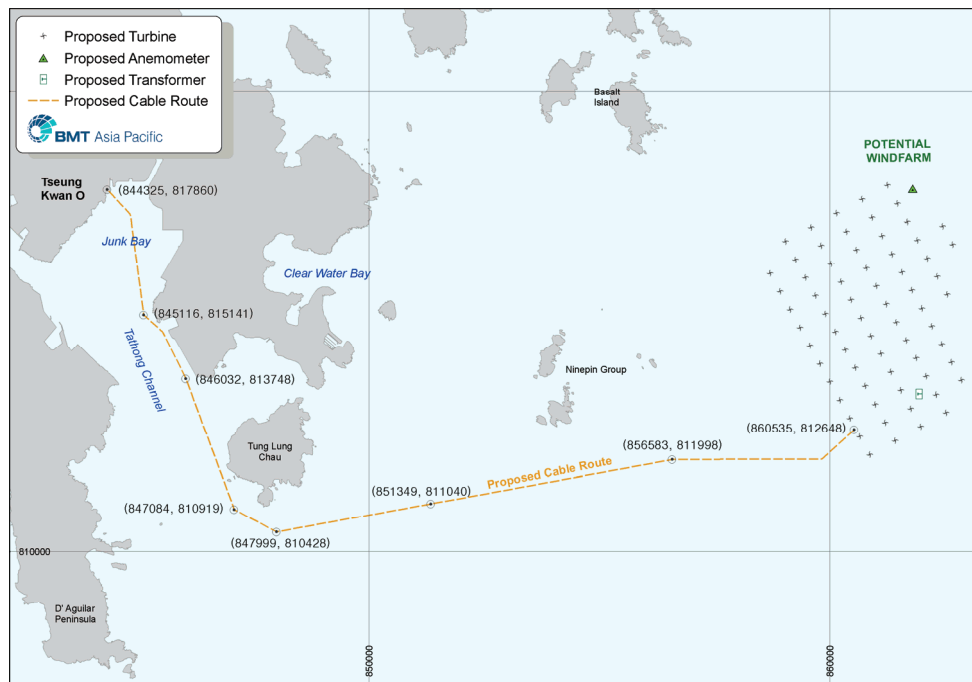
1.1.1.3 The turbines will be arranged in a grid, and each will be anchored to the seabed by a foundation consisting of a jacket structure with suction caissons. The turbines will be linked by collection cables to an offshore transformer platform from which electricity shall be transmitted to shore via two 132kV cables. A research mast will also be installed to collect data on the offshore environment. [Figure 1.1](#) presents a schematic of the components of a typical offshore wind farm.

Figure 1.1 Components of a Typical Offshore Wind Farm



Source: UK Department of Trade & Industry (DTI), 2002.

1.1.1.4 At its closest point, the Project would be approximately 9 km and 5km east of the Clearwater Bay peninsula and the main Ninepin Islands, respectively. [Figure 1.2](#) displays the Project location and finalised layout of the turbine array.

Figure 1.2 Project Location and Configuration

1.1.1.5

Full details of the Project, including site selection and construction options, are presented in Section 2 of the stand-alone EIA Study Report.

1.2

Environmental Monitoring & Audit Objectives

1.2.1.1

As regards Environmental Monitoring & Audit (EM&A) requirements, Clause 2.1 of the EIA Study Brief (ESB-146/2006) specifically refers to need to:

- (xiii) Propose the provision of mitigation measures so as to minimize pollution, environmental disturbance and nuisance during construction and operation of the Project;
- (ix) Investigate the feasibility, practicability, effectiveness and implications of the proposed mitigation measures;
- (xi) Identify, assess and specify methods, measures and standards, to be included in the detailed design, construction and operation of the Project which are necessary to mitigate these environmental impacts and cumulative effects and reduce them to acceptable levels; and
- (xiii) Design and specify environmental monitoring and audit requirements to ensure the effective implementation of the recommended environmental protection and pollution control measures.

1.2.1.2

Accordingly, this EM&A Manual has been compiled to specify the recommended environmental monitoring and audit requirements, where considered necessary for

the concerned environmental aspects, to ensure effective implementation of the environmental protection and pollution control measures.

1.2.1.3 This Manual provides systematic procedures for carrying out recommended monitoring and audit works for checking potential environmental impacts that may arise from the Project. Mitigation measures recommended in the EIA report for each key environmental aspect are also summarized and presented in this Manual.

1.2.1.4 The main objectives of this EM&A programme are to:

- Provide a database of baseline environmental quality for subsequent checking during the construction phase of the works;
- Provide information at an early stage for identification of potential problem areas and formulation of additional environmental mitigation measures where necessary should any of the environmental control measures or practices fail to achieve the target standards;
- Monitor the effectiveness of the proposed mitigation measures;
- Verify the environmental impacts predicted in the EIA Study for the project;
- Determine project compliance with relevant regulatory standards, requirements and guidelines;
- Outline remedial measures to be undertaken if unexpected problems or unacceptable impacts arise; and
- Provide data against which environmental audits may be undertaken effectively.

1.3 Summary of EM&A Requirements

1.3.1.1 The proposed EM&A programme shall be implemented during the design, pre-construction, construction and operational phases of the Project. [Table 1.1](#) summarises the EM&A requirements.

Table 1.1 Summary of EM&A Requirements

	Design	Pre-Construction	Construction	Operation
Waste Management	-	-	Yes	-
Water Quality	-	Yes	Yes	-
Marine Ecology	-	Yes	Yes	-
Avifauna	-	-	Yes	Yes
Cultural Heritage	-	Yes	-	-

1.4

Content and Structure of the EM&A Manual

1.4.1.1

This Manual contains the following:

- Duties of the Environmental Team and Independent Environmental Checker with respect to the EM&A requirements during the course of the Project;
- Information on project organisation;
- Requirements with respect to the construction schedule and the necessary EM&A programme to track the varying environmental impacts;
- Definition of Action and Limit Levels;
- Establishment of event and action plans;
- Requirements of reviewing pollution sources and working procedures required in the event of non-compliance of the environmental criteria; and
- Requirements of presentation of EM&A data and appropriate reporting procedures.

1.4.1.2

This EM&A Manual shall be regarded as an evolving document that may need to be reviewed and updated. An updated EM&A Manual should be prepared by the Environmental Team Leader and verified by the Independent Environment Checker before submission to the Engineer's Representative and Environmental Protection Department (EPD) for agreement.

1.4.1.3

Following this introductory section, this EM&A Manual has been structured as follows:

- Section 2: Project Organization
- Section 3: Waste Management

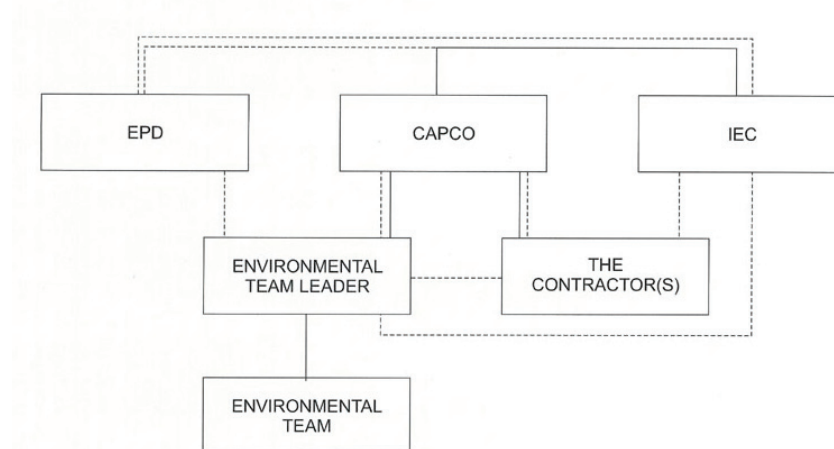
- Section 4: Water Quality
- Section 5: Ecology
- Section 6: Cultural Heritage
- Section 7: Reporting

2 Project Organisation

2.1 Background

2.1.1.1 **Figure 2.1** displays the proposed EM&A organization. The responsibilities of the respective parties for development and implementation of an effective EM&A programme are presented under the following sub-sections.

Figure 2.1 Project Organisation



2.2 Environmental Team (ET)

2.2.1.1 An Environmental Team (ET) shall be appointed to conduct the monitoring and auditing works and to provide specialist advice on undertaking and implementation of environmental responsibilities.

2.2.1.2 The ET Leader shall carry out the recommended EM&A programme for this Project. Neither ET Leader nor ET shall be in any way an associated body of Engineer's Representative, Independent Checker (Environmental) or Contractor. The ET Leader shall plan, organise and manage the implementation of the EM&A programme, and ensure that the EM&A works are undertaken to the required standards. The ET Leader shall have relevant professional qualifications in environmental control and possess at least 7 years experience in EM&A and/or environmental management subject to the approval of the Engineer's Representative.

2.2.1.3 The ET Leader shall be responsible for the implementation of the EM&A programme in accordance with the EM&A requirements specified in this Manual. The ET Leader shall keep a contemporaneous logbook for recording each and every instance or circumstance or change of circumstances that may affect the compliance with the recommendations of the EIA study. The Independent Checker

(Environmental) and EPD shall keep this logbook readily available for inspection.

2.2.1.4

Sufficient and 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. The broad categories of works of the ET comprise the following:

- Sampling, analysis and statistical evaluation of monitoring parameters with reference to the EIA study recommendations and requirements;
- Environmental site surveillance;
- Inspection and audit of compliance with environmental protection, and pollution prevention and control regulations;
- Inspection and audit of compliance with procedures established to enable an effective response to environmental incidents, exceedances or non-compliance;
- Assess the effectiveness of the environmental mitigation measures implemented;
- Monitor the implementation of environmental mitigation measures;
- Monitor compliance with the environmental protection clauses/specifications in the Contract;
- Review the construction schedule and provide comments as necessary;
- Review work methodologies which may affect the extent of environmental impact during the construction phase and comment as necessary;
- Complaint investigation, evaluation and identification of corrective measures;
- Liaison with the Project Independent Checker (Environmental) on all environmental performance matters, and timely submission of all relevant EM&A proforma for approval of the Independent Checker (Environmental);
- Advice to the Contractor on environmental improvement, awareness, enhancement matters, etc., on site; and
- Timely submission of the EM&A report to the Project Proponent and the EPD.

2.2.1.5

In the event of any exceedance of Action / Limit levels, the ET shall inform the Independent Checker (Environmental), Engineer's Representative and the Contractor within one working day (Monday to Friday except public holidays). The ET shall also advise of any change in circumstances or any non-compliance with the EIA study so that appropriate remedial actions may be taken promptly by the Contractor.

2.2.1.6

The ET is also responsible for the preparation of the monthly EM&A reports for submission to Independent Checker (Environmental), the Contractor and the Engineer's Representative, and through the Engineer's Representative, to EPD. The ET shall assist the Contractor and the Engineer's Representative in formulating any necessary corrective actions and/or additional mitigation measures, and liaising with relevant Government Departments where necessary.

2.3 Independent Environmental Checker [IEC]

- 2.3.1.1 The IEC shall be responsible for the duties defined in this EM&A Manual and the issued Environmental Permit (EP). The IEC shall audit the overall EM&A programme including the implementation of all environmental mitigation measures, submissions relating to EM&A, and any other submissions required in this EM&A Manual. The IEC shall also be responsible for verifying the environmental acceptability of permanent and temporary works, relevant design plans and submissions referred under this Manual.
- 2.3.1.2 The IEC shall verify the log-book prepared and kept by the ET Leader. The IEC shall notify EPD, within 24 hours of receipt of notification from the ET Leader of any such instance or circumstance or change of circumstances or non-compliance with the EIA study, which might affect the monitoring or control of adverse environmental impact.
- 2.3.1.3 The main duty of the IEC is to carry out independent environmental audit of the Project. This shall include, inter alia, the following:
- Review and audit in an independent, objective and professional manner in all aspects of the EM&A programme;
 - Validate and confirm the accuracy of monitoring results, appropriateness of monitoring equipment, monitoring locations with reference to the locations of the nearby sensitive receivers, and monitoring procedures;
 - Carry out random sample check and audit on monitoring data and sampling procedures, etc;
 - Conduct random site inspection (at least once a month);
 - Audit the EIA study recommendations and requirements against the status of implementation of environmental protection measures on site;
 - Review the effectiveness of environmental mitigation measures and project environmental performance;
 - On an as needed basis, verify and certify the environmental acceptability of the construction methodology (both temporary and permanent works), relevant design plans and submissions under the environmental permit. Where necessary, the IEC shall agree in consultation with the ET Leader and the Contractor the least impact alternative;
 - Verify investigation results of complaint cases and the effectiveness of corrective measures;
 - Verify EM&A report submitted and certified by the ET Leader; and
 - Feedback audit results to Engineer's Representative/ET by signing according to the Event/Action Plans specified in this EM&A Manual.

2.4 The Contractor

- 2.4.1.1 The Contractor shall include all construction contractors, operators during the operational phase of the project and sub-contractors, working on site at any one time.
- 2.4.1.2 The Contractor is responsible for providing requested information to the ET in the event of any exceedance in the environmental criteria (Action/Limit levels) specified in this Manual or other current environmental standards and to rectify unacceptable practices. The Contractor shall discuss with the ET Leader, IEC and Engineer's Representative on any additional mitigation measures identified to be required by the ET and implement the agreed measures to alleviate any identified environmental impact to acceptable levels. The design and implementation of the control and mitigation measures shall be the responsibility of the Contractor.
- 2.4.1.3 In the event that the ET needs to undertake complaint investigation work, the Contractor and the Engineer shall co-operate with the ET Leader in providing all the necessary information and assistance for completion of the investigation. If mitigation measures are required following the investigation, the Contractor shall promptly carry out these measures.
- 2.4.1.4 The Contractor shall report to the ET Leader on the action(s) taken targeting at environmental protection for inclusion in the monthly report to be prepared by the ET.

2.5 Engineer's Representative (ER)

- 2.5.1.1 The ER shall be responsible for overseeing the operations of the Contractor and the ET. The ER shall advise, co-ordinate and give appropriate instructions for the efficient implementation of specific environmental mitigation measures required, and / or outstanding EM&A works required to be conducted by ET.
- 2.5.1.2 The ER shall supervise the Contractor's activities and ensure that the requirements in the EM&A Manual and other government's standards are fully complied with. He shall inform the Contractor when action is required to reduce impacts in accordance with the Event/Action Plans. He shall review the EM&A Reports submitted by the ET and follow up the recommendations. He shall ensure that the Contractor is implementing the environmental controls and mitigation measures as set out in the EIA study and EM&A Manual, as well as additional measures necessary for compliance with the relevant environmental standards.
- 2.5.1.3 In the event that the ET needs to undertake complaint investigation work, the ER and the Contractor shall co-operate with the ET Leader in providing all the necessary information and assistance for completion of the investigation. If mitigation measures are required following the investigation, the ER shall ensure that the Contractor has carried them out.

3 Waste Management

3.1 Introduction

- 3.1.1.1 The assessment has concluded that under proper handling, storage, collection, transportation and disposal of waste materials generated during construction of the Project will not give rise to any significant impacts. However, a waste management plan will be formulated and an audit of the Contractor's waste management practices shall be conducted by the ET as described below (refer section 3.7.1.3 of EIA).
- 3.1.1.2 No adverse environmental impact will arise with the implementation of good waste management practices and accordingly no mitigation is required.

3.2 Waste Management Plan & Waste Audits

- 3.2.1.1 The Waste Management Plan (WMP) shall prepared by the Contractor to describe arrangements for waste avoidance, re-use and recycling, including all handling, storage and transfer requirements.
- 3.2.1.2 The WMP should be refined and updated as more detailed information is generated on the volume of dredged marine mud. Similarly, it should be regularly reviewed and updated at least monthly throughout construction.
- 3.2.1.3 The Contractor shall designate a manager during project construction to supervise the implementation of waste management control measures as recommended in the Implementation Schedule, [Appendix A](#) of this Manual.
- 3.2.1.4 The WMP and waste flow tables shall be subject to a monthly audit by the ET, with the audits to focus on ensuring:
- Wastes arising are handled, stored, collected, transferred and disposed of an environmentally acceptable manner and comply with the relevant requirements under the Waste Disposal Ordinance (WDO) and its regulations;
 - The Contractor(s) properly implements the appropriate environmental protection and waste control measures as outlined in the Implementation Schedule to avoid or otherwise control potential impacts;
 - The WMP is effectively implemented; and
 - The re-use and recycling of materials is encouraged.
- 3.2.1.5 The construction Contractor(s) must ensure that the necessary disposal permits or licences are obtained from appropriate authorities in accordance with the various Ordinances.

4 Water Quality

4.1 Introduction

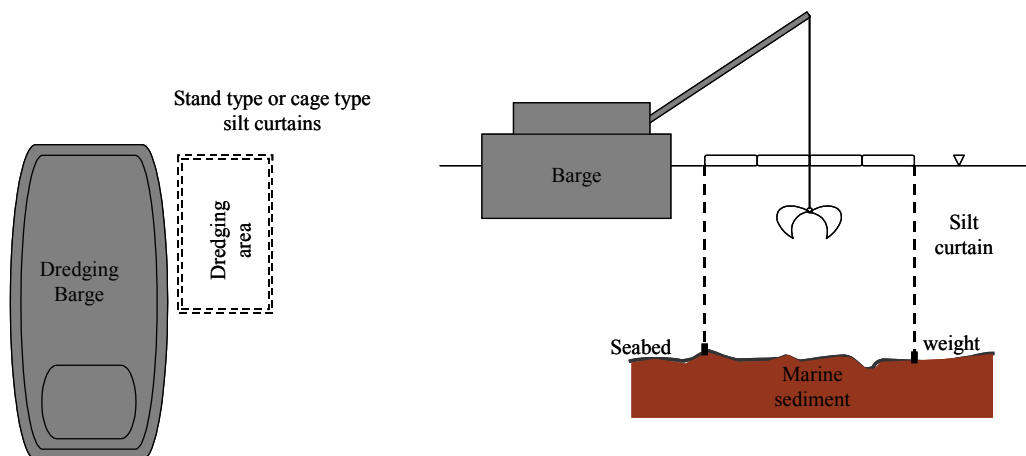
4.1.1.1 This section presents the requirements, methodology, equipment, monitoring locations, criteria and protocols for the monitoring and audit of water quality impacts during the construction phase of the Project. Water quality modelling carried out for the EIA indicates that the potential water quality impacts associated with the dredging and jetting, water pumping and other marine activities would be within acceptable levels and no adverse water quality impacts are expected.

4.1.1.2 In order to ensure no adverse water quality impacts on the water sensitive receivers throughout the construction period, water quality monitoring and audit is proposed to cover the dredging activities in Tseung Kwan O and a section of jetting operation in the near shore waters where the water sensitive receivers are nearest to the sites for dredging and jetting operations. Based on the model predictions and the site trial for suction caisson installation conducted on 22nd May 2008, the installation of the power and collection cables, and suction caissons in the offshore waters would have negligible effect on the water sensitive receivers. Water quality monitoring in the offshore waters is therefore not proposed.

4.2 Mitigation Measures

4.2.1.1 Mitigation measures to minimise water quality impacts during construction are presented in Appendix A. [Figure 4.1](#) displays the arrangement of the silt curtains.

Figure 4.1 Arrangement of Silt Curtain during Dredging in Junk Bay



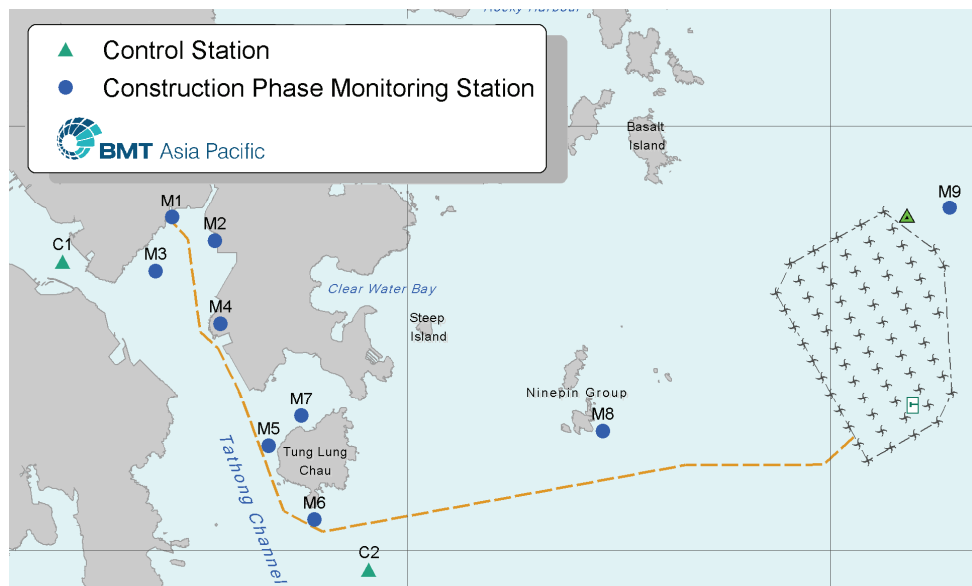
4.3 Monitoring Requirements

4.3.1 Baseline Monitoring

4.3.1.1 Baseline water quality conditions shall be established and agreed with EPD prior to the commencement of works. The purposes of the baseline monitoring are to establish ambient conditions prior to the commencement of the construction works and to demonstrate the suitability of the proposed impact monitoring and control stations.

4.3.1.2 **Figure 4.2** shows the locations of the proposed impact monitoring and control stations.

Figure 4.2 Proposed Water Quality Control and Impact Monitoring Stations



4.3.1.3 These locations are subject to further review prior to the commencement of the monitoring. Should there be any changes of the monitoring locations, the new locations shall be submitted to EPD for approval four weeks before the commencement of baseline monitoring.

4.3.1.4 The baseline conditions shall normally be established by measuring the water quality parameters specified in section 4.3.3. The measurements shall be taken at all designated monitoring stations including control points, 3 days per week, for at least 4 weeks prior to the commencement of construction works.

4.3.1.5 There shall not be any construction activities over water in the vicinity of the points during the baseline monitoring.

4.3.1.6 In exceptional case when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall seek approval from the IEC and EPD on an appropriate set of data to be used as baseline reference.

4.3.1.7 Baseline monitoring schedule shall be submitted to EPD one week prior to the commencement of baseline monitoring. The interval between 2 sets of monitoring shall not be less than 36 hours.

4.3.2 Construction Phase Monitoring

4.3.2.1 During the course of the construction works, monitoring shall be undertaken 3 days per week, at mid-flood and mid-ebb tides, with sampling at the designated monitoring points (Figure 4-2). The interval between 2 sets of monitoring shall not be less than 36 hours except there are exceedances of Action and / or Limit levels, in which case the monitoring frequency will be increased. The frequency of monitoring shall be agreed with EPD at least 2 weeks before undertaking any works.

4.3.2.2 Upon completion of all marine works, a post project monitoring exercise on water quality shall be carried out for one week in the same manner as the impact monitoring.

4.3.2.3 The proposed water quality monitoring schedule for construction phase monitoring shall be submitted to EPD at least two weeks before the first day of the monitoring month. EPD shall also be notified immediately of any changes in schedule.

4.3.3 Monitoring Parameters

4.3.3.1 Monitoring for dissolved oxygen (DO), temperature, turbidity, pH, suspended solids (SS), total inorganic nitrogen (TIN) and unionised ammonia (NH₃-N) shall be undertaken at designated monitoring locations. The purpose is to ensure that any deterioration in water quality can be readily detected and timely action can be taken to resolve any problems. It should be noted that DO, temperature, turbidity and pH should be measured in-situ whereas others are assayed in a laboratory.

4.3.3.2 The instrument for measuring Dissolved Oxygen should be portable and weatherproof using a DC power source. It should have a membrane electrode with automatic temperature compensation complete with a cable, and should be capable of measuring:

- DO level in the range of 0-20 mg/L and 0-200% saturation; and
- Temperature between 0-45 °C.

4.3.3.3 The instrument for turbidity measurement should be portable and weatherproof using a DC power source. It should have a photoelectric sensor capable of measuring turbidity between 0-1000 NTU, such as a Hach model 2100P or similar approved.

All pH meters, DO meters and turbidimeters shall be checked and calibrated prior to use. DO meters and turbidimeters shall be calibrated by a laboratory accredited

under HOKLAS or any other international accreditation scheme, and subsequently re-calibrated at 3 monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes shall be checked with certified standard solutions before each use. Wet bulb calibrations for all DO meters shall be carried out before measurement at each monitoring location. For the on site calibration of field equipment, BS 127:1993 *Guide to field and on-site test methods for the analysis of waters* should be observed.

- 4.3.3.4 For suspended solid sampling an instrument (eg Kahlsico Water Sampler), which is a PVC cylinder (capacity not less than 2 litres), which can be effectively sealed with latex cups at both ends, will be used. The sampler will 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. Water samples for suspended solids measurement will be collected in high-density polythene bottles, packed in ice (cooled to 4°C without being frozen), and delivered to the laboratory in the same day as the samples were collected.
- 4.3.3.5 In association with the water quality parameters, other relevant data shall also be measured, such as monitoring location / position, time, weather conditions, and any special phenomena and description of work underway at the construction site etc.
- 4.3.3.6 The Contractor shall custom develop a suitable pro-forma for the in-situ field monitoring. An example is provided in [Appendix B](#).

4.3.4 Laboratory Measurement and Analysis

- 4.3.4.1 Analysis for SS, TIN and NH₃-N will be carried out in a HOKLAS or other international accredited laboratory. Water samples of about 500mL will be collected at the monitoring stations for carrying out the laboratory SS determination. The SS determination work will start within 24 hours after collection of the water samples. The analyses will follow the standard methods as described in APHA *Standard Methods for the Examination of Water and Wastewater, 19th Edition*, unless otherwise specified (APHA 2540D for SS) with a detection limit of 1 mg L⁻¹ or less.
- 4.3.4.2 The submitted information should include the chain of custody forms, pre-treatment procedures, instrument use, Quality Assurance/Quality Control (QA/QC) details (such as blank, spike recovery, number of duplicate samples per-batch etc), detection limits and accuracy.
- 4.3.4.3 The QA/QC details will be in accordance with requirements of HOKLAS or another internationally accredited scheme that HOKLAS has an agreement with. [Table 4.1](#) presents the limits of detection established for *in-situ* and laboratory measurements.

Table 4.1 Detection Limits and Precision for Water Quality Parameters

Parameter	Limit of Detection
-----------	--------------------

Parameter	Limit of Detection
Dissolved Oxygen	0.1 mg L ⁻¹
Salinity	0.01 ppt
Temperature	0.1 °C
pH	0.01 units
Turbidity (NTU)	0.1 NTU
Suspended Solids	1 mg L ⁻¹

Upon completion of all marine works, a post project monitoring exercise on water quality shall be carried out for one week in the same manner as the impact monitoring.

4.3.5

Monitoring Locations

4.3.5.1

Figure 4.2 and Table 4.2 indicate the locations of water quality monitoring points during construction phase and their coordinates respectively. The final locations and number of the monitoring points shall be agreed with EPD at least 2 weeks before undertaking any works. The status and locations of water quality sensitive receivers may change after issuing this manual. If such case exists, the ET Leader shall propose updated monitoring locations and seek approval from the IEC and EPD.

Table 4.2 Proposed Stations for Baseline and Construction Monitoring

Station	Description	Easting	Northing
M1	Coral Communities at Junk Island	844428	817976
M2	WSD Seawater Intake at Tseung Kwan O	845525	817388
M3	Coral Communities at Junk Bay	844083	816837
M4	Coral Communities at Fat Tong Chau West	845348	815252
M5	Coral Communities at Tung Lung Chau West	846913	812366
M6	Coral Communities at Tung Lung Chau South	847745	811046
M7	Tung Lung Chau FCZ	847347	813080

Station	Description	Easting	Northing
M8	South Ninepins	854226	812598
M9	Victor Rock	862619	818033
C1	Control Station 1	841751	816679
C2	Control Station 2	848585	809709

4.3.5.2 When alternative monitoring locations are proposed, they shall be chosen based on the following criteria:

- At locations close to and preferably at the boundary of the mixing zone of the major site activities as indicated in the EIA report, which are likely to have water quality impacts;
- Close to the sensitive receptors which are directly or likely to be affected;
- For monitoring locations located in the vicinity of the sensitive receptors, care shall be taken to cause minimal disturbance during monitoring;
- Control stations shall be located, as far as is practicable, both upstream and down stream of the works area.

4.3.5.3 Control stations are necessary to compare the water quality of the potentially impacted sites with the ambient water quality. Control stations shall be located outside the area of influence of the works and, as far as practicable, not affected by any other works.

4.3.5.4 Measurements shall be taken at 3 water depths, namely, 1m below water surface, mid-depth and 1m above seabed. Exception is given to locations where the water depth less than 6m; in that case 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 the IEC and EPD on all the monitoring stations.

4.3.5.5 Replicates in-situ measurements and samples collected from each independent sampling event are required for all parameters to ensure a robust statistically interpretable dataset.

4.4 Water Quality Compliance

4.4.1.1 Water quality monitoring will be evaluated against Action and Limit Levels. The key assessment parameters are dissolved oxygen and suspended sediment and thus Action and Limit Levels based on the assessment criteria are identified for these. However turbidity can also provide valuable instantaneous information on water quality and thus an Action Limit is also recommended for this parameter to facilitate quick responsive action in the event of any apparent unacceptable

deterioration attributable to the works. Table 4.3 presents the proposed Action and Limit Levels.

4.4.1.2 Action and Limit levels are used to determine whether operational modifications are necessary to mitigate impacts to water quality. In the event that the levels are exceeded, appropriate actions in Event and Action Plan should be undertaken and a review of works should be carried out by the Contractor(s).

4.4.1.3 Any noticeable change to water quality will be recorded in the survey reports and will be investigated and remedial actions will be undertaken to reduce impacts. Particular attention will be paid to the Contractor(s)'s implementation of the recommended mitigation measures.

4.4.1.4 It should be noted that all Action Limit levels presented in Table 4.3 may be revised based on the baseline data to be collected in advance of construction works. If deemed necessary, the ET in consultation with the Contractor(s) will propose revised Action Limit levels and seek approval from The Windfarm Operator, the IEC and EPD.

Table 4.3 Action and Limit Levels for Water Quality

Parameters	Action (mg L ⁻¹)	Limit (mg L ⁻¹)
DO in mgL ⁻¹ (surface, middle, bottom)	5%-ile of baseline data for surface and middle layer.	4 mg/L (except 5 mg/L for FCZ) or 1%-ile of baseline data for surface and middle layer
	5%-ile of baseline data for bottom layer	2 mg/L or 1%-ile of baseline data for bottom layer
Turbidity in NTU in mg L ⁻¹ (depth averaged)	95%-ile of baseline data or 120% of upstream control station's turbidity at the same tide of the same day.	99%-ile of baseline or 130% of upstream control station's turbidity at the same tide of the same day.
Suspended Solids in mg L ⁻¹ (depth averaged),	95%-ile of baseline data or 120% of upstream control station's SS at the same tide of the same day.	99%-ile of baseline or 130% of upstream control station's SS at the same tide of the same day and specific sensitive receiver water quality requirements (e.g. required suspended solids levels for concerned sea water intakes).
SS (surface layer) at monitoring stations close to WSD salt water intakes	10 mg/L	10 mg/L
TIN in mg/L (depth-averaged)	95%-ile of baseline data	99%-ile of baseline data
NH3-N in mg/L (depth-averaged)	95%-ile of baseline data or 0.021 mg/L, whichever higher	99%-ile of baseline data or 0.021 mg/L, whichever higher

Notes:

1. For DO, non-compliance occurs when monitoring results are lower than the limits.
2. For SS and turbidity, non-compliance occurs when monitoring result are higher than the limits.
3. All figures in the table are for reference only and the EPD may amend the figures whenever it is considered necessary.

4.4.1.5

The IEC will be empowered to audit the environmental performance of construction aspects of the EM&A programme, validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations and procedures. If any exceedance occurs, the ET, IEC and the Contractor(s) will follow the actions stated in the Event and Action Plan presented in [Table 4.4](#).

Table 4.4 Event and Action Plan for Construction Phase Water Quality Monitoring

Event	Action		
	ET ⁽¹⁾	IEC ⁽¹⁾	Contractor(s)
Action Level being exceeded by one sampling day	1.Repeat in-situ measurement to confirm findings;	1.Discuss with the ET and the Contractor(s) on the mitigation measures;	1.Inform The Windfarm Operator and confirm notification of the exceedance in writing;
	2.Identify source(s) of impact;	2.Review proposals on mitigation measures submitted by the Contractor(s) and advise The Windfarm Operator accordingly;	2.Rectify unacceptable practice;
	3.Inform the IEC, the Contractor(s) and The Windfarm Operator;		3.Check plant and equipment;
	4.Check monitoring data, plant, equipment and the Contractor(s)'s working methods;	3.Assess the effectiveness of the implemented mitigation measures.	4.Consider changes of working methods;
	5. If exceedance occurs at WSD salt water intake, inform WSD;		5.Discuss with the ET and the IEC and propose mitigation measures to the IEC and The Windfarm Operator;
	6. Discuss mitigation measures with IEC and Contractor; and		6.Implement the agreed mitigation measures.
	7. Repeat measurement on next day of exceedance, if the exceedance is project related.		

Action			
Event	ET ⁽¹⁾	IEC ⁽¹⁾	Contractor(s) The Windfarm Operator
<p>Action Level being exceeded by more than one consecutive sampling days</p>	<p>1. Repeat in-situ measurement to confirm findings; 2. Identify source(s) of impact; 3. Inform the IEC, the Contractor(s) and The Windfarm Operator 4. Check monitoring data, plant, equipment and Contractor(s)'s working methods; 5. If exceedance occurs at WSD salt water intake, inform WSD; 6. Discuss mitigation measures with IEC and Contractor; 7. Ensure mitigation measures are implemented; 8. Prepare to increase the monitoring frequency to daily; and 9. Repeat measurement on next day of exceedance, if the exceedance is project related.</p>	<p>1. Discuss with the ET and the Contractor(s) on the mitigation measures; 2. Review proposals on mitigation measures submitted by the Contractor(s) and advise The Windfarm Operator accordingly; 3. Assess the effectiveness of the implemented mitigation measures. 5. Discuss with the ET and the IEC and propose mitigation measures to the IEC and The Windfarm Operator within 3 working days;</p>	<p>1. Inform The Windfarm Operator and confirm notification of the exceedance in writing; 2. Rectify unacceptable practice; 3. Check plant and equipment; 4. Consider changes of working methods; 5. Discuss with the ET and the IEC and propose mitigation measures to the IEC and The Windfarm Operator within 3 working days; 6. Implement the agreed mitigation measures.</p>

Action			
Event	ET ⁽¹⁾	IEC ⁽¹⁾	Contractor(s) The Windfarm Operator
<p>Limit Level being exceeded by one consecutive sampling day</p>	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm findings; 2. Identify source(s) of impact; 3. Inform the IEC, the Contractor(s) and The Windfarm Operator; 4. Check monitoring data, plant, equipment and Contractor(s)'s working methods; 5. If exceedance occurs at WSD salt water intake, inform WSD; 6. Discuss mitigation measures with IEC and Contractor; 7. Ensure mitigation measures are implemented; and 8. Increase the monitoring frequency to daily until no exceedance of Limit level, if the exceedance is project related. 	<ol style="list-style-type: none"> 1. Discuss with the ET / Contractor(s) on the mitigation measures; 2. Review proposals on mitigation measures submitted by the Contractor(s) and advise The Windfarm Operator accordingly; 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Immediate stoppage of works; 2. Inform The Windfarm Operator and confirm notification of the exceedance in writing; 3. Rectify unacceptable practice; 4. Check plant and equipment; 5. Consider changes of working methods; 6. Discuss with the ET, the IEC and The Windfarm Operator and propose mitigation measures to the IEC and The Windfarm Operator within 3 working days; 7. Implement the agreed mitigation measures.
			<ol style="list-style-type: none"> 1. Discuss with IEC, ET and Contractor on the proposed mitigation measures; 2. Request Contractor to critically review the working methods; 3. Make agreement on the mitigation measures to be implemented; and 4. Assess the effectiveness of the implemented mitigation measures.

Event	ET ⁽¹⁾	IEC ⁽¹⁾	Action	Contractor(s)	The Windfarm Operator
Limit Level being exceeded by more than one consecutive sampling days	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm findings; 2. Identify source(s) of impact; 3. Inform the IEC, the Contractor(s) and The Windfarm Operator; 4. Check monitoring data, plant, equipment and Contractor(s)'s working methods; 5. If exceedance occurs at WSD salt water intake, inform WSD; 6. Discuss mitigation measures with IEC and Contractor; 7. Ensure mitigation measures are implemented; and 8. Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days, if the exceedance is project related. 	<ol style="list-style-type: none"> 1. Discuss with ET and Contractor(s) on the mitigation measures; 2. Review proposals on mitigation measures submitted by the Contractor(s) and advise The Windfarm Operator accordingly; 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Immediate stoppage of works; 2. Inform The Windfarm Operator and confirm notification of the exceedance in writing; 3. Rectify unacceptable practice; 4. Check plant and equipment; 5. Consider changes of working methods; 6. Discuss with the ET, the IEC and The Windfarm Operator and propose mitigation measures to the IEC and The Windfarm Operator within 3 working days; 7. Implement the agreed mitigation measures; 8. As directed by The Windfarm Operator, slow down or stop all or part of the construction activities. 	<ol style="list-style-type: none"> 1. Discuss with the IEC, the ET and the Contractor(s) on the proposed mitigation measures; 2. Request Contractor(s) to critically review working methods; 3. Make agreement on the mitigation measures to be implemented; 4. Assess effectiveness of the implemented mitigation measures; 5. Consider and instruct, if necessary, the Contractor(s) to slow down or to stop all or part of the marine work until no exceedance of Limit Level. 	

Note: (1) ET – Environmental Team, IEC – Independent Environmental Checker

5 Ecology

5.1 Benthic Ecology

5.1.1.1 No environmental monitoring & audit is proposed for the benthic infauna community, as no significant adverse impacts are anticipated.

5.1.1.2 For the benthic epifauna, particularly corals, it is proposed that water quality monitoring be conducted at Fat Tong Chau during dredging activities in Junk Bay to ensure levels of suspended solids outside the silt curtain enclosure do not exceed the Water Quality Objectives.

5.1.1.3 The details of water quality monitoring are presented in [Section 4](#) of this EM&A Manual.

5.1.2 Coral Monitoring

5.1.2.1 Although adverse impacts to any corals are not predicted to occur as a result of the mitigation measures adopted during cable or turbine installation, the project proponent has offered to conduct coral impact monitoring at those sites with the most valuable coral communities identified in proximity to the cable alignment (value > moderate & distance < 400m (about 3 time mixing zone) to verify that the project will have no adverse ecological impacts.

5.1.2.2 Under these criteria the site adjacent to the transmission cable at Tung Lung Chau South is identified for monitoring. Literature reviews and dive surveys undertaken as part of the EIA identified this site as of moderate to high ecological value due to the abundance and diversity of coral found there.

5.1.2.3 The EIA has predicted that no impacts will occur at Victor Rock and South Ninepins sites given that they lie over 400m away from works areas. However, as a further precaution given their moderate to high value, the project proponent has also offered to conduct coral monitoring at one site at Victor Rock when turbines are installed within 1km and at one site at the South Ninepins when cable jetting is conducted within 1km.

5.1.2.4 The measures proposed for this project are similar to those in, "*The proposed Submarine Gas Pipelines from Cheng Tou Jiao Liquefied Natural Gas Receiving Terminal, Shenzhen to Tai Po Gas Production Plant, Hong Kong*" (EIA 089/2003) submitted by the Hong Kong Gas China Gas Company Ltd.

5.1.3 Sampling Methodology

5.1.3.1 The objective of the monitoring will be to identify any adverse impacts on corals at Tung Lung Chau South, South Ninepins and Victor Rock as a result of the cable jetting and turbine installation and to ensure appropriate action is being taken to reduce any impacts.

5.1.3.2

The coral site monitoring will be reviewed together with Water Quality (WQ) monitoring results, which can identify any high concentrations of suspended solids created during jetting or turbine installation.

5.1.4

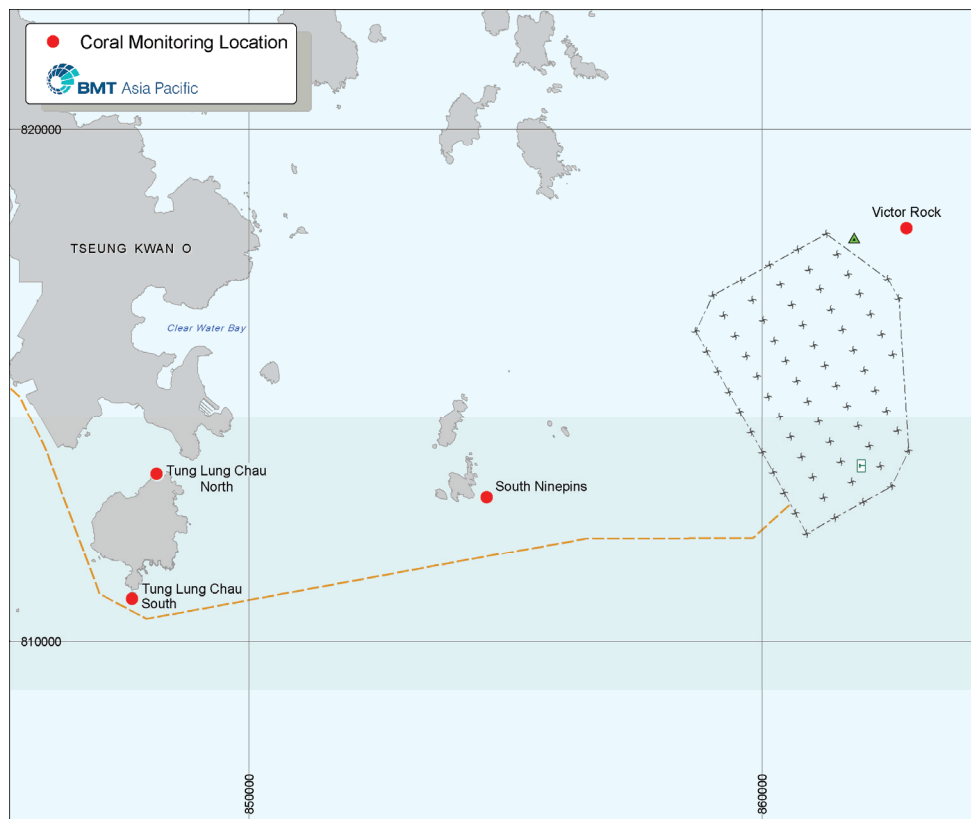
Monitoring Locations

5.1.4.1

The monitoring programme will include dive surveys at three impact and one control station. The impacts to corals during works can then be inferred through a comparison between the stations and the WQ monitoring results.

Station Type	Location	Overall Value	GPS Position
Impact Monitoring	Tung Lung Chau South	Moderate / High	N 22 14 569 E 114 16 982
Impact Monitoring	South Ninepins	Moderate/High	N 23 15 327 E 114 21 161
Impact Monitoring	Victor Rock	Moderate/High	N 22 18 163 E 114 25 927
Control Station	North Tung Lung Chau	Ref: Section 5.5.1.12	N 22 15 554 E 114 17 315

Figure 5.1 Coral Monitoring Locations



5.1.4.2 The control station area at North Tung Lung Chau is considered appropriate as it will not be within the Works impact zone and any effects noted at this site will be due to other environmental effects outside of the jetting and turbine installation works.

5.1.4.3 The number and location of the corals to be tagged at the impact and control stations shall be randomly assigned in the field and will include a minimum of 20 hard coral colonies and 20 octocoral/black coral groups in 2 depth zones, with depth zones being consistent at the impact and control sites.

5.1.5 Monitoring Techniques

5.1.5.1 The coral monitoring work shall be undertaken by Marine Scientist(s) that is(are) experienced in SCUBA based field identification of sessile benthic taxa. The personnel shall be a qualified marine biologist with a postgraduate degree in marine biology and/or specialist knowledge of hard & soft corals. The same coral specialist(s) must be used for each dive survey to maintain consistency in the documentation and shall only be commissioned following advanced approval by AFCD.

5.1.5.2 It is expected that four surveys will be required for each of the jetting sites (Tung Lung Chau South and South Ninepins):

- Baseline Survey – Prior to jetting works a Baseline Survey and coral tagging exercise will be conducted
- Impact Monitoring (2 surveys at each site) - One survey during each of the two cable installations passes.
- Post Project Monitoring – A final survey following completion of all Works within the area.

5.1.5.3 It is expected that three surveys will be required at the Victor Rock site:

- Baseline Survey – Prior to turbine installation a Baseline Survey and coral tagging exercise will be conducted
- Impact Monitoring - One survey during turbine installation within 1km of Victor Rock.
- Post Project Monitoring – A final survey following completion of all Works within the area.

5.1.6 Baseline Survey/Coral Tagging

5.1.6.1 The baseline survey's objective will be to develop a quantitative estimate of coral cover and abundance and identify the most suitable coral species to be tagged monitored during the works programme. All coral fauna including stony corals, octocorals and black coral will be considered.

- 5.1.6.2 The dive survey will include a general reconnaissance to update the detailed survey gathered as part of the EIA, and identify the number and location of coral colonies to be tagged. At each site shallow, coral communities will be sampled and recorded, as identified below:
- Each survey area will be of 100 m (shoreline length) by ~10 m width.
 - Ten 10 m long replicate transects should be laid haphazardly within the boundaries of each site, orientated parallel to the shore where possible.
 - On an initial dive representative photographs and video will be taken along each transect and general data on the diversity, abundance and health (i.e. any signs of bleaching or bleaching, mucus secretion and necrosis) of the corals in the general area will be recorded
 - Candidate corals shall be identified. Tagged corals shall then be identified and photographed; information recorded shall include location, size and condition. Priority shall be given to tagging the largest intact colonies,
 - Survey time, date, metocean (wind, wave, current and tidal level) and meteorological (temperature & pressure, light levels) information shall be recorded.
 - Sediment cover at each tagged coral shall be recorded including the percentage coverage, thickness, colour and texture.

5.1.6.3 Any area of sediment, bleaching, or partial/total mortality present in the coral community area that covers >10% of the survey/coral area will be counted and specifically documented on each survey.

5.1.6.4 Any other specific observations on coral health will be noted in the field and included in the survey report.

5.1.7 Impact Monitoring

5.1.7.1 The focus of the impact monitoring will be to identify any impacts to corals from adjacent jetting or turbine installation due to sedimentation or elevated Suspended Solids (SS) levels.

5.1.7.2 Impact monitoring will be undertaken daily during any jetting operations within 400m of the Tung Lung Chau South site, within 1km of the South Ninepins site and when turbine installation occurs within 1km of the Victor Rock site. A report together with associated photographs and video will be submitted to AFCD & EPD within 2 days of each survey for review purposes. This information will be submitted together with the WQ monitoring results.

5.1.7.3 The data collected will be the same range of particulars collected in the Baseline surveys, as identified above.

5.1.8 Post Works Monitoring

5.1.8.1 Post works project monitoring will occur two weeks after completion of any jetting or turbine installation adjacent to the impact sites. This monitoring will consist of a

replication of the photo and video transects detailed for Baseline Monitoring

5.1.9

Marine Ecology Action Plan

5.1.9.1

The focus of the ecological monitoring is the detection of any ecological impacts on the coral communities at the Impact site. If impacts are detected this will lead to a review of the jetting or turbine installation operations and mitigation measures. The action plan is triggered following an assessment of any % changes from the baseline of the following Impact Parameters:

- Sediment Cover (% of coral surface);
- Bleaching (% of surface bleached white);
- Partial Mortality (% of surface, or for soft corals total number branches that exhibit mortality).
- Necrosis (% of surface, or for soft corals total number branches that exhibit necrosis).
- Mucus Secretion (% of coral surface)
- The following limits for any of the Impact Parameters on the tagged corals (Hard or Soft) may be identified as follows:
- Action Level – A 15% increase in any Impact Parameter percentage at more than 20% of the tagged coral colonies at the Impact sites that is not reported at the Control sites, then the Action Level is exceeded (Step 2).
- Limit Level – A 25% increase in any Impact Parameter percentage at more than 20% of the tagged coral colonies at the Impact sites that is not reported at the Control sites, then the Limit Level is exceeded (Step 3).

5.1.9.2

Step 1 If no increase in Impact Parameters is observed - no action is required and (following report of the summary findings at the end of each survey day to the Environmental Team Leader) a formal report should be issued to the IEC, Contractor, Project Proponent, AFCD and EPD. This reporting should cover the previous 2 days of monitoring.

5.1.9.3

Step 2 If the Action Level limits are exceeded the ET Leader should inform all parties and the survey data reviewed together with the WQ reports.

- If the WQ monitoring shows no effects of the jetting or turbine installation works, then this Action Level is not triggered and/or.
- If the WQ data illustrates increases and exceedances in Suspended Solids or turbidity then the ET Leader should review with the Contractor the best manner to reduce impacts most appropriate method of reducing suspended solids during jetting or turbine installation. This method should then be enacted on the next working day.

5.1.9.4

Step 3 If the Limit Level limits are exceeded the ET Leader should inform all parties immediately and inform the Contractor to suspend jetting or turbine installation operations until a solution can be identified according to the requirements of AFCD and EPD. Once the solution has been identified and

agreed with all parties jetting or turbine installation may commence.

5.2 Marine Mammals

5.2.1 Acoustic Monitoring

- 5.2.1.1 The Finless Porpoise is a cryptic species and difficult to see because it is small, has a grey body colour that matches deeper waters and lacks a dorsal fin. As such, boat-based visual observations are of limited application when attempting to monitor the use of large areas of marine habitat by this species.
- 5.2.1.2 Passive acoustic monitors shall be deployed that allow for continuous monitoring, as such devices allow the high frequency clicks of porpoises to be easily distinguished from other marine animals. Specifically, C-PODs (Cetacean - Porpoise Detectors) shall be deployed to continuously monitor activity in all conditions. Product details can be found at www.chelonia.co.uk.
- 5.2.1.3 The acoustic monitoring shall comprise two tasks:
- **Joint Visual / C-POD Calibration Survey:** As bottom-mounted acoustic monitoring devices have not previously been used for detecting finless porpoises, it is important that these be calibrated relative to visual surveys. It is thus proposed that a line transect survey be conducted in conjunction with placement of C-PODs using standard AFCD-approved line transect methodology for calibration purposes. Given the low level of sightings (and, hence potentially, acoustic contacts), the line transects and C-PODs should be conducted for sufficient time for statistical robustness relative to inter-calibration.
- 5.2.1.4 One option for this work, to be discussed and agreed with AFCD prior to commencement, is to conduct the joint acoustic / visual survey in HKSAR *southwestern* waters where finless porpoise activity is relatively high (compared with offshore eastern waters), and hence with greater potential for good quality calibration data. Under this scenario, for example, deployment of 2 or 3 C-PODs combined with a 3-month visual survey would likely yield good quality data for C-POD calibration. Ultimately the number of C-PODs to be deployed and the necessary duration of visual transect survey for calibration would depend on exactly where this part of the survey programme was to be conducted.
- 5.2.1.5 The second task:
- **Placement of C-PODs:** After inter-calibration of acoustic and visual data, the second aspect of the programme shall involve placement of these devices within and just outside the wind farm area. As porpoise clicks are substantially above 100 kHz in frequency, the detection distance is likely to be on the order of low 100's of meters from the bottom-mounted C-PODs. This will influence the number and configuration of C-PODs deployed.
- 5.2.1.6 The C-PODs deployed will need to be serviced every three to four months to

download accumulated data and replace batteries. It is proposed that the C-PODs be installed after installation of the turbines when security from trawling damage / loss can be afforded, and for a sufficient period of time to obtain a robust record of marine mammal usage of the area, especially due to the great inter-seasonal and inter-year differences already known for finless porpoises.

5.2.2 Exclusion Zone Visual Monitoring

5.2.2.1 The proposed foundation type and its installation method will not result in any adverse underwater disturbance to marine mammals. However, as a precautionary measure a 250 metre exclusion zone shall be implemented around the works barge during installation of foundations and turbine sub-structures.

5.2.2.2 The marine mammal exclusion zone should be monitored by the qualified person(s) with an unobstructed, elevated view of the area from the installation barge. Marine works activities should not begin until the qualified person certifies that the exclusion zone is continuously clear of marine mammals for a period of 30 minutes.

5.3 Avifauna

5.3.1 Field Monitoring

5.3.1.1 Bird usage of the Project environs is generally not significant, with survey data displaying relatively low abundance of a small number of species in the wind farm and buffer area. There are however, on a seasonal basis, significant numbers of breeding terns present to the northwest of the Project, while occasional observations of other species of conservation importance were made during the baseline surveys.

5.3.1.2 Therefore, although no adverse impacts on birds have been predicted, the new (to the HKSAR) nature and location of the Project justify monitoring of the distribution and disturbance effects of the operational wind farm on bird species of conservation importance, namely:

- White-bellied Sea Eagle
- Black-naped Tern
- Bridled Tern
- Roseate Tern
- Red-necked Phalarope
- Cattle Egret
- Aleutian Tern
- White-winged Black Tern, and
- Black-tailed Gull.

5.3.1.3 The species listed above were recorded during thorough boat-based baseline surveys, but may not represent all species that utilise the Project area given its size. As such, all species observed during construction / operational phase monitoring shall be recorded and a decision shall be made as to the need to extend

the list of priority species for data evaluation as appropriate.

Objectives

5.3.1.4 Specifically, the monitoring programme shall attempt to compare bird abundance and distribution, site utilization, species occurrence and any behavioural data collected during construction and operation of the wind farm against the baseline to verify the findings of the EIA Study that the Project will not:

- Present a barrier to bird movement; or
- Displace birds from the area.

5.3.1.5 If the construction / operational phase data suggests any significant effects (e.g. significant discrepancy from the baseline in terms of species occurrence, distribution or site utilization preference from the baseline) and/or a significant decrease in abundance then the need for collision re-assessment on the bird species of key concern shall initially be judged by competent contractor of the project. Additional focused surveys / bird-tracking for breeding species (terns / WBSE) shall be performed if new breeding colonies are identified within or in close proximity to the wind farm during the monitoring period.

Methodology & Locations

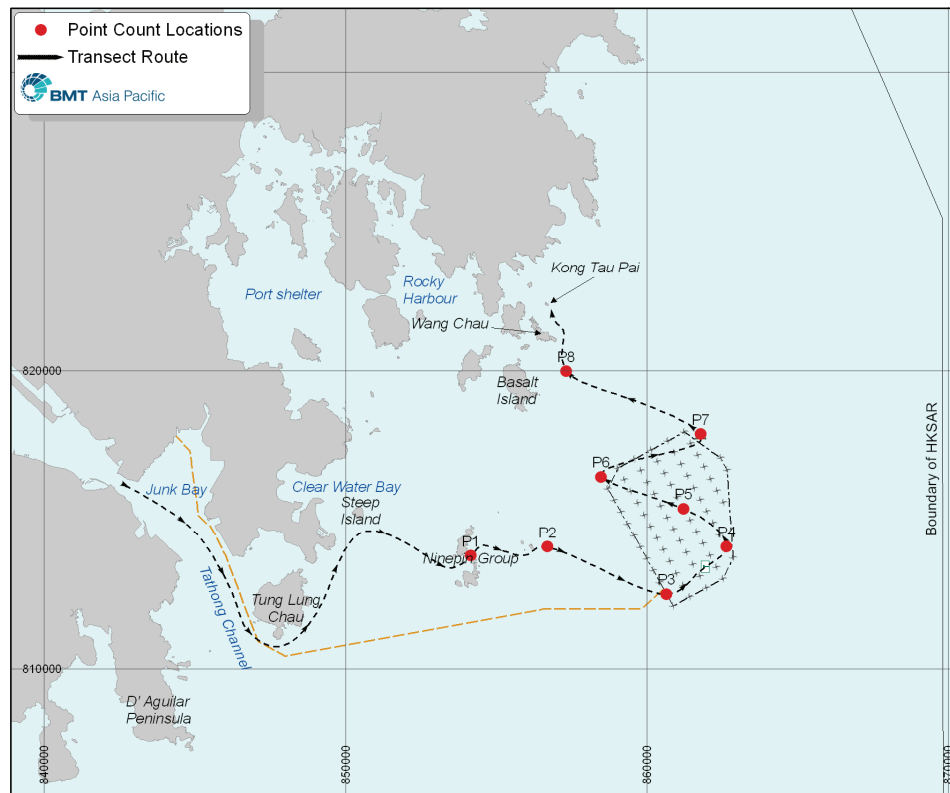
5.3.1.6 Boat-based monitoring shall be conducted at intervals ranging from weekly to monthly during the second year of construction and during the first year of operation. Surveys shall be conducted more frequently during bird migratory periods.

5.3.1.7 Monitoring shall be conducted along the same fixed transect route for daytime bird survey (approximately 7 hours per each survey day) as adopted for the baseline surveys, including 30-minute duration fixed-point counts at each of the survey points P1 to P8 and Kong Tau Pai. This approach shall enable direct comparison of construction / operational phase data with baseline data.

5.3.1.8 The transect route shall cover the proposed wind farm and the adjacent area, including the offshore islets that are confirmed or susceptible nesting ground for breeding terns and White-bellied Sea Eagle (WBSE).

5.3.1.9 [Figure 5.1](#) displays the survey route and the positioning of point count locations to be adopted.

Figure 5.1 Fixed Transect Route for Boat-based Monitoring



- 5.3.1.10 All boat-based surveys shall be conducted by a professional ornithologist, with additional staff support for breeding bird point counts, for example, provided as appropriate.
- 5.3.1.11 The boat-based survey shall involve scanning on both sides of the boat by the observer to ensure no under-counting. For each bird sighting, the position of the observer shall be recorded using a GPS navigator. An estimate of the distance of bird from observer shall be made, aided by the use of a range finder to allow the analysis of bird distribution across environmental gradients (e.g. distance gradients away from the proposed wind farm).
- 5.3.1.12 For all bird sightings along the transect route, information including species identity, number of individuals, behaviour (e.g. at flight or foraging), height and direction of flight and maturity of the birds (adult / juvenile) shall be recorded.
- 5.3.1.13 Bird surveys shall be conducted during daytime and in suitable weather conditions (e.g. at Beaufort scale <5) to enable the best visibility and observer efficiency, and hence data reliability, as well as personnel safety.
- 5.3.1.14 [Appendix B](#) presents a survey pro-forma for data recording. It is the responsibility of the Contractor to ensure the form actually used satisfies their requirements and those of AFCD.

Monitoring Frequency

5.3.1.15 Baseline survey frequency varied depending on the diversity and abundance of bird species anticipated to be in the Project area. Similarly, the Study recommended the following survey frequency for the construction / operational phase monitoring:

- **Spring Migratory Period:** covers the spring migration of seabirds from March through May @ 1x / week.
- **Summer Breeding Period:** covers the breeding season of the three breeding terns from July through August @ 1x / month.
- **Autumn Migratory Period:** covers the autumn migration of seabirds from September through November @ 2x / month.
- **Winter Period:** covers the key breeding season for WBSE of December through February @ 2x / month.

5.3.1.16 This survey frequency is proposed for both years of survey, to produce data sets for (a) the second year of construction-cum-first year of partial operation, and (b) the first year of full operation.

5.3.2 Data Analysis & Reporting

5.3.2.1 Following the baseline data presentation methods as adopted for the EIA Study, data handling shall involve collation of survey data in the appropriate pro-forma for entry to MS Excel or other suitable spreadsheet for analysis, and into ArcView GIS to develop cumulative distribution maps for each species of conservation interest across the survey period.

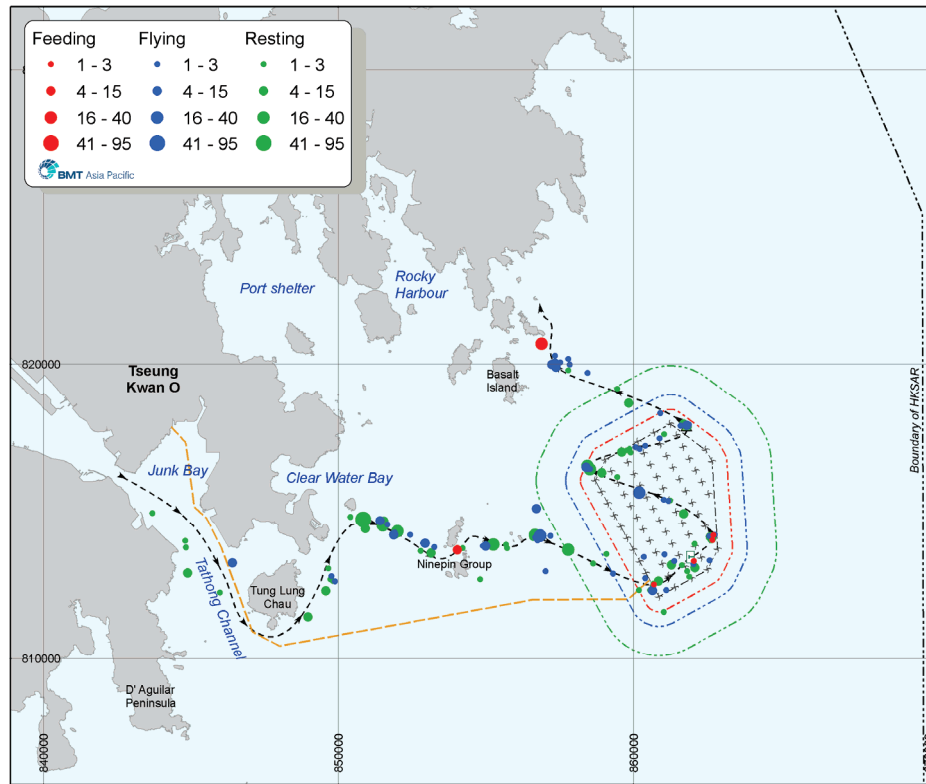
5.3.2.2 The maps shall also present accumulated seasonal data as bird numbers are anticipated to be too small in most cases for any meaningful seasonal comparison, although seasonal data shall be tabulated to support data analysis. [Figure 5.2](#) presents an example of data distribution mapping.

5.3.2.3 Following international studies of wind farm developments on bird communities (for example, Petersen & Fox 2007*) a χ^2 two-sample test or, if bird numbers are too low, Fisher's exact test shall be conducted to assess the minimum detectable change in bird numbers within and adjacent to the wind farm. Data corrections shall be adopted as necessary. The analysis shall compare baseline survey bird numbers with construction / operation phase surveys within:

- The wind farm footprint, and
- The wind farm footprint plus 1 km buffer zone.

* Petersen, I. K. and Fox, A. D. (2007). Changes in bird habitat utilisation around the Horns Rev 1 offshore wind farm, with particular emphasis on Common Scoter. Commissioned by Vattenfall A/S.

Figure 5.2 Example of Bird Distribution Mapping



5.3.2.4

The reporting requirements shall be as broadly outlined in section 7 of this Manual, and shall specifically include field data tables and data analysis in each quarterly report and annual report, and graphical presentation of cumulative spatial data in annual reports.

6 Cultural Heritage

6.1 Supplementary Marine Geophysics Survey

6.1.1 Site Survey

6.1.1.1 It is the full intention that the Project gives priority to impact avoidance through the sensitive location of turbines and cables, rather than impact mitigation. To ensure the Project development does not result in any unforeseen impacts on objects of marine archaeological potential, further marine geophysical comprising seismic and magnetic surveys shall be conducted across the Study Area as the detailed engineering design advances, and before any marine construction works commence.

6.1.1.2 The marine geophysics survey specification shall be prepared by a qualified geophysicist or marine archaeologist and shall be subject to the approval of the AMO prior to conducting any survey work.

6.1.2 Reporting

6.1.2.1 Upon completion of the surveys, a Report shall be prepared by the qualified marine archaeologist for submission to AMO to include inter alia, the findings of the further marine geophysical survey and a discussion on the need for dive surveys.

6.1.2.2 In addition to the mitigation measures stated in the EIA documents, the further marine geophysical survey report shall recommend appropriate mitigation measures to address adverse impact, if any. All the mitigation measures should be implemented and monitored before the commencement of construction works.

6.1.2.3 Should any additional targets of archaeological significance be identified during these surveys, potential adverse impacts shall be mitigated via a strategy of avoidance.

6.2 Marine Vessel Positioning

6.2.1.1 The EIA Study has identified several marine archaeology targets in the Project area that may be potentially affected by marine construction activities. [Table 6.1](#) summarises the location and distance of targets from proposed works locations.

Table 6.1 Distance Separation of Targets from Works Areas

Target	East	North	Size (m)	Distance from Works (m)	Nature and Scale of Works
A1	861767	817021	4 x 16	0 / 160	Array cable jetting / Turbine foundation
A2	859299	815872	6 x 46	190	
A3	860994	814898	1 x 4	230	
A4	859200	815735	5 X 9	280	
A5	859250	816803	11 x 36	210	Turbine foundation
A6	859969	817189	4 x 7	230	
A7	861076	812689	7 x 10	160	
A8	845551	814126	2@ 1m ea. (with 6m separation)	130	Transmission cable jetting

6.2.1.2 The closest targets to works locations are:

- Target A1 – positioned directly on the array cable route on the preferred North-South array cable alignment, or 160m from the nearest turbine.
- Target A8 - approximately 130m from the transmission cable route.

6.2.1.3 For Target A1, a potential wreck with dimension 4m x 16m, direct impact from array cable jetting is anticipated. The Jetting operation involves fluidising sediments whilst cables are being laid and buried into the desired sediment depth using a remotely operated vehicle (ROV). The anticipated direct impact is potential damage to this target from high-pressured water jetting.

6.2.1.4 Target A8 is located within an active trawling zone about 130m from the transmission cable jetting. Based on the distance separation as indicated by the current layout arrangement, no significant direct or indirect impacts are anticipated.

6.2.1.5 In order to ensure no adverse impacts on targets identified, a 150m buffer separation zone shall be implemented around all targets with the use of on-board GPS systems for marine vessel positioning. The contractor shall be required to maintain such records during construction for those works in the vicinity of the targets for subsequent audit by the ET.

7 Reporting

7.1 General

7.1.1.1 The following reporting requirements are based upon a paper-documented approach. However, the same information shall be provided in an electronic medium upon agreeing the format with the ER and EPD.

7.1.1.2 All the monitoring data (baseline and impact) shall also be submitted in an agreed electronic format in accordance with the requirements under Annex 21 of the EIAO TM. This would enable a transition from a paper/historic and reactive approach to an electronic/real time proactive approach.

7.2 Baseline Monitoring Report

7.2.1.1 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 IEC, the ER and EPD. The ET Leader shall liaise with the relevant parties on the exact number of copies needed. The format and content of the report and the presentation of the baseline monitoring data to be submitted to EPD shall be agreed with EPD prior to submission.

7.2.1.2 The baseline monitoring report shall include at least the following:

1. Up to half a page executive summary;
2. Brief project background information;
3. Drawings showing locations of the baseline monitoring stations;
4. An updated programme on construction of the proposed road with milestones of environmental protection/mitigation activities annotated;
5. Monitoring results (in both hard and diskette copies) together with the following information:
 - Monitoring methodology;
 - Types of equipment used and calibration details;
 - Parameters monitored;
 - Monitoring locations;
 - Monitoring date, time, frequency and duration; and
 - QA/QC results and detection limits.
6. Details on influencing factors, including:
 - Major activities, if any, being carried out on the site during the period;
 - Weather conditions during the period; and

- Other factors which might affect the results.
7. Determination of the Action Limit 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 actions for the parameters monitored;
 8. Revisions for inclusion in the EM&A Manual; and
 9. Comments and conclusions.

7.3 Monthly EM&A Reports

7.3.1.1 The results and findings of all EM&A work required in the Manual shall be presented in a monthly EM&A report that shall be prepared by the ET Leader. The EM&A report shall be endorsed by IEC, and then submitted to EPD within 10 working days of the end of each reporting month. The first report is due in the month after the establishment phase commences.

7.3.1.2 A pre-agreed number of copies of each monthly EM&A report shall be submitted to each of the four parties: the Contractor, the IEC, the ER and 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 required.

7.3.1.3 The ET Leader shall review the number and location of monitoring stations and parameters to be monitored every 6 months or on a needed basis in order to cater for the changes in surrounding environment and nature works in progress.

7.3.2 First Monthly EM&A Report

7.3.2.1 The first monthly EM&A report shall include at least the following:

1. Executive Summary (1-2 pages);
 - Breaches of Action Limit levels;
 - Complaint Log;
 - Notifications of any summons and successful prosecutions;
 - Reporting Changes; and
 - Future key issues.
2. Basic Project Information
 - Project organisation including key personnel contact names and telephone numbers;
 - Programme with fine tuning of activities showing the inter-relationship with environmental protection/mitigation measures for the month;
 - Management structure; and
 - Work undertaken during the month.
3. Environmental Status

- Works undertaken during the month with illustrations (such as location of works); and
 - Drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations.
4. Summary of EM&A requirements including:
- All monitoring parameters;
 - Environmental quality performance limits (Action Limit levels);
 - Environmental mitigation measures, as recommended in the EIA report;
 - Event/Action Plans; and
 - Environmental requirements in contract documents.
5. Implementation Status
- Advice on the implementation status of environmental protection and pollution control/mitigation measures as recommended in the EIA study report, summarised in the updated implementation schedule.
6. Monitoring Results (in both hard and electronic copies) including:
- Monitoring methodology;
 - Types of equipment used and calibration details;
 - Parameters monitored;
 - Monitoring locations;
 - Monitoring date, time, frequency, and duration;
 - Weather conditions during the period;
 - Graphical plots of the monitored parameters in the month annotated against:
 - ◆ Major activities being carried out on site during the period;
 - ◆ Weather conditions that may affect the results; and
 - ◆ Any other factors which might affect the monitoring results.
 - QA/QC results and detection limits;
 - Waste generation and disposal records; and
 - All monitoring results should be tabulated with exceedances highlighted for ease of reference.
7. Report on Non-compliance, Complaints, Notifications of Summons and Successful Prosecutions
- Record of all non-compliance (exceedances) of the environmental quality performance limits (Action 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, result 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.

8. Comments, Recommendations and Conclusions

- An account of the future key issues reviewed from the works programme and work method statements;
- Advice on the waste management status; and
- Submission of implementation status proforma, proactive environmental protection proforma, regulatory compliance proforma, site inspection proforma, data recovery schedule and complaint log summarising the EM&A of the period.

7.3.3

Subsequent Monthly EM&A Reports

7.3.3.1

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

1. Executive Summary (1-2 pages)
 - Breaches of Action Limit levels;
 - Complaint log;
 - Notifications of any summons and successful prosecutions;
 - Reporting changes; and
 - Future key issues.
2. Environmental Status
 - Programme with fine tuning of activities showing the inter-relationship with environmental protection/mitigation measures for the month;
 - Work undertaken during the month with illustrations included (such as location of works); and
 - Drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations.
3. Monitoring Results to provide monitoring results (in both hard and electronic copies) together with the following information.
 - Monitoring methodology;
 - Types of equipment used and calibration details;
 - Parameters monitored;
 - Monitoring locations;
 - Monitoring date, time, frequency, and duration;
 - Weather conditions during the period;
 - Graphical plots of the monitored parameters in the month annotated

against;

- ◆ Major activities being carried out on site during the period;
 - ◆ Weather conditions that may affect the results; and
 - ◆ Any other factors which might affect the monitoring results.
- QA/QC results and detection limits;
 - Waste generation and disposal records; and
 - All monitoring results should be tabulated with exceedances highlighted for ease of reference.
4. Implementation Status
- Advice on the implementation status of environmental protection and pollution control/mitigation measures as recommended in the EIA study report, summarised in the updated implementation schedule.
5. Report on Non-compliance, Complaints, Notifications of Summons and Successful Prosecutions
- Record of all non-compliance (exceedances) of the environmental quality performance limits (Action 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, result 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.
6. Comments, Recommendations and Conclusions
- An account of the future key issues reviewed from the works programme and work method statements;
 - Advice on the waste management status; and
 - Submission of implementation status proforma, proactive environmental protection proforma, regulatory compliance proforma, site inspection proforma, data recovery schedule and complaint log summarising the EM&A of the period.
7. Appendices
- Action Limit 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:

- Major activities being carried out on Site during the periods;
- Weather conditions during the period; and
- 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; and
- Outstanding issues and deficiencies.

7.4 EM&A Summary Reports

7.4.1 Quarterly EM&A Summary Reports

7.4.1.1

The quarterly EM&A summary report, which should generally be around 5 pages (~3 pages of text / tables and ~2 pages of figures), should contain at least the following listed information:

1. Up to half a page executive summary;
2. Basic project information including a synopsis of the project organisation, programme, contacts of key management, and a synopsis of work undertaken during the quarter;
3. A brief summary of EM&A requirements including:
 - Monitoring parameters;
 - Environmental quality performance limits (Action Limit levels); and
 - Environmental mitigation measures, as recommended in the EIA report.
4. Advice on the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the EIA report, summarised in the updated implementation schedule, including waste generation and disposal records;
5. Drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
6. Graphical plots of the trends of monitored parameters over the past 4 months (the last month of the previous quarter and the present quarter) for representative monitoring stations annotated against:
 - The major activities being carried out on site during the period;
 - Weather conditions during the period; and
 - Any other factors that might affect the monitoring results.
7. Comments, Recommendations and Conclusions
 - Advice on the solid and liquid waste management status;
 - A summary of non-compliance (exceedances) of the environmental quality performance limits (Action Limit levels);
 - A brief review of the reasons for and the implications of non-compliance

including review of pollution sources and working procedures;

- A summary description of the action taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;
- A summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;
- A summary record of all 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; and
- Comments (e.g., effectiveness and efficiency of the mitigation measures), recommendations (e.g., any improvement in the EM&A programme) and conclusions for the quarter.

7.4.1.2 Apart from the above, the first quarterly summary report should also confirm that the monitoring work is proving effective and that it is generating data with the necessary statistical power to categorically identify or confirm the absence of impact attributable to the works.

7.4.2 Final EM&A Summary Report

7.4.2.1 Timing for completion of the EM&A Programme shall be confirmed by Engineer's Representative in liaison with the IEC. Impact monitoring shall continue until the completion of all construction works as approved by the ER.

7.4.2.2 The final EM&A summary report shall include the following:

1. An executive summary;
2. Basic project information including a synopsis of the project organisation, programme, contacts of key management, and a synopsis of work undertaken during the entire construction phase, including baseline phase activities, of the works;
3. A brief summary of EM&A requirements including:
 - Monitoring parameters;
 - Environmental quality performance limits (Action Limit levels); and
 - Environmental mitigation measures, as recommended in the EIA report.
4. Advice on the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the EIA report, summarised in the updated implementation status proformas, including waste generation and disposal records;
5. Drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
6. Graphical plots of the trends of monitored parameters over the period of construction for representative monitoring stations annotated against:
 - The major activities being carried out on site during the period;

- Weather conditions during the period;
 - Any other factors which might affect the monitoring results; and
 - The return of ambient environmental conditions in comparison with baseline data.
7. Provide clear-cut decisions on the environmental acceptability of the project with reference to the specific impact hypothesis;
 8. Advice on the solid and liquid waste management status;
 9. Comments, Recommendations and Conclusions
 - A summary of non-compliance (exceedances) of the environmental quality performance limits (Action Limit levels);
 - A brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures;
 - A summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;
 - A summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;
 - Review the monitoring methodology adopted and with the benefit of hindsight, comment on its effectiveness (including cost effectiveness);
 - A summary record of all notification 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;
 - Recommend any improvement in the EM&A programme; and
 - A conclusion to state the return to ambient conditions.

7.5 Data Keeping

- 7.5.1.1 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 and be ready for inspection upon request.
- 7.5.1.2 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. All the documents and data shall be kept for at least one year after completion of the Project.

7.6 Interim Notifications of Limit Exceedance

7.6.1.1 With reference to Event/Action Plans in previous sections, when the environmental quality limits are exceeded, the ET shall immediately notify the IEC, Engineer's Representative and EPD, as appropriate.

7.6.1.2 The notification shall be followed up with advice to EPD on the results of the investigation, proposed action and success of the action taken, with any necessary follow-up proposals.

APPENDIX A

Environmental Mitigation Implementation Schedule

A. Environmental Mitigation Implementation Schedule

A.1 Waste Management

Table A.1 Implementation Schedule for Waste Management

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation?	Who will implement?	Location	What requirements or standards for the measures to achieve?
3.5.1.2	<ul style="list-style-type: none"> The Waste Management Plan (WMP) shall prepared by the Contractor to describe arrangements for waste avoidance, re-use and recycling, including all handling, storage and transfer requirements. The WMP should be refined and updated as more detailed information is generated on the volume of dredged marine mud. Similarly, it should be regularly reviewed and updated at least monthly throughout construction. 	Before and during construction	Contractor	All work sites	Waste Disposal Ordinance (Cap 354) ETWB 34/2002 Dumping at Sea Ordinance (Cap 466)
3.5.2.1	<ul style="list-style-type: none"> A marine disposal license shall be obtained from EPD. 	Prior to marine dredging	Contractor	Junk Bay dredge sites	ETWB 34/2002 Dumping at Sea Ordinance (Cap 466)

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation?	Who will implement?	Location	What requirements or standards for the measures to achieve?
3.5.2.2	<ul style="list-style-type: none"> ● Bottom opening of barges shall be fitted with tight fitting seals to prevent leakage of material. Excess material shall be cleaned from the decks and exposed fittings of barges and dredgers before the vessel is moved. ● Monitoring of the barge loading shall be conducted to ensure that loss of material does not take place during transportation. Transport barges or vessels shall be equipped with automatic self-monitoring devices as specified by the EPD. ● Barges or hopper barges shall not be filled to a level that would cause the overflow of materials or sediment-laden water during loading or transportation. 	During transportation and disposal of the dredged sediment	Contractor	At all construction work sites	Waste Disposal Ordinance (Cap 354) ETWB 34/2002 Dumping at Sea Ordinance (Cap 466)
3.5.3 4.9.1.4	<ul style="list-style-type: none"> ● The Contractor shall be required to register with the EPD as a chemical waste producer. ● The contractor shall follow the guidelines stated in the relevant CoP. 	During Construction and Operation	Contractor / Operator	At all work sites	Waste Disposal (Chemical Waste) (General) Regulation Code of Practice on the Packaging, Labeling and Storage of Chemical Wastes
3.5.4.1 4.9.1.3 4.9.2.3	<ul style="list-style-type: none"> ● An adequate number of portable toilets, if necessary, should be provided for the construction and maintenance workforce is sufficient are not provided at any onshore assembly area. ● Portable toilets shall be maintained in a state that will not deter the workers from using them. Night soil shall be regularly collected by a licensed collector for disposal at a Sewage Treatment Works. 	During Construction and Operation	Contractors / Operator	At all work sites	Waste Disposal Ordinance (Cap 354)

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation?	Who will implement?	Location	What requirements or standards for the measures to achieve?
3.5.5	<ul style="list-style-type: none"> • General refuse shall be stored in fully contained units separate from chemical wastes. The general refuse storage area shall be regularly maintained by a reputable waste collector, with waste to be disposed at a designated refuse transfer station. • The Contractor shall be responsible for identifying which materials can be recycled / reused, whether on site or off site. In the event of the latter, the Contractor shall make arrangements for the collection of the recyclable materials. Separate labelled bins for their deposit shall be provided if feasible. • The Contractor is required to maintain a clean and hygienic site throughout the Project. 	During Construction and Operation	Contractors / Operator	At all work sites	ETWBTC (Works) No. 6/2002A, Enhanced Specification for Site Cleanliness and Tidiness

A.2

Water Quality, Marine Ecology & Fisheries

Table A.2 Implementation Schedule for Water Quality, Marine Ecology & Fisheries Protection

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation?	Who will implement?	Location	What requirements or standards for the measures to achieve?
3.5.4.1	<ul style="list-style-type: none"> An adequate number of portable toilets, if necessary, should be provided for the construction and maintenance workforce if sufficient facilities are not provided at any onshore assembly area. 	During Construction and Operation	Contractors / Operator	At all work sites	Water Pollution Control Ordinance (Cap. 358)
4.9.1.3	<ul style="list-style-type: none"> Portable toilets shall be maintained in a state that will not deter the workers from using them. Night soil shall be regularly collected by a licensed collector for disposal at a Sewage Treatment Works. 				WQOs
4.9.1.1	<ul style="list-style-type: none"> Working rate for dredging should not exceed 6,300 m³ / day for two dredgers. 	During marine dredging	Contractor	Junk Bay	Water Pollution Control Ordinance (Cap. 358)
5.10.1	<ul style="list-style-type: none"> Closed grab dredgers should be used for dredging. The mechanical grabs should be properly maintained to minimise spillage of sediment. Silt curtains should be provided closely surrounding the dredging point to minimise dispersion of sediment plumes. 				WQOs
4.9.1.1	<ul style="list-style-type: none"> Jetting speed should not exceed 75 m/hr in the section between Junk Bay and south of Tung Lung Chau. 	During cable jetting	Contractor	At all cable locations	Water Pollution Control Ordinance (Cap. 358)
5.10.2	<ul style="list-style-type: none"> Jetting speed should not exceed 150 m/hr for jetting operation carried out in the remaining sections of the transmission power cable and the array cable at the wind farm. 				WQOs

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation?	Who will implement?	Location	What requirements or standards for the measures to achieve?
4.9.1.1	<ul style="list-style-type: none"> Pumping rate for seawater removal from suction caissons during foundation installation should not exceed 1,200 m³ / hr per foundation or 300 m³ / hr per pump. 	During foundation installation	Contractor	At all turbine foundation	Water Pollution Control Ordinance (Cap. 358) WQOs
4.9.1.2	<ul style="list-style-type: none"> Water Quality Monitoring 	Before construction and during Jetting operations. One week after completion of works	Contractor	Nine sites shown in Figure 4.2 of EM&A Manual	Water Pollution Control Ordinance (Cap. 358) WQOs
5.12.1.5	<ul style="list-style-type: none"> Coral monitoring 	Before construction, during Jetting operations and until 2 weeks after completion of Jetting at impact sites	Contractor	Tung Lung Chau South, South Ninepins and Victor Rock	Additional precaution suggested by project proponent.
6.8.1.1	<ul style="list-style-type: none"> Marine mammal exclusion zone 	During installation of foundations and turbine sub-structures	Contractor	250m around works barge	Additional precaution agreed to by project proponent.
6.10.1.2	<ul style="list-style-type: none"> Marine Mammal Acoustic Monitoring 	During operation	Contractor	Wind farm footprint	Additional measure agreed to by project proponent.
7.9.1.1	<ul style="list-style-type: none"> Avifauna Field Monitoring 	Second year of construction, during 1 year of operation	Contractor	Transect route shown in Figure 7.11 of EIA	Additional measure agreed to by project proponent.

A.3

Cultural Heritage

Table A.3 Implementation Schedule for Cultural Heritage Protection

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation?	Who will implement?	Location	What requirements or standards for the measures to achieve?
9.10.1	<ul style="list-style-type: none"> Align the array cable to avoid potential impacts upon Target A1. 	During Construction	Contractor	Near Target A1 within wind farm footprint	Antiquities and Monuments Ordinance (Cap. 53)
9.10.2	<ul style="list-style-type: none"> Implement a 150m-diameter buffer zone around each identified target to ensure potential impacts can be avoided. Within these buffer zones there shall be no permanent works or temporary anchoring of construction or maintenance vessels. The buffer separation shall be implemented with the use of on-board GIS systems for marine vessel manoeuvring. 	During Construction	Contractor	At all Targets	Antiquities and Monuments Ordinance (Cap. 53)
9.12.1.1	<ul style="list-style-type: none"> To ensure the Project development does not result in any unforeseen impacts on objects of marine archaeological potential, further marine geophysical comprising seismic and magnetic surveys shall be conducted across the Study Area as the detailed engineering design advances, and before any marine construction works commence. 	Before Construction	Contractors / Operator	Across Study Area	Antiquities and Monuments Ordinance (Cap. 53)

A.4

Landscape & Visual

Table A.4 Implementation Schedule for Landscape & Visual Aspects

EIA Ref.	Recommended Environmental Protection Measures / Mitigation Measures	Timing of implementation?	Who will implement?	Location	What requirements or standards for the measures to achieve?
10.6.3.4	<ul style="list-style-type: none"> Management of construction duration to the practical minimum. Management of the number of pre-construction and construction vessels and vessel movements at the practical minimum. Adopt a regular pattern of turbines to create a balanced, controlled appearance, as opposed to random or clustered groups. The design of turbines should be slender and elegant, with the use of a single mast, rather than multiple footings or a pylon structure 	Design and Construction	Contractor	At wind farm footprint	EIAO (Cap 499)
10.6.3.4	<ul style="list-style-type: none"> Painting offshore in visually neutral / recessive colours where consistent with safety requirements. Control night-time lighting and glare by hooding all lights, including safety lights where consistent with meeting safety requirements. Ensure non-reflective materials used in construction of offshore structures. 	During Construction and Operation	Contractor	At wind farm footprint	EIAO (Cap 499)

APPENDIX B

Avifauna Data Pro-forma

Date	Time	Species	Number	Adult	Juvenile	Easting	Northing	Behaviour	Height over Water (m)	Direction (if flying)
23-May-06	1036	Pacific Reef Egret	1			855953.1364	813910.8071	Re	50	
23-May-06	1037	Pacific Swift	4			856229.0840	814161.7620	Fe	50	
23-May-06	1040	Red-necked Phalarope	1			856695.5949	814042.4079	FI		
23-May-06	1117	Red Knot	15							

Behavior Codes: Re = Resting, Fe = Feeding, FI = Flying, etc

Observer(s):	Data Checker:
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