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Environmental Monitoring and Audit Manual  
Comprehensive Development and Wetland Protection  
Near Yau Mei San Tsuen  
(Final Report)

Prepared by  
**ENVIRON Hong Kong Limited**

**in association with**

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## 1. INTRODUCTION

### 1.1 Background

- 1.1.1 The Project Proponent, Asia King Development Limited, is the registered owner of a development site near Yau Mai San Tsuen in Yuen Long. A residential development and a Wetland Conservation Area (WCA) (hereinafter collectively called the "Project") is proposed to be developed at the OU(CDWPA) zone near Yau Mei San Tsuen. The planning intention of the zone is to allow comprehensive low-density residential development/ redevelopment with the protection and conservation of the existing continuous and contiguous fish ponds within the zone.
- 1.1.2 According to Item P of Part 1, Schedule 2 of the EIAO, the Project is classified a "Designated Project" since it is a residential development other than New Territories exempted house within the Deep Bay Buffer Zone 2.
- 1.1.3 As part of the Environmental Impact Assessment (EIA) study for the Project, a Manual for guiding the setup of an Environmental Monitoring and Audit (EM&A) programme to check the implementation of the relevant environmental mitigation measures recommended in the EIA, is required. The EM&A programme will be useful in providing a means to verify the effectiveness and adequacy of the mitigation measures recommended in the EIA such that additional mitigation measures or remedial action, if deemed necessary, can be formulated.
- 1.1.4 As part of the EIA study for the Project, ENVIRON Hong Kong Limited (the Consultant) has been commissioned as the lead consultant to prepare this EM&A manual.
- 1.1.5 Through the EIA study for the Project, a number of environmental mitigation measures are recommended to be implemented during the design, construction, and operational phases of the Project. These mitigation measures and their implementation requirements are summarised in the Implementation Schedule contained in Appendix I of this EM&A Manual.
- 1.1.6 This Manual provides systematic procedures for the carrying out of recommended monitoring and auditing works for checking of potential environmental impacts which may arise from the project. Mitigation measures recommended in the EIA Report for each key environmental aspect are also summarised and presented.
- 1.1.7 Environmental regulations currently enforced in Hong Kong pertaining to air quality, noise and waste, etc. and the recommendations given in the EIA study report for the Project have been observed in the preparation of this Manual.

### 1.2 Objectives of this EM&A Programme

- 1.2.1 The main objectives of the EM&A programme include:
- To provide a database on baseline environmental quality for subsequent checking of any short or long term environmental impacts arising from the Project;
  - To 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;
  - To monitor the performance of the Project from an environmental viewpoint and the sufficiency and effectiveness of the implemented mitigation measures;
  - To verify the environmental impacts predicted in the EIA Study for the Project;
  - To determine compliance of the Project with relevant regulatory standards, requirements and guidelines;
  - To take remedial action should unexpected problems or unacceptable impacts be identified;



- To provide baseline and compliance monitoring data to assist the carrying out of effective environmental audits.

### 1.3 Content of this EM&A Manual

1.3.1 The recommended EM&A programme in this Manual basically contains the following information:

- Duties of various parties involved in the environmental monitoring and audit programme;
- Information on project organisation, construction schedule and activities;
- Information on the tentative construction programme and the necessary environmental monitoring and audit programme to track the varying environmental impacts;
- Definition of Action and Limit levels, and establishment of Event and Action Plans;
- Requirements of reviewing pollution sources and work procedures in the event of non-compliance of the environmental criteria;
- Requirements of presentation of environmental monitoring and audit data and appropriate reporting procedures;
- An Implementation Schedule (Appendix I) of the environmental mitigation measures recommended in the EIA report for the Project;
- Record forms (Appendix II) to be adopted where applicable during the construction phase of the Project.

1.3.2 The EM&A Manual shall be regarded as an evolving document that should be updated when necessary in order to maintain its relevance during the detailed design stage and/or the construction phase (e.g. when alternative monitoring locations are proposed). The updated EM&A Manual shall be submitted to the ER and EPD for agreement.

## **2. PROJECT DESCRIPTION**

### **2.1 The Site and Its Environs**

- 2.1.1 The Site is located at Lot Nos. 3054 BRP and 3055 in DD 104 near Yau Mei San Tsuen, Mai Po, Yuen Long and the total site area is about 8.1 ha. The Project Site is primarily farmland abutting the Yau Pok Road near Kam Pok Road. It is located at the periphery of the Deep Bay area and is bounded by a number of existing and planned residential developments adjacent to the Castle Peak Road and the San Tin Highway. The whole development is located within the Deep Bay Buffer Zone 2, abutting with existing residential development to its west (Fairview Park), east (Yau Mei San Tsuen) and north (Royal Palms and Palm Springs).
- 2.1.2 The proposed development mainly includes a wetland restoration area of about 3.8 ha within the Wetland Conservation Area (WCA), and construction of 3-storey houses, club house, swimming pool, site drainage system and ancillary facilities. Figure 2-1 shows the MLP of the Project.

### **2.2 Implementation of the Project**

- 2.2.1 Appendix IV shows the tentative construction programme of the Project. Construction activities are planned to commence in third quarter 2015 for completion in later 2018.
- 2.2.2 Construction work is planned to be undertaken in phases. The construction works involve establishment of a Wetland Restoration Area (WRA) (i.e. Phase A), which will be conducted first involving mainly re-profiling of bunds for re-distributing the soil to create gentle slope and deep water area. Subsequently, the site formation work for the residential portion of the Project Area will be conducted. For the residential portion, the site formation work is planned to be undertaken into 3 phases, namely Phases B, C and D. Once earthwork for wetland restoration and the establishment of noise barrier around the residential portion are completed, site formation and pre-loading will start in Phase B. The site formation in Phase C and D will start after the commencement of Phase B. The locations of different phases are shown in Figure 5-2.

### **2.3 Environmental Monitoring and Audit Requirements**

- 2.3.1 The EIA study has identified the likely environmental impacts during construction and operational phases of the Project. These impacts can be minimized to acceptable levels with the implementation of environmental mitigation measures and environmental monitoring and audit (EM&A) requirements. An EM&A Implementation Schedule of the environmental mitigation measures recommended in the EIA Report is also provided in Appendix I. To ensure the environmental acceptability of the proposed development, monitoring and audit requirements have been identified and are described in details in the subsequent sections.
- 2.3.2 The following areas, identified in the EIA for this Project, will require EM&A during the construction or operational phase:
- Air Quality;
  - Noise Impact;
  - Water Quality;
  - Sewerage;
  - Waste Management;
  - Landscape and Visual; and
  - Ecology.

### 3. PROJECT ORGANISATION

- 3.1.1 The key parties in a typical EM&A programme include the Contractor, the Engineer<sup>1</sup> or the Engineer's representative<sup>1</sup> (hereinafter referred to as the ER), the Project proponent (PP), the Environmental Team (ET), the Independent Checker (Environment) (IEC), and the Environmental Protection Department (EPD). 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 in the EIA, this EM&A Manual, as well as the Project Environmental Permit (EP) for the duration of the Project.
- 3.1.2 A typical construction phase environmental monitoring and audit procedure is enclosed in **Figure 3-1** for reference. The main duties and responsibilities of each party shall include but not be limited to the followings:

#### Environmental Team

- 3.1.3 An Environmental Team (ET) shall be appointed to carry out the recommended EM&A works for the Project including all the required monitoring exercises unless otherwise specified. Suitably qualified staff shall be included in the ET, and resources for the implementation of the EM&A programme shall be allocated in time, to enable fulfilment of the Project EM&A requirements as specified in the EIA, this EM&A Manual., and the Project Environmental Permit. The ET shall be headed by an ET Leader<sup>2</sup> in fulfilling the EM&A duties.
- 3.1.4 The ET Leader (ETL) shall plan, organise and manage the implementation of the EM&A programme specified in the EIA, EM&A Manual, and to ensure that the EM&A works are undertaken to the required standards. The ET Leader shall have relevant experience and professional qualifications and possesses at least 7 years' experience in EM&A or environmental management subject to the approval of the ER and the Director of Environmental Protection (DEP).
- 3.1.5 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 log-book of each and every instance or circumstance or change of circumstances which may affect the EIA and each and every non-compliance with the Environmental Permit or the recommendations in the EIA report. This log-book shall be kept readily available for inspection by the IEC, and DEP or his authorized officers. The ET shall not be in any way an associated body of the IEC or the Contractor for the Project.
- 3.1.6 The board categories of works of the ET comprise the followings:
- Sampling, analysis and statistical evaluation of monitoring parameters with reference to the EIA study recommendations and requirements as well as that required in the EM&A Manual;
  - Analyse the EM&A data and review the success of EM&A programme to cost effectively confirm the adequacy of mitigation measures implemented and the validity of the EIA predictions and to identify any adverse environmental impacts arising;
  - Schedule the environmental site audit/ surveillance;
  - Audit of compliance with environmental protection, and pollution

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<sup>1</sup> For the purpose of this manual, the "Engineer" shall refer to the Engineer as defined in the Contract and the Engineer's Representative (ER), in cases where the Engineer's powers have been delegated to the ER, in accordance with the Contract.

<sup>2</sup> The Environmental Team (ET) leader, who shall be responsible for and in charge of the ET, refers to the person delegated the role of executing the environmental monitoring and audit requirements.

prevention and control regulations;

- Monitor the implementation of environmental mitigation measures;
- Monitor compliance with the environmental protection clauses/specifications in the Contract;
- Review construction programme and comment as necessary;
- Review work methodologies and comment as necessary;
- Complaint investigation, evaluation and identification of corrective measures in accordance with the procedure mentioned in the EM&A Manual;
- Liaison with the Project IEC on all environmental performance matters, and timely submission of all relevant EM&A proforma for IEC's approval;
- Advice to the Contractor on environmental improvement, awareness, enhancement matters, etc., on site;
- Advise on suitable mitigation measures in case of exceedance of Action and Limit levels in accordance with the Event and Action Plans; and
- Timely submission of the EM&A report to the Project Proponent and the DEP.

- 3.1.7 In the event of any exceedance in action/ limit levels, the ET shall immediately inform the IEC, Engineer/ ER and the Contractor and adhere to the procedures specified in the relevant Event and Action Plan of this EM&A Manual, so that appropriate remedial action can be undertaken by the Contractor promptly. The ET is also responsible for the preparation of the EM&A reports for submission to IEC, the Contractor and the ER, and EPD. The ET shall assist the Contractor and the ER in formulating any necessary corrective actions and/ or additional mitigation measures, and liaising with relevant Government Departments where necessary.

#### Independent Checker (Environment)

- 3.1.8 The Independent Checker (Environment) (IEC) shall advise the ER on environmental issues related to the project. The IEC shall not be in any way an associated body of the Contractor or the ET for the Project. The IEC shall be empowered to audit from an independently viewpoint the environmental performance of construction. The IEC shall be a person who has at least 7 years' experience in EM&A or environmental management subject to approval of the ER and the DEP. The IEC shall be responsible for the duties defined in the EIA, this EM&A Manual, and shall audit the overall EM&A programme, including the implementation of all environmental mitigation measures, submissions required in this EM&A Manual, and any other submissions required under the Environmental Permit. The IEC shall be responsible for verifying the environmental acceptability of permanent and temporary works, relevant design plans and submissions under the Environmental Permits. The IEC shall verify the log-book prepared and kept by the ET Leader. The IEC shall notify DEP by fax, within 24 hours of each and every occurrence, change of circumstances or non-compliance with the EIA Report or the Environmental Permit, which might affect the monitoring or control of adverse environmental impact.
- 3.1.9 The main duty of the IEC is to carry out independent environmental audit of the Project. This shall include, inter alias, the followings:
- Review and audit in an independent, objective and professional manner 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;
- Audit the EIA 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 a need basis, verify and audit 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 by the ET Leader;
- Adhere to the procedure for carrying out complaint investigation in accordance with the procedure mentioned in the EM&A Manual; and
- Feedback audit results to ET/ER according to the Event/ Action Plans specified in this EM&A Manual and by signing off relevant EM&A proformas.

#### The Contractor

- 3.1.10 The Contractor is responsible for providing assistance to the ET in carrying out the monitoring and EM&A duties, and 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 adhere to the procedure for carrying out complaint investigation in accordance with the procedure mentioned in the EM&A Manual. The Contractor shall discuss with the ET, IEC and ER 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 Contractor shall submit the proposals on mitigation measures in case of exceedances of Action and Limit level in accordance with the Event and Action Plans, and implement the measures to reduce the impact. The Contractor shall report to the ET on the actions taken targeting at environmental protection for inclusion in the monthly report to be prepared by the ET.

#### The Engineer/ Engineer's Representative (ER)

- 3.1.11 The ER shall be responsible for overseeing the operations of the Contractor and the ET. He shall advise, co-ordinate and give instruction when appropriate for efficient implementation of any specific environmental mitigation measures identified to be required by the contractor, and/or outstanding EM&A works required to be carried out by ET in consultation with the IEC. The ER shall supervise the Contractor's activities and ensure that the requirements in the EIA Report and EM&A Manual 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 report and EM&A Manual, as well as additional measures necessary for compliance with the relevant environmental standards. The Engineer shall adhere to the procedure for carrying out complaint investigation in accordance with the procedure mentioned in the EM&A Manual.

## 4. AIR QUALITY

### 4.1 Introduction

4.1.1 During construction the Contractor shall follow the Air Pollution Control (Construction Dust) Regulation to implement dust mitigation measures during construction to minimize the dust impact to the nearby air sensitive receivers and to ensure the effectiveness of the implementation of dust mitigation measures recommended in the final EIA report and this EM&A Manual.

### 4.2 Air Quality Parameters

4.2.1 According to the EIA report, with the implementation of recommended mitigation measures no adverse air quality impact is anticipated during construction. Nevertheless, EM&A programme is also proposed to monitor the effectiveness of implementation of mitigation measures. Monitoring and audit of Total Suspended Particulate (TSP) levels shall be carried out by the ET during the construction phase, which include site formation, slope construction and subsequent roadwork, to ensure that any deteriorating air quality could be readily detected and timely action taken to rectify the situation.

4.2.2 1-hour TSP levels shall be measured according to the recommended programme. 1-hour TSP levels shall be measured by following the standard high volume sampling method as set out in Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B.

4.2.3 Upon approval of the ER, 1-hour TSP levels can alternatively be measured by direct reading methods which are capable of producing comparable results as that by the high volume sampling method, to indicate short event impacts. However, the ET should submit sufficient information to the IEC and the ER to prove that the instrument is capable of achieving a comparable result as that a High Volume Sampler (HVS) and maybe used for 1-hr sampling.

4.2.4 All relevant data including temperature, pressure, weather conditions, elapsed-time meter reading for the start and stop of the sampler, identification and weight of the filter paper, and other special phenomena and work progress of the concerned site etc. shall be recorded down in details, where appropriate. A sample data sheet is shown in Appendix II.

### 4.3 Monitoring Equipment

4.3.1 Regarding the high volume sampling method, High Volume Sampler (HVS) in compliance with the following specifications shall be used for carrying out the monitoring:

- 0.6-1.7 m<sup>3</sup>/min. (20-60 SCFM) adjustable flow range;
- Equipped with a timing/control device with  $\pm 5$  minutes accuracy for 24 hours operation;
- Installed with elapsed-time meter with  $\pm 2$  minutes accuracy for 24 hours operation;
- Capable of providing a minimum exposed area of 406 cm<sup>2</sup> (63 in<sup>2</sup>);
- Flow control accuracy:  $\pm 2.5\%$  deviation over 24-hr sampling period;
- Equipped with a shelter to protect the filter and sampler;
- Incorporated with an electronic mass flow rate controller or other equivalent devices;
- Equipped with a flow recorder for continuous monitoring;
- Provided with a peaked roof inlet;

- Incorporated with a manometer;
  - Able to hold and seal the filter paper to the sampler housing at horizontal position;
  - Easy to change the filter; and
  - Capable of operating continuously for 24-hr period.
- 4.3.2 If the ET proposes to use a direct reading dust meter to measure 1-hr TSP levels, he shall submit sufficient information to the IEC to prove that the instruments is capable of achieving a comparable result as that the HVS and may be used for the 1-hr sampling. The instrument shall also be calibrated regularly, and the 1-hr sampling shall be determined periodically by HVS to check the validity and accuracy of the results measured by direct reading method.
- 4.3.3 During the course of the project, the ET is responsible for provision of the monitoring equipment. He shall ensure that sufficient number of HVSs with an appropriate calibration kit, and direct reading dust meters are available for the carrying out of baseline monitoring, regular impact monitoring and ad hoc monitoring.
- 4.3.4 The HVSs shall be equipped with an electronic mass flow controller and be calibrated against a traceable standard at regular intervals. All the equipment, calibration kit, filter papers, etc. shall be clearly labelled.
- 4.3.5 Initial calibration of HVSs shall be conducted upon installation and thereafter at bi-monthly intervals. The transfer standard shall be traceable to the internationally recognised primary standard and be calibrated annually. The calibration data shall be properly documented for future reference by the concerned parties such as the IEC. All the data should be converted into standard temperature and pressure condition.
- 4.3.6 The flow-rate of the sampler before and after the sampling exercise with the filter in position shall be verified to be constant and be recorded down in the data sheet. Sample forms are provided in Appendix II.
- 4.3.7 Wind data monitoring equipment shall also be provided and set up at a conspicuous location for logging wind speed and wind direction near to the dust monitoring locations. The location for equipment installation shall be proposed by the ET and agreed with the ER and IEC. For installation and operation of wind data monitoring equipment, the following points shall be observed:
- The wind sensors should be installed on masts at an elevated level 10m above ground so that they are clear of obstructions or turbulence caused by the buildings;
  - The wind data should be captured by a data logger and to be downloaded for processing at least once a month;
  - The wind data monitoring equipment should be re-calibrated at least once every six months; and
  - Wind direction should be divided into 16 sectors of 22.5 degrees each.
- 4.3.8 In exceptional situations, the ET may propose alternative methods to obtain representative wind data upon approval from the ER and agreement from the IEC.

#### **4.4 Laboratory Measurement / Analysis**

- 4.4.1 A clean laboratory with constant temperature and humidity control, and equipped with necessary measuring and conditioning instruments, to handle the dust samples collected, shall be available for sample analysis, and equipment calibration and maintenance. The laboratory should be HOKLAS accredited or other internationally accredited laboratory.
- 4.4.2 If a site laboratory is set up or a non-HOKLAS accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment shall be approved by the ER in consultation with the IEC. Measurement performed by the laboratory shall be

demonstrated to the satisfaction of the ER and the IEC. The IEC shall conduct regular audit to the measurement performed by the laboratory to ensure the accuracy of measurement results. The ET shall provide the ER with one copy of the Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B for his reference.

- 4.4.3 Filter paper of size 8"x10" shall be labelled before sampling. It shall be a clean filter paper with no pinholes, and shall be conditioned in a humidity controlled chamber for over 24-hr and be pre-weighed before use for the sampling.
- 4.4.4 After sampling, the filter paper loaded with dust shall be kept in a clean and tightly sealed plastic bag. The filter paper is then returned to the laboratory for reconditioning in the humidity controlled chamber followed by accurate weighing by an electronic balance with readout down to 0.1 mg. The balance shall be regularly calibrated against a traceable standard.
- 4.4.5 All the collected samples shall be kept in a good condition for 6 months before disposal.

#### 4.5 Proposed Monitoring Locations

- 4.5.1 The air quality impact assessment presented in the EIA report indicated that the nearby air sensitive receivers (ASRs) would not be subjected to adverse dust impact when recommended dust mitigation measures are properly applied onsite. The dust mitigation measures have been recommended and shall be implemented by the Contractor in accordance with the requirements under the Air Pollution Control (Construction Dust) Regulation. The Contractor shall be responsible for the design and implementation of the dust mitigation measures.
- 4.5.2 Figure 4-1 shows the locations of the proposed air quality monitoring locations identified for the air quality monitoring during construction. Table 4-1 summarizes the locations of air quality monitoring stations.

**Table 4-1 Locations of Air Quality Monitoring Stations**

Monitoring Station ID	Corresponding ASR in EIA Report	Representative for
AM1	A07	Yau Mei San Tsuen village house
AM2	A16	Fairview Park
AM3	A17	Palm Springs

- 4.5.3 The selection of the above monitoring locations has taken into account the air quality assessment results presented in the EIA report and the availability of the monitoring locations. Since most of the ASRs assessed in the EIA which are worst affected by the construction works, are private residential development areas, access permission to these locations is unlikely be granted by the property owner. As such, nearby public areas that are in adjacent to the concerned ASRs have been selected for the monitoring.
- 4.5.4 Before commencement of monitoring, the ET Leader shall review the status and availability of monitoring locations which may change after issuing this Manual, and availability of continuous electricity supply for the HVS. If such cases exist, the appointed ET Leader may propose alternative monitoring locations taking into consideration of the latest status, availability and/or accessibility of the various possible monitoring locations. The alternative monitoring locations proposed by the ET shall be approved by the ER and agreed by IEC. When alternative monitoring locations are proposed, the following criteria should be followed as far as practicable:
- At the site boundary or such locations close to the major dust emission sources;



- Close to the sensitive receptors; and
  - Take into account the prevailing meteorological conditions.
- 4.5.5 The ET Leader shall agree with the ER in consultation with the IEC on the position of the HVSs for installation of the monitoring equipment. When positioning the samplers, the following points shall be noted:
- A horizontal platform with appropriate support to secure the samplers against gusty wind should be provided;
  - No two samplers should be placed less than 2 meter apart;
  - The distance between the sampler and an obstacle, such as buildings, must be at least twice the height that the obstacle protrudes above the sampler;
  - A minimum of 2 metres of separation from walls, parapets and penthouses is required for rooftop samplers;
  - A minimum of 2 metre separation from any supporting structure, measured horizontally is required;
  - No furnace or incinerator flue is nearby;
  - Airflow around the sampler is unrestricted;
  - The sampler is more than 20 metres from the dripline;
  - Any wire fence and gate, to protect the sampler, should not cause any obstruction during monitoring;
  - Permission must be obtained to set up the samplers and to obtain access to the monitoring stations; and
  - A secured supply of electricity is needed to operate the samplers.

#### 4.6 Baseline Monitoring

- 4.6.1 Baseline monitoring shall be carried out by the appointed ET Leader at all of the designated monitoring locations for at least 14 consecutive days prior to the commissioning of the construction works to obtain hourly TSP samples. 1-hr sampling shall also be done at least 3 times per day during daytime when the highest dust impact is expected. The ET Leader should inform the IEC, ER and DEP on the baseline monitoring programme before commencement such that the IEC can conduct on-site audit to ensure accuracy of the baseline monitoring results.
- 4.6.2 During the baseline monitoring, there should not be any dust generation construction activities in the vicinity of the monitoring stations arising from the Site.
- 4.6.3 In case the baseline monitoring cannot be carried out at the designated monitoring locations during the baseline monitoring period, the ET Leader shall carry out the monitoring at alternative locations which can effectively represent the baseline conditions at the impact monitoring locations. The alternative baseline monitoring locations shall be approved by the ER and agreed with IEC.
- 4.6.4 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall liaise with the IEC and EPD to agree on an appropriate set of data to be used as a baseline reference and submit to ER for approval.
- 4.6.5 If the ET Leader considers that the ambient conditions have been changed and a repeat of the baseline monitoring is required to be carried out for obtaining the updated baseline levels, the monitoring should be carried out at times when the contractor's activities are not generating dust in the proximity of the monitoring station. Should change in ambient conditions be determined, the baseline levels and, in turn, the air quality criteria, should be revised. The revised baseline levels and air quality criteria should be agreed with the IEC and DEP.

**4.7 Impact Monitoring**

- 4.7.1 The ET Leader shall carry out impact monitoring during the course of the construction works at the recommended dust monitoring stations.
- 4.7.2 For 1-hr TSP monitoring, a sampling frequency of at least three times in every six-days shall be undertaken during the hours when the highest dust impact is predicted to occur based on the nature of the construction works.
- 4.7.3 In case of non-compliance with the air quality criteria, more frequent monitoring exercise, as specified in the following section, shall be conducted within 24 hours after the result is obtained. This additional monitoring shall be continued until the excessive dust emission or the deterioration in air quality is rectified.

**4.8 Event and Action Plan for Air Quality**

- 4.8.1 The baseline monitoring results form the basis for determining the air quality criteria for the impact monitoring. The ET shall compare the impact monitoring results with air quality criteria set up for 1-hour TSP. Table 4-2 shows the air quality criteria, namely Action and Limit levels to be used. Should non-compliance of the air quality criteria occurs, the ET shall undertake the relevant action in accordance with the Action Plan in Table 4-3.

**Table 4-2 Action and Limit Levels for Air Quality**

Parameters	Action	Limit
1 Hour TSP Level in $\mu\text{g}/\text{m}^3$	For baseline level $\leq 384 \mu\text{g}/\text{m}^3$ , Action level = (Baseline level x 1.3 + Limit level) /2; For baseline level $> 384 \mu\text{g}/\text{m}^3$ , Action level = Limit level;	500 $\mu\text{g}/\text{m}^3$

**Table 4-3 Event/Action Plan for Air Quality**

EVENT	ACTION			
	ET Leader	IEC	ER	CONTRACTOR
<b>ACTION LEVEL</b>				
Exceedance for one sample	<ol style="list-style-type: none"> <li>1. Identify source, investigate the causes of exceedance and propose remedial measures</li> <li>2. Inform ER, IEC and Contractor</li> <li>3. Repeat measurement to confirm finding</li> <li>4. Increase monitoring frequency to daily</li> </ol>	<ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET</li> <li>2. Check Contractor's working method</li> </ol>	<ol style="list-style-type: none"> <li>1. Notify Contractor</li> </ol>	<ol style="list-style-type: none"> <li>1. Rectify any unacceptable practice</li> <li>2. Amend working methods if appropriate</li> </ol>
Exceedance for two or more consecutive samples	<ol style="list-style-type: none"> <li>1. Identify source, investigate the causes of exceedance and propose remedial measures</li> <li>2. Inform ER, IEC and Contractor</li> <li>3. Repeat measurements to confirm findings</li> <li>4. Increase monitoring frequency to daily</li> <li>5. Discuss with IEC and Contractor on remedial actions</li> <li>6. If exceedance continues, arrange meeting with IEC and ER</li> <li>7. If exceedance stops, cease additional monitoring</li> </ol>	<ol style="list-style-type: none"> <li>1. Checking monitoring data submitted by ET</li> <li>2. Check Contractor's working method</li> <li>3. Discuss with ET Leader and Contractor on possible remedial measures</li> <li>4. Advise the ER on the effectiveness of the proposed remedial measures</li> <li>5. Supervisor implementation of remedial measures</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing</li> <li>2. Notify Contractor</li> <li>3. Ensure remedial measures properly implemented</li> </ol>	<ol style="list-style-type: none"> <li>1. Submit proposals for remedial actions to IEC within 3 working days of notification</li> <li>2. Implement the agreed proposals</li> <li>3. Amend proposal if appropriate</li> </ol>

EVENT	ACTION			
	ET Leader	IEC	ER	CONTRACTOR
<b>LIMIT LEVEL</b>				
Exceedance for one sample	<ol style="list-style-type: none"> <li>1. Identify source, investigate the causes of exceedance and propose remedial measures</li> <li>2. Inform ER, EPD, IEC and Contractor</li> <li>3. Repeat measurement to confirm finding</li> <li>4. Increase monitoring frequency to daily</li> <li>5. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results</li> </ol>	<ol style="list-style-type: none"> <li>1. Checking monitoring data submitted by ET</li> <li>2. Check Contractor's working method</li> <li>3. Discuss with ET and Contractor on possible remedial measures</li> <li>4. Advise the ER on the effectiveness of the proposed remedial measures</li> <li>5. Supervisor implementation of remedial measures</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing</li> <li>2. Notify Contractor</li> <li>3. Ensure remedial measures properly implemented</li> </ol>	<ol style="list-style-type: none"> <li>1. Take immediate action to avoid further exceedance</li> <li>2. Submit proposals for remedial actions to IEC within 3 working days of notification</li> <li>3. Implement the agreed proposals</li> <li>4. Amend proposal if appropriate</li> </ol>
Exceedance for two or more consecutive samples	<ol style="list-style-type: none"> <li>1. Identify source, investigate the causes of exceedance and propose remedial measures</li> <li>2. Notify ER, EPD, IEC and Contractor</li> <li>3. Repeat measurement to confirm findings</li> <li>4. Increase monitoring frequency to daily</li> <li>5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented</li> <li>6. Arrange meeting with IEC and ER to discuss the remedial actions to be taken</li> <li>7. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results</li> <li>8. If exceedance stops, cease additional monitoring</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss amongst ER, ET and Contractor on the potential remedial actions</li> <li>2. Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly</li> <li>3. Supervise the implementation of remedial measures</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing</li> <li>2. Notify Contractor</li> <li>3. In consultation with the IEC, agree with the Contractor on the remedial measures to be implemented</li> <li>4. Ensure remedial measures properly implemented</li> <li>5. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated</li> </ol>	<ol style="list-style-type: none"> <li>1. Take immediate action to avoid further exceedance</li> <li>2. Submit proposals for remedial actions to IEC within 3 working days of notification</li> <li>3. Implement the agreed proposals</li> <li>4. Resubmit proposals if problem still not under control</li> <li>5. Stop the relevant portion of works as determined by the ER until the exceedance is abated</li> </ol>

**4.9 Construction Mitigation Measures**

- 4.9.1 The EIA report has recommended various dust control and mitigation measures. The following measures are specifically recommended in the EIA for implementation together with those presented in the Air Pollution Control (Construction Dust) Regulation. An implementation schedule is provided in Appendix I.
- 4.9.2 Good site management practices are important in reducing potential air quality impacts. As a general guidance, the contractor shall maintain high standard of housekeeping to prevent emission of fugitive dust emission. Loading, unloading, handling and storage of fuel, raw materials, products, wastes or by-products should be carried out in a manner so as to minimize the release of visible dust emission.
- 4.9.3 The speed of the trucks travelling on haul roads within the Project Site will be controlled at 10 kph or below in order to reduce dust impact and for safe movement around the Project Site. Any piles of materials accumulated on or around the work areas shall be cleaned up regularly. Cleaning, repair and maintenance of all plant facilities within the work areas shall be carried out in a manner without generating fugitive dust emissions. The material shall be handled properly to prevent fugitive dust emission before cleaning.
- 4.9.4 It is expected that no concrete batching will be required for the Project works, and concrete will be brought to the site in "ready-mixed" state or in pre-cast elements

instead. However, if concrete batching is required at the site, the plant should be cleaned and watered regularly as a good practice. Cement and other fine grained materials delivered in bulk should be stored in enclosed silos fitted with high level alarm indicator. Wet mix batching process is preferred over dry mix batching. In addition, concrete batching plant shall comply with the specified process (SP) licence requirements including specified emission limits and dust control measures.

4.9.5 All relevant dust control measures stipulated in the Air Pollution Control (Construction Dust) Regulation would be fully implemented. Mitigation measures include:

- The designated haul road should be hard paved to minimize fugitive dust emission;
- During the site formation works, the active works areas should be water sprayed with water browser or manually eight times during day-time from 0800 to 1800 hours. The Contractor(s) should ensure that the amount of water spraying is just enough to dampen the exposed surfaces without over-watering which could result in surface water runoff;
- Dump trucks for transporting dusty materials should be totally enclosed using impervious sheeting;
- Any excavated dusty materials or stockpile of dusty materials should be covered entirely by impervious sheeting or sprayed with water so as to maintain the entire surface wet, and recovered or backfilled or reinstated as soon as possible;
- Dusty materials remaining after a stockpile is removed should be wetted with water;
- The area where vehicle washing takes place and the section of the road between the washing facilities and the exit point should be paved with e.g. concrete, bituminous materials or hardcore or similar;
- The Contractor(s) shall only transport adequate amount of fill materials to the Project Site to minimize stockpiling of fill materials on-site, thus reducing fugitive dust emission due to wind erosion;
- Should temporary stockpiling of dusty materials be required, it shall be either covered entirely by impervious sheeting, placed in an area sheltered on the top and the 3 sides; or sprayed with water so as to maintain the entire surface wet;
- All dusty materials shall be sprayed with water prior to any loading, unloading or transfer operation so as to maintain the dusty material wet;
- vehicle speed to be limited to 10 kph except on completed access roads;
- The portion of road leading only to a construction site that is within 30 m of a designated vehicle entrance or exit should be kept clear of dusty materials;
- Every vehicle should be washed to remove any dusty materials from its body and wheels before leaving the construction sites;
- The load of dusty materials carried by vehicle leaving a construction site should be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle;
- The working area of excavation should be sprayed with water immediately before, during and immediately after (as necessary) the operations so as to maintain the entire surface wet; and
- Use of effective dust screens, sheeting or netting to be provided to enclose dry scaffolding which may be provided from the ground floor level of the building or if a canopy is provided at the first floor level, from the first floor level, up to the highest level (maximum four floors for this Project) of the scaffolding where scaffolding is erected around the perimeter of a building under construction.

4.9.6 In order to minimize potential cumulative dust impacts, the Contractor(s) shall carry out site formation works in phases (i.e. different sub-zones) (a total of 21 sub-zones as

shown in **Appendix 3-8**, and with an average % active works area of 5% for each sub-zone as shown in **Appendix 3-9** of the EIA Report). Within each of Phases B to D, there will be only one sub-zone under construction in any one time. Once construction for a sub-zone is completed, the works area will be compacted, covered by tarpaulin sheet and hydroseeded before construction of another zone. Watering will also be applied on regular basis (eight times a day during day time from 0800 to 1800 hours for a dust suppression efficiency of 90%). Thus, there will be no cumulative construction impacts. Works area shall be properly covered at the end of working day to minimize wind erosion.

- 4.9.7 Part of the Wetland Restoration Area (WRA) will comprise existing fish ponds, where pond sediments could be found. Pond sediments are usually rich in organic matters, and therefore may potentially give rise to odour nuisance to the surrounding area when a large amount of such materials are exposed. Any exposed surface and excavated materials will need to be covered by impervious sheet or immediately backfilled during the construction phase, the potential odour nuisance from exposed pond sediments during excavation and pond filling, if any, should be minimized.
- 4.9.8 In order to minimize potential odour nuisance, the following control measures will be implemented:
- Exposed surface shall be immediately filled by filling materials
  - Malodorous excavated materials, if any, will be placed as far as possible from any ASRs;
  - Excavated malodorous materials will be removed away from the Project Site within 24 hours or as soon as possible;
  - Malodorous materials, if stockpiled on-site, will be covered entirely by plastic tarpaulin sheets;
  - Regular odour patrol shall be carried out by the ET and the Contractor during the re-profiling works for the WRA to ensure the effectiveness of the control measures implemented; and
  - Should disposal of pond sediment be required, if any, it shall follow the requirements stated in Buildings Department's PNAP ADV-21 for "Management Framework for Disposal of Dredged/ Excavated Sediment".
- 4.9.9 The effectiveness of the above control measures shall be checked as part of the EM&A programme. An implementation schedule of the above is provided in Appendix I. If the measures adopted and implemented by the contractor are found not be sufficient, the Contractor shall liaise with the ET Leader and IEC on the implementation of some other mitigation measures. The additional mitigation measures shall be approved by the ER before implementation.

#### **4.10 Recommended Operational Phase Mitigation Measures**

- 4.10.1 The proposed development can satisfy the HKPSG requirements in terms of buffer distance from nearby roads. Thus, no adverse air quality impacts due to vehicular emissions are anticipated.
- 4.10.2 The layout of the facilities for the proposed development will be carefully planned such that the refuse collection point of the residential development (a potential odour source) will be away from the residential area but will be close to the main access area connecting the main road. During the detailed design phase, the minimisation of odour at the refuse collection point will be considered to further reduce any localized impact.
- 4.10.3 The interim Sewage Treatment Plant (STP) proposed for the Project Site will be located within a totally enclosed building. The exhaust will be directed away from nearby ASRs.

- 4.10.4 With environmental conscious design of an effective odour removal system at the exhaust of the STP (with an odour removal efficiency of not less than 99.5%), the odour concentration at the exhaust would be significantly reduced and no odour impact is expected to arise from the operation of the interim on-site STP. Brine disposal during maintenance will be away from residential area as much as possible and close to the vehicular access connecting the nearby road.
- 4.10.5 During operation, RCP will be provided for the residential development. A licensed waste collector shall be employed to collect domestic waste on daily basis. Localized impact and minimization of odour nuisance will be considered during detailed design.

## 5. NOISE

### 5.1 Noise Parameters

- 5.1.1 The construction noise level shall be measured in terms of the A-weighted equivalent continuous sound pressure level (LAeq). LAeq(30 min.) shall be used as the monitoring parameter for the time period between 0700-1900 hours on normal weekdays. For all other time periods, LAeq(5 min) shall be employed for comparison with the NCO criteria. Percussive piling will require a Construction Noise Permit to be issued by EPD in advance.
- 5.1.2 As supplementary information for data auditing, statistical results such as L<sub>10</sub> and L<sub>90</sub> shall also be obtained for reference. A sample data record sheet is shown in Appendix II for reference.

### 5.2 Monitoring Equipment

- 5.2.1 As referred to in the Technical Memorandum issued under the Noise Control Ordinance (NCO), sound level meters in compliance with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications shall be used for carrying out the noise monitoring. Immediately prior to and following each noise measurement, the accuracy of the sound level meter shall be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements may be accepted as valid only if the calibration levels before and after the noise measurement agrees to within 1.0dB.
- 5.2.2 Noise measurements should be made in accordance with standard acoustical principles and practices in relation to weather conditions.
- 5.2.3 The ET Leader is responsible for the availability of the monitoring equipment. He shall ensure that sufficient noise measuring equipment and associated instrumentation are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. All the equipment and associated instrumentation shall be clearly labelled.

### 5.3 Monitoring Locations

- 5.3.1 The proposed locations for noise monitoring during the construction phase are shown in Table 5-1 below, while their geographical locations are also provided in Figure 5-1.

**Table 5-1 Locations of Construction Noise Monitoring Stations**

Monitoring Station ID	Corresponding NSR in EIA Report	Representative for
NM1	N3	Fairview Park
NM2	N4c	Fairview Park
NM3	N5	Temporary house at Yau Mei San Tsuen
NM4	N6	Palm Springs
NM5	N11	Temporary house at Yau Mei San Tsuen
NM6	N_Ch	Christian Ministry Institute

- 5.3.2 The selection of the above monitoring locations has taken into account the noise impact assessment results presented in the EIA report and the availability of the monitoring locations. Since most of the NSRs assessed in the EIA which are worst affected by the construction works, are private residential development (with private garden) at existing Fairview Park and Palm Springs, access permission to these locations is unlikely be granted by the property owner. As such, nearby public area and school that are in adjacent to the concerned ASRs have been selected for the

monitoring.

- 5.3.3 The EIA study has identified there are planned development sites nearby (e.g. planned REC Site, Planned RD Site and "V" zone), the ET Leader shall also review the status of these planned development projects and propose additional noise monitoring locations where necessary when these planned development sites are occupied at the time of construction of this Project. The proposed monitoring locations shall be agreed with the IEC, ER and DEP.
- 5.3.4 The status and availability of monitoring locations may change after issuing this Manual. If such cases exist, the appointed ET Leader may propose alternative monitoring locations taking into consideration of the latest status, availability and/or accessibility of the various possible monitoring locations. The alternative monitoring locations proposed by the ET shall be approved by the ER and agreed by IEC. When alternative monitoring locations are proposed, the following criteria should be followed as far as practicable:
- At locations close to the major site activities which are likely to have noise impacts;
  - Close to the noise sensitive receivers; and
  - For monitoring locations located in the vicinity of the sensitive receivers, care shall be taken to cause minimal disturbance to the occupants during monitoring.
- 5.3.5 The monitoring station shall normally be at a point 1m from the exterior of the sensitive receivers building facade and be at a position 1.2m above ground. If there is problem with access to the normal monitoring position, an alternative position may be chosen, and a correction to the measurements shall be made. For reference, a correction of +3dB(A) shall be made to free field measurement data. The ET Leader shall agree with the IEC on the monitoring position and the corrections adopted. Once the positions for the monitoring stations are chosen, the baseline monitoring and the impact monitoring shall be carried out at the same positions.

#### **5.4 Baseline Monitoring**

- 5.4.1 Baseline monitoring shall be carried out by the ET prior to the commencement of the construction works. The baseline monitoring shall be carried out daily for a period of at least 14 consecutive days prior to the commissioning of the construction works. The ET Leader should inform the IEC, ER and DEP on the baseline monitoring programme before commencement such that the IEC can conduct on-site audit to ensure accuracy of the baseline monitoring results.
- 5.4.2 There shall not be any construction activities in the vicinity of the stations during the baseline monitoring.
- 5.4.3 In exceptional cases, such as insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall liaise with IEC and EPD for agreement on an appropriate set of data to be used as the baseline reference and submit to the ER for approval.

#### **5.5 Impact Monitoring**

- 5.5.1 Noise monitoring shall be carried out at all the designated monitoring stations during the construction phase of the Project. The monitoring frequency shall depend on the scale of the construction activities. The following is an initial guide on the regular monitoring frequency for each station on a per week basis when noise generating activities are underway
- (a) one set of measurement between 0700-1900 hours on normal weekdays (i.e. Monday to Saturday);



- 5.5.2 General construction work carrying out during restricted hours is controlled by Construction Noise Permit (CNP) system under the NCO. Without a valid construction noise permit (CNP) issued by EPD under Noise Control Ordinance (NCO), no construction work shall be carried out during restricted hours<sup>3</sup>. Once a valid CNP for the construction activities is issued by EPD, the ET Leader shall be appointed to carry out additional noise measurements and the IEC shall also be appointed to carry out additional site investigations and audits during the restricted hours specified in the CNP. Generally speaking, one set of measurement shall at least include 3 consecutive Leq(5min) results for construction works to be carried out during restricted hours or following the requirement specified in the CNP.
- 5.5.3 Moreover, the ET Leader shall propose an additional noise monitoring schedule certified by the IEC to the ER for approval before the commencement of the construction works during the restricted hours.
- 5.5.4 In case of non-compliance with the construction noise criteria, more frequent monitoring as specified in the Event and Action Plan shall be carried out. This additional monitoring shall be continued until the recorded noise levels are rectified or proved to be irrelevant to the construction activities.

**5.6 Event and Action Plan for Construction Noise**

- 5.6.1 The Action and Limit Levels for construction noise are defined in Table 5-2. In case that a valid CNP is issued by EPD, the Action Level is the same as the non-restricted hours and the Limit Level shall be the same as the standard stated in the CNP.
- 5.6.2 Should non-compliance of the criteria occurs, actions in accordance with the Action Plan as shown in Table 5-3 should be carried out.

**Table 5-2 Action and Limit Levels for Construction Noise**

Time Period	Action	Limit
0700-1900 hrs on normal weekdays	When one documented complaint is received	75 dB(A)
Restricted hours		Same as CNP

\* Reduce to 70dB(A) for schools and 65dB(A) during school examination periods.

**Table 5-3 Event and Action Plan for Construction Noise Monitoring**

EVENT	ACTION			
	ET Leader	IEC	ER	CONTRACTOR
<b>ACTION LEVEL</b>				
Action Level	<ol style="list-style-type: none"> <li>1. Notify ER, IEC and Contractor</li> <li>2. Carry out investigation</li> <li>3. Report the results of investigation to the ER, IEC and Contractor</li> <li>4. Discuss with the IEC and Contractor, and formulate remedial measures</li> <li>5. Increase monitoring frequency to check mitigation effectiveness</li> </ol>	<ol style="list-style-type: none"> <li>1. Review the analysed results submitted by the ET</li> <li>2. Review the proposed remedial measures by the Contractor and advise the ER accordingly</li> <li>3. Supervise the implementation of remedial measures</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing</li> <li>2. Notify Contractor</li> <li>3. Require Contractor to propose remedial measures for the analysed noise problem</li> <li>4. Ensure remedial measures are properly implemented</li> </ol>	<ol style="list-style-type: none"> <li>1. Submit noise mitigation proposals to IEC</li> <li>2. Implement noise mitigation proposals</li> </ol>
Limit Level	<ol style="list-style-type: none"> <li>1. Notify IEC, ER, EPD and Contractor</li> <li>2. Identify source</li> <li>3. Repeat measurement to</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss amongst ER, ET, and Contractor on the potential remedial</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing</li> <li>2. Notify Contractor</li> </ol>	<ol style="list-style-type: none"> <li>1. Take immediate action to avoid further exceedance</li> </ol>

<sup>3</sup> All days during the evening 1900 to 2300 hours, and the night-time, 2300 to 0700 hours, and all hours of the general holidays including Sundays

EVENT	ACTION			
	ET Leader	IEC	ER	CONTRACTOR
	confirm findings 4. Increase monitoring frequency to daily 5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented 6. Inform IEC, ER and EPD the causes & actions taken for the exceedances 7. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results 8. If exceedance stops, cease additional monitoring	actions 2. Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly 3. Supervise the implementation of remedial measures	3. Require Contractor to propose remedial measures for the analysed noise problem 4. Ensure remedial measures are properly implemented 5. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated	2. Submit proposals for remedial actions to IEC within 3 working days of notification 3. Implement the agreed proposals 4. Resubmit proposals if problem still not under control 5. Stop the relevant portion of works as determined by the ER until the exceedance is abated

**5.7 Noise Mitigation Measures (Construction Phase)**

- 5.7.1 The EIA report has recommended various construction noise control and mitigation measures. These are summarised below for easy reference. An implementation schedule is also provided in Appendix I. The Contractor shall be responsible for the design and implementation of these recommended measures.
- 5.7.2 Noise emissions from construction sites can be minimized by adopting a number of practicable noise mitigation options, such as:
  - Use of quiet/silenced equipment (QPMEs);
  - Use of movable noise barriers to shield construction activities;
  - Erecting temporary noise barriers and Provision of Noise Enclosure;
  - Phasing of the Construction Activities during Site Formation; and
  - Good site practice and noise management.

Selecting Quiet/ Silenced PME

- 5.7.3 Quiet types of equipment for use in construction activities are available in Hong Kong. Quiet type Powered Mechanical Equipment (QPMEs) are recommended to be used in the EIA report. It is advised that the Contractor should diligently seek equivalent models of quiet/ silenced PMEs with Sound Power Level (SWLs) similar to or less than that as presented in the EIA report as far as practicable.
- 5.7.4 Table 5-4 presents the QPMEs assumed in the EIA report that are likely required during the construction works of the Project, quiet/silenced plant with SWL similar to or less than those presented in the below table, shall be adopted by the Contractor as far as possible.

**Table 5-4 Inventory of QPMEs**

Quiet Type PME	Reference	SWL per unit, dB(A)
Excavator, mini-robot mounted	EPD *	94
Breaker, Excavator mounted	BS5228: D3/100	112
Lorry	BS5228:D3/59	105
Generator, super silenced	CNP103	95
Mobile Crane	Hitachi Sumitomo SCX700, 132kW	101
Power Rammer (Petrol)	BS5228: D3/119	105
Air Compressor	CNP001	100
Saw, Circular, Wood	BS5228:D7/78	106
Concrete Lorry Mixer	BS5228: D6/35	100
Concrete Pump	BS5228: D6/36	106
Poker, vibratory, hand-held	BS5228: D6/40	98
Generator, Standard	Atlas Copco: QAS18	91
Roller, Vibratory	Sakai: SG350	95
Saw, circular, wood	BS5228:D7/78	106
Continuous Flight Auger (CFA) piles (piling, earth auger)	BS5228: C12/42	108
Bulldozer	Komatsy modelled D21A-B	102
Excavator	BS5228:D3/79	101
Dump truck	BS5228:D9/39	103
Asphalt Paver	BS5228: D8/24	101
Road Roller	Sakai: SG350	95
Dump Truck (5.5 tonne < Gross vehicle weight <= 38 tonne)	EPD *	105

**Remark:**

The list of QPMEs is based on Appendix 4-3B of the EIA report. Please refer to Appendix 4-3B for the construction plants assumed during each construction phase.

Quiet PMEs are based on BS 5228: Part 1: 2009, unless otherwise specified.

\* EPD website: [http://www.epd.gov.hk/epd/english/application\\_for\\_licences/guidance/files/OtherSWLe.pdf](http://www.epd.gov.hk/epd/english/application_for_licences/guidance/files/OtherSWLe.pdf)

**Use of Temporary Noise Barriers**

- 5.7.5 Erection of temporary noise barriers between noise sources and NSRs will be effective in reducing the potential construction noise impact, especially for the low-rise village huts which are the target NSRs to be protected.
- 5.7.6 Additional noise mitigation measures in terms of movable noise barriers are also proposed to shield construction plants. The movable noise barriers should have

sufficient surface density of at least 10 kg/m<sup>2</sup> or material providing equivalent acoustic performance to block the line of sight from the sensitive receivers. There should not be any gaps and openings at the noise barriers and site hoardings to avoid noise leakage. The design of the noise barriers shall be proposed by the work contractor(s), and approved by the Engineers Representative (RE) and the Environmental Team in accordance with the Project EM&A Manual.

- 5.7.7 There will be minor construction works within the Phase A area in order to establish the wetland area within a relatively short duration (i.e. re-profiling work of the existing earth bund to be carried out within 1 wet season within the WRA). Erection of the tall fixed construction phase noise barrier along the boundary of the wetland in Phase A, would definitely reduce the effectiveness of the wetland during the construction phase of the residential portion of the Project Site, thus it is not proposed.
- 5.7.8 Instead, the amount of QPMEs at Phase A's works area will be kept to a minimum in order to minimize potential noise impact. During the Phase A works, movable noise barriers shall also be erected near the site boundary adjacent to the nearby NSRs at Yau Mei San Tsuen so as to shield construction plant from these NSRs. In addition, 3m tall site hoarding will also be erected along the Project site boundary. After the completion of the re-profiling work of the wetland, minor landscape work will be carried out and that the wetland is assumed to function during the construction phase of the residential portion of the Project Site (i.e. Phase B to D). In view of maintaining the function of the wetland (Phase A), there is a possibility to demolish the site hoarding surrounding the Phase A once the Project Ecologist considers that the wetland is ready to function as it is designed.
- 5.7.9 Fixed temporary noise barrier is also proposed near the existing Fairview Park as well as near the existing Yau Mei San Tsuen in order to alleviate elevated construction noise level over there. In addition, when the planned REC Site in adjacent to the Project Site is occupied with sensitive receivers during construction of this Project, fixed temporary noise barrier will also need to be erected near the concerned development site. Locations of proposed fixed temporary noise barriers are shown in **Figure 5-2**. The exact location is subject to the contractor(s) and the prior approval from the Resident Engineer (RE).
- 5.7.10 In order to ensure construction noise is controlled throughout the construction period, fixed temporary noise barriers shall be erected prior to site formation works of Phases B to D. It is estimated that 6m high temporary fixed noise barriers (with top level at 8mPD level) shall be sufficient to shield the concerned existing/ planned NSRs at Fairview Park and the planned REC Site, while 4.5m high noise barriers is required to be erected adjacent to the existing Yau Mei San Tsuen (**Figures 5-2** refers). Erection of temporary fixed noise barriers will be carried out section by section and precast units will be used for the foundation of the noise barrier as much as possible. Since standard site hoarding of 3m tall will also be erected along the site boundary, the concerned temporary fixed noise barriers can be combined with the site hoarding.
- 5.7.11 The concerned temporary fixed noise barriers shall have sufficient surface density of at least 10 kg/m<sup>2</sup> or material providing equivalent acoustic performance. There shall not be any gaps and openings at the noise barriers and site hoardings to avoid noise leakage. The design of the noise barriers shall be proposed by the work contractor(s), and approved by the Engineers Representative (RE) and the Environmental Team in accordance with the Project EM&A Manual.
- 5.7.12 3m tall fixed temporary noise barrier is proposed to be erected at Project site boundary adjacent to Yau Pok Road when the planned RD Site is occupied during construction in order to alleviate any residual noise impacts (see **Figures 4-6 and 4-6B**). Since standard site hoarding of 3m tall will also be erected along the site boundary, the concerned temporary fixed noise barriers can be combined with the site hoarding. The concerned temporary fixed noise barriers should have sufficient surface density of at least 10 kg/m<sup>2</sup> or material providing equivalent acoustic performance. There should not

be any gaps and openings at the noise barriers and site hoardings to avoid noise leakage. The design of the noise barriers shall be proposed by the work contractor(s), and approved by the Engineers Representative (RE) and the Environmental Team in accordance with the Project EM&A Manual.

#### Other Recommended Noise Mitigation Measures

5.7.13 It is also recommended that good housekeeping activities shall also be carried out to further minimize the potential construction noise impact, and these are summarised below. The following good site practices are also recommended for incorporation into the contractual requirements :

- Contractor shall comply with and observe the Noise Control Ordinance (NCO) and its current subsidiary regulations;
- Before the commencement of any work, the Contractor shall submit to the Engineer for approval the method of working, equipment and sound-reducing measures intended to be used at the Project Area;
- Contractor shall devise and execute working methods that will minimize the noise impact on the surrounding environment; and shall provide experienced personnel with suitable training to ensure that these methods are implemented;
- Only well-maintained plants should be operated on-site;
- Plants should be serviced regularly during the construction programme;
- Machines that may be in intermittent use should be shut down or throttled down to a minimum between work periods;
- Silencer and mufflers on construction equipment should be utilised and should be properly maintained during the construction programme;
- Noisy activities can be scheduled to minimize exposure of nearby NSRs to high levels of construction noise. For example, noisy activities can be scheduled for midday or at times coinciding with periods of high background noise (such as during peak traffic hours);
- Noisy equipment such as emergency generators shall always be sited as far away as possible from noise sensitive receivers;
- Mobile plants should be sited as far away from NSRs as possible; and
- Material stockpiles and other structures should be effectively utilised as noise barrier, where practicable.

5.7.14 The Contractor is also encouraged to arrange construction activities with care so that concurrent construction activities are avoided as much as possible. The Contractor should closely liaise with the nearby school so that noisy activities are not undertaken during school's examination period.

5.7.15 EM&A will be carried out for this Project during the construction phase in order to monitor the construction noise level and to verify the effectiveness of the above noise mitigation measures. The ET shall closely monitor contractor's performance and the residual noise level at the school. Should unacceptable construction noise level be identified during the construction noise monitoring, necessary actions following the standard Event and Action Plan specified above, will be required.

### **5.8 Operational Phase Noise Mitigation Measures**

5.8.1 The STP will be totally enclosed and acoustic louvre/ silencer would be applied at the exhaust of STP to further reduce its noise level.

- 5.8.2 During detailed design, the acoustic performance of the interim STP should be reviewed and acoustic treatments such as provision of acoustic louvre, acoustic silencer and noise treatments inside the plant room (e.g. acoustic shrouds or enclosure at pump) shall be proposed so that the noise level at louvre of STP should be 74dB(A) or below in order to meet the noise criteria. To be conservative, the above noise calculation assumes that the louvre of the STP will be facing the nearest NSR. In fact, by directing louvre away from the NSR as far as possible, it could provide additional noise reduction.
- 5.8.3 No EM&A is required during the operational phase.

## 6. WATER QUALITY MONITORING

### 6.1 Introduction

- 6.1.1 A water quality impact assessment has been undertaken for the proposed development. The water quality impact assessment in the EIA indicated that no adverse impacts on water quality would be expected for the construction and operational phase of the Project, with proper implementation of the recommended environmental mitigation measures/ best management practices.
- 6.1.2 In order to ensure proper implementation of mitigation measures, regular water quality monitoring and site auditing programme is proposed to be carried out during the construction phase.

### 6.2 EM&A Requirements

- 6.2.1 The Contractor shall adopt the Best Management Practices (BMPs) given in the Practice Notes for Professional Persons on "Construction Site Drainage" (ProPECC PN 1/94)) in controlling water pollution during the construction phase. During the operational phase, the water quality impact control measures recommended in the EIA should be implemented. For operational phase sewage discharge of STP, details should refer to "Sewerage and Sewage Treatment" in Section 7.
- 6.2.2 Water quality monitoring at designated locations at the nearby inland water bodies are proposed to be carried out during the construction phase to monitor any sub-standard water discharge into the nearby water bodies from the Site.
- 6.2.3 Regular environmental audits in accordance with Section 11 of this Manual shall be undertaken during the construction works to ensure the proper implementation of the mitigation measures for potential construction water quality impact.
- 6.2.4 The environmental audit shall be undertaken by the ET during construction and shall include a walk over of the active works area and surroundings. It shall include: visual inspection of the implementation of the runoff and drainage control measures from the works area; inspections of water quality surrounding the site and the project discharge areas. In particular, any brown coloured water or suspended solids laden discharge shall be noted and considered to be unacceptable, triggering the Event and Action Plan.
- 6.2.5 The environmental audit shall include a review of the effectiveness of measures to minimize surface runoff and their effectiveness for reducing erosion and retaining suspended solids laden runoff within the site. The following will be included during the review:
- Inspection of the effectiveness of silt removal facilities and erosion and sediment control structures to ensure proper and efficient operation at all times and particularly during rainstorms;
  - Inspection of the effectiveness of control measures to prevent soil erosion and sediment laden run-off from the Site;
  - Inspection of the effectiveness of collection, handling, storage and disposal of materials to ensure they do not enter the nearby stormwater drainage system; and
  - Review of the Contractor's compliance with discharge license requirements.

### 6.3 Control/ Mitigation Measures

#### Construction Phase

- 6.3.1 The EIA report has recommended mitigation measures during the construction and operational phases of the Project. In particular, the following mitigation measures are

required to be implemented. The implementation schedule for the recommended mitigation measures is also presented in Appendix I.

- 6.3.2 Control of potential water quality impact arising from the construction works shall be implemented based on the following principles:
- Minimisation of runoff;
  - Prevention or minimisation of the likelihood of the identified pollutants being in contact with rainfall or runoff; and
  - Measures to abate pollutants in the stormwater runoff.
- 6.3.3 The Contractor shall apply for a discharge licence under the WPCO and the discharge shall comply with the terms and conditions of the licence.
- 6.3.4 Contractor(s) of this Project is required to submit a Construction Phase Drainage Management Plan with details of the design of the temporary site drainage system for the approval of the Engineers Representative (RE) and the Environmental Team in order to ensure that the mitigation measures are in place.
- 6.3.5 Regular inspection (weekly) of the site drainage system and the implementation of the Plan shall be carried out by the Contractor(s), RE, and ET in order to ensure no off-site spillage of runoff and that the mitigation measures are effectively implemented. Any deficiencies identified shall be rectified by the Contractor(s).

#### *Construction Runoff General Requirements*

- 6.3.6 Besides, the Best Management Practices (BMPs) given in the ProPECC PN 1/94 shall be implemented in controlling water pollution during the whole construction phase. The main practices provided in the above-mentioned document (i.e. ProPECC PN 1/94) are also summarized in the following paragraphs which should be implemented by the contractor during the construction phase, where practicable:
- High loading of suspended solids (SS) in construction site runoff shall be prevented through proper site management by the contractor;
  - The boundary of critical work areas shall be surrounded by ditches or embankment. Accidental release of soil or refuse into the adjoining land should be prevented by the provision of site hoarding or earth bunds, etc. at the site boundary. These facilities should be constructed in advance of site formation works and roadworks;
  - Consideration should be given to plan construction activities to allow the use of natural topography of the Project Area as a barrier to minimize uncontrolled non-point source discharge of construction site runoff;
  - Temporary ditches, earth bunds should be provided to facilitate directed and controlled discharge of runoff into storm drains via sand/ silt removal facilities such as sand traps and sedimentation basins. Oil and grease removal facilities should also be provided where appropriate, for example, in area near plant workshop/ maintenance areas;
  - Sedimentation basins and sand traps designed in accordance with the requirements of ProPECC Note PN 1/94 should be installed at the construction site for collecting surface runoff;
  - Sand and silt removal facilities, channels and manholes should be maintained and the deposited silt and grit should be removed regularly by the contractor, and at the



onset of and after each rainstorm to ensure that these facilities area functioning properly;

- Slope exposure should be minimized where practicable especially during the wet season. Exposed soil surfaces should be protected from rainfall through covering the temporarily exposed slope surfaces or stockpiles with tarpaulin or the like;
- Haul roads should be protected by crushed rock, gravel or other granular materials (i.e. hard paved) to minimize discharge of contaminated runoff;
- Slow down water run-off flowing across exposed soil surfaces;
- Plant workshop/ maintenance areas should be bunded and constructed on a hard standing. Sediment traps and oil interceptors should be provided at appropriate locations;
- Manholes (including newly constructed ones) should be adequately covered or temporarily sealed so as to prevent silt, construction materials or debris from getting into the drainage system;
- Construction works should be programmed to minimize soil excavation works where practicable during rainy conditions;
- Chemical stores should be contained (bunded) to prevent any spills from contact with water bodies. All fuel tanks and/ or storage areas should be provided with locks and be sited on hard surface;
- Chemical waste arising from the Project Area should be properly stored, handled, treated and disposed of in compliance with the requirements stipulated under the Waste Disposal (Chemical Waste) (General) Regulation;
- Drainage facilities must be adequate for the controlled release of storm flows.
- During re-profiling of the existing bunds within the WRA, materials requiring temporary storage on-site will be securely stored and covered, if possible. Dried up mud materials can then be used for marshland formation.
- Vehicle wheel washing facilities should be provided at the site exit such that mud, debris, etc. deposited onto the vehicle wheels or body can be washed off before the vehicles are leaving the site area;
- Section of the road between the wheel washing bay and the public road should be paved with backfill to reduce vehicle tracking of soil and to prevent site run-off from entering public road drains;
- Bentonite slurries, if any to be generated, shall be reconditioned and reused as far as practicable. Spent bentonite should be kept in a separate slurry collection system for disposal at a marine spoil grounds subject to obtaining a marine dumping licence from EPD. If used bentonite slurry is to be disposed of through public drainage system, it should be treated to meet the respective applicable effluent standards for discharges into sewers, storm drains or the receiving waters.
- Sewage generated from the construction workforce should be contained in chemical toilets before connection to public foul sewer can be provided. Chemical toilets should be provided at a minimum rate of about 1 per 50 workers. The facility should be serviced and cleaned by a specialist contractor at regular intervals;
- Spillage of fuel oils or other polluting fluids should be prevented at source. It is recommended that all stocks should be stored inside proper containers and sited on sealed areas, preferably surrounded by bunds.

*Construction of Residential Portion*

- During construction of residential portion, temporary drains, peripheral site drainage comprising precast concrete u-channels, sedimentation basins, sand traps and similar facilities in accordance with the requirements of ProPECC Note PN 1/94 will be provided within the residential portion and along the edge of its boundary as per good practices in order to divert surface runoff away from WRA, temporary wetland enhancement area, ecological links, and nearby sensitive receivers such as Fairview Park Nullah before discharge into NTMDC after passing sand traps. Figure 6-2 shows the indicative site drainage conceptual layout during construction phase.

*Construction of WRA*

During the construction of WRA of the Project Site, in order to minimize disturbance to the rest of the Project Site it is proposed that:

- Through transferring the pond water within ponds of the WRA, the need for discharging pond water into the surrounding water bodies during the construction of the Project will not be necessary.
- The major construction works involved in WRA relate to the re-profiling of the bunds. To minimize disturbance to the rest of the Project Area it is proposed that the works are conducted on one pair of ponds at a time. Pond water will be drained to other neighbouring ponds for temporary storage, thus no discharge will be required.
- Surface runoff from the residential portion will be diverted away from the WRA by drainage channels in order to avoid overflow of the pond under extreme weather condition (e.g. heavy rainfall).
- Temporary peripheral site drainage system comprising precast concrete u-channels along site boundary with sedimentation basins, sand traps and similar facilities will be provided in accordance with the requirements stipulated in ProPECC PN 1/94.
- Given the proposed mitigation measures above, an EM&A programme is required to ensure the proper implementation of the recommended measures and provide a proactive system to rectify any problem identified.
- There should be no discharge of surface runoff into Fairview Park Nullah; existing stream to the south of Palm Springs; and existing ponds at off-site locations. Treated surface runoff will be diverted away from these locations and discharged into NTMDC after passing through sand traps and sedimentation basins. Figure 6-2 refers.

*Construction of Temporary Wetland Enhancement Area*

- 6.3.7 During construction of Temporary Wetland Enhancement Area, appropriate temporary peripheral site drainage should be provided which comprises precast concrete u-channels surrounding the construction area, surface runoff is diverted away from nearby existing drainage channels for discharge into NTMDC after passing through sand traps and sedimentation basins.
- 6.3.8 During operation of the temporary enhancement area, appropriate temporary drainage will also be provided surrounding the concerned enhancement area to divert surface runoff away from the enhancement area in order to avoid any adverse water quality impact on this area. **Figure 6-2** shows the indicative site drainage during construction phase.
- 6.3.9 Once the WRA is in operation, the temporary wetland enhancement area will become part of the construction site of the residential portion, and will be filled up to the

proposed site formation level. Remaining water in the shallow ponds will be by soakaway mechanism and no pond draining is expected.

### **Operational Phase**

- 6.3.10 The Project Proponent or the developer shall be responsible for the following measures. For operational phase sewage discharge of STP, details should refer to “Sewerage and Sewage Treatment” in Section 7.

#### *Sewage Discharge of STP*

- 6.3.11 **Permanent Sewage Disposal** - All domestic sewage generated will be discharged to the public sewerage system via a terminal manhole located at the southern boundary of the Project Site, which will further connect to the planned public sewer at Yau Pok Road. The discharge from the club house and swimming pool shall apply for a discharge licence under the WPCO, and the discharge shall comply with the terms and conditions of a licence and the standards for effluents specified in the licence, as well as conditions in Environmental Permit.
- 6.3.12 **Interim Sewage Disposal** - An interim STP is proposed with the discharge point at the adjacent Ngau Tam Mei Drainage Channel in case the public sewerage is not available when the Project is in operation. The design of the interim STP will follow the requirement of no net increase of pollution loading. A discharge licence under the WPCO will be obtained for the discharge from the STP, and the discharge shall comply with the terms and conditions of a licence and the standards for effluents specified in the licence as well as conditions in the Environmental Permit. Samples of treated effluent will be taken regularly and tested according to the discharge licence under the WPCO and the conditions in the Environmental Permit to ensure compliance with discharge standards.
- 6.3.13 Precautionary measures have also been proposed in Section 7.2 so that adverse water quality impact due to sewage overflow, emergencies discharge, and change in flow regime is unlikely to occur. In addition, equalization tank will be provided in the STP for temporary storage of sewage in case of outage of the interim STP, and tank away will be provided for proper disposal at designated sewage treatment works to be assigned by DSD.
- 6.3.14 The discharge from the club house and swimming pool shall apply for a discharge licence under the WPCO, and the discharge shall comply with the terms and conditions of a licence and the standards for effluents specified in the licence, as well as conditions in Environmental Permit of this Project.
- 6.3.15 During decommissioning, the interim sewerage system within the development area will be designed in such a way to facilitate the future connection to the planned Ngau Tam Mei sewerage system with the flow direction to be controlled by several flow control devices such as valves or stop-log, etc. Switching over from the interim system to the permanent system will be done by regulating the flow direction through the flow control devices and by abandoning the sewer which connects to the interim STP. Details of which are provided Section 7.2. Tank away will be provided for any remaining small amount of sewage in the STP for proper disposal at designated sewage treatment works to be assigned by DSD.
- 6.3.16 The mitigation measures listed above will be implemented by the Project Proponent, and managed and maintained by the property management company and its contractors during operational phase.

#### *Storm Water Discharge*

6.3.17 Best Management Practices (BMPs) have been proposed for the development, which are summarised below:

- Exposed surface shall be avoided within the proposed development to minimize soil erosion. Development site shall be either hard paved or covered by landscaping area where appropriate.
- The landscaped open area should be managed and maintained by the property management company (and its contractor) during operation.
- Paved area of development has been minimized by a simpler and more effective internal road layout, at which proposed houses are allocated on both sides of the road. Thus hard paved area of internal access road as well as increase in surface runoff, can be minimised.
- The roadside channel along Yau Pok Road will be retained to maintain the original flow path. The drainage system will be designed to avoid any case of flooding based on the 1 in 50 year return period.
- **Figure 6-3** shows the indicative site drainage layout during operational phase. Detailed design of the drainage system will be carried out during detailed design stage. Drainage system of the development shall be designed in such a way that surface runoff from the residential area is directed towards the internal access road, where appropriate drainage system with control facilities have been proposed. Additional paved U-channels with screening facilities are also provided along the edge of residential portion to avoid uncontrolled spillage of runoff.
- There should be no discharge of surface runoff into the sensitive areas such as the proposed WRA; ecological corridors; and Fairview Park Nullah.
- Street level tree planting shall be introduced along both sides of the internal access road, which can help to reduce soil erosion and as a buffer zone between the residential area and the drainage system along roadside.
- Evergreen trees species, which in general generate relatively smaller amount of fallen leaves, should be selected where possible.
- Fertilizer will only be applied on landscape area when needed. If required, the fertilizer should be applied in early Spring and in later summer in order to avoid major rainy season as far as possible. Slow release fertilizer should be selected as far as possible to minimize the amount of nutrient to be washed out by rain. Application of fertilizer should not be arranged before forecasted heavy rainfall, and over dosing should be avoided. The fertilizer application strategy is to be implemented by an experienced contractor through the property management company during operation.
- Screening facilities such as standard gully grating and trash grille, with spacing which is capable of screening off large substances such as fallen leaves and rubbish should be provided at the inlet of drainage system as well as at upstream location of the u-channels.
- Road gullies with standard design and silt traps and oil interceptors should be incorporated during the detailed design to remove particles present in stormwater runoff.
- Drainage outlet of any covered car park should be connected to foul sewers via petrol interceptors or similar facilities

In addition to the above, subject to detailed design, standard manholes with desilting opening/ sand trap designed for first flush flow (capable of providing at least 5 minutes' detention time) can be provided at final discharge point before discharge into NTMDC.

The feasibility of alternative measure such as Vortex grit separator would also be considered during the detailed design stage.

- 6.3.18 In the event of emergency (e.g. car accident) where there is a major spillage of oil, chemical or fuel, dispersants or firefighting foam, etc., a system of contaminant bunding will be implemented as appropriate.
- 6.3.19 Good management measures such as regular cleaning and sweeping of road surface/ open areas is suggested. The road surface/ open area cleaning should also be carried out prior to occurrence of rainstorm.
- 6.3.20 Manholes, as well as stormwater gullies, ditches provided among the residential development will be regularly inspected and cleaned (e.g. monthly) by the property management company. Additional inspection and cleansing should be carried out before forecast heavy rainfall.

#### *During Operation of WRA*

- 6.3.21 The WRA is not designed for pollution abatement but as ecological mitigation measures of the development. All pond water of WRA will be obtained by direct rainfall and will be retained and re-circulated during drain-down periods as necessary. No surface or groundwater supplies will be used for WRA operations.
- 6.3.22 Ponds in the WRA will be designed in such a way that they are self-contained and there is no outlet connecting to nearby channel/inland water, thus there will be no discharge from the ponds within the WRA. Surface runoff from the residential portion will be diverted away from the WRA by drainage channels in order to avoid overflow of the pond under extreme weather condition (e.g. heavy rainfall).
- 6.3.23 No fertilizers and pesticides will be routinely used for vegetation management in the WRA, hence avoiding the potential source of contamination into the adjacent watercourses which connect to the Deep Bay.
- 6.3.24 The WRA will be designed in such a way that overflow will be diverted into proper drainage system of the development site before discharge into NTMDC through the proposed drainage system. During operation, under the management of Wetland Ecologist, who will advise on the management of wetland, pond water will be transferred between ponds within the WRA, in order to self-contain water within the WRA.

#### **Mitigation Implementation Schedule**

- 6.3.25 The implementation schedules of mitigation measures for water quality control during construction and operational phases are presented in **Appendix I**. The mitigation measures listed above will be implemented by the Project Proponent.
- 6.3.26 During construction phase, the effectiveness of these water quality control measures shall be implemented by the Contractor and checked by the ET. If the above measures are not sufficient to restore the water quality to an acceptable level, the Contractor shall liaise with the ET Leader, propose to ER, and IEC for approval, on the implementation of some additional mitigation measures.
- 6.3.27 During operational phase, the management and maintained will be carried out by the property management company/ Incorporated Owners. The Project Proponent would assume the responsibilities of all the mitigation measures contained in the EIA report until an agreement is reached between the Project Proponent and relevant parties on the funding, implementation, management and maintenance of mitigation measures.

## 6.4 Water Quality Parameters

- 6.4.1 The ET should carry out spot check to ensure that the Contractor has undertaken all recommended control measures to prevent direct contact of pollutants with rainwater or runoff, and measures to abate contaminants in the stormwater runoff.
- 6.4.2 The parameters shown in Table 6-1 are recommended to be recorded/ monitored in the routine monitoring programme.

**Table 6-1 Water Quality Parameters**

Phase	Water Quality Parameters
Construction	<ul style="list-style-type: none"> <li>• Temperature (°C)</li> <li>• pH (pH unit)</li> <li>• Turbidity (NTU)</li> <li>• Water Depth (m)</li> <li>• Dissolved oxygen (DO) (mg/L and % of saturation)</li> <li>• Suspended solids (SS) (mg/L)</li> </ul>

- 6.4.3 It is recommended to carry out sampling at least three times per week to measure turbidity, suspended solids, dissolved oxygen, pH, and water temperature at the control and impact monitoring locations recommended below. The monitoring frequency required shall be reviewed after the first three months and regularly thereafter.
- 6.4.4 In association, other relevant data such as monitoring locations/positions, time, water depth, water temperature, weather conditions, and any special phenomena and work underways should be recorded. A sample monitoring record sheet is shown in Appendix II for reference.

## 6.5 Monitoring Equipment

- 6.5.1 All monitoring equipment shall be provided by the ET and approved by the ER in consultation with the IEC.

### Dissolved Oxygen and Temperature Measuring Equipment

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

### Turbidity Measurement Instrument

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

### Suspended Solids

- 6.5.5 A water sampler comprises a transparent PVC cylinder, with a capacity of not less than 2 litres and can be effectively sealed with latex cups at both ends. The sampler shall

also have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth (e.g. Kahlsico Water Sampler or an approved similar instrument).

- 6.5.6 Water samples for suspended solids measurement should be collected in high density polythene bottles, packed in ice (cooled to 4°C without being frozen), and delivered to the laboratory as soon as possible after collection.

#### pH Meter

- 6.5.7 Measurement of pH level will be recorded in-situ by a pH meter which shall consist of a potentiometer, a glass electrode, a reference electrode and a temperature-compensating device. The range of pH value shall be 0 to 14 with 0.1 as the base unit.

#### Checking and Calibration of Equipment

- 6.5.8 All in-situ monitoring instrument shall be checked, calibrated accordingly before use. The DO meter 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 calibration for a DO meter shall be carried out before measurement at each monitoring location.
- 6.5.9 For the on-site calibration of field equipment, the BS 127:1993, "Guide to Field and on-site test methods for the analysis of waters" shall be observed.
- 6.5.10 Sufficient stocks of spare parts shall be maintained for replacements when necessary. Backup monitoring equipment shall also be made available so that monitoring can proceed uninterrupted even when some equipment is under maintenance, calibration, etc.

### **6.6 Laboratory Measurement / Analysis**

- 6.6.1 Water samples for suspended solids (SS) analysis should be stored in high density polythene bottles with no preservative added, packed in ice (cooled to 4°C without being frozen), delivered to the laboratory, and analysed as soon as possible after collection within 24 hours.
- 6.6.2 Analysis of SS shall be carried out in a HOKLAS or other internationally accredited laboratory. The detection limit of SS shall be 2 mg/L or better. The SS determination shall follow APHA 17ed 2540D or equivalent methods subject to approval of DEP.
- 6.6.3 The testing laboratory shall be HOKLAS accredited (or if not, approved by the ER) and comprehensive quality assurance and control procedures in place in order to ensure quality and consistency in results.
- 6.6.4 If a site laboratory is set up, or a non-HOKLAS and non-international accredited laboratory, is hired for carrying out the laboratory analysis, the laboratory equipment, analytical procedures, and quality control may require to be submitted to the DEP. The ET Leader shall provide the ER and IEC with one copy of the relevant chapters of the "Standard Methods for the Examination of Water and Wastewater" updated edition and any other relevant document for his reference.

### **6.7 Proposed Monitoring Locations**

- 6.7.1 It is recommended to establish control and impact monitoring stations to monitor water quality impact during construction phase. The impact monitoring stations have been selected at locations in vicinity to the construction site that may potentially be affected during the construction phase. Water quality at these locations shall be monitored

during the construction. The control stations have been selected such that they are located within the same water body as the impact monitoring stations but are located outside the area of influence of the works. Data collected from the control stations enables a comparison of the water quality at the potentially impacted site with the ambient water quality.

- 6.7.2 The proposed water quality monitoring stations are shown in Table 6-2. The control stations (C1 to C3) are set at the upstream locations, while monitoring stations W1 to W3 are the corresponding impact stations at the downstream locations of the nearby water courses surrounding the Site. Figure 6-1 presents the approximate locations of the water quality monitoring stations.

**Table 6-2 Locations of Water Quality Monitoring Stations**

Phase	Monitoring Station ID	Description of Monitoring Station	Purpose of the Monitoring Station *	Coordinates of the Monitoring Station **
Construction Phase	C1	Fairview Park Nullah	Serve as the control station at upstream location of construction site and impact station W1	823213.4 838066.3
	W1	Fairview Park Nullah	Serve as the impact station at downstream location of construction site and control station C1	823484.0 837863.9
	C2	Watercourse Along Southern Boundary of Palm Springs	Serve as the control station at upstream location of construction site and impact station W2.	823811.6 837878.2
	W2	Watercourse Along Southern Boundary of Palm Springs	Serve as the impact station at downstream location of construction site and control station C2.	823405.7 838120.9
	C3	Ngau Tam Mei Drainage Channel	Serve as the control station at upstream location of construction site and impact station W3.	823965.6 837782.7
	W3	Ngau Tam Mei Drainage Channel	Serve as the impact station at downstream location of construction site and control station C3	823608.4 837736.5

**Remark:** \* With regard to the above control and impact monitoring stations, the ET Leader shall check the tidal condition at the water quality monitoring locations before each sampling in order to identify water flow direction (e.g. with reference to the tidal information from Hong Kong Observatory and the on-site observation on water flow direction). The tidal condition and water flow direction shall be taken into account in analysing the water sampling results. In case it is identified that the water flow direction is influenced by tidal condition, the ET Leader shall determine which station would represent the control station (upstream of construction site and outside the area of influence of the works) and which station would represent the impact station (downstream of construction site influenced by the works). The ET Leader shall report above findings in the EM&A report.

\*\* HK-Grid 1980 coordinates provided for reference only. Before commencement of water sampling, the ET Leader shall propose the exact monitoring locations and coordinates to the IEC and ER for approval.

- 6.7.3 The status and availability of monitoring locations may change after issuing this Manual. If such cases exist, the appointed ET Leader may propose alternative monitoring locations taking into consideration of the latest status, availability and/or accessibility of the various possible monitoring locations. The ET shall seek approval from the IEC, ER and DEP on the alternative monitoring locations proposed prior to the commencement of the baseline and construction phase sampling programme.
- 6.7.4 When alternative monitoring locations are proposed, they should 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, 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 should be taken to cause minimal disturbance during monitoring; and
  - control station shall be selected at a location to allow a comparison of the water quality at the potentially impacted site with the ambient water quality. The control station shall be selected such that it is located within the same body of water as the impact monitoring station but is located outside the area of influence of the works.
- 6.7.5 Given that the proposed water quality monitoring stations are mostly shallow water courses nearby, it is expected that water samples shall be collected at mid-depth level only. However, in case alternative monitoring stations are proposed by the ET, measurement shall be taken at 3 water depths, except where the water depth less than 6 m, the mid-depth station may be omitted. Should the water depth be less than 3 m, only the mid-depth station shall be monitored.
- 6.7.6 Enough replicates in situ measurements and sample collected from each independent sampling event are required for all parameters to ensure a robust statistically interpretable dataset.
- 6.7.7 The Contractor shall also submit the wastewater effluent discharge plan as stipulated in the Water Discharge License to the ET and the IEC in order to better monitor the effluent discharge of the construction site.
- 6.7.8 The Project Site is surrounded by existing ponds at off-site locations near the north-western, north-eastern, and eastern of the site boundary (see Figure 6-1). Since these ponds are private owned, permission for continuous access for carrying out water quality monitoring during the construction phase is unlikely to be obtained. It is also not practical to seek permission from each private owner before each water sampling. Thus, water quality monitoring is not proposed at these existing ponds. Instead, it is proposed that the ET shall walk over of the active works area and the surroundings (including ponds immediately adjacent to the Project Site) to carry out regular visual inspections during the construction phase. After the construction of the WRA, the visual inspection shall also cover ponds within the WRA to make sure they are not affected by the construction activities within the residential portion of the Project Site. The visual inspection shall include inspection implementation of the runoff and drainage control measures from the works area; inspections of water quality surrounding the site and the project discharge areas. This would prevent potential impacts on nearby environs (e.g. ponds in vicinity of the Project Site) and ensure that the mitigation measures recommended in the EIA are properly implemented. In particular, any brown coloured water or suspended solids laden discharge is considered to be unacceptable, and will trigger the Event and Action Plan. The frequency of visual inspection shall be the same as the impact water quality monitoring (i.e. 3 times per week). Should any suspended solids laden or brown coloured water be identified, the procedures stated in the Event and Action Plan shall be followed and the inspection frequency shall be increased.

## 6.8 Baseline Monitoring

- 6.8.1 Baseline conditions of water quality should be established by the ET and agreed with IEC and DEP. The purposes of the baseline monitoring are to establish ambient conditions prior to the commencement of the works, to demonstrate the suitability of the proposed control and impact monitoring stations, and for establishment of the action and limit levels.
- 6.8.2 The baseline conditions should be established by measuring the water quality parameters specified in section 6.4 above. The measurements shall be taken at all the designated control and monitoring stations, 3 days a week, for a period of 4 weeks

prior to the commencement of construction works. The interval between two sets of monitoring shall not be less than 36 hours, and the baseline monitoring schedule shall be submitted to DEP and IEC at least one week prior to the commencement of the baseline monitoring. Alternative proposal including the sampling frequencies proposed by the ET should be agreed with IEC and DEP in prior.

- 6.8.3 There shall not be any major construction activities in the vicinity of the stations during the baseline monitoring.
- 6.8.4 In exceptional cases when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall seek approval from EPD on an appropriate set of data to be used as baseline reference.

### **6.9 Impact Monitoring**

- 6.9.1 During the course of the construction works, impact monitoring shall be undertaken three days per week, with sampling/measurement at the designated control and impact monitoring stations. The interval between two sets of monitoring shall not be less than 36 hours except where there are exceedances of Action and/or Limit levels, in which case the monitoring frequency shall be increased.
- 6.9.2 Given that the proposed water quality monitoring stations are mostly shallow water courses nearby, it is expected that water samples shall be collected at mid-depth level and the water quality is measured. In case the water depth is very limited, the ET shall take water sample with care in order not to disturb the sediment at the bottom of the water quality monitoring location. If water sampling cannot be undertaken at the monitoring location due to site constraints, ETL shall propose alternative sampling location as far as practicable and seek prior agreement from the IEC and DEP. Record of the condition of the monitoring location shall be taken and reported to justify the decision of not carrying out the sampling.
- 6.9.3 Upon completion of all construction activities, a post project monitoring exercise on water quality shall be carried out for four weeks in the same manner as the impact monitoring. The results of the monitoring shall be presented in the Final EM&A Summary Report.
- 6.9.4 Proposed water quality monitoring schedule shall be faxed to EPD at least 1 week before the first day of the monitoring month. EPD shall also be notified immediately for any changes in schedule by fax.

### **6.10 Event and Action Plan for Water Quality**

- 6.10.1 The water quality criteria, namely Action and Limit levels shall be based on the results of baseline monitoring, the Water Quality Objectives, or based on the results of statistical analysis on the difference between impact monitoring results and the control station. The Action and Limit Levels for water quality is presented in Table 6-3. Should non-compliance of the action or limit levels occur, the ET and Contractor should review and identify the potential source(s) of impact, devise and implement appropriate mitigate measures in a collaborative manner.
- 6.10.2 When the monitoring results of the water quality parameters at any designated monitoring stations exceed the water quality criteria, the actions in accordance with the Event and Action Plan specified in Table 6-4 shall be carried out.

**Table 6-3 Typical Action and Limit Levels for Water Quality**

Parameters	Action	Limit
DO in mg/L (Surface, Middle & Bottom)	<u>Surface &amp; Middle</u> 5%-ile of baseline data for surface and middle layer; or  <u>Bottom</u> 5%-ile of baseline data for bottom layer; or	<u>Surface &amp; Middle</u> 4 mg/L or 1%-ile of baseline data for surface and middle layer  <u>Bottom</u> 2 mg/L or 1%-ile of baseline data for bottom layer
SS in mg/L (depth-averaged)	95%-ile of baseline data or 120% of upstream control station's SS recorded on the same day	99%-ile of baseline data or 130% of upstream control station's SS recorded on the same day
Turbidity (Tby) in NTU (depth-averaged)	95%-ile of baseline data or 120% of upstream control station's turbidity recorded on the same day	99%-ile of baseline data or 130% of upstream control station's turbidity recorded on the same day

**Remark:** The proposed water quality monitoring stations are mostly shallow water courses nearby, it is expected that water samples shall be collected at mid-depth level only (Section 6.9.2 refers). However, action and limit levels for other water depths are also provided in the above table in case alternative monitoring stations are proposed by the ET.

**Table 6-4 Event and Action Plan for Water Quality Monitoring**

EVENT	ACTION			
	ET	IEC	ER	CONTRACTOR
<b>ACTION LEVEL</b>				
Action level being exceeded by one sampling day	<ol style="list-style-type: none"> <li>1. Identify source(s) of impact;</li> <li>2. Inform IEC, contractor and ER;</li> <li>3. Check monitoring data, all plant, equipment and Contractor's working methods;</li> <li>4. Discuss mitigation measures with IEC and Contractor; and</li> <li>5. Repeat measurement on next day of exceedance.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss with ET and Contractor on the mitigation measures.</li> <li>2. Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; and</li> <li>3. Assess the effectiveness of the implemented mitigation measures.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss with IEC on the proposed mitigation measures; and</li> <li>2. Make agreement on the mitigation measures to be implemented.</li> </ol>	<ol style="list-style-type: none"> <li>1. Inform the ER and confirm notification of the non-compliance in writing;</li> <li>2. Rectify unacceptable practice, if any;</li> <li>3. Check all plant and equipment;</li> <li>4. Consider changes of working methods;</li> <li>5. Discuss with ET and IEC and propose mitigation measures;</li> <li>6. Implement the agreed mitigation measures.</li> </ol>
Action level being exceeded by two or more consecutive sampling days	<ol style="list-style-type: none"> <li>1. Identify source(s) of impact;</li> <li>2. Inform IEC, contractor and ER;</li> <li>3. Check monitoring data, all plant, equipment and Contractor's working methods;</li> <li>4. Discuss mitigation measures with IEC, ER and Contractor;</li> <li>5. Ensure mitigation measures are implemented;</li> <li>6. Prepare to increase the monitoring frequency to daily;</li> <li>7. Repeat measurement on next day of exceedance.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss with ET and Contractor on the mitigation measures.</li> <li>2. Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; and</li> <li>3. Assess the effectiveness of the implemented mitigation measures.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss with IEC on the proposed mitigation measures; and</li> <li>2. Make agreement on the mitigation measures to be implemented.</li> <li>3. Assess the effectiveness of the implemented mitigation measures.</li> </ol>	<ol style="list-style-type: none"> <li>1. Inform the ER and confirm notification of the non-compliance in writing;</li> <li>2. Rectify unacceptable practice;</li> <li>3. Check all plant and equipment and</li> <li>4. Consider changes of working methods;</li> <li>5. Discuss with ET and IEC and propose mitigation measures to IEC and ER within 3 working days;</li> <li>6. Implement the agreed mitigation measures.</li> </ol>

EVENT	ACTION			
	ET	IEC	ER	CONTRACTOR
<b>Limit Level</b>				
Limit level being exceeded by one sampling day	<ol style="list-style-type: none"> <li>1. Repeat measurement on next day of exceedance to confirm findings;</li> <li>2. Identify source(s) of impact;</li> <li>3. Inform IEC, contractor, ER and EPD;</li> <li>4. Check monitoring data, all plant, equipment and Contractor's working methods;</li> <li>5. Ensure mitigation measures are implemented; and</li> <li>6. Discuss mitigation measures with IEC, ER and Contractor;</li> </ol>	<ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET and Contractor's working methods;</li> <li>2. Discuss with ET and Contractor on possible mitigation measures; and</li> <li>3. Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly.</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing;</li> <li>2. Discuss with IEC, ET and Contractor on the proposed mitigation;</li> <li>3. Request Contractor to critically review the working methods;</li> <li>4. Make agreement on mitigation measures to be implemented; and</li> <li>5. Ensure mitigation measures are properly implemented.</li> </ol>	<ol style="list-style-type: none"> <li>1. Inform the ER and confirm notification of the non-compliance in writing;</li> <li>2. Rectify unacceptable practice;</li> <li>3. Check all plant and equipment and consider changes of working methods;</li> <li>4. Discuss with ET, IEC and ER and propose mitigation measures to ER and IEC within 3 working days; and</li> <li>5. Implement the agreed mitigation measures.</li> </ol>
Limit level being exceeded by two or more consecutive sampling days	<ol style="list-style-type: none"> <li>1. Repeat measurement on next day of exceedance to confirm findings;</li> <li>2. Identify source(s) of impact;</li> <li>3. Inform IEC, contractor, ER and EPD;</li> <li>4. Check monitoring data, all plant, equipment and Contractor's working methods;</li> <li>5. Discuss mitigation measures with IEC, ER and Contractor;</li> <li>6. Ensure mitigation measures are implemented; and</li> <li>7. Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET and Contractor's working methods.</li> <li>2. Discuss with ET and Contractor on possible mitigation measures;</li> <li>3. Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly; and</li> <li>4. Supervise the implementation of mitigation measures.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss with IEC, ET and Contractor on the proposed mitigation measures;</li> <li>2. Request Contractor to critically review the working methods;</li> <li>3. Make agreement on the mitigation measures to be implemented;</li> <li>4. Ensure mitigation measures are properly implemented; and</li> <li>5. Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the construction activities until no exceedance of Limit level.</li> </ol>	<ol style="list-style-type: none"> <li>1. Inform the ER and confirm notification of the non-compliance in writing;</li> <li>2. Take immediate action to avoid further exceedance;</li> <li>3. Discuss with ET, IEC and ER and propose mitigation measures to ER and IEC within 3 working days;</li> <li>4. Implement the agreed mitigation measures;</li> <li>5. Resubmit proposals of mitigation measures if problem still not under control; and</li> <li>6. As directed by the ER, to slow down or to stop all or part of the construction activities until no exceedance of Limit level.</li> </ol>

## 7. SEWERAGE AND SEWAGE TREATMENT

### 7.1 Introduction

- 7.1.1 The sewage generated from the Project Area will be conveyed to a terminal manhole located at the southern boundary of the Project Area which will further connect to the 500 mm diameter proposed public sewer at Yau Pok Road (Figure 7-1 refers).
- 7.1.2 Provision of on-site sewage treatment plant as an interim scheme to handle the sewage generated from the development before the availability of public sewerage for connection is therefore proposed (Figure 7-2).
- 7.1.3 The on-site sewage treatment plant is for temporary use during the interim period only in case the public sewerage cannot be commenced on time. The sewerage system within the development area will be designed to facilitate the future connection to the planned Ngau Tam Mei sewerage system with the flow direction to be controlled by flow control devices. Once the government public sewerage system becomes available, the on-site sewage treatment plant will be decommissioned. Switching over from the interim system to the permanent system will be done by regulating the flow direction through operations of the flow control devices and abandoning the sewer leading to the interim STP.
- 7.1.4 The operation and maintenance requirements of the interim sewage treatment plant has been identified and summarised below.

### 7.2 EM&A Requirements

- 7.2.1 The sewage generated from the Project Area will be conveyed to a terminal manhole located at the southern boundary of the Project Area which will further connect to the 525 mm diameter proposed public sewer at Yau Pok Road. The tentative location of terminal manhole is shown in Figure 7-1.
- 7.2.2 Since the timing which the sewerage system of the development could only be connected to the public sewerage system is uncertain. Therefore, it is necessary to consider the provision of the on-site sewage treatment facility, as mentioned in Section 3.9.4 of the EIA - Study Brief as an interim measure to handle the sewage generated from the development until connection to public sewerage by DSD is available.
- 7.2.3 The interim STP will be provided by the Project Proponent while the operation and maintenance will be responsible by the property management office (PMO) of the development (and its contractors) under the supervision of the Incorporated Owners (IO). The Project Proponent will also be responsible for connecting the sewerage system of the development to the public system when it is available and decommission the interim STP. While the operation and maintenance will be carried out by the future PMO and the IO, the Project Proponent would assume the responsibilities of all the mitigation measures contained in the EIA report including the employment of ET and IEC for the EM&A works during the operation of the interim STP only until an agreement is reached between the Project Proponent and relevant parties on the funding, implementation, management and maintenance of mitigation measures.
- 7.2.4 It should also be pointed out that the on-site sewage treatment plant is for temporary use during the interim period only in case the public sewerage cannot be commenced on time. The sewerage system within the development area will be designed to facilitate the future connection to the planned Ngau Tam Mei sewerage system with the flow direction to be controlled by several flow control devices such as valves or stop-log, etc. Switching over from the interim system to the permanent system will be done by regulating the flow direction through operations of the flow control devices and abandoning the sewer leading to the interim STP. Residual sewage left in the interim STP would be tanked away and the abandoned STP and downstream sewers will be filled up with soil and concrete. Therefore, there should be no discharge of sewage

discharge into the nearby water body during decommissioning of the interim STP. To minimize disturbance to the residents, all sewers for connection to the public system within the development will also be constructed at the initial stage.

- 7.2.5 In this regard, membrane bioreactor (MBR) plus reverse osmosis (RO) supplement with denitrification process and coagulation by metal salt to precipitate soluble phosphorus is proposed for the on-site treatment facility.
- 7.2.6 At the downstream of MBR system, Reverse Osmosis (RO) system is proposed to further polish the MBR effluent and eliminate the residual pollution loads of the interim STP. RO system is a proven membrane technology used for the removal of dissolved constituents. RO membrane module with pore sizes from 0.1 to 1nm can act as a barrier to all dissolved salts, inorganic molecules as well as organic molecules with a molecular weight greater than approximately 300 under the high operating pressures up to 100 bars. This treatment technology is well-established for drinking water treatment, wastewater reuse, seawater desalination, and other industrial applications.
- 7.2.7 Once the government public sewerage system becomes available, the on-site sewage treatment plant will be decommissioned.
- 7.2.8 Proper operation and maintenance of interim sewage treatment plant is essential to safeguard the quality of discharge effluent, subject to the following aspects:
- (i) Only competent technicians to be employed by the property management office to operate the STP. They are to be fully conversant with the operating procedures as stipulated in the operation and maintenance manuals.
  - (ii) The proposed STP only serves the proposed development and thus the operation and maintenance (O&M) cost would be borne by the future management office of the development. The Project Proponent will ensure the design of STP is cost-effective such that the O&M cost imposed is reasonable.
  - (iii) The STP is to be kept in a tidy state. This includes regular hosing down, scraping of the walkways, whitewashing the walls, cleaning and painting the metalwork, and maintaining adequate lighting and ventilation.
  - (iv) Where parts of the STP are sited beneath ground, forced ventilation will be provided.
  - (v) An easily accessible sampling point will be provided for taking samples of the treated effluent.
  - (vi) Samples of treated effluent will be taken regularly and tested according to the discharge license under the Water Pollution Control Ordinance as well as the conditions specified in the Environmental Permit of this Project under the EIAO in order to ensure compliance with discharge standards.
  - (vii) The production of sludge is estimated to be 6m<sup>3</sup>/d and RO concentrate generated is estimated to be 20% of the RO which is 32m<sup>3</sup>/d.
  - (viii) Based on reference to other similar projects, the dewatered sludge will be collected by a licensed collector at regular intervals and disposed at the landfill. As an alternative to on-site dewatering of sludge, sludge could be transferred by tankers to Government's STW for off-site treatment due to its small quantity. Provided that the handling, storage and disposal of the wastes are properly managed and accidental release to the surrounding environment does not occur, adverse environmental impacts are not expected. In any case our sludge handling arrangement will be in compliance with requirements of the Water Pollution Control Ordinance (WPCO). Such approach for sludge disposal has also been adopted for some other projects, such as "Liantang / Heung Yuen Wai Boundary Control Point and Associated Works", "Redeveloped Lo Wu Correctional Institution" and "CLP Black Point Power Station".

- (ix) The Project Proponent will be responsible for the future sewer connection to the public sewer upon its available in the future and STP decommissioning with connection details subject to agreement of DSD. Appropriate conditions could be imposed in the Environmental Permit (EP) to ensure the EP holder to take up the responsibility to ensure connection to public sewer when trunk sewer is ready.
- (x) The obsolete STP and the connecting sewer will be filled up by soil and concrete once decommissioned.

The discharge of treated effluent from the interim STP should follow the licence requirements under the WPCO as well as the conditions specified in the Environmental Permit of this Project under the EIAO. Samples of treated effluent will be taken regularly and tested by a HOKLAS or other internationally accredited laboratory according to the above-mentioned requirements to ensure compliance with discharge standards.

7.2.9 The following measures will be adopted in order to eliminate adverse impact due to potential sewage overflow, emergencies discharge and change in flow regime beyond the expectation of this assessment:

- (i) Adequate spare parts for the plant will have to be made readily available by storage.
- (ii) Qualified personnel will be hired to inspect the condition and maintain the plant on a regular basis.
- (iii) Regular test, maintenance and replacement of membranes, plants and equipment will be carried out in accordance to the recommendations from manufacturers or as recommended by the qualified personnel after inspection.
- (iv) Equalization tank with capacity of 443 m<sup>3</sup> (i.e. 3 x ADWF) will be provided to withhold the sewage temporarily in case of outage or overflow of the interim STP.
- (v) Tank away will be provided for prolonged outage of the interim STP, for disposal of sewage at designated sewage treatment works to be assigned by DSD

7.2.10 Operation and maintenance requirements of the interim sewage treatment plant have been provided in the EIA, which are also reproduced in Appendix I for implementation. With these measures in place, the EIA indicates that no adverse sewerage impact will be incurred as a result of the development.

7.2.11 Measures regarding sewage generated by the workforce during the construction phase are already addressed in Chapter 6 above.

### 7.3 Monitoring Requirements

7.3.1 During operation of the STP, samples of treated effluent will be taken regularly and tested according to the discharge licence under the Water Pollution Control Ordinance as well as the conditions specified in the Environmental Permit (EP) of this Project to ensure compliance with relevant discharge standards. The sampling frequency and parameters shall follow the licence conditions under the WPCO as well as the EP conditions of this Project. As an indication, it is proposed that the sampling works are carried out on monthly basis during the first 3 months' of operation of the STP. After that, the STP operation is stabilised and sampling shall be carried out quarterly. The monitoring frequency and parameters are subject to the discharge licence and the EP condition, but the following has provided a guideline.

**Table 7-1 Treated Effluent Monitoring Parameters**

Phase	Monitoring Parameters
Operation of STP	<ul style="list-style-type: none"> <li>• BOD<sub>5</sub></li> <li>• TSS</li> <li>• NH<sub>3</sub>-N</li> <li>• TN-N</li> <li>• E.coli</li> <li>• TP</li> </ul>

**Remark:** The above parameters are selected for assessment in the EIA report.

7.3.2 ET shall be responsible for the sampling works, and the sampling and testing shall be carried out by a HOKLAS or other internationally accredited laboratory. Should any in-situ measurements be required, all monitoring equipment shall be provided by the ET and approved by the IEC, and the equipment requirements stated in Sections 6.5 and 6.6 shall be followed. Prior to the commencement of sampling works, the ET Leader shall agree the sampling location(s) with the IEC and EPD. The EM&A results shall be prepared by the ET Leader and endorsed by the IEC, and submitted to EPD and other authorities which may be required in the EP/ licence. The frequency of reporting and the required time frame shall conform to the licence requirements under WPCO as well as requirements in the EP. Once the government public sewerage system becomes available and the on-site STP is decommissioned, ET Leader shall seek IEC and EPD's approval to cease the sampling works, and the EM&A works can be terminated.

7.3.3 While the operation and maintenance of the STP will be carried out by the property management office and its contractors, ET shall liaise with the relevant parties to make sure the operation of the STP is effective and all the mitigation measures are implemented. The Action and Limit Levels for the monitoring of discharge from the STP is provided in Table 7-2. The proposed RO Permeate quality of this Project has been adopted as the Limit Level to fulfil the no net increase in pollution loading requirement in Deep Bay. While 90 percentile of the Limit Level has been proposed as the Action Level.

**Table 7-2 Action and Limit Levels for Treated Effluent Discharge**

Parameters	Action Level *	Limit Level **
• BOD <sub>5</sub>	3.2	3.5
• TSS	2	2
• NH <sub>3</sub> -N	0.45	0.5
• TN-N	0.9	1.0
• E.coli	0	0
• TP	0.1	0.1

**Remark:** The unit of above parameters is mg/L, except E.coli (no./ 100ml).

\* Based on 90%-ile of the Limit Level except TSS and TP, which is based on the lowest detention limit by a local HOKLAS laboratory. Thus, exceedance of the specified value for TSS and TP would imply exceedance of both the Action and Limit Levels.

\*\* Proposed RO permeate quality of the STP as extracted from Table 6-6 of the EIA report.

7.3.4 In case exceedance of the Action Level/ Limit Levels, ET and the PMO (and its contractor(s)) should review and identify the potential source(s) of impact, devise and implement appropriate mitigate measures in a collaborative manner. The event and action plan detailed blow shall be implemented by the relevant parties. Should a confirmed exceedance of the Limit Level is identified, EPD shall be notified. Discharge of treated effluent will then be suspended and all sewage will be diverted to the equalization tank for temporary storage until the problem is rectified. And if prolonged outage of the interim STP is anticipated, tankers will be arranged to transport the sewage for disposal at designated sewage treatment works to be assigned by DSD.



**Table 7-3 Event and Action Plan for Treated Effluent Discharge**

EVENT	ACTION			
	ET	IEC	PMO (and its contractor) *	IO *
<b>ACTION LEVEL</b>				
Action level being exceeded by one sampling	<ol style="list-style-type: none"> <li>1. Confirm findings with the laboratory;</li> <li>2. Identify source(s) of impact;</li> <li>3. Inform IEC, PMO and IO;</li> <li>4. Check with PMO that all plant, equipment, and working methods are properly implemented/ followed;</li> <li>5. Discuss follow up actions with IEC and PMO; and</li> <li>6. Repeat measurement on next day of exceedance.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss with ET and PMO on follow up actions.</li> <li>2. Review proposals on follow up actions submitted by PMO and advise the IO accordingly; and</li> <li>3. Assess the effectiveness of the implemented follow up actions.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check all plant and equipment;</li> <li>2. Rectify unacceptable practice, if any;</li> <li>3. Discuss with ET and IEC, and propose follow up actions; and</li> <li>4. Implement the agreed follow up actions.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss with PMO and IEC on the proposed follow up actions; and</li> <li>2. Make agreement on the follow up actions to be implemented.</li> </ol>
Action level being exceeded by two or more consecutive samplings	<ol style="list-style-type: none"> <li>1. Confirm findings with the laboratory;</li> <li>2. Identify source(s) of impact;</li> <li>3. Inform IEC, PMO and IO;</li> <li>4. Check with PMO that all plant, equipment, and working methods are properly implemented/ followed;</li> <li>5. Discuss follow up actions with IEC and PMO;</li> <li>6. Repeat measurement on next day of exceedance; and</li> <li>7. Ensure follow actions are implemented.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss with ET and PMO on the follow up actions and agree on time frame.</li> <li>2. Review proposals on follow up actions submitted by PMO and advise the IO accordingly;</li> <li>3. Confirm with ET the implementation of follow up actions; and</li> <li>4. Assess the effectiveness of the implemented follow up actions.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check all plant and equipment;</li> <li>2. Rectify unacceptable practice, if any;</li> <li>3. Discuss with ET and IEC, and propose follow up actions; and</li> <li>4. Implement the agreed actions and within the agreed time frame.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss with PMO and IEC on the proposed follow up actions;</li> <li>2. Make agreement on the follow up actions to be implemented and the time frame; and</li> <li>3. Assess the effectiveness of the implemented actions with the IEC.</li> </ol>

EVENT	ACTION			
	ET	IEC	PMO (and its contractor) *	IO *
<b>Limit Level</b>				
Limit level being exceeded by one sampling	<ol style="list-style-type: none"> <li>1. Confirm findings with the laboratory;</li> <li>2. Identify source(s) of impact;</li> <li>3. Inform IEC, PMO, IO, and EPD;</li> <li>4. Check with PMO that all plant, equipment and working methods are properly implemented/ followed;</li> <li>5. Discuss mitigation measures with IEC, PMO and IO;</li> <li>6. Ensure mitigation measures are implemented within the agreed time frame;</li> <li>7. Repeat measurement upon resume of operation of the STP.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and confirm monitoring data submitted by ET;</li> <li>2. Notify EPD;</li> <li>3. Discuss with ET, PMO and IO on mitigation measures;</li> <li>4. Review the proposed mitigation measures submitted by PMO and advise the IO accordingly;</li> <li>5. Confirm with ET the implementation of mitigation measures;</li> <li>6. Assess the effectiveness of the implemented mitigation measures; and</li> <li>7. In case of a confirmed exceedance of Limit Level, advise the PMO and IO to suspend the discharge of the treated effluent from the STP and to divert sewage to the equalization tank for temporarily storage until the problem is rectified.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check all plant and equipment;</li> <li>2. Rectify unacceptable practice, if any;</li> <li>3. Discuss with ET and IEC on the proposed mitigation measures;</li> <li>4. Ensure mitigation measures are properly implemented within the agreed time frame; and</li> <li>5. Suspend the discharge of treated effluent upon a confirmed exceedance of Limit Level and the advice from the IEC and IO. Sewage to be diverted to equalization tank for temporarily storage.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss with PMO and IEC on the proposed mitigation measures;</li> <li>2. Make agreement on mitigation measures to be implemented and the time frame;</li> <li>3. Assess the effectiveness of the implemented actions with the IEC;</li> <li>4. Request PMO to critically review the operation of the plant and to make sure the plant operates effectively;</li> <li>5. Instruct the PMO to suspend the discharge of treated effluent upon advice from the IEC, and to divert sewage to the equalization tank for temporarily storage.</li> </ol>
Limit level being exceeded by two or more consecutive samplings	<ol style="list-style-type: none"> <li>1. Confirm findings with the laboratory;</li> <li>2. Identify source(s) of impact;</li> <li>3. Inform IEC, PMO, IO, and EPD;</li> <li>4. Check with PMO that all plant, equipment and working methods are properly implemented/ followed;</li> <li>5. Discuss mitigation measures with IEC, PMO and IO;</li> <li>6. Ensure mitigation measures are implemented within the agreed time frame;</li> <li>7. Repeat measurement upon resume of operation of the STP.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and confirm monitoring data submitted by ET;</li> <li>2. Notify EPD;</li> <li>3. Discuss with ET, PMO and IO on mitigation measures;</li> <li>4. Review the proposed mitigation measures submitted by PMO and advise the IO accordingly;</li> <li>5. Supervise the implementation of mitigation measures;</li> <li>6. Assess the effectiveness of the implemented mitigation measures;</li> <li>7. In case of a confirmed exceedance of Limit Level, advise the PMO and IO to suspend the discharge of the treated effluent from the STP and to divert sewage to the equalization tank for temporarily storage until the problem is rectified; and</li> <li>8. In case of prolonged outage of the STP, advise the PMO and IO to transport sewage for disposal at designed sewage treatment works to be assigned by DSD.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check all plant and equipment;</li> <li>2. Rectify unacceptable practice, if any;</li> <li>3. Discuss with ET and IEC on the proposed mitigation measures;</li> <li>4. Ensure mitigation measures are properly implemented within the agreed time frame;</li> <li>5. Suspend the discharge of treated effluent upon a confirmed exceedance of Limit Level and the advice from the IEC and IO. Sewage to be diverted to equalization tank for temporarily storage; and</li> <li>6. In case of prolonged outage of the STP to transport sewage for disposal at designed sewage treatment works to be assigned by DSD.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss with PMO and IEC on the proposed mitigation measures;</li> <li>2. Make agreement on mitigation measures to be implemented and the time frame;</li> <li>3. Assess the effectiveness of the implemented actions with the IEC;</li> <li>4. Request PMO to critically review the operation of the plant and to make sure the plant operates effectively;</li> <li>5. Instruct the PMO to suspend the discharge of treated effluent upon advice from the IEC, and to divert sewage to the equalization tank for temporarily storage; and</li> <li>6. In case of prolonged outage of the STP, instruct the PMO to transport sewage for disposal at designed sewage treatment works to be assigned by DSD.</li> </ol>

Remark: \* The Project Proponent would assume the responsibilities of the IO and PMO until an agreement is reached between the Project Proponent and relevant parties on the funding, implementation, management and maintenance of mitigation measures.

## **8. WASTE MANAGEMENT**

### **8.1 General Requirements**

- 8.1.1 The contractor is responsible for waste control within the construction site, removal of the waste material produced from the site and implementation of any mitigation measures to minimize waste or redress problems arising from waste generated on the site.
- 8.1.2 The Contractor shall also pay attention to the Waste Disposal Ordinance, the Dumping at Sea Ordinance, the Public Health and Municipal Services Ordinance and the Water Pollution Control Ordinance, and carry out the appropriate waste management work. The relevant licence/permit, such as the effluent discharge licence, the chemical waste producer registration, etc. shall be obtained.
- 8.1.3 Waste management measures have been proposed in the Project EIA report. These measures are also reproduced in Appendix I, which shall be implemented for this Project.

### **8.2 During Detailed Design**

- 8.2.1 The demolition and construction work shall be considered in the planning and design stages to reduce the generation of Construction and Demolition (C&D) waste where possible. Landfill disposal shall only be considered as the last resort.
- 8.2.2 Construction methods with minimum waste generation quantity and other environmental impacts shall be considered in the detailed design.
- 8.2.3 Refuse collection points (RCP) will be provided for the residential development. In order to comply with Building Regulation, mechanical ventilation will be provided. The odour nuisance to the public can be minimized by incorporating the odour absorption system.

### **8.3 Waste Management Measures During Construction**

- 8.3.1 As discussed above, waste management/ control measures are provided in Appendix I for implementation. Some of the recommended waste management/ control measures are presented below.
- 8.3.2 The excavated material may be generated during site clearance and site formation stages, which should be sorted on-site and could be reused as part of the filled material, or for the landscape area or the formation of vegetation bund within the Wetland Restoration Area given the quality of these materials should suffice the required uses, and is subject to detailed design stage. The remaining inert portion and non-inert portion of C&D waste will be disposed of at public fill facility and landfill site, respectively, where necessary. It should be noted that landfill disposal shall only be considered as the last resort.
- 8.3.3 Demolition material would be generated from clearance of a small number of huts on-site. A “selective demolition” approach shall be adopted so that reusable material such as wood, metal, and steel can be segregated for reuse or recycling as far as practicable. Inert building debris such as concrete and brick can also be reused on-site as lining or fill material. The remaining part comprising of degradable waste shall be properly disposed of at landfills.
- 8.3.4 Nevertheless, the generation of wastes from these materials shall be minimized as far as practicable through recovery, reuse and/ or recycling. Whenever practicable, the production of construction waste due to over-ordering or as “side-products” of construction activities shall be minimized by the contractor through careful design, planning, good site management, control of ordering procedures, segregation and reuse of materials.

- 8.3.5 Wooden boards can be reused on-site or off-site, though the reusability and quantity of final waste will depend on the quality, size and shape of the boards. Those timbers which cannot be reused again shall be sorted and stored separately from all inert waste before disposed of at landfills.
- 8.3.6 Should construction site hoarding be erected, metal fencing or building panels, which are more durable than wooden panels, are recommended to be used as far as practicable. Opportunity shall also be sought to re-use any wooden boards used in site fencing on-site or off-site. Concrete and masonry can be crushed and used as fill material if practicable. On-site incineration of wooden waste is prohibited.
- 8.3.7 In order to avoid dust, odour and erosion impacts, all stockpile areas at the Project Area shall be covered with tarpaulin or impermeable sheets. Any vehicle carrying C&D waste shall have their load covered when leaving the works area. Vehicles shall be routed as far as possible to avoid sensitive receivers in the area.
- 8.3.8 General refuse generated at the construction site shall be stored separately from construction and chemical wastes to avoid cross contamination. A reliable waste collector shall be employed by the Contractor to remove general refuse from the construction site on a daily basis where appropriate to minimize the potential odour, pest and litter impacts.
- 8.3.9 Open burning for the disposal of construction waste or the clearance of the Project Area in preparation for construction work is prohibited under the Air Pollution Control (Open Burning) Regulation.
- 8.3.10 Upon appointment, the main contractor of each construction contract shall prepare and implement a Waste Management Plan (WMP), which shall be developed and incorporated in the Environmental Management Plan (EMP) to be prepared for this Project in accordance with ETWB TCW No. 19/2005 – Environmental Management on Construction Sites which should describe the arrangements for avoidance, reuse, recovery, recycling, storage, collection, treatment and disposal of different categories of waste to be generated from the construction activities. Such a management plan should incorporate site specific factors, such as the designation of areas for segregation and temporary storage of reusable and recyclable materials. The EMP should be submitted to the Engineer for approval. The contractor shall implement the waste management practices in the EMP throughout the construction stage of the Project. The EMP shall be reviewed regularly and updated (preferably monthly) by the contractor. The EMP shall take into account the recommended mitigation measures in the EIA Report.
- 8.3.11 The EMP shall provide recommendations for appropriate disposal routes if waste cannot be recycled. The EMP shall include the method statement for demolition and transportation of the excavated materials and other construction wastes. The EMP shall be approved before the commencement of construction. All mitigation measures arising from the approved EMP shall be fully implemented. The project proponent will ensure that the day-to-day operations comply with the approved EMP. According to the EMP, the project proponent shall control the disposal of public fill, C&D materials and C&D waste to public fill reception facilities, sorting facilities and landfills respectively through a trip-ticket system. The project proponent shall require the contractor to separate public fill from C&D waste for disposal at appropriate facilities. In addition, the project proponent shall record the disposal, reuse and recycling of C&D materials for monitoring purposes.
- 8.3.12 In formulating the EMP in respect to waste management, the following hierarchy should be considered:
- Avoidance and minimization to reduce the potential quantity of C&D materials generated;
  - Reuse of materials as practical as possible;

- Recovery and Recycling as practical as possible;
  - Proper treatment and disposal in respect to relevant laws, guidelines and good practice; and
  - Landfill disposal shall only be considered as the last resort.
- 8.3.13 Based on the above waste management options, a good management and control plan would be formulated. Good management and control can prevent the generation of significant amount of waste. On-site sorting of construction wastes will be recommended. Secondary on-site sorting can be achieved by avoiding the generation of “mixed waste” through good site control. Construction wastes shall be sorted to remove contaminants, with the inert materials broken up into small pieces before being transported to landfill sites.
- 8.3.14 Construction methods with minimum waste generation quantity and other environmental impacts shall be considered.
- 8.3.15 In addition, the contractor(s) shall be required to reuse inert C&D materials (e.g. excavated soil) or in other suitable construction sites as far as possible, in order to minimize the disposal of C&D materials to public fill reception facilities. The project proponent shall encourage the contractor to maximize the use of recycled or recyclable C&D materials, as well as the use of non-timber formwork to further minimize the generation of construction waste.
- 8.3.16 The following additional control/ mitigation measures are recommended to be followed by the Contractor:
- Storage of different waste types – different types of waste should be segregated and stored in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal. An on-site temporary storage area equipped with required control measures (e.g. dust) should be provided;
  - Trip-ticket system – in order to monitor the proper disposal of non-inert C&D waste to landfills and to control fly-tipping, a trip-ticket system should be included as one of the contractual requirements and audited by the Environmental Team;
  - Records of Wastes – a recording system for the amount of wastes generated, recycled and disposed (including the disposal sites) should be proposed;
  - Training – The contractor should provide his workers with proper training of appropriate waste management procedure to achieve waste reduction as far as practicable and cost-effective through recovery, reuse and recycling and avoid contamination of reusable C&D materials;
  - Incorporate the “Recommended Pollution Control Clauses for Construction Contracts” in respect to removal of waste material from the construction site into the contract of the contractor.

No excavation of pond sediment is expected due to the Project works, however, in case such pond sediment is encountered during construction, testing and disposal of excavated sediment shall follow the requirements in PNAP ADV-21<sup>4</sup>, where appropriate. The stockpiled malodorous materials should be covered entirely by plastic tarpaulin sheets and removed from Project Area as soon as possible within 24 hours. Disposal of excavated sediment shall follow the requirements stated in Buildings Department’s PNAP ADV-21 for “Management Framework for Disposal of Dredged/ Excavated Sediment”.

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<sup>4</sup> PNAP ADV-21, Management framework for disposal of dredged/ excavated sediment, April 2007 version, published by Buildings Departments.

*Waste minimisation*

- 8.3.17 The Contractor shall submit to the Engineer for approval a waste management plan with appropriate mitigation measures including the allocation of an area for waste segregation and shall ensure that the day-to-day site operations comply with the approved waste management plan.
- 8.3.18 The Contractor shall minimize the generation of waste from his work. Avoidance and minimisation of waste generation can be achieved through changing or improving design and practices, careful planning and good site management.
- 8.3.19 The Contractor shall ensure that different types of wastes are segregated on-site and stored in different containers, skips or stockpiles to facilitate reuse/recycling of waste and, as the last resort, disposal at different outlets as appropriate.
- 8.3.20 Excavated top soil materials due to retaining wall construction shall be reused on-site for the site formation of developable area, formation of landscape area within the developable area or the construction of the wetland area. Therefore, it is expected that there will not be any disposal of the excavated material. In case there is any surplus excavated material or the concerned material is found not suitable for re-use on-site, this will be disposed of at public fill facility. Landfilling will only be the last resort in any case.
- 8.3.21 The reuse and recycling of waste shall be practised as far as possible. The recycled materials shall include paper/cardboard, timber and metal etc.
- 8.3.22 The Contractor shall ensure that Construction and Demolition (C&D) materials are sorted into public fill (inert portion) and C&D waste (non-inert portion). The public fill which comprises soil, rock, concrete, brick, cement plaster/mortar, inert building debris, aggregates and asphalt shall be reused in earth filling, reclamation or site formation works. The C&D waste which comprises metal, timber, paper, glass, junk and general garbage shall be reused or recycled and, as the last resort, disposal of at landfills.
- 8.3.23 The Contractor shall record the amount of wastes generated, recycled and disposed of (including the disposal sites).
- 8.3.24 The Contractor shall use a trip ticket system for the disposal of C&D materials to any designated public filling facility and/or landfill.
- 8.3.25 Training shall be provided for workers about the concepts of site cleanliness and appropriate waste management procedure, including waste reduction, reuse and recycling.
- 8.3.26 Spent bentonite slurries, if any, will be handled and disposed of properly in accordance with the requirements set out in the Practice Note for Professional Persons (PN1/94) Construction Site Drainage.

*Waste Nuisance Control*

- 8.3.27 The Contractor shall not permit any sewage, waste water or effluent containing sand, cement, silt or any other suspended or dissolved material to flow from the Project Area onto any adjoining land or allow any waste matter [or refuse] which is not part of the final product from waste processing plants to be deposited anywhere within the Project Area [or onto any adjoining land]. He shall arrange removal of such matter from the Project Area [or any building erected or to be erected thereon] in a proper manner to the satisfaction of the Engineer in consultation with the Director of Environmental Protection

### *Chemical Waste Control*

- 8.3.28 The Contractor shall observe and comply with the Waste Disposal (Chemical Waste) (General) Regulation for handling, storage and disposal of chemical wastes.
- 8.3.29 The Contractor shall apply for registration as chemical waste producer under the Waste Disposal (Chemical Waste) (General) Regulation when chemical waste is produced. All chemical waste shall be properly stored, labelled, packaged and collected in accordance with the Regulation.
- 8.3.30 The Contractor shall prevent fuel and lubricating oil leakage from plant and storage sites from contaminating the construction site. All compounds in work areas shall be positioned on areas with hard paving and served by drainage facility. Sand/ silt traps and oil interceptors shall be provided at appropriate locations prior to the discharge points.
- 8.3.31 If off-site disposal of chemical waste is required, they shall be collected and delivered by licensed contractors to Tsing Yi Chemical Waste Treatment Facility and be disposed of in strict accordance with the Waste Disposal (Chemical Waste) (General) Regulation. Contractors shall register with EPD as chemical waste producers when disposal of chemical waste is anticipated to be required. Chemical waste materials have to be stored on-site with suitable containers and away from water bodies so that leakage or spillage is prevented during the handling, storage, and subsequent transportation.

## **8.4 Waste Management Measures During Operation**

- 8.4.1 Refuse collection points (RCP) will be provided for the residential development. In order to comply with Building Regulation, mechanical ventilation will be provided. The odour nuisance to the public can be minimized by incorporating the odour absorption system. With proper management and maintenance of the waste facilities, possible leachate impact from the RCP is not anticipated.
- 8.4.2 Collection bins for used aluminium cans, waste paper and glass bottles should be provided at strategic locations of the residential development area to promote and encourage recycling by residents during the operational phase.

## **8.5 Site Audit**

- 8.5.1 The implementation schedule of the recommended mitigation measures is presented in Appendix I.
- 8.5.2 During the site inspections and the document review procedures as mentioned in this manual (Section 11 refers), the ET shall pay special attention to the issues relating to waste management, and check whether the Contractor has implemented the recommended mitigation measures.
- 8.5.3 Auditing should be carried out periodically to determine if waste is being managed in accordance with prescribed waste management procedures and the EMP. The audits should examine all aspects of waste management including waste generation, storage, recycling, treatment, transportation, and disposal. The general site inspections including waste management issues will be undertaken weekly by the ET to check all construction activities for compliance with all appropriate environmental protection and pollution control measures, including those set up in the EMP. Meanwhile, waste management audit will also be carried out as part of the monthly audit by the IEC.

## **9. LANDSCAPE AND VISUAL**

### **9.1 Introduction**

- 9.1.1 The potential impacts on landscape and visual amenity originate from construction works (including materials stockpiling, excavation, and other construction activities) as well as from built structures. As the identified impacts are of limited significance, the recommended mitigation measures would be sufficient in rectifying residual impacts due to the development of the Project. Details of the suggested mitigation measures are given below.
- 9.1.2 It is recommended that EM&A for landscape and visual resources is undertaken during the design, construction and operational phases of the project. The design, implementation and maintenance of landscape mitigation measures should be monitored to ensure that they are fully realised and that potential conflicts between the proposed landscape mitigation measures and any other project works and operational requirements are resolved at the earliest possible stage without compromise to the intent of the mitigation measures. Implementation management and maintenance of the mitigation measures recommended by the EIA will be monitored through the site audit programme.

### **9.2 Mitigation Measures**

- 9.2.1 The Landscape and Visual Impact Assessment (LVIA) of the EIA recommended a series of mitigation measures for the construction and operation stages to ameliorate the landscape and visual impacts of the project. The plan of landscape and visual mitigation measures extracted from the EIA report, is presented in Figure 9-1.
- 9.2.2 The measures for both the construction and operation stage as recommended in the EIA are summarised in Table 9-1 to Table 9-5 below, which shall be adopted during the detailed design, and be built as part of the construction works so that they are in place at the date of commissioning of the Project. A programme for the mitigation measures as well as the agencies responsible for the funding, implementation, management and maintenance of the mitigation measures are provided.

An indicative list of species appropriate for mitigation planting is provided in Table 9-5 below. The planting within the Wetland Restoration Area has been provided in Appendix III of this Manual, which is also reproduced in Table 9-5 for reference.



**Table 9-1 Proposed Landscape Enhancement/ Mitigation Measures – Construction Phase**

ID No.	Landscape Mitigation Measure	Funding Agency	Implementation Agency
<b>CM1</b>	<p><b>Proper protection of existing trees designated to be retained in-situ</b></p> <p>Existing trees designated to be retained in-situ will be properly protected. This may include the clear demarcation and fencing-off of tree protection zones, tight site supervision and monitoring to prevent tree damage by construction activities, and periodic arboricultural inspection and maintenance to uphold tree health. A total of 6 nos. of trees will be retained in-situ (refer to Appendix 11-1 in EIA report; Broad brush Tree Schedule 1). Other trees mostly are growing in raised ridges or slopes between ponds and vegetable fields, which result in difficulties for tree to be retained or transplanted.</p>	Project Proponent	Project Proponent (via Contractor)
<b>CM2</b>	<p><b>Enhancement of Wetland/Pond Area Expansion</b></p> <p>Existing abandoned wetland/ pond area will be expanded and enhanced into a larger and comprehensive wetland restoration area. The enhancement works of wetland/pond will be commenced in early stage to establish the migration of some ecological habitats. Along the interfaces between the proposed residential areas and the WRA, it is proposed to erect a 3m high perimeter temporary fence/ hoarding to define the site and prevent unauthorized access. This perimeter temporary fence/hoarding will be buffered by planting of moderate to tall sized trees and shrub. Enhancement of the wetland/pond will result in the increase of the wetland/pond area from its current 3.0 ha to around 3.8 ha.</p>	Project Proponent	Project Proponent (via Contractor)

**Table 9-2 Proposed Visual Enhancement / Mitigation Measures – Construction Phase**

ID No.	Visual Mitigation Measures	Funding Agency	Implementation Agency
<b>CM3</b>	The height of temporary noise barrier along development boundary is kept to the minimum required. Temporary Noise Barrier finishes and materials will be re-used from the approved existing temporary noise barrier from Wo Shang Wai project which have an opaque and non-reflective material with colour blending in with the environment to minimize visual impact and to avoid bird strike.	Project proponent	Project proponent (via Contractor)
<b>CM4</b>	Advance screen planting of fast growing large shrub and ground cover species to noise barriers and hoardings.	Project proponent	Project proponent (via Contractor)
<b>CM5</b>	Control of night-time lighting by hooding all lights.	Project proponent	Project proponent (via Contractor)
<b>CM6</b>	Reduction of construction period to practical minimum.	Project proponent	Project proponent (via Contractor)

**Table 9-3 Proposed Landscape Enhancement/ Mitigation Measures – Operation Phase**

ID No.	Landscape and Visual Mitigation Measure	Funding Agency	Implementation Agency	Management Agency	Maintenance Agency
OM1	<p><b>Maximizing Tree Preservation Effort</b></p> <p>Healthy existing trees that are not affected by the proposed development will be retained in-situ. Affected existing trees that are of high to medium amenity value and high to medium survival rate after transplanting will be transplanted.</p>	Project proponent	Project proponent	Project Proponent	Project Proponent
OM2	<p><b>Provision of New Trees</b></p> <p>Compensatory tree planting shall be provided for soft landscape in the proposed development. The tree compensation to tree loss ratio shall be at least 1:1 in term of quantity and quality within the Project Site. Required numbers and locations of compensatory trees shall be determined and agreed separately with Government during the Tree Felling Application process under ETWBTC 3/2006.</p>	<p><u>Wetland Restoration Area</u></p> <p>Project Proponent</p>	<p><u>Wetland Restoration Area</u></p> <p>Project Proponent</p>	<p><u>Wetland Restoration Area</u></p> <p>Project Proponent</p>	<p><u>Wetland Restoration Area</u></p> <p>Project Proponent</p>
		<p><u>Residential Area</u></p> <p>Project Proponent</p>	<p><u>Residential Area</u></p> <p>Project Proponent</p>	<p><u>Residential Area</u></p> <p>Project Proponent</p>	<p><u>Residential Area</u></p> <p>Project Proponent</p>
OM3	<p><b>Suitable Design for WRA and Residential Development</b></p> <p>The landscape design for the wetland restoration area in the north and western portion of the Project Site will be maximised for wetland habitat restoration consistent with achieving other parameters and the design on the residential development on the center to south western portion of the Project Site will adopt a rural, naturalistic approach with open space to compliment the original landscape character. Emphasis will be placed on a balanced approach between trees and grass/herbs. Use native species will be proposed for the planting design theme. No access is allowed for unauthorized person. Along the interfaces between the proposed to erect a 1.8m high fence wall. Natural materials, such as timbers, will be mostly used for landscape hardworks. Management and maintenance of the WRA shall be carried out by a separate unit from the residential estate and follow the specifications in Section 5.5 of Appendix 8-10.</p>	Project Proponent	Project Proponent	Competent Conservation Agent identified by Project Proponent	Competent Conservation Agent identified by Project Proponent
OM4	<p><b>Provision of Buffer Planting along WRA</b></p> <p>Tree and shrub planting will be provided at strategic locations along the WRA to ensure connectivity with the adjacent habitats while minimising potential disturbance impact to the wetland.</p>	Project Proponent	Project Proponent	Competent Conservation Agent identified by Project Proponent	Competent Conservation Agent identified by Project Proponent

**Table 9-4 Proposed Visual Enhancement / Mitigation Measures – Operation Phase**

ID No.	Visual Mitigation Measures	Funding Agency	Implementation Agency	Management Agency	Maintenance Agency
OM5	<b>Continuous belt of screen planting within the Project Site</b> Continuous buffer planting along the south-western and southern boundary of the Project Site and along the edge of residential area adjacent to WRA will be provided and planted outside the fence/boundary wall by featuring trees capable of reaching a height >10m within 10 years.	Project Proponent	Project Proponent	Incorporated Owners	Management Company
OM6	Use appropriate (visually unobtrusive and non-reflective) building materials and colours in built structures.	Project proponent	Project proponent	Private Owners	Private Owners
OM7	Streetscape elements (e.g. paving, signage, street furniture, lighting etc.) sensitively designed in a manner that responds to the local context, and minimizes potential negative landscape and visual impacts. Lighting units to be directional and minimizing unnecessary light spill.	Project proponent	Project proponent	Owners Committee	Management Company

**Table 9-5 Indicative Mitigation Planting Species for Different Areas**

Screen/Buffer Planting (Boundary)		
<u>Trees</u> <i>Acacia auriculiformis</i> <i>Casuarina equisetifolia</i> <i>Celtis sinensis</i> *) <i>Eucalyptus citriodora</i> <i>Sapium sebiferum</i> *) <i>Sterculia lanceolata</i> *)	<u>Palms / Bamboos</u> <i>Chrysalidocarpus lutescens</i> <i>Bambusa textilis</i> <i>Bambusa vulgaris</i> ‘Striata’	<u>Shrubs</u> <i>Schefflera arboricola</i> <i>Gardenia jasminoides</i> *) <i>Ligustrum sinensis</i> *) <i>Ficus microcarpa</i> ‘Golden Leaves’ <i>Murraya paniculata</i> <i>Melastoma candidum</i> *) <i>Raphiolepis indica</i> *) <i>Rhodomyrtus tomentosa</i> *)
Street Trees		
<i>Aleurites moluccana</i> <i>Bauhinia variegata</i> <i>Bischofia javanica</i> *) <i>Cinnamomum burmanii</i> +)	<i>Elaeocarpus balansae</i> <i>Grevillea robusta</i> <i>Spathodea campanulata</i>	<i>Melaleuca quinquenervia</i> <i>Peltophorum pterocarpum</i>
Garden and Amenity Planting		
<u>Trees</u> <i>Bauhinia blakeana</i> *) <i>Bombax ceiba</i>	<u>Shrubs</u> <i>Breynia nivosa</i> <i>Buddleja asiatica</i> *)	<u>Groundcover</u> <i>Asclepias curassavica</i> <i>Asparagus sprengeri</i>

<p><i>Cassia surattensis</i> <i>Crateva unilocularis</i> <i>Delonix regia</i> <i>Elaeocarpus hainanensis</i> <i>Ficus benjamina</i> <i>Gordonia axillaris</i> *) <i>Litsea glutinosa</i> *) <i>Machillus breviflora</i> *) <i>Magnolia grandiflora</i> <i>Mallotus paniculatus</i> *) <i>Melia azedarach</i> <i>Michelia alba</i> <i>Plumeria rubra var. Acutifolia</i> <i>Reevesia thyrsoidea</i> *) <i>Schefflera heptaphylla</i> *) <i>Schima superba</i> *) <i>Spathodea campanulata</i></p>	<p><i>Camellia japonica</i> <i>Cuphea hyssopifolia</i> <i>Gardenia jasminoides</i>*) <i>Hibiscus tiliaceus</i>*) <i>Hypericum chinense</i> <i>Iris tectorum</i> <i>Ixora stricta</i> <i>Jasminum sambac</i> <i>Ligustrum sinensis</i> *) <i>Melastoma candidum</i>*) <i>Osmanthus fragrans</i> <i>Russelia equisetiformis</i> <i>Rhaphiolepis indica</i>*) <i>Rhododendron simsii</i>*) <i>Rhodomyrtus tomentosa</i>*) <i>Spathiphyllum</i> sp.</p>	<p><i>Hymenocallis littoralis</i>*) <i>Lantana montevidensis</i> <i>Liriope spicata</i>*) <i>Nephrolepis hirsutula</i>*) <i>Portulaca oleracea</i>*) <i>Rhoeo discolor</i> <i>Setcreasea purpurea</i> <i>Syngonium</i> sp. <i>Tracheloepermum jasminioides</i>*) <i>Zephyranthus carinata</i></p>
Planting Within Wetland Restoration Area		
<p><u>Shallow Water Mix</u> <i>Cyperus malaccensis</i>*) <i>Eleocharis spiralis</i>*) <i>Juncus effusus</i>*) <i>Ludwigia adscendens</i>*) <i>Polygonum barbatum</i>*) <i>Schoenoplectus triangulatus</i>*)</p> <p><u>Reed bed Species</u> <i>Phragmites australis</i></p> <p><u>Marsh Mix</u> <i>Bacopa monnieri</i>*) <i>Commelina diffusa</i>*) <i>Eleocharis spiralis</i>*) <i>Panicum repens</i>*) <i>Ludwigia adscendens</i>*) <i>Ludwigia octovalvis</i>*) <i>Polygonum barbatum</i>*) <i>Polygonum glabrum</i>*)</p>	<p><u>Grassy Bund Mix</u> <i>Paspalum paspaloides</i>*) <i>Cynodon dactylon</i>*)</p> <p><u>Bamboo Clump</u> <i>Bambusa eutuldoides</i></p> <p><u>Wooded Bund (between residential area and proposed marsh and reed habitats at Areas 17, 18, A1 and A2)</u> Shrub: <i>Gardenia jasminoides</i>*) <i>Ilex asprella</i>*) <i>Ilex pubescens</i>*) <i>Ligustrum sinensis</i> *) <i>Melastoma candidum</i>*) <i>Rhaphiolepis indica</i>*) <i>Rhodomyrtus tomentosa</i>*)</p> <p>Trees: <i>Hibiscus tiliaceus</i>*) <i>Livistona chinensis</i></p>	<p><u>Wooded Bund (along herpetofauna corridor buffer)</u> Shrub <i>Rhodomyrtus tomentosa</i>*) <i>Gardenia jasminoides</i>*) <i>Ilex pubescens</i>*) <i>Melastoma candidum</i>*) <i>Ligustrum sinensis</i> *)</p> <p>Tree <i>Hibiscus tiliaceus</i>*) <i>Livistona chinensis</i> <i>Sapium sebiferum</i>*) <i>Sterculia lanceolata</i>*)</p> <p><u>Wooded Bund (around Area 40)</u> Shrub: <i>Hibiscus tiliaceus</i>*) <i>Rhodomyrtus tomentosa</i>*) <i>Melastoma candidum</i>*)</p> <p>Trees: <i>Celtis sinensis</i>*) <i>Cleistocalyx operculatus</i> <i>Sapium sebiferum</i>*) <i>Sterculia lanceolata</i>*) <i>Ligustrum sinensis</i> *)</p>

\*) Native species

### 9.3 Landscape/ Ecological Enhancement Measures

- 9.3.1 Further to the mitigation measures outlined above, the northern part of the Project Site along the adjacent boundary is proposed as a Wetland Restoration Area (ecological ponds and marsh/reedbed areas) with a total area of 3.8ha. These increase ponds and marsh/reedbed areas will also ecological value to wildlife and benefit to the project site, and the wider area.
- 9.3.2 The ponds and marsh/reedbed areas will consist mainly of open deep water with some emergent vegetation around the pond fringes. Access will be restricted except for management or maintenance purposes only. The entire Wetland Restoration Area will be screened by tree and shrub planting to ensure that the ecological functionality of the pond and marsh/reedbed areas is not adversely affected by visitors. Visitor interaction with the Pond area will be limited to broken views through the buffer planting (Figure 11-18 in the EIA report) (Also in Figure 9-1 of this Manual).
- 9.3.3 A Wetland Restoration Plan for the proposed enhancement measure has also been prepared and presented in Section 10 of this Manual.

### 9.4 Design Phase Audit

- 9.4.1 The landscape measures proposed within the EIA to mitigate the landscape and visual impacts of the scheme should be embodied in the detailed landscape design drawings and contract documents including the protection of existing trees, the restoration and minor extension of existing wetland and the planting of new trees and shrubs. Designs should be checked to ensure that the measures are fully incorporated and that potential conflicts with civil engineering, structures, lighting, signage, drainage, underground utilities and operational requirements are resolved prior to construction.
- 9.4.2 The design phase EM&A requirements for landscape and visual resources comprise the audit of the detailed landscaping drawings and specifications to be prepared during the detailed design together with ensuring that the design is sensitive to landscape and visual impacts as required under mitigation measures. Monitoring of design works against the recommendations of the landscape and visual impact assessments within the EIA should be undertaken when the designs are produced to ensure that they fulfil the intentions of mitigation measures.
- 9.4.3 Audits shall be carried out by a Registered Landscape Architect, as a member of the ET. The landscape auditor shall review the designs at two points in time:
- when the first draft of design drawings is prepared; and
  - when the draft Tender Documents are prepared.
- 9.4.4 The auditor shall liaise with the Landscape Architect and Project Engineer to ensure all measures have been incorporated in the design in a format that can be specified to the Contractor for implementation. In the event of a non-conformity, the Event/Action plan as detailed in Table 9.4 below should be followed.

**Table 9-6 Event/Action Plan for Design Phase**

Action Level	Landscape Auditor	Project Engineer (ER)	Project Landscape Architect (PLA)
Non Conformity (with Design Standards and Specification)	<ul style="list-style-type: none"> <li>Identify Source</li> <li>Inform ER and PLA</li> <li>Discuss remedial actions with ER, PLA</li> <li>Verify remedial actions when complete</li> </ul>	<ul style="list-style-type: none"> <li>Notify PLA</li> <li>Discuss remedial actions with PLA</li> <li>Ensure remedial designs are fully incorporated</li> </ul>	<ul style="list-style-type: none"> <li>Amend designs</li> <li>Discuss remedial actions with ER</li> </ul>

**9.5 Baseline Monitoring**

9.5.1 Baseline monitoring for the landscape and visual resources will comprise checking and updating of:

- Landscape resources identified in the EIA, elements of particular concern to be re-checked and any changes identified;
- habitat maps in the EIA; and
- Landscape and visual impact assessments included in the EIA Report, to include updated photos of any LCAs and LRs which have changed since the EIA was carried out.

9.5.2 The baseline monitoring shall be carried out by a qualified person of the ET. The landscape and visual baseline will be confirmed with reference to the above. The baseline monitoring report shall be audited by a Registered Landscape Architect, as a member of the ET. The qualification of proposed Registered Landscape Architect shall be submitted to the ER for approval and agreed with the IEC.

**9.6 Construction and Operation Phase Audit**

9.6.1 A specialist Landscape Sub-Contractor (on the approved Government list) shall be employed by the Contractor for the implementation of landscape construction works and subsequent maintenance operations during the establishment period. Advance planting and wetland formation will be conducted within the first half of the construction contract. Thus, the establishment works will be undertaken through the latter half of the construction contract and extend throughout the Contractor’s one year maintenance period which will fall within the first operational year of the project. The intention is to provide at least a 12 month establishment period for the majority of the landscape works. After that, the management and maintenance works will be carried out by the agents specified in Table 9-1 to Table 9-4 above.

9.6.2 All measures undertaken by both the Contractor and the specialist Landscape Sub-Contractor during the construction phase and first year of the operational phase shall be audited by a Registered Landscape Architect, as a member of the ET, on a regular basis to ensure compliance with the intended aims of the mitigation measures. The qualification of proposed Registered Landscape Architect shall be submitted to the ER for approval and agreed with the IEC. Site inspections should be undertaken at least once every two weeks throughout the construction period and once every two months during the operational phase.

9.6.3 The broad scope of the audit is detailed below but should also be undertaken with reference to the more specific checklist provided in Table 9-7. Operational phase auditing will be restricted to the last 12 months of the establishment works of the landscaping proposals and thus only those items below concerning this period are relevant to the operational phase.

- The extent of the agreed works area should be checked regularly during the construction phase and any trespass by the Contractor beyond the limit of the works, including any damage to existing trees and woodland, shall be noted.
- The progress of the engineering works should be regularly reviewed on site to identify the earliest practical opportunities for the landscape works to be undertaken.
- All existing vegetation, streams, ponds and other features within the study area which are not directly affected by the works should be retained and protected.
- The methods of protecting existing vegetation proposed by the Contractor should be acceptable and enforced.
- Preparation, lifting, transport and re-planting operations for any transplanted trees should comply with approved methods and relevant standards.
- The design and construction of buildings should conform to requirements of the EIA.
- All landscaping works should be carried out in accordance with the EIA and with approved specifications.
- Planting of new trees, shrubs, groundcover, climbers, grasses and other plants, together with the replanting of any transplanted trees, should be carried out within the right season and according to approved methods and relevant standards.
- All necessary horticultural operations and replacement planting should be undertaken throughout the Establishment Period to ensure the healthy establishment and growth of both transplanted trees and all new plants.

**Table 9-7 Construction/Operation Audit Checklist**

Area of Works	Items to be Monitored
Works Area	Check the extent of the Works to ensure that the Works Area is not exceeded.
Protection of all trees and woodland blocks to be retained	Identify and demarcate trees / vegetation to be retained, erect physical protection (e.g. fencing), monitor against possible incursion, physical damage, fire, pollution, surface erosion, etc.
Streams and ponds	Ensure no run-off into existing streams or ponds.
Clearance of existing vegetation	Identify and demarcate trees / vegetation to be cleared, check extent of works to minimize damage, monitor adjacent areas against possible incursion, physical damage, fire, pollution, surface erosion, etc.
Topsoil stripping	Ensure existing topsoil is stripped and stored under recognised good practice and is hydroseeded and regularly turned to prevent anaerobic conditions.
New buildings	Ensure no buildings are greater than 3 storeys and that finish treatments comply with mitigation requirements.
Boundaries	Ensure hoarding and noise barriers are erected as required.
Night-time lighting	Ensure night-time lighting is directional (away from VSRs), hooded and shielded.
Plant supply	Monitor operations relating to the supply of specialist plant material (including the collection, germination and growth of plants from seed) to ensure that plants will be available in time to be used within the construction works.
Landscape and wetland treatments generally	Check that wetland and hard / soft landscape designs conform to intent of mitigation measures and agreed designs.
Soiling, planting, etc.	Monitor implementation and maintenance of soiling and planting works against possible incursion, physical damage, fire, pollution, surface erosion, etc.
Establishment Works	Monitor implementation of maintenance operations during Establishment Period.



9.6.4 In the event of non-compliance the responsibilities of the relevant parties are detailed in the Event/Action Plan provided on Table 9-8 below:

**Table 9-8 Event/Action Plan for Construction/Operation Phase**

Action Level	ET	IEC	ER	Contractor
Non-conformity on one occasion	<ol style="list-style-type: none"> <li>1. Identify source.</li> <li>2. Inform IEC and ER.</li> <li>3. Discuss remedial actions with IEC, ER and Contractor.</li> <li>4. Monitor remedial actions until rectification has been completed.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check report.</li> <li>2. Check Contractor's working method.</li> <li>3. Discuss possible remedial measures with ES and Contractor.</li> <li>4. Advise the ER on effectiveness of proposed remedial measures.</li> <li>5. Check implementation of remedial measures.</li> </ol>	<ol style="list-style-type: none"> <li>1. Notify Contractor.</li> <li>2. Ensure remedial measures are properly implemented.</li> </ol>	<ol style="list-style-type: none"> <li>1. Amend working methods.</li> <li>2. Rectify damage and undertake any necessary replacement.</li> </ol>
Repeated Non-conformity	<ol style="list-style-type: none"> <li>1. Identify source.</li> <li>2. Inform Project Proponent, IEC and ER. Inform EPD as necessary.</li> <li>3. Increase monitoring frequency.</li> <li>4. Discuss remedial actions with IEC, ER and Contractor.</li> <li>5. Monitor remedial actions until rectification has been completed.</li> <li>6. If exceedance stops, cease additional monitoring.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check monitoring report.</li> <li>2. Check Contractor's working method.</li> <li>3. Discuss possible remedial measures with ES and Contractor.</li> <li>4. Advise ER on effectiveness of proposed remedial measures.</li> <li>5. Supervise implementation of remedial measures.</li> </ol>	<ol style="list-style-type: none"> <li>1. Notify Contractor.</li> <li>2. Ensure remedial measures are properly implemented.</li> </ol>	<ol style="list-style-type: none"> <li>1. Amend working methods.</li> <li>2. Rectify damage and undertake any necessary replacement.</li> </ol>

## 10. ECOLOGICAL MITIGATION

### 10.1 Introduction

- 10.1.1 Apart from the residential development, wetland restoration within the Project Area is also a major objective of the Project. A Wetland Restoration Area (WRA) has been designated within the Project Area and the long-term management requirement has been detailed in the Wetland Restoration Plan of the EIA report (also reproduced in Appendix III of this Manual).
- 10.1.2 The ecological assessment carried out in the EIA study has addressed the ecological consequences of the development and concluded that the overall ecological impacts would be low with a net ecological gain following the completion of the Project. Some negative impacts are expected during the construction phase. However, such potential impacts on the ecology shall be minimized with proper management and monitoring programs as scheduled in the Wetland Restoration Plan.

#### EM&A Requirements

- 10.1.3 The following paragraphs describe some general EM&A recommendations of the WRA and mitigation measures proposed in the EIA report. While the following information shall also be referred to for both the construction and operational phase requirements, which shall be implemented accordingly:
- Requirements of the WRA (both construction and operation phases), and the proposed design of the WRA are provided in a Wetland Restoration Plan in Appendix III of this Manual, which shall be referred to for implementation. For ease of reference, this Wetland Restoration Plan is reproduced and attached in Appendix III of this Manual; and
  - An implementation schedule of recommended measures in the EIA that will need to be implemented, is reproduced in Appendix I of this EM&A Manual.

### 10.2 Establishment of Wetland Restoration Area

- 10.2.1 The habitats in the north of the Project Area (including ponds, marsh, seasonally wet grassland and agricultural land) will be retained and enhanced. Wetland compensation will be provided for the residual loss of wetland habitats within the Project Area. In addition, a strip of Wetland & Visual Buffer will be provided at the WBA-side of the development (along the interface between WCA and WBA) according to the TPB PG No.12C.
- 10.2.2 A total of 3.8 ha of wetland habitat will be enhanced / restored within the (WRA. The design of wetland within the WRA is such that the overall wetland function of the Project Area will be increased in comparison to existing conditions. Details of the design rationale and management and monitoring methodologies for these wetland habitats within the WRA are given in the Wetland Restoration Plan in Appendix III and the layout is shown in Figure 10-2. Table 8-39 to Table 8-46 of the EIA also describe the functions of each proposed wetland habitat within the WRA.
- 10.2.3 In addition to protect an existing flight line, and to conform with the principles of “No-Net-Loss in Wetland” and avoidance of pond filling or other works detrimental to the wetland ecological function, the existing isolated Area 40 (currently utilized for cultivating ornamental carp) will be retained. Further, the proposed residential development will set back about 9 m to 19m from the north eastern boundary adjoining area 20 for an ecological corridor connecting Area 40 and the restored wetland at A1. This ecological corridor will function together with the abutting area 20 outside the Project Area as a whole to form an extension of wetland from the WCA to the drainage channel. Area 40 will then become part of the functional wetland system in Deep Bay Area (see Section 2 of the EIA and Appendix III of this Manual).

- 10.2.4 The main WRA is situated on the northern side of the Project Area, comprising three deep water ponds separated by grassy bunds and bordered by areas of shallow water (except the pond located in Pond 18). Several gravel islands are situated in the shallow water zones, with two bamboo clumps planted in the middle of the south-westernmost gravel island. Several clumps of bamboo will also be planted in the northern and south-western boundaries of the Area. Three marsh cells are proposed in the southeast of the WRA and separated by grassy bunds. To minimize disturbance, the main WRA will be buffered from the proposed development by wooded bund and/or reed, and from the existing development in the north by grassy bund/reedbed.
- 10.2.5 Wooded bunds will be constructed by planting of trees and shrubs along the boundaries of the marsh, reedbed where it interfaces the residential portion, and around Area 40.
- 10.2.6 Area 40 will be re-profiled as a pond with shallow and deep water surrounded by wooded planting, which will provide screening from human disturbance created by activity in adjacent residential buildings and the proposed cycle track to the south. The ecological corridor between Area 40 and the main WRA, in the form of shallow water lined with reedbed, would further serve as an additional buffer to the strip of WCA to the east of the Project Area.
- 10.2.7 Clear demarcation of the Project Area limits is required in order to minimize and contain any disturbance during the construction period. Special attention will be paid to the northern and north-western limits of the Project Area, which are adjacent to the inactive/abandoned ponds connected with the Deep Bay wetland system. These pond areas and the associated wildlife are regarded as ecologically sensitive receivers from the proposed development.
- 10.2.8 Reedbed and wooded bund habitats, fenced by a perimeter fence of 1.8 m high on the landward side, will be formed along the interface between the WRA and the proposed residential area. Together with landscape planting and (any) retention of existing trees along the interface, mature reedbed and moderate-sized shrubs and trees will minimize disturbance to waterbirds in the open water zones and marshy habitats. In order to ensure that direct human disturbance to waterbirds in the adjacent wetlands will be avoided as far as possible, no unsupervised public access into the WRA and the adjacent ponds will be allowed.
- 10.2.9 On the boundary between the WRA and the adjacent ponds outside the Project Area a 1.8 m high wire mesh fence will be formed to prevent unsupervised public access from surrounding footpaths without reducing ecological continuity and connectivity with the adjacent wetland habitats.
- 10.2.10 To ensure the continuity of habitats for wetland-dependent taxa, in particular herpetofauna, and to fulfil the 'No-Net-Loss' of wetland habitats criterion, the following measures safeguarding the continuity of wetland habitats will be implemented:
- Provision of wetland habitats in a unit contiguous and continuous with the existing ponds in the west and east including measures to restore linkages between (currently isolated) Area 40 and the wider wetland system;
  - Avoidance of anthropogenic structures in the boundaries adjacent to the existing wetland habitats, and employment of natural barriers such as grassy bund, reedbed and (wet) wooded planting, which will serve as potential roosting and foraging sites for many species; and
  - Concentration of the proposed development in the south and west of the Project Area, adjacent to existing anthropogenic habitats (Yau Pok Road and Fairview Park) to reduce additional anthropogenic impacts to a minimum
- 10.2.11 The detailed rationale of formulating the target species for the WRA is given in Section 4.2 of Appendix III, and a summary of the target species is also shown in Table 8-51 of

the EIA.

### **10.3 Mitigation Measures for Construction of WRA**

- 10.3.1 Construction of the Wetland Restoration Area will involve temporary occupation of wetland habitats within the Project Area. Noise and increased human disturbance arising from the construction of WRA will deter the utilisation of wetland habitat in proximity to the WRA by disturbance-sensitive species (mostly large waterbirds).

#### *Provision of Temporary Wetland Enhancement Area*

- 10.3.2 Impacts of temporary loss of foraging area to the wetland-dependent bird species due to the temporary occupation of wetland habitats are minimized by the provision of temporary wetland enhancement area (see Figure 10-1).
- 10.3.3 This temporary wetland enhancement area will be located at the south-western part of the Project Area by the utilization of an area of existing agricultural land in the west of the Project Area for the temporary provision of shallow water pond (0.75ha) and marsh (0.35ha) during WRA construction. Only, minor adjustments to the existing agricultural regime following traditional wetland agricultural practices will be necessary.
- 10.3.4 The temporary wetland enhancement area will provide shallow water and marsh habitat by practicing traditional wetland agricultural practices. The operation of this temporary wetland enhancement area will cease after the completion of the construction and planting/ replacement planting works of the WRA.

#### *Construction Program*

- 10.3.5 The re-profiling of the WRA will be conducted during the first year of construction and prior to the main construction of the proposed residential development, and will be conducted during the wet season to minimize impacts and disturbance to wetland birds during the period of greatest abundance of waterbirds.

#### *Suppression on Noise and Light Pollution*

- 10.3.6 A temporary hoarding and a movable noise barrier will be erected around the WRA during re-profiling to minimize the noise impact due to the site formation and construction of the WRA. Utilization of quiet equipment is also expected to minimize the noise impacts to waterbirds. Night-time light disturbance will be minimized by limiting the amount of lighting on the Project Area and by locating light sources away from the adjacent ponds.

### **10.4 Mitigation Measures for Construction Phase**

- 10.4.1 Mitigation measures adopted during the construction phase are proposed in accordance with Annex 16 of the TM on EIAO. The proposed mitigation measures adopted are based on the principles of avoidance and minimisation of any impacts and/or disturbance on the environment.

#### *Mitigation Measures for Construction Phase*

- 10.4.2 As the main ecological impacts are predicted to be habitat loss and disturbance to wildlife during construction, the following mitigation measures would be implemented:

#### *Clear definition of Project Area limits*

- 10.4.3 Clear demarcation of the Project Area limits is required in order to minimize and contain any disturbance during the construction period. Special attention will be paid to the

northern and north-western limits of the Project Area, which are adjacent to the inactive/abandoned ponds connected with the Deep Bay wetland system. These pond areas and the associated wildlife are regarded as ecologically sensitive receivers from the proposed development.

- 10.4.4 The WRA boundary will be delineated during the wetland construction stage. A temporary hoarding will be established to reduce disturbance to off-site habitats and wildlife. During the following 1.5 years of establishment and stabilization of the wetland establishment phase, the temporary hoarding will be replaced with a 1.8 m high fence in order to prevent disturbance to the WRA resulting from access by human and dogs.

*Mitigation Measures for Human/Dog Disturbance to the Newly Formed WRA During Construction Phase*

- 10.4.5 No dogs are allowed on the newly formed WRA at all time. Human access is strictly restricted to the required ecological monitoring work and other management/maintenance of the WRA only.

*Suppression on dust and noise, and avoidance of water pollution*

- 10.4.6 Good site practice for dust and noise suppression should be strictly implemented to ensure that disturbance to adjacent ecologically sensitive habitats is restricted to acceptable levels. Required measures include establishing a temporary hoarding at the northern and north-western side of the Project Area, which is close to the pond habitat, during the construction period of the WRA. Acceptable noise level for wildlife will be achieved in parallel with that required to meet standards for nearby residential areas by following traditional wetland agricultural practice within the WRA and use of quieter plant and temporary/movable noise barriers during construction of the WRA. In addition, the established WRA will act as a buffer between the existing pond areas and the proposed residential development within the Project Area until construction is completed. The hoarding will be retained between the WRA and the remainder of the Project Area throughout the construction period to avoid visual disturbance and reduce noise and dust emissions.
- 10.4.7 During the construction of the residential development, a noise barrier will be established around the whole Project Area (except the WRA) and along the interface between the WRA and the residential development. This would reduce the noise disturbance to an acceptable level for the wildlife and meet standards for nearby residential areas.
- 10.4.8 Design of the temporary noise barriers should include elements which would reduce potential bird collision impact, such as the use of opaque, non-reflective materials and colour that blend in with the environment.
- 10.4.9 Standard good practice site management measures to prevent pollution of ponds by waste, dust and polluted run-off will be required during the construction period. The requirement of appropriate design of the surface water collection system and efficient sewerage management have been specified in Sections 6.2 and 6.3 in order to eliminate on-site run-off to the Channel and Deep Bay system. Any contaminated water and sediment within the site should be removed and not discharged to the WRA or watercourses or wetlands outside the Project Area.

*Construction Program*

- 10.4.10 Site clearance and site formation works of the WRA would be undertaken during the first wet season to avoid disturbance to birds during the dry season. Construction will progress cell by cell and once formation of each cell has been completed planting will be undertaken, thus condensing the WRA construction period to one wet season.

During the second wet season, any replacement planting and plant maintenance would be undertaken. By the start of the second dry season all plants should be established and water levels should be at the operational maximum; at this point the wetland itself should be established and start to function.

- 10.4.11 Planting work will be undertaken progressively in the constructed wetland habitats as formation works are completed sequentially in each cell. Temporary hoarding will remain in place during this period, although the types of activities being undertaken are unlikely to result in significant disturbance to wildlife.
- 10.4.12 The year following construction of the WRA will be the wetland establishment period. The temporary hoarding around the WRA will be removed so that the WRA will be able to integrate with adjacent wetlands and will provide a buffer from ongoing construction work.

#### *Reusing on-site material*

- 10.4.13 Soil and plants on site should be reused as far as possible. A temporary on-site area for storing these re-usable materials should be identified and established at the beginning of construction in order to prevent sediment runoff into nearby watercourses. Relevant requirements for re-use of excavated materials and for controlling surface runoff have been provided in relevant sections of this Manual. As the proposed wetland restoration design requires re-profiling and transforming farmland into freshwater marsh, topsoil will be sorted and those that is suitable for re-use on-site should be stored and reused for constructing the lower-lying freshwater marsh as far as possible. Surplus materials will be disposed of at public facility or landfill site where applicable.

#### *Water source for the open water habitat in the WRA*

- 10.4.14 The sole source of water for the open pond habitat in the WRA is rainwater. Therefore, subject to confirmation that this will not result in saline intrusion, the deepest point of this habitat will be increased to approximately 0.0mPD (to allow an average water depth of 1.5-2.0m in deep water areas) to increase water storage capacity in the dry season.

#### *Construction of the WRA*

- 10.4.15 It is expected that the period from commencement of construction of the restored wetland to it being fully operational will be approximately 1.5 years (See Section 10.4.10 above). The restored wetland will act as a buffer to screen the residential area, which is a source of anthropogenic disturbance, from the Wetland Conservation Area (WCA) and integrate with and complementary to the existing wetland habitats to the northwest of the Project Area. The habitats provided within the WRA, including deep water pond with shallow water zone, marsh, reedbed, wooded bund, grassy bund, bamboo clump and gravel, will provide suitable roosting, feeding and breeding grounds for not only the target species, but also a suite of species of conservation importance with similar habitats preferences. The proposed WRA not only provide suitable habitats for the wildlife, but also indirectly enhance the ecological functions of the adjoining wetland habitats within the WCA. No operational impacts on the adjoining wetland systems within the WCA are expected.

## **10.5 Mitigation Measures for Operational Phase**

### *Establishment of WRA*

- 10.5.1 As discussed in Section 8 of the EIA report, significant adverse ecological impacts from the Project will be avoided by following the guiding principles listed in Section 8.10 of the EIA report. There will be no net loss in wetland area and no loss of ponds in the

Project. However, there will be some minor operational impacts including the loss of habitats (the agricultural land for amphibians during the breeding season) and disturbance to wildlife. Species that potentially receive significant impacts from the proposed development are Little Egret, Chinese Pond Heron, Greater Painted-snipe (included on a precautionary basis), Red-throated Pipit and amphibians.

- 10.5.2 The WRA is established to avoid, minimize and mitigate the habitat loss and direct impacts on the target species. The WRA is located at the northern portion of the Project Area and is connected with the existing continuous and contiguous wetland habitats in the Deep Bay Area. The WRA will act as a buffer between the existing wetland systems to the northwest of the Project Area and the proposed residential development and will integrate with and be complementary to these existing wetland habitats.
- 10.5.3 In addition, during WRA construction, a temporary wetland enhancement area, in the form of marsh and shallow water ponds, will be formed in the western part of the Project Area providing temporary refuge for amphibians and suitable foraging habitat for target bird species.
- 10.5.4 The objectives of the establishment of the WRA are:
- To buffer the existing wetland habitats to the northwest of the Project Area from the proposed residential development;
  - To protect these off-site wetland habitats by avoiding direct interference between these wetlands and the proposed residential development; and
  - To provide a mixture of micro-habitats that meets the habitat requirements for the target species and a number of wetland-dependent or associated wildlife.
- 10.5.5 The area of the WRA will be 3.8 ha to mitigate the loss of existing wetland areas within the Project Area (details see Section 4.4 of Appendix III). In addition to the habitat loss, the WRA is designed to mitigate for on-site and off-site disturbance during construction and operational phases as identified in Section 8 of the EIA report. The habitats within the WRA will be designed specifically to meet the habitat requirement of the target species rather than simply restore specific habitats of ecological value.
- 10.5.6 The target species have been selected after a review of the existing ecological interest of the site and its environs, the potential adverse impacts of the residential development on habitats and species of conservation importance, and the opportunities and constraints on the Project Area. Species that were only recorded on occasion and with low to negligible impacts are not included in the selection of the target species. Under these criteria, four bird species and a fauna group are selected:
- Little Egret
  - Chinese Pond Heron
  - Greater Painted-snipe
  - Red-throated Pipit
  - Amphibians
- 10.5.7 The following habitats will be provided within the WRA to meet the requirements for the target species:
- Ponds with deep water area
  - Ponds with shallow water area
  - Reedbed
  - Marsh
  - Wooded bund
  - Grassy bund
  - Bamboo clump
  - Gravel

- 10.5.8 During the operational phase, no sewage or water from the residential areas will be discharged into the WRA, which will be fully self-contained, with rainwater as its sole water source. No fertilizers and herbicides will be routinely used for vegetation management in the WRA, hence reducing any potential source of contamination into the adjacent watercourses that feed into Deep Bay.

Ponds with deep water area

- 10.5.9 Ponds with deep water area will be provided within the WRA. This includes three areas of 1 – 2.5 m in depth of open water, surrounded by reed and grassy bund in the northern section of the WRA and the centre of Area 40 surrounded by shallow water. More than 70% of the water zone will be covered with water by the start of the dry season and > 40% at any other time. Less than 10% of water surface will be covered by emergent or floating vegetation, while the vegetation cover will be managed to be covered by < 10% undesirable flora species.

Ponds with shallow water area

- 10.5.10 Ponds with shallow water area will be provided within the WRA. The shallow water area consists of bands of shallow water (20 cm - < 1 m) area with gentle slopes connected with the deep water zone. More than 70% of the water zone will be covered with water by the start of the dry season and > 40% at any other time. Less than 10% of water surface will be covered by emergent or floating vegetation, while the vegetation cover will be managed to be covered by < 10% undesirable flora species.

Reedbed

- 10.5.11 As part of the WRA, an area of reed *Phragmites australis* will be planted on an undulating pond bottom, bordering the deep water pond and marsh. At least 80% of reedbed will be managed with reed cover. The vegetation cover will be managed to be covered by < 10% undesirable flora species. The reedbed will be managed with 25 – 80% of standing water.

Marsh

- 10.5.12 Freshwater marsh area, to be provided within the WRA, comprising several cells will be constructed within the WRA. This habitat will be planted on an undulating pond bottom, bordering the deep water pond and between the proposed houses. The marsh will be covered by at least 70% of vegetation, with the coverage managed with less than 10% undesirable flora species. It will be managed with 25 – 80% of standing water of which >25% of water to be managed with water level of 10 cm or less.

Wooded bund

- 10.5.13 Wooded bund will be provided within the WRA. Tree/shrub species that are tolerant of flooding conditions and waterlogged soils will be planted along the boundaries of the marsh, reedbed where it interfaces the residential area, and Area 40 of the Project Area to provide screening of wetland habitats from disturbance. The wooded bund is maintained with > 70% of tree canopy cover, with < 10% covered by undesirable flora species.

Grassy bund

- 10.5.14 Grassy bunds, to be provided within the WRA, planted with native herb species will border the WRA in the northern, western and eastern boundaries and between the different pond or marsh cells. The grassy bund will be hydro-seeded. The grass will be



cut in a regular basis and 80% of grass will be maintained with vegetation height at a suitable low level (< 10cm). More than 80% of land will be covered by grass, with < 10% covered by undesirable flora species.

Bamboo clump

- 10.5.15 Several clumps of bamboo, to be provided within the WRA, will be planted on the grassy bunds in the western and northern boundaries. At least 80% of the area will be covered by bamboo, with < 10% covered by undesirable flora species.

Gravel

- 10.5.16 Gravel will be provided within the WRA. Islands of unvegetated bare ground will be scattered in the deep water pond. Such area will be managed with > 80% of bare ground and covered by very low density (< 20%) of herbaceous cover of which < 10% is undesirable flora species.

## 10.6 Monitoring Requirements

Resources required shall include appropriately qualified ecologists with wetland design and management experience, as a member of the ET. The qualification of the ecologists shall be submitted to the ER for approval and agreed with the IEC.

*Baseline Ecological Monitoring*

- 10.6.1 Target species and other wetland-dependent fauna will be monitored within the Project Area and Assessment Area during the 12 months prior to commencement of any site clearance for wetland and/or residential construction. This will provide the baseline for evaluation of the success in achieving numerical targets for the Target Species. The frequency of monitoring is given in Table 10-1 and the methodology for each survey is detailed below under Operational Phase Monitoring. In addition, target species for the WRP, including Little Egret, Chinese Pond Heron, Red-throated Pipit and Greater Painted-snipe, may be revised in light of the findings of the Baseline Ecological Monitoring.

**Table 10-1 Summary of the Baseline Ecological Monitoring for the Yau Mei San Tsuen WRA**

	Baseline Ecological Monitoring
Birds	Twice monthly (including Assessment Area)
Dragonflies and Butterflies	Once per month during March and September to November and twice per month during April to August.
Herpetofauna	Once per month during April to November.
Aquatic invertebrates	Not required.
Benthic Invertebrates	Not required.
Freshwater fish	Not required.
Habitat types	Not required.
Vegetation cover	Not required.
Pedology	Not required.
Water Quality	Not required.
Site Inspections	Not required.

*Construction Phase Ecological Monitoring*

- 10.6.2 Target species and other wetland-dependent fauna will be monitored within the Project Area and Assessment Area during the construction phase of wetland and residential development. This will be important to ensure that any unexpected events or impacts either on- or off-site are quickly identified so that remedial action can be taken. The frequency of monitoring given in Table 10.2 and the methodology for each survey is detailed below under Operational Phase Ecological Monitoring.

**Table 10-2 Summary of Construction and Operational Phase Ecological Monitoring for the Yau Mei San Tsuen WRA**

	Construction Phase Ecological Monitoring	Operational Phase Ecological Monitoring
Birds	Weekly (including Assessment Area).	Monthly (excluding Assessment Area).
Dragonflies and Butterflies	Once per month during March and September to November and twice per month during April to August.	Once per month during March and September to November and twice per month during April to August.
Herpetofauna	Once per month during April to November.	Once per month during April to November.
Aquatic invertebrates	Not required.	At six monthly intervals at the end of the wet season (September) and the end of the dry season (March).
Benthic Invertebrates	Not required.	At six monthly intervals at the end of the wet season (September) and the end of the dry season (March).
Freshwater fish	Not required.	At six monthly intervals at the end of the wet season (September) and the end of the dry season (March).
Habitat types	Not required.	At six monthly intervals at the end of the wet season (September) and the end of the dry season (March).
Vegetation cover	Not required.	At six monthly intervals at the end of the wet season (September) and the end of the dry season (March).
Pedology	Not required.	Yearly in the early wet season.
Water Quality	Following filling with water monthly for <i>in situ</i> water quality and every six months (end of the wet season and end of the dry season) for laboratory testing.	Monthly for <i>in situ</i> water quality and every six months (end of the wet season and end of the dry season) for laboratory testing.
Site Inspections	Weekly.	Twice per month.

*Operational Phase Ecological Monitoring*

- 10.6.3 Ecological monitoring during the operational phase is essential to assess the effectiveness of the restored/enhanced wetland in attracting wildlife and implementing proper wetland management approach in any unexpected events. Abundance and diversity of fauna groups (birds, dragonflies, butterflies and herpetofauna) and their

prey (aquatic invertebrates, benthic invertebrates and freshwater fish) are required for the monitoring. The management strategy and requirements of the WRA during the operational phase, are provided in the Wetland Restoration Plan in Appendix III. Monitoring will be limited to the Project Area and conducted to cover the ecological attributes detailed below:

#### *Monitoring of Birds*

- 10.6.4 Monitoring of bird species is required in order to demonstrate success of the restored/enhanced wetland in supporting, as a minimum, the target number of bird target species recorded during the Baseline Ecological Monitoring.
- 10.6.5 Surveys will be undertaken monthly. During each survey visit, the surveyor will walk slowly around the perimeter of the wetland and along each bund, and identify and enumerate all birds heard or seen. Surveys will commence within one hour of sunrise and last for approximately two hours

#### *Monitoring of Dragonflies and Butterflies*

- 10.6.6 Although dragonfly and butterfly are not the target species of the WRA, their utilization of the site will reflect the effectiveness of the restored/enhanced wetland and will be useful in assessing the effectiveness of the management strategy.
- 10.6.7 Transect surveys for dragonflies and butterflies will be undertaken once per month during March and September to November and twice per month during the peak period of dragonfly emergence in April to August. Survey duration will be approximately 2 hours and surveys will be conducted during the middle of the day, to coincide with the peak flight time for these species.
- 10.6.8 During the surveys a fixed survey route will be followed. All dragonfly species observed will be identified and counted. Dragonfly exuviae will be recorded qualitatively to monitor breeding success. All butterfly species will be identified and numbers estimated quantitatively or semi-quantitatively.
- 10.6.9 For dragonflies, transect surveys will be supplemented by quantitative monitoring of emergence using exuviae emergence traps. Six traps will be used and inspected once per week between March and August.

#### *Monitoring of Herpetofauna*

- 10.6.10 Herpetofauna surveys focus on breeding amphibians and the reptile community. One day-time survey (primarily aimed at detecting reptiles) will be conducted each month during April to November. Surveys will take place during the middle of the day, the peak period of reptile activity. One night-time survey (primarily aimed at detecting breeding amphibians) will be conducted each month during the period from March to August. Night time surveys will be undertaken during the first hours of darkness and will focus on the detection of vocalising amphibians. During the surveys a fixed survey route will be walked. All reptiles and amphibians observed or heard will be identified, and their abundance estimated. Habitat use and breeding activity will be recorded.

#### *Monitoring of Aquatic Invertebrates*

- 10.6.11 Aquatic invertebrates will be surveyed to ascertain or confirm that invertebrate food for avifauna and amphibians is available during the operational phase. This monitoring data will form baseline data for wetland management in the future. Monitoring of aquatic invertebrates will be conducted at six monthly intervals at the end of the wet season (September) and the end of the dry season (March). Sweep-netting will be used to sample aquatic species in the water column and clinging to vegetation at the

water-bund interface. The sweep-net will be a D-shaped net of 30 cm diameter with a 1 mm mesh. Each sample will comprise two 2-metre sweeps of the net from which all captured specimens are removed. The first sweep will be carried out at the water surface and the second as close to the wetland bed as possible. Each set of sweeps will be taken along the water-bund interface. Two randomly located replicate samples will be taken from each pond and marsh cell (giving eight samples in total).

- 10.6.12 Samples will be placed in labelled containers together with preservative for transporting to the laboratory. Once in the laboratory, specimens will be rinsed in water, placed on a white sorting tray and sorted for identification to species level using a binocular microscope. Where partial body parts are identified, only heads will be counted.
- 10.6.13 The number of each macro-invertebrate species will be ascertained for each replicate sample for all taxa groups. A total dry weight biomass will be determined for each of the above groups.
- 10.6.14 The number and species of any fish captured incidentally during the sampling will be recorded.

#### *Monitoring of Benthic Invertebrates*

- 10.6.15 As with the monitoring of aquatic invertebrates, benthic invertebrates will be surveyed to ascertain or confirm the availability of invertebrate food for avifauna and amphibians during the operational phase. The data will form baseline data for wetland management in the future. Monitoring of benthic invertebrates will be conducted at six monthly intervals at the end of the wet season (September) and the end of the dry season (March). Cylindrical benthic cores 10 cm in diameter and 10 cm in depth will be taken from the substrate at the base of the wetland to obtain quantitative data on benthic invertebrate populations. Five randomly located replicate cores will be collected from the shallows of each pond and marsh cell. Core contents will be bagged and stored in a cooler for subsequent sorting. Samples will be analysed in the same way as for sweep netting.

#### *Monitoring of Freshwater Fish and Crustaceans*

- 10.6.16 The purpose of freshwater fish survey during the operational phase is to monitor prey availability for the waterbirds and to check whether ecological objectives might be compromised by fish species or abundance. This monitoring data will form baseline data for wetland management in the future. Monitoring of freshwater fish and crustaceans will be conducted at six monthly intervals at the end of the wet season (September) and the end of the dry season (March). Throw and drag-netting will be undertaken once every six months in each pond. A fishing throw-net with a mesh size of 30 mm, a diameter of about 4 m and a surface area of about 14 m<sup>2</sup> will be used to catch larger fish and a drag net of mesh size < 10 mm will be used to sample smaller fish and shrimps. Five randomly-placed replicates with each net are conducted in each pond. Fish caught will be enumerated and identified to species. For individuals larger than 10 cm, the weight and length will be recorded, and then released back into the wetland.

#### *Monitoring of Habitats Types*

- 10.6.17 Habitat monitoring will be conducted at six monthly intervals at the end of the wet season (September) and the end of the dry season (March).

#### *Monitoring of Vegetation Cover*

- 10.6.18 Detailed floristic surveys will be conducted in each habitat type (reedbed, marsh,

grassy bund and wooded bund) at six monthly intervals at the end of the wet season (September) and the end of the dry season (March). Transects will run through the habitats of reedbed, marsh and grassy bund, with a fixed number of quadrats in each. 2m X 2m quadrats will be used in the habitats of reedbed, marsh and grassy bund, while fixed transects will run through the wooded bund.

- 10.6.19 Within each 2m X 2m quadrat, all plant species and their densities will be identified to species-level and estimated respectively. The percentage cover of bare ground, leaf litter cover and coverage by each species will also be measured. The tallest height of each plant species will be measured to be the nearest cm. Any rare or protected species will also be identified within the quadrats.
- 10.6.20 Along the fixed transects placed in the wooded bund area, all woody species and their health conditions will be recorded and assessed respectively.

#### *Pedology Monitoring*

- 10.6.21 Pedology monitoring aims to provide data regarding pond soil condition (such as any soil contamination or change of soil chemical properties due to any earthwork or drainage process) for any necessary management action. These monitoring data will form the baseline data for wetland management in the future. Sediment in each pond and marsh cell will be monitored at the beginning of the establishment period of the WRA and also after any contamination event. Three sediment samples will be collected from each pond and marsh cell and sent to a HOKLAS-accredited laboratory for analysis. The following parameters will be monitored:

- % volatile solids
- Oxidation/Reduction (Redox) potential
- pH
- Total nitrogen
- Total oxidized carbon
- Total phosphorus
- Total reactive phosphorus

#### *Monitoring of Water Quality*

- 10.6.22 In-situ water quality will be measured in each pond and marsh cell once per month. The following parameters will be monitored:

- Temperature
- pH
- Salinity
- Turbidity
- Dissolved oxygen

- 10.6.23 Additional measurements of these parameters should also be made in order to inform management decisions (e.g. fish re-stocking programme) and in response to unexpected events (e.g. algal blooms or fish die-offs).

- 10.6.24 In addition, every six months (end of the wet season and end of the dry season) water samples will be sent to a HOKLAS-accredited laboratory for analysis. The following parameters will be monitored:

- Ammoniacal nitrogen
- Biochemical oxygen demand
- Total oxidized nitrogen
- Total phosphorus

- Total reactive phosphorus (orthophosphate)

## 10.7 Wetland Quality Performance Limits and Action Plans

10.7.1 Table 10.3 shows the proposed Wetland Quality Performance Limits and the corresponding Contingency Plans.

**Table 10-3 Wetland Quality Performance Limits and Contingency Plan**

Parameters	Action Level	Limit Level	Action
Flooding/storm damage	N.A.	N.A.	Review damage in conjunction with short-term weather forecast. Shed water from site or transfer internally if possible using combination of sluices, pipes and pumps. Review damage and determine severity and undertake repairs/modifications to the design.
Area of water in the pond – wet season levels	< 70 & > 95%	< 60 & > 100 %	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: adjust water level by pumping to reinstate the area/ re-profiling/ other measures.
Area of water in the pond – dry season levels	< 50 & > 95%	< 40 & > 95%	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: adjust water level by pumping to reinstate the area/ re-profiling/ other measures.
Emergent or floating vegetation in the open water pond (although it is not proposed to plant emergent or floating vegetation as part of the restoration process, it is to be expected that these will colonise the wetland over time)	> 10 %	> 20 %	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: manual or mechanical vegetation clearance; check nutrient levels and fish stocks; adjust water quality and fish numbers (in case water quality is affecting herbivorous fish stock levels or there are low levels of herbivorous fish).
Reedbed reed cover	< 80%	< 60%	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: carry out weeding or planting.
Reedbed water cover	< 25% & > 80%	< 15% & > 95%	Action level exceedance: pump to restore water levels. Limit level exceedance: pump to restore water levels; review water management regime in medium term.
Marsh vegetation cover	< 70%	< 50%	Action level exceedance: review plant

Parameters	Action Level	Limit Level	Action
			status and growth. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: undertake supplemental planting.
Wooded bund canopy cover	< 70%	< 50%	Action level exceedance: review tree status and growth. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: undertake supplemental tree planting.
Grassy bund cover	< 80 %	< 50%	Action level exceedance: review grass status and growth. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: undertake supplemental planting.
Bamboo clump cover	< 80 %	< 50%	Action level exceedance: review bamboo status and growth. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: undertake supplemental planting.
Gravel vegetation cover	> 20%	> 30%	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: manual or mechanical vegetation clearance.
Undesirable plant species (all wetland)	> 10% of vegetation in WRA or in any pond or marsh cell	> 20% of vegetation in WRA or in any pond or marsh cell	Action level exceedance: removal by weeding. Limit level exceedance: removal by weeding, if problem is likely to return/deteriorate review design and management regime.
Undesirable fauna including invasive/exotic aquatic invertebrates	Presence	Negatively impacting wetland function	Action level exceedance: treatment or removal (or other method if suitable). Limit level exceedance: increase frequency of treatment or removal (or other method if suitable), review management protocols and design.
Salinity	> 2 ppt	> 5 ppt	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: water exchange/ add water/ remove identified contamination source/ other measures.
pH	pH outside the range between 6.5 – 8.0	pH outside the range between 6.0 – 8.5	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: lime/ add

Parameters	Action Level	Limit Level	Action
			peanut residue/ mix with other water sources/ drain and lime/ other measures.
Dissolved oxygen	< 2 mg/l	< 1 mg/l	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: pump and mix water/ aeration/ remove identified contamination source/ other measures.
Total oxidized nitrogen (nitrite and nitrate) concentration	> 5 mg/l	> 10 mg/l	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: water exchange/ add water/ remove identified contamination source/ other measures.
Total phosphorus concentration	> 5 mg/l	> 10 mg/l	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: water exchange/ add water/ remove identified contamination source/ other measures.
Total ammonia concentration	> 3 mg/l	> 6 mg/l	Action level exceedance: double the monitoring frequency, identify and review the problem. If the problem is likely to deteriorate, the action plan for limit level exceedance should be implemented. Limit level exceedance: water exchange/ add water/ remove identified contamination source/ other measures.
Target species abundance	Abundances of all target species < specified target levels in two successive monitoring periods	Abundances of all target species < specified target levels in four successive monitoring periods	Action level exceedance: Review the monitoring data and reasons for low numbers of target species. If the reduction in abundance is attributable to activities within the site, stop/ reduce such activity or carry out other measures (e.g. erect buffering screen or buffer planting). If the reduction in abundance is attributable to disturbance from outside the site (e.g. intense construction activity outside the site), increase buffering screen (short-term) and/or buffer planting (long-term) or carry out other measures. If the reduction in abundance is attributable to external factors (e.g. natural population fluctuation) or other man-made factors increase the monitoring frequency, identify and review the problem, and review the management regime. If the



Parameters	Action Level	Limit Level	Action
			<p>problem is likely to worsen, the action plan for limit level exceedance should be carried out.</p> <p>Limit level exceedance: Review the management regime and carry out restocking/ increase draining period and/or frequency/ erect buffering screen (short-term)/ increase buffer planting (long-term)/ other measures</p>

**10.8 Fisheries Impacts**

- 10.8.1 According to the EIA report, no significant fisheries impacts are predicted as a result of the proposed Project; hence the development and implementation of a monitoring and audit programme for assessing the effects on fisheries resources and operations is not considered necessary. However, an emergency response plan for any water pollution in the fish ponds surrounding the Project Area will be implemented. AFCD would be informed of any exceedance of Action/Limit Levels during water quality monitoring, which are described in Table 10-3. Also, good site practices will be implemented during the construction phase of the Project. Excavated material and other inert construction wastes produced will be transferred to proper recipients (i.e. landfill).
- 10.8.2 During the operation phase, no significant impact is anticipated and thus no specific measure for fisheries impact has to be implemented.

## 11. SITE ENVIRONMENTAL AUDIT

### 11.1 Site Surveillance

- 11.1.1 Site surveillance provides a direct means to trigger and enforce the specified environmental protection and pollution control measures are in compliance with the contract specifications. They shall be undertaken regularly and routinely by ET to inspect the construction activities in order to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented by the Contractor in accordance with the EM&A recommendations. With well-defined pollution control and mitigation specifications and a well-established site inspection, deficiency and action reporting system, the site inspection is one of the most effective tools to enforce the environmental protection requirements on the construction site.
- 11.1.2 The ET Leader is responsible for formulation of the environmental site inspection, deficiency and action reporting system, and for carrying out the site inspections under the EM&A works. He shall, in consultation with the IEC, prepare and submit a proposal on the site inspection, deficiency and action reporting procedures (including any checklists and forms) within 21 days of the construction contract commencement to the Contractor for agreement and to the ER for approval. A preliminary site inspection, deficiency and action reporting system in form of a flow chart is prepared for reference. This is shown in Figure 11-1 for review and refinement by the ET Leader at the commencement of the Project.
- 11.1.3 Regular site inspections shall be carried out at least once per week for all works areas. The areas of inspection shall not be limited to the environmental situation, pollution control and mitigation measures within the Site, it should also review the environmental situation outside the site area which is likely to be affected, directly or indirectly, by the site activities. The ET leader shall make reference to the following information in conducting the inspection:
- The EIA recommendations and requirements on environmental protection and pollution control mitigation measures;
  - Works progress and programme, and site plans;
  - Individual construction works methodology proposals (which shall include proposal on associated pollution control measures);
  - The contract specifications on environmental protection and pollution prevention control;
  - The relevant environmental protection and pollution control laws, ProPECC Notes; and
  - Previous site inspection results.
- 11.1.4 The satisfactory implementation of relevant recommended mitigation measures shall be checked during the ET's regular site inspections during the relevant phases of construction works.
- 11.1.5 The Contractor shall update with the ET Leader on all relevant information of the construction contract for him to carry out the site inspections. The inspection results and its associated recommendations on improvements to the environmental protection and pollution control works shall be submitted, in a site inspection proforma, to the IEC and the Contractor in a site inspection proforma within 24 hours, for reference and for taking immediate action. The Contractor shall follow the procedures and time frame as stipulated in the environmental site inspection, deficiency and action reporting system formulated by the ET Leader to report on any remedial measures subsequent to the site inspections.
- 11.1.6 *Ad hoc* site inspections shall also be carried out by the ET and/or IEC when significant environmental problems are identified. Inspections may also be required subsequent

to receipt of an environmental complaint, or as part of the investigation work, as specified in the Action Plan for environmental monitoring and audit.

## **11.2 Environmental Compliance with Legal and Contractual Requirements**

- 11.2.1 There are contractual environmental protection and pollution control requirements as well as environmental protection and pollution control laws in Hong Kong, which the construction activities shall comply.
- 11.2.2 The ET Leader shall review the progress and programme of the works to check that relevant environmental laws have not been violated, and that any foreseeable potential for violating the laws can be prevented.
- 11.2.3 The Contractor shall regularly copy relevant documents to the ET Leader so that the checking work can be carried out effectively. The document shall at least include the updated Work Progress Reports, the updated Works Programme, the application letters for different licence/permits under the environmental protection laws, and all the valid licence/permit. The site diary shall also be available for the ET's inspection upon his request.
- 11.2.4 After reviewing the document, the ET Leader shall advise the ER and the Contractor of any non-compliance with the contractual and legislative requirements on environmental protection and pollution control for them to take follow-up actions. If the ET Leader's review concludes that the current status on licence/permit application and any environmental protection and pollution control preparation works may not cope with the works programme or may result in potential violation of environmental protection and pollution control requirements by the works in due course, he shall also advise the Contractor and the ER accordingly. The review shall be copied to IEC for any follow-up action.
- 11.2.5 Upon receipt of the advice, the Contractor shall undertake immediate action to remedy the situation. The ER shall check that appropriate actions have been taken by the Contractor in order that the environmental protection and pollution control requirements are fulfilled.

## **11.3 Environmental Complaints**

- 11.3.1 Complaints received on environmental issues shall be referred to the ET Leader for carrying out complaint investigation procedures. The ET shall undertake the steps given below upon receipt of the complaints. The complaint investigation procedures are also presented in form of a flow chart in Figure 11-2 for easy reference.
- Log complaint and date of receipt onto the complaint database and inform the IEC immediately;
  - Investigate the complaint to determine its validity, and to assess whether the source of the problem is due to works activities;
  - If a complaint is valid and due to works, identify mitigation measures in consultation with the IEC;
  - If mitigation measures are required, advise the Contractor accordingly;
  - Review the Contractor's implementation of the identified a required mitigation measures, , and the concurrent situation;
  - If the complaint is transferred from EPD, submit interim report to EPD on status of the complaint investigation and follow-up action within the time frame assigned by EPD;
  - Undertake additional monitoring and audit to verify the compliant if necessary, and ensure that any valid reason for complaint does not recur

through proposed amendments to work methods, procedures, machines and/or equipment, etc;

- Report the investigation results and the subsequent actions to the source of complaint (If the source of complaint is identified through EPD, the results should be reported within the time frame assigned by EPD); and
- Log a record the complaint, investigation, the subsequent actions and the results in the monthly EM&A reports.

11.3.2 The ER shall notify the Project Proponent of any complaints received and keep him well informed of the actions being taken to settle these complaints.

11.3.3 During the complaint investigation work, the Contractor and ER shall co-operate with the ET Leader in providing all the necessary information and assistance for completion of the investigation. If mitigation measures (in consultation with the IEC, see Section 11.3 above) are required following the investigation, the Contractor shall promptly carry out the measures. The ER shall ensure that the measures have been carried out by the Contractor.

#### **11.4 Documentation**

11.4.1 All documentation is required to be filed in a traceable and systematically manner and ready for inspection upon request. Site document, such as monitoring field records, laboratory analysis records, meeting minutes, correspondences etc., shall be cross-referenced by the ET Leader and be ready for inspection upon request. All Construction Phase EM&A results and findings shall be documented in the Construction Phase EM&A report prepared by the ET Leader and endorsed by IEC prior to disseminate to the Contractor, ER and EPD.

11.4.2 All documentation to the Director of Environmental Protection shall be in paper form and/or electronic form (in the format in agreement with the Director) upon request. Prior to submission, the water quality data software format shall be agreed with EPD. All documents and data shall be kept for at least one year after the completion of the construction contract. All submissions (reports, data, and correspondences etc.) to the Director of Environmental Protection shall be liable to use freely for the purposes of communicating environmental data and the owner of information shall claim no copyright. Any request to treat all or part of a submission in confidence will be respected, but if no such request is made it will be assumed that the submission is not intended to be confidential.

## 12. REPORTING

### 12.1 General

- 12.1.1 The following reporting requirements based upon a paper-documented approach. However, the same information can be provided in an electronic medium upon agreeing the format with the ER and EPD. All the monitoring data (baseline and impact) shall also be submitted in diskettes in an agreed format. This would enable a transition from a paper/historic and reactive approach to an electronic/real time proactive approach.

### 12.2 Baseline Monitoring Report

- 12.2.1 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 the relevant parties such as the Contractor, the IEC, the ER, EPD, and AFCD. Before the submission, 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 representation of the baseline monitoring data to be submitted shall be agreed with EPD and AFCD.
- 12.2.2 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 construction programme with milestones of environmental protection/mitigation activities annotated;
  5. Monitoring results (in both hard and diskette copies) together with the following information:
    - Monitoring methodology;
    - Name of laboratory and types of equipment used and calibration details;
    - Parameters monitored;
    - Monitoring locations (and depth);
    - Monitoring date, time, frequency and duration;
    - QA/QC results and detection limits.
  6. Details on influencing factors, including:
    - Major activities, if any, being carried out on the site during the period;
    - Weather conditions during the period;
    - Other factors which might affect the results.
  7. Determination of the Action and Limit Levels (AL levels) for each monitoring parameter and statistical analysis of the baseline data, the analysis shall conclude if there is any significant difference between control and impact stations for the parameters monitored;
  8. Revisions for inclusion in the EM&A Manual; and
  9. Comments and conclusions.

### 12.3 Monthly EM&A Reports

- 12.3.1 The results and findings of all EM&A work required in the Manual shall be recorded and submitted by the ET Leader during construction phase. Based on this information, a monthly EM&A reports shall be prepared by the ET Leader and endorsed by the IEC, and submitted to EPD within 10 working days of the end of each reporting month, with the first report due in the month after construction commences. Copies of each monthly EM&A report shall be submitted to the parties including the Contractor, the IEC, the ER, EPD, and AFCD. 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.
- 12.3.2 The ET Leader shall review the number and location of monitoring stations and parameters to monitor every 6 months or on as needed basis in order to cater for the changes in surrounding environment and nature of works in progress.

### 12.4 First Monthly EM&A Report

- 12.4.1 The first monthly EM&A report shall include at least but not be limited to the following:
1. Executive Summary (1-2 pages);
    - Breaches of AL levels;
    - Complaint Log;
    - Notifications of any summons and successful prosecutions;
    - Reporting Changes;
    - Future key issues.
  2. Basic Project Information
    - Project organisation including key personnel contact names and telephone numbers;
    - Construction Programme with fine tuning of construction activities showing the inter-relationship with environmental protection/mitigation measures for the month;
    - Management structure;
    - Works undertaken during the month.
  3. Environmental Status
    - Works undertaken during the month with illustrations (such as location of works, daily, dredging/filling rates, percentage fines in the fill material used);
    - Drawing 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 and Limit levels);
    - Event-Action Plans;
    - Environmental mitigation measures, as recommended in the project EIA study final report;
    - Environmental requirements in contract documents;

5. Implementation Status
  - Advice on the implementation status of environmental protection and pollution control/mitigation measures including measures for ecological, and the landscape and visual impacts, as recommended in the project EIA study report, summarised in the updated implementation schedule.
6. Monitoring Results (in both hard and diskette copies) together with the following information;
  - Monitoring methodology;
  - Name of laboratory and types of equipment used and calibration details;
  - Parameters monitored;
  - Monitoring locations (and depth);
  - Monitoring date, time, frequency, and duration;
  - Weather conditions during the period;
  - 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;
  - Any other factors which might affect the monitoring results; and
  - QA/QC results and detection limits.
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 and Limit levels);
  - Record of all complaints received (written or verbal) for each media, including locations and nature of complaints investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;
  - Record of all notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislations, 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. Others
  - An account of the future key issues reviewed from the works programme and work method statements;
  - Advice on the solid and liquid waste management status;
  - Submission of implementation status proforma, proactive environmental protection proforma, regulatory compliance proforma, site inspection proforma, data recovery schedule and complaint log summarizing the EM&A of the period.

## 12.5 Subsequent Monthly EM&A Reports

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

1. Executive Summary (1-2 pages)
  - Breaches of AL levels;
  - Complaint Log;
  - Notifications of any summons and successful prosecutions;
  - Reporting Changes;
  - Future key issues.
2. Environmental Status
  - Construction Programme with fine tuning of construction activities showing the inter-relationship with environmental protection/mitigation measures for the month;
  - Works undertaken during the month with illustrations including key personnel contact names and telephone numbers;
  - Drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations.
3. Implementation Status
  - Advice on the implementation status of environmental protection and pollution control/mitigation measures including measures for ecological, and landscape and visual impacts, as recommended in the project HA study report, summarised in the updated implementation schedule.
4. Monitoring Results to provide monitoring results (in both hard and diskette copies) together with the following information
  - Monitoring methodology;
  - Name of laboratory and types of equipment used and calibration details;
  - Parameters monitored;
  - Monitoring locations (and depth);
  - Monitoring date, time, frequency, and duration;
  - Weather conditions during the period;
  - 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;
    - Any other factors which might affect the monitoring results;
    - QA/QC results and detection limits.
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 and Limit levels);
  - Record of all complaints received (written or verbal) for each media, including locations and nature of complaints investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;
  - Record of all notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislations, including locations and nature of the breaches, investigation, follow-up actions taken, result and summary;



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- Review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures;
  - 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. Others
- An account of the future key issues reviewed from the works programme and work method statements;
  - Advice on the solid and liquid waste management status.
7. Appendix
- AL levels
  - Graphical plots of trends of monitored parameters at key stations over the past four reporting periods for representative monitoring stations annotated against the following:
    - Major activities being carried out on Site during the period;
    - Weather conditions during the period;
    - Any other factors which might affect the monitoring results
    - Monitoring schedule for the present and next reporting period
    - Cumulative statistics on complaints, notifications of summons and successful prosecutions
    - Outstanding issues and deficiencies

## 12.6 Quarterly EM&A Summary Reports

12.6.1 During construction period, the quarterly EM&A summary report, which should generally be around 5 pages (including about 3 pages of text and tables and 2 pages of figures) should contain at least the following listed information. Apart from these, 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. Copies of quarterly report shall be submitted to the parties including the Contractor, the IEC, the ER, EPD, and AFCD. Before submission of the first report, the ET Leader shall liaise with the parties on the exact number of copies and format of the reports in both hard copy and electronic medium required.

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 and Limit levels); and
  - Environmental mitigation measures, as recommended in the project EIA study final report;
4. Advice on the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the project EIA study report, summarised in the updated implementation schedule;
5. Review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures;
6. Drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
7. 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 which might affect the monitoring results;
8. Advice on the solid and liquid waste management status;
9. A summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
10. A brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures;
11. For project where measurement of suspended solids is required, quarterly assessment of construction impacts on suspended solids at the project site, including, but not limited to, a comparison of the difference between the quarterly mean and 1.3 times of the ambient mean, which is defined as 30% increase of the baseline data or EPD data, of the related parameters by using appropriate statistical procedures. Suggestion of appropriate mitigation measures if the quarterly assessment analytical results demonstrate that the quarterly mean is significantly higher than the 1.3 on water quality times of the ambient mean ( $p < 0.05$ );
12. A summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;

13. A summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;
14. A summary record of all notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislations, locations and nature of the breaches, investigation, follow-up actions taken and results;
15. 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; and
16. Proponents' contacts and any hotline telephone number for the public to make enquiries.

## 12.7 Final EM&A Summary Reports

12.7.1 Upon the completion of construction works and termination of construction phase EM&A programme of this Project, a final EM&A summary report shall be submitted. Copies of EM&A report shall be submitted to the parties including the Contractor, the IEC, the ER, EPD and AFCD. Before submission of the EM&A report, the ET Leader shall liaise with the parties on the exact number of copies and format of the reports in both hard copy and electronic medium required. 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 period;
3. A brief summary of EM&A requirements including:
  - Monitoring parameters;
  - Environmental quality performance limits (Action and Limit levels); and
  - Environmental mitigation measures, as recommended in the project EIA study final report;
4. Advice on the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the project EIA study report, summarised in the updated implementation status proformas;
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 construction period 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. Compare and contrast the EM&A data with the EIA predictions and annotate with explanation for any discrepancies;
8. Provide clear-cut decisions on the environmental acceptability of the project with reference to the specific impact hypothesis;
9. Advice on the solid and liquid waste management status;
10. A summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);

11. A brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures;
12. A summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;
13. A summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;
14. Review the monitoring methodology adopted and with the benefit of hindsight, comment on its effectiveness (including cost effectiveness);
15. A summary record of all notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislations, locations and nature of the breaches, investigation, follow-up actions taken and results;
16. Review the practicality and effectiveness of the EIA process and EM&A programme (e.g. effectiveness and efficiency of the mitigation measures), recommend any improvement in the EM&A programme; and
17. A conclusion to state the return of ambient and/or the predicted scenario as per EIA findings.

## **12.8 Operational Phase EM&A Reports**

- 12.8.1 Copies of the report shall be submitted to the relevant parties. Before submission of the report, the ET Leader shall liaise with the parties on the exact number of copies and format of the reports in both hard copy and electronic medium required.
- 12.8.2 During operation of the WRA, the data obtained from the monitoring programme will be used to inform adaptive management measures. Monitoring data and information regarding adaptive management measures undertaken will be submitted to relevant authorities, including relevant stakeholders and relevant Government Departments such as AFCD and EPD. The monitoring requirements and frequency shall refer to Section 10.6 and Appendix III, and conform to the requirements of the EP. The frequency of reporting and the required time frame shall conform to the requirements of the EP.
- 12.8.3 During operation of the interim STP, monitoring on quality of treated effluent that is discharged from the STP shall refer to Section 7.3, and conform to the licence requirements under the WPCO as well as the conditions specified in the Environmental Permit. The monitoring results shall be submitted to EPD and other authorities which may be required in the EP/ licence. The frequency of reporting and the required time frame shall conform to the licence requirements under WPCO as well as requirements of the EP.
- 12.8.4 Reporting of monitoring results during the last 12 months establishment period of the landscape proposal according to Section 9-6 is required. The monitoring results shall be submitted to EPD and other authorities which may be required in the EP. The frequency of reporting and the required time frame shall conform to the requirements of the EP.

## **12.9 Forms to be Adopted**

- 12.9.1 To facilitate the management of the EM&A programme for the construction works, the ET Leader shall keep records of EM&A activities during the construction phase of the Project (including those presented in the preceding sections). These records shall be made available for inspection and audit by the ER/ IEC/ EPD during the entire construction phase. Sample record forms are presented in Appendix II which should be adopted where applicable, and amended by ET Leader where necessary. These forms are listed as follows:

- Implementation Status Proforma;
- Data Recovery Schedule;
- Site Inspection Proforma;
- Proactive Environmental Protection Proforma;
- Regulatory Compliance Proforma;
- Complaint Log;
- Sample Template for Interim Notifications of Environmental Quality Limits Exceedances;
- Data Sheet for TSP Monitoring;
- Noise Monitoring Field Record Sheet; and
- Water Monitoring Field Record Sheet.

## **12.10 Data Keeping**

12.10.1 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. All relevant information shall be clearly and systematically recorded in the document. The monitoring data shall also be recorded in magnetic media form, and the software copy can be available upon request. The water quality data software format shall be agreed with EPD. All the documents and data shall be kept for at least one year after completion of the construction contract.

## **12.11 Interim Notifications of Environmental Quality Limit Exceedances**

12.11.1 With reference to Event/Action Plans in previous sections, when the environmental quality limits are exceeded, the ET shall immediately notify the ER & EPD, as appropriate. 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. A sample template for the interim notifications is shown in Appendix II.