

**TERRITORY DEVELOPMENT DEPARTMENT
NEW TERRITORIES EAST DEVELOPMENT OFFICE**

**Agreement No. CE 16/99
Feasibility Study for Housing Development at
Whitehead and Lee On in
Ma On Shan, Sha Tin**

**Final Report
Environmental Monitoring and Audit Manual**

**October 2002
Ref: 2095/R13.3**

Report Authorized For
Issue By:



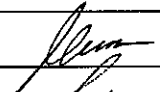
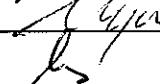
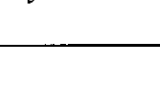
For and on Behalf of
Binnie Black & Veatch Hong Kong Limited

Binnie Black & Veatch Hong Kong Limited
in association with

**City Planning Consultants Limited
MVA Hong Kong Limited
Ronald Lu & Partners (HK) Limited
Urbis Limited
Larry H.C. Tam & Associates Limited**

CONTENTS

	Page
1. INTRODUCTION	1
1.1 Purpose of the Manual	1
1.2 Background	2
1.3 Environmental Monitoring and Audit Requirements	2
1.4 Summary of Mitigation Measures and Implementation Schedule	3
1.5 Environmental Policy and Project Management Organization and Responsibilities	3
1.6 Implementation	10
1.7 Designated Projects	11
2. AIR QUALITY	13
2.1 Introduction	13
2.2 Air Quality Parameters	13
2.3 Monitoring Equipment	14
2.4 Laboratory Measurement / Analysis	16
2.5 Monitoring Locations	16
2.6 Baseline Monitoring	18
2.7 Impact Monitoring	18
2.8 Event and Action Plan for Air Quality	19
2.9 Dust Mitigation Measures	21
3. NOISE	22
3.1 Introduction	22
3.2 Noise Parameters	23
3.3 Monitoring Equipment	23
3.4 Construction Noise Monitoring Locations	24
3.5 Baseline Monitoring	25
3.6 Impact Monitoring	25
3.7 Event and Action Plan for Construction Noise Monitoring	26
3.8 Noise Mitigation Measures	29
3.9 Operational Traffic Noise Monitoring	31
4. WATER QUALITY	34
4.1 Introduction	34
4.2 Water Quality Parameters	34
4.3 Monitoring Equipment	35

	Name	Signature	Date
Prepared	Manuel Chua		11/10/02
Checked	Lok Yan		11/10/02
Reviewed	C.Y. Hung		10/02

CONTENTS
(cont'd)

4.4	Laboratory Measurement / Analysis	37
4.5	Monitoring Locations	37
4.6	Baseline Monitoring	38
4.7	Impact Monitoring	39
4.8	Event and Action Plan for Water Quality	39
4.9	Water Quality Mitigation Measures	41
5.	LANDSCAPE AND VISUAL	42
5.1	Introduction	42
5.2	Mitigation Measures	42
5.3	Design Phase Audit	45
5.4	Baseline Monitoring	46
5.5	Construction and Operational Phase Audit	46
6.	SITE ENVIRONMENTAL AUDIT	50
6.1	Site Inspections	50
6.2	Compliance with Legal and Contractual Requirements	51
6.3	Environmental Complaints	52
6.4	Choice of Construction Method	52
7.	REPORTING	53
7.1	General	53
7.2	Documentation	53
7.3	Baseline Monitoring Report	53
7.4	Monthly EM&A Reports	54
7.5	Data Keeping	61
7.6	Interim Notifications of Environmental Quality Limit Exceedances	62

FIGURES

1.1	Location of Study Area
1.2	Master Layout Plan (Preferred Development Option)
1.3	Lines of Authority for EM&A Programme of Whitehead Development
1.4	Lines of Communication for Reporting Function for EM&A Programme of Whitehead Development
1.5	Recommended Area Requiring Archaeological Field Evaluation
2.1	Sample TSP Monitoring Data Sheet
2.2	Location of Air Quality Monitoring Stations
3.1	Sample Construction Noise Monitoring Data Record Sheet
3.2	Location of Construction Noise Monitoring Stations
3.3	Operational Stage Traffic Noise Monitoring - Field Survey Record Sheet
3.4	Location of Traffic Noise Monitoring Stations

CONTENTS
(cont'd)

- 4.1 Sample Water Quality Monitoring Record Sheet
- 4.2 Location of Water Quality Monitoring Stations
- 6.1 Complaint Response Procedures
- 7.1 Sample Template for Interim Notification of Environmental Quality Limit Exceedances

TABLES

- 1.1 Description of Column Headings for the Implementation Schedule
- 1.2 Tentative Development Schedule
- 1.3 Designated Projects under this Project
- 2.1 Location of Air Quality Monitoring Stations
- 2.2 Action and Limit Levels for Air Quality
- 2.3 Event/Action Plan for Air Quality
- 3.1 Location of Noise Monitoring Stations
- 3.2 Action and Limit Levels for Noise
- 3.3 Event/Action Plan for Noise
- 3.4 Locations of Operational Traffic Noise Monitoring Stations
- 4.1 Action and Limit Levels for Water Quality
- 4.2 Event and Action Plan for Water Quality
- 5.1 Proposed Construction Stage Mitigation Measures
- 5.2 Proposed Operation Stage Mitigation Measures
- 5.3 Event/Action Plan for Design Phase
- 5.4 Construction/Operational Phase Audit Checklist
- 5.5 Event/Action Plan for Construction/Operational Phase

APPENDIX

- Appendix A1 Implementation Schedule for Recommended Mitigation Measures
- Appendix A2 Implementation Schedule for Recommended Mitigation Measures of Designated Project Road D1
- Appendix A3 Implementation Schedule for Recommended Mitigation Measures of Likely Designated Project – Drainage Works
- Appendix B Proforma for EM&A Programme

1. INTRODUCTION

1.1 Purpose of the Manual

1.1.1 The purpose of this Environmental Monitoring and Audit (EM&A) Manual is to guide the setup of an EM&A programme to ensure compliance with the Environmental Impact Assessment (EIA) study recommendations, to assess the effectiveness of the recommended mitigation measures and to identify any further need for additional mitigation measures or remedial action. This Manual outlines the monitoring and audit programme to be undertaken for the construction of Housing Development at Whitehead and Lee On in Ma On Shan, Shatin (hereafter refer to as the Project). It aims to provide systematic procedures for monitoring, auditing and minimising of the environmental impacts associated with the construction works and operation of the Project. It should be noted that the EM&A Manual will be subject to further review during the detailed design stage.

1.1.2 Hong Kong environmental regulations for air and water quality, noise and waste, the Hong Kong Planning Standards and Guidelines, and recommendations in the EIA Report on Whitehead Development have served as environmental standards and guidelines in the preparation of this Manual. Nevertheless, this Manual shall not remove the responsibility of the personnel outlined in Section 1.5 (Client, Contractor's Environmental Team, Environmental Team Leader and Independent Environmental Checker) to comply with the above-mentioned regulations, standards, guidelines and Environmental Permit (EP) conditions and the recommendations in the approved EIA Final Report if any.

1.1.3 This Manual contains the following:

- (a) duties of the Client, Contractor, Engineer & Engineer's Representative, Environmental Team (ET), Environmental Team Leader (ET Leader) and Independent Environmental Checker (IEC) with respect to the environmental monitoring and audit requirements during construction;
- (b) information on project organisation and programming of construction activities for the project;
- (c) requirements with respect to the construction schedule and the necessary environmental monitoring and audit programme to track the varying environmental impact;
- (d) definition of Action and Limit Levels;
- (e) establishment of Event and Action Plans;
- (f) requirements of reviewing pollution sources and working procedures required in the event of non-compliance of the environmental criteria; and

- (g) requirements of presentation of environmental monitoring and audit data and appropriate reporting procedures.

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. The ET leader, who shall be responsible for and in charge of the ET, shall refer to the person delegated the role of executing the environmental monitoring and audit requirements.

1.2 **Background**

1.2.1 Territory Development Department (TDD) proposes to conduct a feasibility study for housing development (the Study) in Whitehead and Lee On area in Ma On Shan. The Study Area is about 60 hectares covering the Whitehead peninsula, the proposed Ma On Shan Railway Wu Kai Sha Station and the private land in between Whitehead and Wu Kai Sha Station. The location of the Study Area is shown in Figure 1.1. The Study is to establish a preferred development option for the Study Area. The Preferred Development Option will provide private housing development to accommodate about 6,800 flats for an estimated population of 17,000 and about 11 ha of recreational facilities such as water recreation centre, visitor/heritage/ecological centres, themed dining and botanical garden. The Project within the Study Area will involve site formation works, infrastructure including building substructure and superstructure, roads, drains, sewers and utilities, and landscaped areas. The Preferred Development Option is shown on Figure 1.2.

1.2.2 The study is a Designated Project under Schedule 3 of the Environmental Impact Assessment Ordinance (EIAO) [Cap 499] and requires an Environmental Impact Assessment (EIA) report to be approved under the EIAO. The Study also include a number of Schedule 2 Designated Projects and these are elaborated in the later sections.

1.3 **Environmental Monitoring and Audit Requirements**

Introduction

1.3.1 The EM&A requirements are based on the findings of the EIA Study undertaken in accordance with the EIA Study Brief No. ESB-029/1999. The Project within the Study Area will involve site formation works, infrastructure including substructure and superstructure, roads, drains, sewers and utilities, and landscaped areas. These activities have the potential to impact on the existing environment. Mitigation measures have been recommended in the EIA Report to prevent potential adverse impacts from the construction and operation of the Whitehead development. Based on these recommendations, the EM&A requirements for the Project are summarised below.

1.3.2 The EIA Report identified the likely environmental impacts associated with the proposed development. It has been identified that these impacts can be minimised to acceptable levels with the implementation of the recommended mitigation measures. In order to ensure compliance with relevant environmental standards, the following impacts will require EM&A during construction stage:

- (a) noise
- (b) air quality (construction dust)
- (c) water
- (d) landscape and visual

1.3.3 During operation stage, traffic noise and landscape & visual monitoring are recommended.

1.3.4 Details of the EM&A requirements and procedures are stipulated in the subsequent sections.

1.4 Summary of Mitigation Measures and Implementation Schedule

1.4.1 The summary of the mitigation measures for both the construction and operation phase of the Project as recommended in the EIA Study is presented in the form of an Implementation Schedule. Description of each heading is tabulated in Table 1.1. The Implementation Schedule is attached in Appendix A.

Table 1.1
Description of Column Headings for the Implementation Schedule

Column Heading	Description
EIA Ref.	Describes the section number or reference in the EIA Report.
EM&A Log Ref.	Describes the section number or reference in the EM&A Manual.
Environmental Protection Measures	Describes the recommended mitigation measures, courses of action or subsequent deliverables that are to be adopted, undertaken or delivered to avoid, minimise or ameliorate predicted environmental impacts.
Location/Duration of Measures/Timing of Completion of Measures	Describes the spatial area in which the recommended mitigation measures are to be implemented together with details of the programming or timing of their implementation.
Implementation Agent	Describes where the responsibility lies for the implementation of the recommended mitigation measures.
Implementation Stage	Describes the stage at which the recommended mitigation measures are to be implemented; either during the Design (Des), Construction (C), or Operation (O).
Relevant Legislation & Guidelines	Describes the controlling legislation or guidelines that are either required to be complied with, or should be complied with as good practice.

1.5 **Environmental Policy and Project Management Organization and Responsibilities**

- 1.5.1 An Environmental Policy Statement issued by the Project Proponent (TDD) is shown below. The statement identifies the TDD's intentions and principles in relation to the project's environmental performance, which will provide a framework for action and for the setting of environmental objectives and targets.

**Territory Development Department
Environmental Policy**

The Territory Development Department, in undertaking project management services in civil engineering projects for policy bureaux, places due emphasis on the need to sustain and where possible to improve the quality of our environment. We endeavour to achieve this through the implementation of our Environmental Management System and commitment to the following:

- Adopting technologies and measures both through project design and during construction to prevent or reduce environmental pollution and nuisance.
- Imposing environmental requirements on our contractors and consultants to ensure the mitigation and prevention of potential impacts resulting from projects managed by the Department.
- Monitoring the environmental performance of our contractors during construction works to ensure contractor's compliance with our environmental requirements.
- Observing the principles of Waste Reduction, Re-use, and Recycling wherever practicable and feasible.
- Undertaking the landscape and environmental mitigation works to enhance the living environment of new development areas and their hinterland.
- Ensuring compliance with relevant environmental legislative and other requirements.
- Providing environmental education and training to all staff to increase their awareness of environmental protection.
- Achieving continual improvement in environmental performance through the establishment and attainment of environmental objectives and targets.

Every member of staff will ensure that this environmental Policy is understood, implemented and maintained.

Signed (WONG Hung-kin)
Director of Territory Development
18 December 2001

Note:

A Chinese version of the Environmental Policy is also available in the Territory Development Department's website (http://www.info.gov.hk/tdd/chi/about/env_policy.htm).

- 1.5.2 The project organisation and lines of communication with respect to environmental protection works are shown in Figures 1.3 and 1.4 respectively.

The Client

1.5.3 The Client shall be responsible for:

- (a) the broad supervision of the EM&A Programme, its members and the timely production and quality of the outputs;
- (b) engaging and managing the Engineer/Engineer Representative and the Independent Environmental Checker (IEC);
- (c) meeting the agreed objectives and deadlines as set out in this Manual; and
- (d) ensuring full compliance with the EIA recommendations, related Environmental Permit conditions, EM&A Manual and all other relevant Hong Kong environmental legislation/guidelines and contractual requirements, and the quality of the deliverables.

1.5.4 The Client shall also provide appropriate information to the monthly EM&A reports such as:

- (a) any design changes; and
- (b) public consultation and liaison meetings involving the District Councils, area committee, interest groups, etc.

Contractor

1.5.5 Each Contractor shall be responsible for:

- (a) Employing and providing assistance to an Environmental Team (ET) who will be under direction of the ET leader to undertake monitoring, laboratory analysis and reporting of environmental monitoring and audit;
- (b) implementing environmental controls and mitigation as set out in this manual as well as any additional measures necessary for compliance with the environmental control standards;
- (c) following any reasonable directions and corrective actions given by the Engineer or the ER(s) particularly as the result of the implementation of event/action plan and co-operate with the environmental performance review undertaken by the IEC;
- (d) complying with and observing all environmental Ordinances, bye-laws, regulations and rules for the time being in force in Hong Kong governing the control of any form of pollution, including air, noise, water and waste pollution, and implementing environmental controls and mitigation as set out in this manual as well as any additional measures necessary for compliance with the environmental control standards; and

- (e) Carrying out all works in such a manner as to cause as little impact as possible to environs and the Contractor shall be held responsible for any claims which may arise from such impacts.

The Engineer

1.5.6 The Engineer will be responsible for:

- (a) ensuring that the EM&A programme is fully implemented in accordance with the EIA Report, Environmental Permit and this EM&A Manual;
- (b) ensuring that the Contractor is implementing environmental controls and mitigation as set out in the contract specifications, EIA Report, Environmental Permit and this EM&A Manual as well as any additional measures necessary for compliance with the environmental control standards;
- (c) ensuring that the Contractor is implementing and enforcing event/action plans when exceedances of Action and Limit (A/L) levels or complaints occur;
- (d) reviewing the monitoring and audit reports submitted by the ET leader;
- (e) implementing a 'stop work' action if repeated exceedance of target levels justifies this action;
- (f) following up and closing out corrective actions in accordance with the event/action plans; and
- (g) investigating and auditing the Contractor's equipment and work methodologies with respect to pollution control and environmental mitigation, and to anticipate environmental issues that may require mitigation before the problem arises.

1.5.7 The division of the responsibilities under the Engineer are given in the following paragraphs.

The Engineer's Representative (ER(s))

1.5.8 The ER(s) have a key role to play with the EM&A programme, undertaking:

- (a) an engineering audit of environmental reports;
- (b) site liaison;
- (c) implementing and enforcing event/action plans under the Contract when exceedances of AL levels or complaints occur; and

- (d) ensuring that measures to protect the environment are sufficient, properly and regularly maintained under the Contract.

The Environmental Team (ET)

1.5.9 The ET led by ET leader will hold a key position with the EM&A programme.

1.5.10 Appropriate staff shall be included in the ET to fulfil the following EM&A duties:

- (a) environmental monitoring of various aspects such as noise, air quality, and water quality as required by this EM&A Manual and using the procedures outlined in this EM&A Manual;
- (b) recording activities or operations taking place at the site before or during the monitoring period;
- (c) recording factors such as weather conditions at the time of sampling or data collection;
- (d) undertaking regular maintenance and calibration of equipment so that accurate data are collected with precision;
- (e) reporting to the ET leader any abnormality in monitoring process and any difficulties encountered; and
- (f) ensuring that monitoring results are sent to both the ER and the ET leader within the time frame as agreed by the ER.

Environmental Team Leader (ET Leader)

1.5.11 The ET leader shall have relevant professional qualifications, or have sufficient relevant EM&A experience subject to approval of the Engineer. The ET leader will be responsible for:

- (a) reviewing the EIA final report and the detailed designs to ensure that the EIA recommendations and any other measures identified during the reviews are incorporated into the designs;
- (b) ensuring that the contracts, licences and detailed designs of the Study incorporate the measures recommended in the EIA report;
- (c) checking that timely implementation of mitigation measures identified in the EIA final report occurs;
- (d) examining Contractors' rolling works programmes, method statements, licence application and other relevant documentation so as to ensure the best practice would

be implemented to generate no unacceptable impacts to the established guidelines/standards;

- (e) identifying any potential unanticipated or greater than expected impacts;
- (f) formulating any necessary preventative or remedial measures to be actioned for these potential impacts;
- (g) liaising with the Engineer(s) and Contractors on environmental considerations both regularly and as necessary;
- (h) undertaking environmental site inspection and audit both regularly and on ad-hoc basis at a frequency appropriate to the intensity of the works;
- (i) approval of the appointment and the direction of the ET and supervising the ET;
- (j) reviewing the monitoring data produced taking into account any factors which may influence these data;
- (k) interpreting the reviewed data with reference to A/L levels and baseline and control data;
- (l) considering cumulative impacts from nearby construction works and ascertaining whether any extraneous activities, unrelated to the construction work on the site, may have influenced the data;
- (m) implementing event/action plans when exceedances of A/L levels or complaints occur;
- (n) liaising and consulting with all relevant parties during the implementation of action plans;
- (o) establishing the A/L levels of water quality and Action Level of air quality;
- (p) reviewing the EM&A programme after the collection and analysis of the baseline data. Modifying the EM&A programme in terms of parameters, sites, sample sizes, frequency etc. if appropriate in consultation with the Independent Environmental Checker (IEC), Engineer, EPD and Client;
- (q) modifying the EM&A programme in consultation with the ER(s), EPD, and other government departments if necessary throughout the period of Works;
- (r) producing and circulating reports:
 - (i) on a regular basis as required in this manual;
 - (ii) when action plans are implemented;
 - (iii) when responding to public complaints; and

- (s) implementing the complaints procedures.

Independent Environmental Checker (IEC)

- 1.5.12 The IEC shall be employed prior to commencement of construction of the Whitehead development. The IEC shall have at least 7 years experience in EM&A or environmental management.
- 1.5.13 The IEC shall audit the overall EM&A programme including the implementation of all environmental mitigation measures, submissions relating to EM&A, and any other submission required under the Environmental Permit.
- 1.5.14 In addition, the IEC shall be responsible for verifying the environmental acceptability of permanent and temporary works, relevant design plans and submissions under the Environmental Permit.
- 1.5.15 The IEC shall arrange and conduct monthly general site inspections of the different works areas.
- 1.5.16 The IEC shall ensure that impact monitoring is conducted at the correct locations at the correct frequency as identified in this Manual.
- 1.5.17 The IEC shall report the findings of the site inspections and other environmental performance reviews to the Client and the EPD.

1.6 Implementation

- 1.6.1 For the Wu Kai Sha Station, with the commissioning of the railway by 2004, it is understood that the KCRC has planned to complete the property development at the site by 2006.
- 1.6.2 The majority of the Lok Wo Sha site is under single ownership. The proposed development at this site could be completed by the developer by 2008 taking into account the required statutory procedures for the proposed CDA zoning.
- 1.6.3 The residential development and recreational development at Whitehead is scheduled for completion in 2008. Implementation is currently proposed to be undertaken by a private developer as one project.
- 1.6.4 Table 1.2 is the tentative works programme for the project. This programme is for information of the ET Leader to get an initial idea of the projection of the works. The ET Leader shall make reference to the actual works progress and programme during the construction stage to schedule the EM&A works, and the Contractor shall provide the respective information to the ET Leader for formulating the EM&A schedule.

Table 1.2
Tentative Development Programme

Development	Start	Finish
Wu Kai Sha Station development	2002	2006
Lok Wo Sha development (site formation)	2003	2004
Lok Wo Sha development (infrastructure and building works)	2004	2008
Whitehead Sites 2, 3 and recreational centres (site formation)	2003	2004
Whitehead Sites 2, 3 and recreational centres (infrastructure and building works)	2005	2008
	Occupational Date	
Wu Kai Sha Station development	2006	
Lok Wo Sha and Whitehead development	2008	

1.7 Designated Projects

1.7.1 This Project is a planning and engineering feasibility study of the Study Area with a project area covering more than 20 ha and is, therefore, considered by EPD as a Designated Project (DP) under Item 1 of Schedule 3 of the *Environmental Impact Assessment Ordinance* (EIAO) [Cap 499]. The Project contains various Schedule 2 DPs which under the EIAO require Environmental Permits (EPs) to be granted by EPD before they can be constructed and operated. Individual works that are considered as DP under Schedule 2 of the EIAO may directly apply for EPs by referring to this Schedule 3 EIA subject to the satisfaction and agreement from EPD. Supplementary visual impact assessment for the Road D1 project which is a Schedule 2 DP is required to be prepared as necessary. Table 1.3 summarises the list of DPs and non-DPs under this Project.

Table 1.3
Designated Projects under this Study

Works under this Project	EIAO Schedule 2 Part I Category Reference	Designated Project	Remarks	EM&A Requirement**
Construction of district distributor roads D1	A.1	Yes	District distributor road	Noise, Water, Landscape and Visual
Construction of drainage works	I.1	Likely*	Discharges into an area which is less 300 m from the nearest boundary of an existing or planned site of cultural heritage and Conservation Area (CA)*	Noise, Water, Landscape and Visual
Construction of local roads L1 and L2	A	No	Local roads	Noise, Water, Landscape and Visual

Works under this Project	EIAO Schedule 2 Part I Category Reference	Designated Project	Remarks	EM&A Requirement**
Construction of Comprehensive Recreation Development (Botanical Garden, Themed Restaurant Park, Heritage / Ecological Centre, Visitor Information Centre, Adventurous Cycle Park, Water Recreation Centre) with a total area of 11 ha	O.8	No	Less than 20 ha in size	Noise, Water, Landscape and Visual
Site formation of Whitehead site	C	No	Dredging or reclamation will not be involved	Air, Noise, Water, Landscape and Visual
Construction of gravity sewers beneath public roads and drainage reserves within and near the development to connect to the existing Area 108 Sewage Pumping Station	F	No	Does not meet category	Noise, Water, Landscape and Visual
Construction of distribution water mains beneath public roads within the development	E	No	Does not meet category	Noise, Water, Landscape and Visual
Extension of networks by utility undertaking	H	No	Does not meet category	Noise, Water, Landscape and Visual
Construction of indoor recreational centre	N	No	Does not meet category	Noise, Water, Landscape and Visual
Construction of salt water pumping station	E	No	Does not meet category	Noise, Water, Landscape and Visual

* It is proposed in this Study that the To Tau Tsuen area be zoned to "CA" in the Ma On Shan OZP. According to PlanD's memo (Ref. (44) in PD/ST 4/9/2 (VI)) dated 24 July 2002, the preserved plantations at the eastern and western ends of the Whitehead headland are proposed to be zoned "CA".

** All EM&A requirements will be undertaken by TDD.

1.7.2 In view of the potential site of archaeological interest identified at Lok Wo Sha and the current inaccessibility of the site, an archaeological site investigation is recommended to be carried out prior to development (Figure 1.5). Subject to the findings of the archaeological site investigation, some of the proposed development may be potentially DPs. In the event that the proposed development works are confirmed as DPs, the EIAO procedure will be carried out by the relevant project proponent.

2. AIR QUALITY

2.1 Introduction

2.1.1 The EIA has predicted that the periods when dust may reach the highest levels at Air Sensitive Receivers (ASRs) are related to the site formation and haul road traffic and the close proximity of the ASRs with the construction sites. With adequate dust suppression measures, dust levels from the Project will not exceed the Air Quality Objectives (AQOs) at nearby ASRs.

2.1.2 Mitigation measures such as watering of exposed areas or pavement of haulage route have been proposed to suppress dust generation. With the implementation of the recommended mitigation backed up by an EM&A programme, the Project should comply with the Air Quality Objectives.

2.1.3 The air quality monitoring is also intended to monitor the effectiveness and efficiency of the implementation of dust suppression measures as a result of the construction of Whitehead Development. Proper mitigation measures shall be implemented as far as possible to ensure the compliance of AQOs at all ASRs as a result of the proposed development.

2.1.4 No exceedance of potential operational air quality has been predicted in the EIA Study. Therefore, no EM&A relating to air quality are required for the operational phase.

2.2 Air Quality Parameters

2.2.1 The impact of fugitive dust on ambient air pollution depends on the quantity and the drift potential of the dust particles injected into the atmosphere. Large dust particles will settle out near the source and particles that are 30-100 μm in diameter are likely to undergo impeded settling. These particles, depending on the extent of atmospheric turbulence, would settle within a distance of 100 m from the source. The main dust impact will arise from fine particles of a diameter less than 30 μm , measured as Total Suspended Particulates (TSP), dispersed over greater distances from the sources. Monitoring and audit of the TSP levels shall therefore be carried out by the ET to ensure that any deteriorating air quality could be readily detected and timely action taken to rectify the situation.

2.2.2 24-hour TSP levels shall be measured by following the standard high volume sample (HVS) method as set out in the *Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B*.

2.2.3 Due to the lengthy delay between sampling time and result availability for 24-hour sampling, 1-hour TSP sampling should also be conducted. 1-hour TSP levels, while assessed under different criteria, are considered to be indicative of forthcoming 24-hour results conducted on the same day. In this way expedient remedial actions, should they be required, may be undertaken based on the 1-hour data, before the 24-hour results become available.

- 2.2.4 1-hour sampling, providing real time airborne particulate measurement, can be undertaken using a direct reading dust meter. Despite the advantages of using a real time monitor to measure particulate concentrations such as in responses of dust complaints, results are not comparable with 24-hour HVS data. Therefore, if the use of direct reading monitor is agreed for 1-hour TSP sampling both baseline and impact monitoring must be carried out by the direct reading method.
- 2.2.5 No comparisons between direct reading and HVS data shall be attempted except that, where the direct reading method for 1-hour TSP is used, the measured TSP concentrations shall be regarded as indicative of the 24-hour TSP results and the actions specified in the following section shall be implemented.
- 2.2.6 All the 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 in details. A sample data sheet is shown in Figure 2.1.

2.3 Monitoring Equipment

- 2.3.1 High volume sampler (HVS) in compliance with the following specifications shall be used for carrying out the 1-hr and 24-hr TSP monitoring:
- (a) 0.6-1.7 m³/min (20-60 SCFM) adjustable flow range;
 - (b) equipped with a timing/control device with +/- 5 minutes accuracy for 24 hours operation;
 - (c) installed with elapsed-time meter with +/- 2 minutes accuracy for 24 hours operation;
 - (d) capable of providing a minimum exposed area of 406 cm² (63 in²);
 - (e) flow control accuracy: +/- 2.5% deviation over 24-hr sampling period;
 - (f) equipped with a shelter to protect the filter and sampler;
 - (g) incorporated with an electronic mass flow rate controller or other equivalent devices;
 - (h) equipped with a flow recorder for continuous monitoring;
 - (i) provided with a peaked roof inlet;
 - (j) incorporated with a manometer;
 - (k) able to hold and seal the filter paper to the sampler housing at horizontal position;
 - (l) easy to change the filter; and

- (m) capable of operating continuously for 24-hr period.
- 2.3.2 The ET is responsible for provision of the monitoring equipment. The ET shall ensure that sufficient number of HVSs with an appropriate calibration kit are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. 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.
- 2.3.3 Initial calibration of dust monitoring equipment 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. All the data should be converted into standard temperature and pressure condition.
- 2.3.4 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 as mentioned in Section 2.2.6.
- 2.3.5 If the ET proposes to use a direct reading dust meter to measure 1-hr TSP levels, he shall submit sufficient information to the ER to prove that the instrument is capable of achieving a comparable result as that the HVS and may be used for the 1-hr sampling. The instrument should 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.
- 2.3.6 Wind data monitoring equipment shall also be provided and set up at conspicuous locations for logging wind speed and wind direction near to the dust monitoring locations. The equipment installation location shall be proposed by the ET Leader and agreed with the ER. For installation and operation of wind data monitoring equipment, the following points shall be observed:
- (a) 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;
 - (b) the wind data should be captured by a data logger and to be downloaded for processing at least once a month;
 - (c) the wind data monitoring equipment should be re-calibrated at least once every six months; and
 - (d) wind direction should be divided into 16 sectors of 22.5 degrees each.
- 2.3.7 In exceptional situations, the ET Leader may propose alternative methods to obtain representative wind data upon approval from the ER and agreement from EPD.

2.4 Laboratory Measurement / Analysis

- 2.4.1 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 achieved accreditation under Hong Kong Laboratory Accreditation Scheme (HOKLAS).
- 2.4.2 In the event 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 and the measurement procedures shall be witnessed by the ER. The ET Leader 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.
- 2.4.3 Filter paper of size 8"x10" shall be labelled before sampling. It shall be a clean filter paper with no pin holes, and shall be conditioned in a humidity controlled chamber for over 24-hr and be pre-weighed before use for the sampling.
- 2.4.4 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 a readout down to 0.1 mg. The balance shall be regularly calibrated against a traceable standard.
- 2.4.5 All the collected samples shall be kept in a good condition for 6 months before disposal.

2.5 Monitoring Locations

- 2.5.1 The dust monitoring locations are shown in Table 2.1 and Figure 2.2. The status and locations of dust sensitive receivers may change after issuing this manual. If such cases exist, the ET Leader shall propose updated monitoring locations and seek approval from ER and agreement from EPD on the proposal.

Table 2.1
Location of Air Quality Monitoring Stations

Air Monitoring Station	Description
A1	Village house in To Tau
A2	Li Po Chung United World College

2.5.2 When alternative monitoring locations are proposed, the following criteria, as far as practicable, should be followed:

- (a) at the site boundary or such locations close to the major dust emission source;
- (b) close to the sensitive receptors; and
- (c) take into account the prevailing meteorological conditions.

2.5.3 The ET Leader shall agree with the ER on the position of the HVS for installation of the monitoring equipment. When positioning the samplers, the following points shall be noted:

- (a) a horizontal platform with appropriate support to secure the samplers against gusty wind should be provided;
- (b) no two samplers should be placed less than 2 meter apart;
- (c) 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;
- (d) a minimum of 2 metres of separation from walls, parapets and penthouses is required for rooftop samplers;
- (e) a minimum of 2 metre separation from any supporting structure, measured horizontally is required;
- (f) no furnace or incinerator flue is nearby;
- (g) airflow around the sampler is unrestricted;
- (h) the sampler is more than 20 metres from the dripline;
- (i) any wire fence and gate, to protect the sampler, should not cause any obstruction during monitoring;
- (j) permission must be obtained to set up the samplers and to obtain access to the monitoring stations; and
- (k) a secured supply of electricity is needed to operate the samplers.

2.6 Baseline Monitoring

- 2.6.1 Baseline monitoring shall be carried out at all of the designated monitoring locations for at least 14 consecutive days prior to the commissioning of the construction works to obtain daily 24-hour TSP samples. 1-hour sampling shall also be done at least 3 times per day while the highest dust impact is expected.
- 2.6.2 During the baseline monitoring, there should not be any construction or dust generation activities in the vicinity of the monitoring stations.
- 2.6.3 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 EPD.
- 2.6.4 In exceptional case, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall liaise with EPD to agree on an appropriate set of data to be used as a baseline reference and submit to ER for approval.
- 2.6.5 Ambient conditions may vary seasonally and shall be reviewed at three monthly intervals. 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 at times when the contractor's activities are not generating dust, at least in the proximity of the monitoring stations. 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 EPD.

2.7 Impact Monitoring

- 2.7.1 The ET shall carry out impact monitoring under direction of the ET Leader during the course of the Works. For regular impact monitoring, the sampling frequency of at least once in every six-days, shall be strictly observed at all the designated monitoring stations for 24-hour TSP monitoring. For 1-hour TSP monitoring, the sampling frequency of at least three times in every six-days should be undertaken when the highest dust impact occurs.
- 2.7.2 The specific time to start and stop the 24-hour TSP monitoring shall be clearly defined for each location and be strictly followed by the operator.
- 2.7.3 In case of non-compliance with the air quality criteria, more frequent monitoring exercise, as specified in the Action Plan in Section 2.8, 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.

2.8 Event and Action Plan for Air Quality

2.8.1 The baseline monitoring results form the basis for determining the air quality criteria for the impact monitoring. The ET Leader shall compare the impact monitoring results with air quality criteria set up for 24-hour TSP and 1-hour TSP. Table 2.2 shows the air quality criteria, namely Action and Limit levels to be used. Should non-compliance of the air quality criteria occurs, the ET, the ER and the Contractor shall undertake the relevant action in accordance with the Action Plan in Table 2.3.

Table 2.2
Action and Limit Levels for Air Quality

Parameters	Action Criteria	Limit
24 Hour TSP Level in $\mu\text{g}/\text{m}^3$	For baseline level $< 108 \mu\text{g}/\text{m}^3$, Action level = average of baseline level plus 30% and Limit level For baseline level $> 108 \mu\text{g}/\text{m}^3$ and baseline level $< 154 \mu\text{g}/\text{m}^3$, Action level = $200 \mu\text{g}/\text{m}^3$ For baseline level $> 154 \mu\text{g}/\text{m}^3$, Action level = 130% of baseline level	260
1 Hour TSP Level in $\mu\text{g}/\text{m}^3$	For baseline level $< 154 \mu\text{g}/\text{m}^3$, Action level = average of baseline level plus 30% and Limit level For baseline level $> 154 \mu\text{g}/\text{m}^3$ and baseline level $< 269 \mu\text{g}/\text{m}^3$, Action level = $350 \mu\text{g}/\text{m}^3$ For baseline level $> 269 \mu\text{g}/\text{m}^3$, Action level = 130% of baseline level	500

Table 2.3 Event/Action Plan for Air Quality

EVENT LEVEL	ACTION			
	ET leader	IEC	ER	Contractor
1. Exceedance for one sample	<ol style="list-style-type: none"> Identify source Inform IEC, ER and Contractor Repeat measurement to confirm findings Increase monitoring frequency to daily 	<ol style="list-style-type: none"> Check monitoring data submitted by ET leader Check Contractor's working method 	<ol style="list-style-type: none"> Notify Contractor 	<ol style="list-style-type: none"> Rectify any unacceptable practice Amend working methods if appropriate
2. Exceedance for two or more consecutive samples	<ol style="list-style-type: none"> Identify source Inform IEC, ER and Contractor Repeat measurement to confirm findings Increase monitoring frequency to daily Discuss with IEC, Contractor and ER on remedial actions required If exceedance continue, arrange meeting with IEC, ER and Contractor If exceedance stops, cease additional monitoring 	<ol style="list-style-type: none"> Checking monitoring data submitted by ET leader. Check Contractor's working method Discuss with ET leader and Contractor on possible remedial measures Advise the ER on the effectiveness of the proposed remedial measures Supervise implementation of remedial measures 	<ol style="list-style-type: none"> Confirm receipt of notification of failure in writing Notify Contractor Ensure remedial measures properly implemented 	<ol style="list-style-type: none"> Submit proposals for remedial actions to IEC and ER within 3 working days of notification Implement the agreed proposals Amend proposal if appropriate
LIMIT LEVEL				
1. Exceedance for one sample	<ol style="list-style-type: none"> Identify source Inform IEC, ER, EPD and Contractor Repeat measurement to confirm findings Increase monitoring frequency to daily Assess effectiveness of Contractor's remedial actions and kept IEC, EPD and ER informed of the results 	<ol style="list-style-type: none"> Check monitoring data submitted by ET leader Check Contractor's working method Discuss with ET leader and Contractor on possible remedial measures Advise the ER on the effectiveness of the proposed remedial measures Audit implementation of remedial measures 	<ol style="list-style-type: none"> Confirm receipt of notification of failure in writing Notify Contractor Ensure remedial measures properly implemented 	<ol style="list-style-type: none"> Take immediate action to avoid for the exceedance Submit proposals for remedial actions to IEC and ER within 3 working days of notification Amend proposal if appropriate
2. Exceedance for two or more consecutive samples	<ol style="list-style-type: none"> Notify IEC, ER, Contractor and EPD Identify source Repeat measurement to confirm findings Increase monitoring frequency to daily Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented Arrange meeting with IEC, Contractor and ER to discuss the remedial actions to be taken Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results If exceedance stops, cease additional monitoring 	<ol style="list-style-type: none"> Discuss amongst ER, ET leader and Contractor on the potential remedial actions Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly Audit the implementation of remedial measures 	<ol style="list-style-type: none"> Confirm receipt of notification of failure in writing In consultation with IEC, agree with the Contractor on the remedial measures to be implemented Ensure remedial measures properly implemented 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. 	<ol style="list-style-type: none"> Take immediate action to avoid for the exceedance Submit proposals for remedial actions to IEC and ER within 3 working days of notification Implement the agreed proposals Resubmit proposals if problem still not under control Stop the relevant portion of works as determined by the ER until the exceedance is abate.

2.9 Dust Mitigation Measures

2.9.1 In order to comply with *Air Pollution Control Ordinance* (APCO), the Contractor should at all times prevent dust nuisance as a results of his activities. The Contractors are required to follow all the requirements for dust control stipulated in the *Air Pollution Control (Construction Dust) Regulation*. Site formation works are likely to cause short-term unacceptable dust impacts on all of the representative ASRs close to the Project development. Therefore, dust suppression measures, such as regular watering the exposed area and haulage pavement, should be installed as part of good construction practice, and they should be incorporated in the Contract Specification and implemented to minimize dust nuisance to within acceptable levels arising from the works. Measures which are employed to minimize impacts on sensitive receivers in the Study Area are also relevant for the protection of ecologically sensitive areas. Other dust suppression measures are highlighted below:

- (i) The Contractor shall observe and comply with the *Air Pollution Control Ordinance* and its subsidiary regulations, particularly the *Air Pollution Control (Construction Dust) Regulation*.
- (ii) The Contractor shall undertake at all times to prevent dust nuisance as a result of his activities. Effective dust suppression measures should be employed to ensure that the air quality, at the boundary of his site and at any ASRs, complies with the Hong Kong Air Quality Objectives.
- (iii) The Contractor shall ensure that there will be adequate water supply / storage for dust suppression purposes.
- (iv) The Contractor shall frequently clean and water the site to minimize fugitive dust emissions.
- (v) Effective water sprays shall be used during the delivery and handling of aggregate, and other similar materials, when dust is likely to be created and to dampen all stored materials during dry and windy weather.
- (vi) Watering of exposed surfaces shall be exercised as often as possible depending on the circumstance.
- (vii) Areas within the site where there is a regular movement of vehicles must be regularly watered.
- (viii) Where dusty materials are being discharged to vehicle from a conveying system at a fixed transfer point, a three-sided roofed enclosure with a flexible curtain across the entry shall be provided. Exhausted fans shall be provided for this enclosure and vented to a suitable fabric filter system.

- (ix) The Contractor shall restricted all motorized vehicles within the site, excluding those on public roads, to a maximum speed of 15 km per hour and confine haulage and delivery vehicles to designated roadways inside the site.
 - (x) Wheel washing facilities shall be installed and used by all vehicles leaving the site. No earth, mud, debris, dust and the like shall be deposited on public roads. Water in wheel cleaning facility shall be changed at frequent intervals and sediments shall be removed regularly. The Contractor shall submit detailed proposals for the wheel cleaning facilities to the Engineer prior to construction of the facility. Such wheel washing facilities shall be usable prior to any earthworks excavating activity on the site. The Contractor shall also provide a hard-surfaced road between any washing facility and the public road.
 - (xi) The Contractor shall devise, arrange methods of working and carrying out the works in such a manner so as to minimize dust impacts on the surrounding environment, and shall provide experienced personnel with suitable training to ensure that these methods are implemented.
 - (xii) All site vehicles' exhausts should be directed vertically upwards or directed away from the ground.
 - (xiii) Any stockpile of dusty material shall be either: (a) covered entirely by impervious sheeting; (b) placed in area sheltered on the top and the three sides; or (c) sprayed with water or a dust suppression chemical so as to maintain the entire surface wet.
- 2.9.2 An implementation schedule for these measures is identified in Appendix A.
- 2.9.3 If the above measures are not sufficient to restore the air quality to acceptable levels upon the advice of ET Leader, the Contractor shall liaise with the ET Leader on some other mitigation measures, propose to ER for approval, and implement the mitigation measures.

3. NOISE

3.1 Introduction

Construction Stage

- 3.1.1 The construction noise assessment shows that unmitigated noise levels might exceed EPD's recommended daytime construction noise level when construction activities occur in close proximity to Noise Sensitive Receivers (NSRs) or when several construction works occur simultaneously.
- 3.1.2 Without mitigation measures, exceedance of noise level is unavoidable because of the close proximity between the construction works and some of the NSRs. Adequate mitigation measures will be required for the construction works to meet the noise levels.

- 3.1.3 The use of quiet plant and working methods, reducing the number of equipment, restricting the number of works and the use of temporary noise barriers to protect the closest residences and schools has been recommended and would be sufficient to reduce noise levels to compliance levels at the NSRs.
- 3.1.4 Noise monitoring should be carried out at selected representative NSRs during the construction period to monitor compliance with the daytime noise levels for the construction activities being undertaken for the Whitehead development. Monitoring is also required to check the effectiveness of the recommended mitigation measures. Ad-hoc monitoring and audit should be carried out at other NSRs in case of complaints, and measures taken to ensure noise criteria are met as far as possible.
- 3.1.5 Notwithstanding the monitoring and audit requirements in this EM&A Manual, the Contractor may be required to undertake additional noise monitoring by EPD in connection to Construction Noise Permit (CNP) application or to demonstrate compliance to *Noise Control Ordinance* (NCO).

Operation Stage

- 3.1.6 Traffic noise impact assessment has predicted that the introduction of environmentally friendly layout design (such as setback, podium, and orientation) has resulted in noise compliance in majority of the planned NSRs within the development.
- 3.1.7 For the school development which exceeded the noise criteria, noise mitigation measures in the form of 3 m tall boundary wall have been proposed.
- 3.1.8 No traffic noise barriers were proposed for the roads under this Project.
- 3.1.9 A traffic noise monitoring programme is suggested during the operational phase of the Project.

3.2 Noise Parameters

- 3.2.1 The construction noise level shall be measured in terms of the A-weighted equivalent continuous sound pressure level (Leq). Leq(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, three consecutive Leq(5 min) shall be employed for comparison with the NCO criteria.
- 3.2.2 As supplementary information for data auditing, statistical results such as L₁₀ and L₉₀ shall also be obtained for reference. A sample data record sheet is shown in Figure 3.1 for reference.

3.3 Monitoring Equipment

- 3.3.1 As referred to in the Technical Memorandum (TM) issued under 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 level from before and after the noise measurement agree to within 1.0dB.
- 3.3.2 Noise measurements should not be made in the presence of fog, rain, wind with a steady speed exceeding 5ms^{-1} or wind with gusts exceeding 10ms^{-1} . The wind speed shall be checked with a portable wind speed meter capable of measuring the wind speed in m/s.
- 3.3.3 The ET is responsible for the provision of the monitoring equipment. The ET 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.
- 3.4 **Construction Noise Monitoring Locations**
- 3.4.1 The construction noise monitoring locations are shown in Table 3.1 and Figure 3.2. The status and locations of noise sensitive receivers may change after issuing this manual. If such cases exist, the ET shall propose updated monitoring locations and seek approval from ER and agreement from EPD of the proposal.

Table 3.1
Location of Construction Noise Monitoring Stations

Construction Noise Monitoring Station	Description
CN1	Village house in To Tau
CN2	Li Po Chung United World College

- 3.4.2 When alternative monitoring locations are proposed, the monitoring locations should be chosen based on the following criteria:
- (a) at locations close to the major site activities which are likely to have noise impacts;
 - (b) close to the noise sensitive receivers (N.B. For the purposes of this section, any domestic premises, hotel, hostel, temporary housing accommodation, hospital, medical clinic, educational institution, place of public worship, library, court of law, performing art centre should be considered as noise sensitive receiver); and
 - (c) for monitoring locations located in the vicinity of the sensitive receivers, care should be taken to cause minimal disturbance to the occupants during monitoring.

3.4.3 The monitoring station shall normally be at a point 1m from the exterior of the sensitive receivers building facade and be at a position 1.2 m above the 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 +3 dB(A) shall be made to the free field measurements.

3.4.4 The ET Leader shall agree with the ER 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.

3.5 **Baseline Monitoring**

3.5.1 Baseline monitoring should be conducted using a sound level meter and data logger at all designated noise monitoring station as shown in Tables 3.1.

3.5.2 At each location, baseline noise levels should be measured prior to construction of the project over two consecutive 7-day calendar week following the methodology stated in Sections 3.2 to 3.4. Leq(30 min) measurement for hours between 0700-1900, and Leq(5 min) measurement between 1900 – 0700 shall be taken. The measurements should be computed from consecutive Leq(5 min) readings taken throughout each 24 hours period.

3.5.3 The survey period should be selected prior to the commencement of construction activities in order to avoid other typical noise sources. The proper functioning of the logger shall be ensured during the monitoring period, and as a minimum, the equipment shall be inspected for a period of not less that one hour every two days to ensure its continued operation and to detail specific noise sources audible at the monitoring location. The calibration of the logger kit shall be as recommended by the manufacturer. Measurements shall be recorded to the nearest 0.1 dB.

3.5.4 There shall not be any construction activities in the vicinity of the stations during the baseline monitoring.

3.5.5 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET leader should liaise with EPD to agree on an appropriate set of data to be used as a baseline reference.

3.6 **Impact Monitoring**

3.6.1 Impact monitoring shall be carried out at all the designated monitoring station in Table 3.1 during construction phase of the project. The regular monitoring frequency for each station on a basis of once every six days when noise generating activities are underway is as follows:

- (a) one set of Leq (30 min) as six consecutive Leq (5 min) between 0700-1900 hours on normal weekdays;

- (b) one set of Leq (15 min) as three consecutive Leq (5 min) between 1900-2300 hours if construction works is carried out during these hours;
 - (c) one set of Leq (15 min) as three consecutive Leq (5 min) between 2300-0700 hours of next day if construction works is carried out during these hours;
 - (d) one set of Leq (15 min) as three consecutive Leq (5 min) between 0700-1900 hours on holidays when construction works of this project is going on.
- 3.6.2 If a school exists near the construction activity, noise monitoring shall be carried out at the monitoring stations for the schools during the school examination periods. The ET leader shall liaise with the school's personnel and the Examination Authority to ascertain the exact dates and times of all examination periods during the course of the contract.
- 3.6.3 In case of non-compliance with the construction noise criteria, more frequent monitoring as specified in the Action Plan in Section 3.7 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.
- 3.7 Event and Action Plan for Construction Noise Monitoring**
- 3.7.1 The Action and Limit levels for construction noise are defined in Table 3.2.
- 3.7.2 The Event/Action Plan in Table 3.3 for both restricted and unrestricted hours shall be carried out.
- 3.7.3 The Environmental Team (ET) is required to adjust the measured noise levels to edit out effects of background and extraneous noise levels based on the available baseline data before making comparisons with the Action and Limit levels. This will help to distinguish the background noise level (which may be different to the baseline) from the noise which could be contributed by the construction works.
- 3.7.4 To achieve this, the baseline time level at that specific time should be subtracted from measured noise level. If the result indicates that the added noise above baseline contributes more than the Limit level, then this triggers the Limit level of the Event/Action Plan. The ET is required to investigate whether this is caused by the proposed development site activities or other extraneous noise sources. If the baseline levels are higher than the Limit levels, then any exceedance of the Limit level triggers investigation of the same.

Table 3.2
Action and Limit Levels for Construction Noise

	Time Period	Action	Limit
Normal hours	0700-1900 hrs on normal weekdays	When one documented complaint is received and based on conditions of the Construction Noise Permit (CNP)	75* dB(A)
Restricted hours	0700-2300 hrs on holidays; and 1900-2300 hrs on all other days		60/65/70** dB(A) or 45/50/55*** dB(A)
	2300-0700 hrs of next day		45/50/55** dB(A) or 30/35/40*** dB(A)

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

** *Limit levels given here are suggestive only, given that Local Control Division of EPD will reserve the right to determine appropriate Areas Sensitivity Ratings and Limit levels in the form of CNP conditions on a case by case basis.*

*** *For works carried out within Designated Areas during restricted hours, certain construction activities and equipment will be subject to this set of Acceptable Noise Levels and Limit Levels, rather than the other ones listed in this table, as defined in Technical Memorandum on Noise from Construction Work in Designated Areas. The Contractor shall obtain a copy of this memorandum for reference.*

Table 3.3 Event/Action Plan for Construction Noise Monitoring

EVENT	ACTION			
	ET Leader	IEC	ER	Contractor
Action Level	<ol style="list-style-type: none"> 1. Notify IEC, Contractor and ER 2. Carry out investigation 3. Report the results of investigation to the IEC, Contractor and ER 4. Discuss with the Contractor and formulate remedial measures 5. Double monitoring frequency 6. Check compliance to Action/Limit Levels after application of mitigation measures 	<ol style="list-style-type: none"> 1. Review the analysed results submitted by the ET leader 2. Review the proposed remedial measures by the Contractor and advise the ER accordingly 3. Review the implementation of remedial measures 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of complaint in writing 2. Notify Contractor 3. Require Contractor to propose remedial measures for the analysed noise problem 4. Ensure remedial measures are properly implemented 	<ol style="list-style-type: none"> 1. Submit noise mitigation proposals to ER and IEC 2. Implement noise mitigation proposals
Limit Level	<ol style="list-style-type: none"> 1. Notify IEC, ER, EPD and Contractor 2. Identify Source 3. Repeat measurement to confirm findings 4. Increase monitoring frequency 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 	<ol style="list-style-type: none"> 1. Discuss amongst ER, ET leader and Contractor on the potential remedial actions 2. Review remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly 3. Audit the implementation of remedial measures 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing 2. Notify Contractor 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 	<ol style="list-style-type: none"> 1. Take immediate action to avoid further exceedance 2. Submit proposals for remedial actions to 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

3.8 Noise Mitigation Measures

- 3.8.1 The predicted noise levels showed that construction works would give rise to adverse daytime noise impacts to some of the NSRs. Mitigation measures are required and the following types of mitigation measures are recommended.

Use of Quiet Plant

- 3.8.2 The use of quiet plant (also referred as silenced equipment) can provide significant reduction in noise level. Quiet plant is defined as PME whose actual sound power level is less than the value specified in the TM for the same piece of equipment. To allow the Contractor some flexibility to select equipment to suit his needs, it is considered too restrictive to specify which specific items of silenced equipment to be used for the construction operations. It should be noted that various types of silenced equipment can be found in Hong Kong and are readily available on the market. BS 5228 also provide examples of quiet construction plant and their sound power level.

Use of Movable (Mobile) Barriers

- 3.8.3 Movable (mobile) barriers can be used to screen NSRs from particular items of plant or noisy operations. Movable barriers of 3 to 5 m height with a small cantilevered upper portion and skid footing can be located within a few metres of stationary plant (e.g. generator, compressor) and within about 5 m or more of a mobile equipment (e.g. excavator, mobile crane), such that the line of sight to the NSR is blocked by the barriers. It would be possible for the Contractor to provide purpose-built noise barriers or screens constructed of appropriate material with a minimum superficial density of 15 kg/m² located close to operating equipment. Certain types of stationary equipment, such as generators and compressors, can be completely screened by movable barriers giving a total noise reduction of 10 dB(A) or more.

Use of Temporary Noise Screening Structures or Purpose-built Temporary Noise Barriers

- 3.8.4 Since some of the NSRs close to the Project area are typically low-rise village houses, it would be effective to have noise screening structures or temporary noise barriers purposely-built along the site boundary to provide additional protection to NSRs close to the construction site. This could be in the form of purposely-built site hoarding constructed from appropriate materials with a minimum superficial density of 15 kg/m². Merely using plywood would not be effective. The noise barrier should have a vertical height of 3.5 m or above, have no gaps or opening at joints. The Contractor should regularly inspect and maintain the noise barrier to ensure its effectiveness.

Good Site Practices

- 3.8.5 Potential construction noise impact can also be minimized or avoided by imposing a combination of the following good site practices:

- (a) Noisy equipment and activities should be sited by the Contractor as far from close-proximity sensitive receivers as practical. Prolonged operation of noisy equipment close to dwellings should be avoided.
- (b) The Contractor should minimise construction noise exposure to the schools (especially during examination periods) as much as possible. The Contractor should liaise with the school and the Examination Authority to ascertain the exact dates and times of all examination periods during the course of the contract and to avoid noisy activities during these periods.
- (c) Noisy plant or processes should be replaced by quieter alternatives where possible. Silenced diesel and gasoline generators and power units, as well as silenced and super-silenced air compressors, can be readily obtained.
- (d) Noisy activities should be scheduled to minimise exposure of nearby sensitive receivers 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).
- (e) Idle equipment should be turned off or throttled down. Noisy equipment should be properly maintained and used no more often than is necessary.
- (f) The power units of non-electric stationary plant and earth-moving plant should be quietened by vibration isolation and partial or full acoustic enclosures for individual noise-generating components.
- (g) Construction activities should be planned so that parallel operation of several sets of equipment close to a given receiver is avoided, thus reducing the cumulative impacts between operations. The numbers of operating items of powered mechanical equipment should be minimised. Noise can be reduced by increasing the distance between the operating equipment and the NSRs or by reducing the number of items of equipment and / or construction activity in the area at any one time.
- (h) Construction plant should be properly maintained (well-greased, damage and worn parts promptly replaced) and operated. Construction equipment often has silencing measures built in or added on, e.g. bulldozer silencers, compressor panels, and mufflers. Silencing measures should be properly maintained and utilised. Where possible, rubber or damping materials should be introduced between metal panels to avoid rattle and reverberation of noise.
- (i) Equipment known to emit sound strongly in one direction, should where possible, be oriented so that the noise is directed away from nearby NSRs.

- (j) Material stockpiles and other structures (such as site offices) should be effectively utilised to shield construction noise. Noise can also be reduced by construction of temporary noise barriers which screen the lower floors from viewing the sites. Temporary noise barriers should be installed at active parts of construction areas where construction equipment is being operated in close proximity to NSRs.
 - (k) The Contractor should devise, arrange methods of working and carry out the works in such manner as to minimise noise impacts on the surrounding environment, and should provide experienced personnel with suitable training to ensure that these measures are implemented properly.
- 3.8.6 An implementation schedule for these measures is identified in Appendix A.
- 3.8.7 If the above measures are not sufficient to restore the construction noise quality to an acceptable levels upon the advice of ET Leader, the Contractor shall liaise with the ET Leader on some other mitigation measures, propose to ER for approval, and carry out the mitigation measures.

3.9 **Operational Traffic Noise Monitoring**

Introduction

- 3.9.1 As some of the noise sensitive receivers close to the proposed road will be exposed to traffic noise during the operational phase, a noise monitoring programme shall be developed to include noise measurements at noise sensitive receivers during the peak traffic hour. The programme shall be carried out by the Environmental Team (ET) to ensure that the traffic noise levels are comparable to those predicted in the Environmental Impact Assessment (EIA) under the full provision of the mitigation measures recommended.

Noise Parameters

- 3.9.2 The traffic noise level shall be measured twice within the first year of the road opening. Measurements shall be made in terms of the A-weighted L_{10} over 3 half hour periods during the peak traffic hour, other metrics like L_{eq} may be added as seen fit. A sample data record sheet is shown in the Figure 3.3 for reference. More details are listed below.

Monitoring Equipment

- 3.9.3 Sound level meters to be used shall be in compliance with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications 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 level from before and after the noise measurement agree to within 1.0 dB(A).

- 3.9.4 Noise measurements should be made in accordance with standard acoustical principles and practices in relation to weather conditions.
- 3.9.5 The ET Leader is responsible for the provision and maintenance 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.

Monitoring Locations

- 3.9.6 The operational noise monitoring locations are shown in Table 3.4 and Figure 3.4. The status and locations of noise sensitive receivers may change after issuing the Environmental Monitoring and Audit Manual. In such cases, the ET Leader shall propose updated monitoring locations and seek approval from the Engineer's Representative, and agreement from the Independent Environmental Checker (IEC)¹ and EPD of the proposal.

Table 3.4
Location of Operational Noise Monitoring Locations

Noise Monitoring Location	Description
TN1	Proposed secondary school
TN2	Proposed residential development at Lok Wo Sha

- 3.9.7 The monitoring locations shall be selected according to the following criteria :
- (a) They should be at NSRs in the vicinity of recommended direct technical remedies; preferably, there should be one representative monitoring locations near each types of noise screening element (i.e. vertical barrier, cantilever barrier, enclosure, boundary wall, etc);
 - (b) One high floor and one medium floor monitoring points should be chosen at each location as far as possible; and
 - (c) Selected monitoring locations should enable monitoring to be done twice within one year after implementation of the mitigation measures during operation of the proposed road.

¹ Please note that this is based on there is an Independent Environmental Checker (IEC), who would be required if the ET Team is associated with the Contractor. If that is not the case (e.g. when the project proponent hires his own ET Team who is not associated with the Contractor), IEC is not necessary and the ET Team can incorporate responsibilities of the IEC.

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

- (a) alternative location shall be similarly exposed to potential noise impacts;
- (b) it shall be close to the noise sensitive receivers; and
- (c) shall be located so as to cause minimal disturbance to the occupants.

3.9.9 The operational noise monitoring shall be carried out at a distance of 1 m from the openable window and 1.2 m above the floor level of the noise sensitive receivers identified. The ET Leader shall agree with the IEC on any necessary corrections adopted.

Baseline Monitoring

3.9.10 No baseline operational noise monitoring is generally required.

Noise Monitoring

3.9.11 Noise monitoring shall be carried out at all the designated traffic noise monitoring stations. The following is an initial guide on the traffic noise monitoring requirements during the operational phase :

- (a) one set of measurements at the morning traffic peak hour on normal weekdays;
- (b) one set of measurements at the evening traffic peak hour on normal weekdays;
- (c) a concurrent census of traffic flow and percentage heavy vehicle shall be obtained for far-side and near-side of the road and the existing road network in the vicinity of each measuring point;
- (d) average vehicle speed estimated for far-side and near-side of the road and the existing road network in the vicinity of each measuring point; and
- (e) the two sets of monitoring data should be obtained within the first year of operation.

3.9.12 Measured noise levels should be compared with predicted noise levels by applying appropriate conversion corrections to allow for the traffic conditions at the time of measurement. Figure 3.3 shows a sample data record sheet for operational noise monitoring.

Traffic Noise Mitigation Measures

3.9.13 In the EIA Report, a series of mitigation measures have been considered for the proposed road to reduce the noise impacts at the NSRs. The best practicable mitigation package is recommended, comprising a combination of measures such as boundary wall and

environmentally friendly layout design to protect NSRs. Details could be found in the Implementation Schedule (Appendix A).

Event and Action Plan

- 3.9.14 The measured/monitor noise levels shall be compared with the predicted results and the predicted traffic flow conditions (calculated noise levels based on concurrent traffic census obtained. In case discrepancies are observed, explanation should be given to justify the discrepancies.

4. WATER QUALITY

4.1 Introduction

- 4.1.1 Water quality monitoring should be carried out during the construction phase to audit the sufficiency of the mitigation measures incorporated into the contractors' design and evaluate their efficiency in mitigating against pollutants entering the aquatic environment.

- 4.1.2 Monitoring of the main discharge points from the development are complicated by the presence of upstream works on the MOS railway and associated property development. To identify and monitor discharges from only the proposed development works, an upstream location (or locations) is required to determine "background" conditions, which will represent run-off from the upstream development. However, the installation of culverts crossing the boundary between the two projects make access for sampling almost impossible. It is therefore recommended that a monitoring location (or locations) is identified as near as possible to where the culvert flows enter the current project site, to determine the quality of upstream run-off. Manholes may be used as sampling points, provided the safety of the sampling team is verified before confirmation of the location.

4.2 Water Quality Parameters

- 4.2.1 Monitoring of pH, turbidity in NTU, dissolved oxygen (DO) in mg/l and suspended solids (SS) in mg/l shall be carried out by the ET to ensure that any deteriorating water quality could be readily detected and timely action be taken to rectify the situation. The former three parameters are measured in-situ while the latter one is determined in the laboratory.
- 4.2.2 In locations draining a workshop or vehicle repair area, oil and grease should be included. Where a canteen or workers facilities are set up, BOD₅ is also required, and in the vicinity of chemical storage facilities, COD is an additional parameter required.
- 4.2.3 In association with the water quality parameters, relevant data shall also be measured, such as monitoring location/position, time, water depth, water temperature, salinity, DO saturation, weather conditions, sea conditions, tidal stage, and any special phenomena and works underway at the construction site.

4.2.4 A sample monitoring record sheet is shown in Figure 4.1 for reference.

4.3 **Monitoring Equipment**

Dissolved Oxygen and Temperature Measuring Equipment

4.3.1 The instrument should be a portable, weatherproof dissolved oxygen measuring instrument complete with cable, sensor, comprehensive operation manuals, and use a DC power source. It should be capable of measuring:-

- (a) a dissolved oxygen level in the range of 0-20 mg/l and 0-200% saturation; and
- (b) a temperature of 0-45 degree Celsius.

4.3.2 It should have a membrane electrode with automatic temperature compensation complete with a cable. Sufficient stocks of spare electrodes and cables should be available for replacement where necessary. (e.g. YSI model 59 meter, YSI 5739 probe, YSI 5795A submersible stirrer with reel and cable or an approved similar instrument).

pH Meter

4.3.3 The instrument shall consist of a potentiometer, a glass electrode, a reference electrode and a temperature-compensating device. It shall be readable to 0.1 pH in a range of 0 to 14. Standard buffer solutions of at least pH 7 and pH 10 shall be used for calibration of the instrument before and after use. Details of the method are given in APHA, 19th ed. 4500-HTB.

Turbidity Measurement Instrument

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

Water Sampling Equipment

4.3.5 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 should have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth (e.g. Kahlsico Water Sampler or an approved similar instrument). This water sampler is recommended for sampling at a water depth greater than 3 meters. For sampling at shallow water, a suitable plastic sampler may be used.

4.3.6 Water samples for SS, BOD₅ and COD 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.

- 4.3.7 Containers for water samples for oil & grease determination should be made of glass with air tight stoppers. The volume of sampling bottles should also be pre-calibrated. They should be cleaned and rinsed with solvent used in the extraction process prior to sampling. Samples should be filled into the sampling bottles to the calibrated marks without using any sampler to avoid loss of oil & grease. The whole volume of samples collected should be used for extraction of oil & grease and the sampling bottles should be rinsed at least twice with solvent for complete transfer of oil & grease contained in the samples. The calibrated volume should be used in calculation of oil & grease.

Water Depth Detector

- 4.3.8 A portable, battery-operated echo sounder should be used for the determination of water depth at each designated monitoring station. This unit can either be handheld or affixed to the bottom of the work boat, if the same vessel is to be used throughout the monitoring programme.

Salinity

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

Location of the Monitoring Site

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

Calibration and Maintenance of In-situ Monitoring Instruments

- 4.3.11 All in-situ monitoring instrument shall be checked, calibrated and certified by a laboratory accredited under HOKLAS or any other international accreditation scheme before use, and subsequently re-calibrated at 3 monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes should be checked with certified standard solutions before each use. Wet bulb calibration for a DO meter shall be carried out before measurement at each monitoring location.
- 4.3.12 For on site calibration of field equipment, the BS 127:1993, "Guide to Field and on-site test methods for the analysis of waters" should be observed.
- 4.3.13 Sufficient stocks of spare parts should be maintained for replacement 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.

4.4 Laboratory Measurement / Analysis

- 4.4.1 Analysis of SS, oil & grease, BOD₅ and COD shall be carried out in a HOKLAS or other international accredited laboratory. Water samples of about 200 ml shall be collected at the monitoring stations for carrying out the laboratory determination. The laboratory determination work shall start within maximum storage time of each parameter after collection of the water samples following an updated version of the APHA *Standard Methods for Examination of Water and Waste Water* (APHA Standard Methods) or equivalent methods subject to the approval of EPD.
- 4.4.2 In the event a site laboratory is set up or a non-HOKLAS and non-international accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment, analytical procedures, and quality control shall be approved by the EPD. All the analysis shall be witnessed by the ER. The ET Leader shall provide the ER with one copy of the relevant chapters of the APHA Standard Methods updated edition and any other relevant document for his reference.
- 4.4.3 For the testing methods of other parameters as recommended by EIA or required by EPD, detailed method procedures should be submitted to EPD for approval prior to the commencement of monitoring programme. If in-house or non-standard methods are proposed, details of the method verification may also be required to submit to EPD. In any circumstance, the sample testing should have comprehensive quality assurance and quality control programmes. The laboratory should prepare to demonstrate the programmes to EPD representatives when requested.

4.5 Monitoring Locations

- 4.5.1 The water quality monitoring locations are shown in Figure 4.2. The status and locations of water quality sensitive receivers and the marine activity sites may change after issuing this manual. If such cases exist, the ET Leader shall propose updated monitoring locations and seek approval from EPD.
- 4.5.2 In general, the monitoring locations should be upstream and downstream of potential drainage locations, noting the constraints from other works as described at the beginning of this section.
- 4.5.3 As site runoff from all projects in the area may flow to Starfish Bay, it is recommended that baseline monitoring should be conducted in Starfish Bay to establish existing conditions against which to measure potential impacts. Two stations should be located near the box culvert outfall and the natural stream outfall (W5 and W6). At least two other stations should be located further offshore, near the Tolo Channel (W7 and W8).
- 4.5.4 Ultimately, stormwater will be discharged through the stormwater drainage systems to the north and west shore of Whitehead development. If construction work is still on-going after the stormwater drainage systems are built, some site runoff may be discharged via this route, and the water quality near the discharge outfalls should be monitored (W1, W2, W3 and W4).

The EPD monitoring station TM6 should be used as a baseline for comparison with monitoring data at the stormwater discharge outfalls.

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

- (a) at locations close to and preferably at the boundary of the mixing zone of the major site activities as indicated in the EIA final report, which are likely to have water quality impacts;
- (b) close to the sensitive receptors which are directly or likely to be affected;
- (c) for monitoring locations located in the vicinity of the sensitive receptors, care should be taken to cause minimal disturbance during monitoring;
- (d) at two or more control stations which shall be at locations representative of the project site in its undisturbed condition. Control stations should be located, as far as is practicable, both upstream and down stream of the works area.

4.5.6 Control stations (C1 and C2) are necessary to compare the water quality from potentially impacted sites with the ambient water quality. Control stations shall be located within the same body of water as the impact monitoring stations but should be outside the area of influence of the works and, as far as practicable, not affected by any other works.

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

4.6 **Baseline Monitoring**

4.6.1 Baseline conditions for water quality shall be established and agreed with DEP prior to the commencement of works. The purposes of the baseline monitoring are to establish ambient conditions prior to the commencement of the works and to demonstrate the suitability of the proposed impact, control and reference monitoring stations. The baseline conditions shall normally be established by measuring the water quality parameters specified in Section 4.2. The measurements shall be taken at all designated monitoring stations including control stations, 3 days per week, at mid-flood and mid-ebb tides, for four weeks prior to the commencement of marine works.

4.6.2 There shall not be any marine construction activities in the vicinity of the stations during the baseline monitoring.

4.6.3 In exceptional cases when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall seek approval from DEP on an appropriate set of data to be used as baseline reference.

4.7 **Impact Monitoring**

4.7.1 During the course of the marine works, monitoring shall be undertaken three days per week, at mid-flood and mid-ebb tides, with sampling/measurement at the designated 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 will be increased.

4.7.2 Upon completion of all marine activities, a post project monitoring exercise on water quality shall be carried out for four weeks in the same manner as the impact monitoring.

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

4.8.1 The water quality criteria, namely Action and Limit levels are shown in Table 4.1. Should the monitoring results of the water quality parameters at any designated monitoring stations indicate that the water quality criteria are exceeded, the actions in accordance with the Action Plan in Table 4.2 shall be carried out.

**Table 4.1
 Action and Limit Levels for Water Quality**

Parameters	Action	Limit
DO in mg/l (Surface, Middle & Bottom)	<u>Surface & Middle</u> 1%-ile of baseline data for surface and middle layer, or midway between 5%-ile of baseline data and Limit levels <u>Bottom</u> 1%-ile of baseline data for bottom layer, or midway between 5%-ile of baseline data and Limit levels	<u>Surface & Middle</u> 4 mg/l except 5 mg/l for FCZ <u>Bottom</u> 2 mg/l
SS in mg/l (depth-averaged)	95%-ile of baseline data and 120% of upstream control station's SS at the same tide of the same day	99%-ile of baseline, 130% of upstream control station's SS at the same tide of the same day and specific sensitive receiver water quality requirements (e.g. required suspended solids level for concerned sea water intakes)
Turbidity (Tby) in NTU (depth-averaged)	95%-ile of baseline data and 120% of upstream control station's Tby at the same tide of the same day	99%-ile of baseline and 130% of upstream control station's Tby at the same tide of the same day
pH	N/A	<6.5 or >8.5

Notes:

- "depth-averaged" is calculated by taking the arithmetic means of reading of all three depths.
- For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.
- For SS and Tby, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.
- All the figures given in the table are used for reference only and the EPD may amend the figures whenever it is considered as necessary.

Table 4.2 Event and Action Plan for Water Quality

Event	ET leader	IEC	ER	Contractor
Action level being exceeded by one sampling day	Repeat in-situ measurement to confirm findings Identify source(s) of impact Inform IEC and Contractor Check monitoring data, all plant, equipment and Contractor's working methods Discuss mitigation measures with IEC and Contractor Repeat measurement on next day of exceedance	Discuss with ET leader and Contractor on the mitigation measures Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly Assess the effectiveness of the implemented mitigation measures	Discuss with IEC on the proposed mitigation measures Make agreement on the mitigation measures to be implemented	Inform the ER and confirm notification of the non-compliance in writing Rectify unacceptable practice Check all plant and equipment Consider changes of working method Discuss with ET leader and IEC and propose mitigation measures to IEC and ER Implement the agreed mitigation measures
Action level being exceeded by more than one consecutive sampling days	Repeat in-situ measurement to confirm findings Identify source(s) of impact Inform IEC and Contractor Check monitoring data, all plant, equipment and Contractor's working methods Discuss mitigation measures with IEC and Contractor Ensure mitigation measures are implemented Prepare to increase the monitoring frequency to daily Repeat measurement on next day of exceedance	Discuss with ET leader and Contractor on the mitigation measures Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly Assess the effectiveness of the implemented mitigation measures	Discuss with IEC on the proposed mitigation measures Make agreement on the mitigation measures to be implemented Assess the effectiveness of the implemented mitigation measures	Inform the ER and confirm notification of the non-compliance in writing Rectify unacceptable practice Check all plant and equipment Consider changes of working method Discuss with ET leader and IEC and propose mitigation measures to IEC and ER Implement the agreed mitigation measures
Limit level being exceeded by one sampling day	Repeat in-situ measurement to confirm findings Identify source(s) of impact Inform IEC, Contractor and EPD Check monitoring data, all plant, equipment and Contractor's working methods Discuss mitigation measures with IEC and Contractor Ensure mitigation measures are implemented Increase the monitoring frequency to daily until no exceedance of Limit level	Discuss with ET leader and Contractor on the mitigation measures Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly Assess the effectiveness of the implemented mitigation measures	Discuss with IEC on the proposed mitigation measures Request Contractor to critically review the working methods Make agreement on the mitigation measures to be implemented Assess the effectiveness of the implemented mitigation measures	Inform the ER and confirm notification of the non-compliance in writing Rectify unacceptable practice Check all plant and equipment Consider changes of working method Discuss with ET leader and IEC and propose mitigation measures to IEC and ER within 3 working days Implement the agreed mitigation measures
Limit level being exceeded by more than one consecutive sampling days	Repeat in-situ measurement to confirm findings Identify source(s) of impact Inform IEC, Contractor and EPD Check monitoring data, all plant, equipment and Contractor's working methods Discuss mitigation measures with IEC and Contractor Ensure mitigation measures are implemented Increase the monitoring frequency to daily until no exceedance of Limit level	Discuss with ET leader and Contractor on the mitigation measures Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly Assess the effectiveness of the implemented mitigation measures	Discuss with IEC on the proposed mitigation measures Request Contractor to critically review the working methods Make agreement on the mitigation measures to be implemented Assess the effectiveness of the implemented mitigation measures Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the marine work until no exceedance of Limit level	Inform the ER and confirm notification of the non-compliance in writing Rectify unacceptable practice Check all plant and equipment Consider changes of working method Discuss with ET leader and IEC and propose mitigation measures to IEC and ER within 3 working days Implement the agreed mitigation measures As directed by the Engineer, to slow down or to stop all or part of the marine work or construction activities

4.9 Water Quality Mitigation Measures

- 4.9.1 All of the impacts identified in the EIA Report can either be eliminated or mitigated to minimize impacts on the nearby aquatic environment. The following mitigation measures are designed to be practical and cost-effective in achieving compliance with water quality standards and should be undertaken by the construction contractor during the construction period.
- 4.9.2 Suspended solids in runoff can be reduced by the provision of a good surface drainage system with suitably designed catchpits to retain sediment. Silt removal devices should be well-maintained. For areas where no drainage is present or prior to drainage being constructed, sediment can be collected by excavating a pit into which surface runoff is directed and where settlement and/or infiltration can occur. A mobile sedimentation tank can also be provided to reduce the SS level of the wastewater.
- 4.9.3 It should be noted that Starfish Bay is a water and ecological sensitive receiver. Any construction activities close to it should be regarded as of particular concern. Silt traps should be installed and well-maintained to prevent any silty runoff from entering Starfish Bay. All wastewater generated during construction must be monitored and treated as necessary prior to discharging into the north and west shore of Whitehead.
- 4.9.4 Stockpiles should be covered during wet season to avoid generating silty runoff. A surrounding drainage system and the use of flat and exposed permeable area will facilitate control and infiltration of site runoff.
- 4.9.5 Site cleanliness and immediate action in case of chemical spill (such as fuel) are the most effective mitigation measures to minimize water quality impacts from general site run-off. In addition, adequate sanitary facilities for workers on site should be provided and grease trap facilities should be installed for any canteen facilities.
- 4.9.6 Concrete washings will increase pH in receiving waterbodies. Close monitoring of pH should be conducted to avoid damage to the marine ecology. Buffer agents can be added to neutralise concrete wastewaters before its discharge to stormdrains or watercourses. A particular location within the site away from any water receiver should be selected for washing the concrete mixer. Infiltration/sedimentation pits should be used to settle out washings before discharge/treatment. Bored-pile suspension should also be settled in infiltration/sedimentation pits.
- 4.9.7 Oil interceptors should be installed for maintenance workshop and storage areas. These should be emptied regularly and should have a by-pass to prevent flushing during periods of heavy rain.

- 4.9.8 A section of road between the wheel washing bay and the public road should be paved, with backfall, to prevent wash water or other site runoff from entering public road drains. Sand and grit from wheel washing bays should be settled out and removed before the water is discharged into storm drains. The wheel washing bay should be designed to reuse settled wheel washing water.
- 4.9.9 For general construction works, mitigation measures and site practice for construction site drainage as stated in ProPECC PN 1/94 should be followed.
- 4.9.10 An implementation schedule for these measures is identified in Appendix A.
- 4.9.11 If the above measures are not sufficient to restore the water quality to an acceptable levels upon the advice of the ET Leader, the Contractor shall liaise with the ET Leader on some other mitigation measures, propose to ER for approval, and carry out the mitigation measures.

5. LANDSCAPE AND VISUAL

5.1 Introduction

- 5.1.1 The EIA has recommended the EM&A for landscape and visual resources is undertaken during both the design, construction and operational phases of the project. The design, implementation and maintenance of landscape mitigation measures is a key aspect of this and should be checked to ensure that they are fully realised and that potential conflicts between the proposed landscape measures and any other project works and operational requirements are resolved at the earliest possible date and without compromise to the intention of the mitigation measures. In addition, implementation of the mitigation measures recommended by the EIA will be monitored through the site audit programme.

5.2 Mitigation Measures

- 5.2.1 The Landscape and Visual Assessment of the EIA recommended a series of mitigation measures to ameliorate the landscape and visual impacts of the project.
- 5.2.2 The measures for both the construction and operation stage as recommended in the EIA are summarised in Tables 5.1 and 5.2 below:

Table 5.1
Proposed Construction Stage Mitigation Measures

ID No.	Mitigation Measure	Funding Agency	Implementation Agency	Management Agency
CM1	Retention and protection of existing beaches at Starfish Bay and Wu Kai Sha. Physical measures implemented to prevent access. Regular checks should be carried out to ensure that the work site boundaries are not exceeded, hoarding is properly maintained and that no damage is being caused to these areas.	TDD	TDD	TDD
CM2	Retention and protection of existing Natural Coastal topography and rock formations. Physical measures implemented to prevent access. Regular checks to be carried out to ensure that the work site boundaries are not exceeded, hoarding is properly maintained and that no damage is being caused to these areas.	TDD / Developer	TDD / Developer	TDD / Developer
CM3	Retention and protection of existing Pine Woodland (7.05ha). Physical measures implemented to prevent access. Regular checks to be carried out to ensure that the work site boundaries are not exceeded, hoarding is properly maintained and that no damage is being caused to these areas.	TDD / Developer	TDD / Developer	TDD / Developer
CM4	Minimisation the extent cutting into the areas of secondary woodland. 1.98ha of them is to be preserved. Extent of clearance to be agreed and marked on site. Regular checks to be carried out to ensure that the work site boundaries are not exceeded, hoarding is properly maintained and that no damage is being caused.	TDD / Developer	TDD / Developer	TDD / Developer
CM5	Decorative hoarding along southern boundary of the site, beaches at Starfish Bay and Wu Kai Sha and around To Tau and Wu Kai Sha Village areas.	TDD / Developer	TDD / Developer	TDD / Developer
CM6	Transplanting of trees that need to be removed and that stand a high chance of successfully re-establishing where feasible.	TDD / Developer	TDD / Developer	TDD / Developer
CM7	Topsoil stripped and stored for re-use. in the construction of the soft landscape works.	TDD / Developer	TDD / Developer	TDD / Developer
CM8	Control of night-time lighting.	TDD / Developer	TDD / Developer	TDD / Developer
CM9	Grass hydroseeding of slopes and development platforms as soon as they are completed.	TDD / Developer	TDD / Developer	TDD / Developer

Table 5.2
Proposed Operation Stage Mitigation Measures

ID No.	Mitigation Measure	Funding Agency	Implem'n Agency	Managem't Agency	Mainten'ce Agency
OM1	Building height and development profile designed to compliment the existing topography and urban forms, in key views. Taller larger scale buildings to be set to the southern side of the site close to Ma On Shan hills and alongside existing high rise residential estates. The northern site should be retained for low-rise development.	Developer	Developer	-	-
OM2	Layout of the proposed development to avoid disturbance of existing Pine Coastal Woodland. 7.05ha of plantation preserved.	TDD / Developer	TDD / Developer	-	-
OM3	Layout of the proposed development to minimise disturbance of existing Secondary Woodland. 1.98ha of secondary woodland preserved	TDD / Developer	TDD / Developer	-	-
OM4	Layout of the proposed development to avoid disturbance of existing knolls and grave sites within the site.	TDD	TDD	-	-
OM5	Layout of the proposed development to avoid disturbance of existing beaches and natural coastline.	TDD / Developer	TDD / Developer	-	-
OM6	The external appearance of building blocks should be carefully detailed in terms of form, colour and finishes such that they are visually integrated as much as possible into the surrounding landscape. The form and surface detailing of these structures should be carefully considered to reduce their apparent mass, and potential glare.	Developer	Developer	Developer	Developer
OM7	The new road structures, elevated viaducts, abutments, and retaining walls should be received sensitive architectural and chromatic treatment.	TDD	TDD	HyD	HyD
OM8	Planting wide canopied shade trees along roadsides to provide shade and greenery. High quality hard landscape treatment of footpaths areas.	TDD	TDD	HyD	LCSD
OM9	Planting of wide canopied shade trees, ornamental flowering trees and shrubs, and high quality hard landscape treatment of pedestrian corridors (in public areas or private development) to provide shade for pedestrians and an attractive green appearance from surrounding view points.	TDD / Developer	TDD / Developer	LCSD / Developer	LCSD / Developer
OM10	Hard and soft landscape treatment of open areas within residential development lots areas to provide shade and shelter and a green appearance from surrounding viewpoints.	Developer	Developer	Developer	Developer

ID No.	Mitigation Measure	Funding Agency	Implem'n Agency	Managem't Agency	Mainten'ce Agency
OM11	Landscape treatment of recreational land uses with extensive tree planting throughout the areas to provide shade and shelter and a green appearance from surrounding view points and screen ground level activity in views from the Harbour. The areas include 3.5ha in Botanical Garden and 2.23ha in other areas of Whitehead Site 1 to also compensate for woodland/plantation vegetation loss during construction. Links should be made to surrounding recreational sites, including the proposed Ma On Shan Waterfront Promenade.	Developer	Developer	LCSD	LCSD
OM12	Landscape treatment of car and coach parking areas with planting of wide canopied trees throughout the site to provide shade and shelter, and ornamental flowering trees and shrubs to a green appearance from surrounding areas.	Developer	Developer	LCSD	LCSD
OM13	Woodland tree and shrub planting should be undertaken to screen existing village settlement areas of To Tau and Wu Kai Sha.	TDD	TDD	HyD	LCSD
OM14	Roadside woodland tree/shrub planting as a buffer / screen along Sai Sha Road or other proposed public / private roads within the proposed development whenever possible.	TDD / Developer	TDD / Developer	HyD / Developer	LCSD / Developer
OM15	Secondary woodland planting (1.07ha) at the Government land near the proposed IRC to compensate for woodland/plantation vegetation lost during construction.	TDD	TDD	AFCD	AFCD
OM16	Secondary woodland planting proposed at the woodland extension (1.87ha) within the Lok Who Sha Development to compensate for woodland/plantation vegetation lost during construction.	Developer	Developer	Developer	Developer
OM17	Woodland tree and shrub planting to screen ecological habitat and recreational areas at the existing beaches at Starfish Bay and Wu Kai Sha from the development.	TDD	TDD	HyD	LCSD

5.3 Design Phase Audit

5.3.1 The landscape measures proposed within the EIA to mitigate the landscape and visual impacts of the scheme should be embodied into the detailed landscape design drawings and contract documents including the protection of existing woodland area and trees, the transplanting of existing trees 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, geo-technical, structural, lighting, signage, drainage, underground utility and operational requirements are resolved prior to construction.

5.3.2 The design phase EM&A requirements for landscape and visual resources comprise the audit of the detailed landscaping specifications to be prepared during the detailed design together with ensuring that the design is sensitive to landscape and visual impacts and that landscape

resources are retained as far as practicable. Monitoring of design works against the recommendations of the landscape and visual impact assessments within the EIA should be undertaken as and when the designs are produced to ensure that they fulfil the intentions of the mitigation measures.

5.3.3 The landscape auditor shall review the designs as and when they are prepared and liaise with the landscape architect and design 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 5.3 below should be followed.

Table 5.3
Event / Action Plan for Design Phase

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

5.4 **Baseline Monitoring**

5.4.1 Baseline monitoring for the landscape and visual resources will comprise a vegetation survey of the entire selected route undertaken on an 'area' basis. Representative vegetation types will be identified along with typical species composition. An assessment of landscape character will be made against which future change can be monitored. The landscape resources and elements of particular concern are to be noted.

5.4.2 The landscape and visual baseline will be determined with reference to any Tree Survey Report prepared and the habitat maps and the landscape and visual impact assessments included in the EIA Report.

5.5 **Construction and Operational Phase Audit**

5.5.1 A specialist Landscape Sub-Contractor should be employed by the Contractor for the implementation of landscape construction works and subsequent maintenance operations during the establishment period. It is proposed that as the majority of the planting works are off-site, the planting will be conducted with 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 be within the first operational year of the project. The intention is to provide at least 12 months establishment period for the majority of the planting works.

5.5.2 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 measures. Site inspections should be undertaken at least once every two weeks throughout the construction period and once every two months during the operational phase. The broad scope of the audit is detailed below but should also be undertaken with reference to the more specific checklist provided in Table 5.4. Operational phase auditing will be restricted to the last 12 months of the establishment works of the landscaping proposals and thus only the items below concerning this period are relevant to the operational phase.

- the extent of the agreed works areas should be regularly checked during the construction phase. Any trespass by the Contractor outside 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, graves, rock formations and other features within the study area which are not directly affected by the works are retained and protected;
- the methods of protecting existing vegetation proposed by the Contractor are acceptable and enforced;
- preparation, lifting transport and re-planting operations for any transplanted trees;
- all landscaping works are carried out in accordance with the EIA and with specifications;
- the planting of new trees, shrubs, groundcover, climbers, ferns, grasses and other plants, together with the replanting of any transplanted trees are carried out properly and within the right season;
- all necessary horticultural operations and replacement planting are undertaken throughout the Establishment Period to ensure the healthy establishment and growth of both transplanted trees and all newly established plants.

Table 5.4
Construction/Operational Phase Audit Checklist

Area of Works	Items to be Monitored
Protection of all trees and woodland blocks to be retained	identification and demarcation of trees / vegetation to be retained, erection of physical protection (e.g. fencing), monitoring against possible incursion, physical damage, fire, pollution, surface erosion, etc.
Protection of existing features to be retained including Starfish Bay, knolls, grasses and rock formations	identification and demarcation of features to be retained, erection of physical protection (e.g. fencing), monitoring against possible incursion, physical damage, fire, pollution, surface erosion, etc.
Clearance of existing vegetation	identification and demarcation of trees / vegetation to be cleared, checking of extent of works to minimise damage, monitoring of adjacent areas against possible incursion, physical damage, fire, pollution, surface erosion, etc.
Transplanting of trees	identification and demarcation of trees / vegetation to be transplanted, monitoring of extent of pruning / lifting works to minimise damage, timing of operations, implementation of all stages of preparatory and translocation works, and maintenance of transplanted vegetation, etc.
Topsoil stripping	ensuring existing topsoil is stripped and stored under recognised good practice and is regularly turned to prevent anaerobic conditions
Night-time lighting	ensuring night-time lighting is shielded away from VSRs
Plant supply	monitoring of operations relating to the supply of specialist plant material (including the collecting, germination and growth of plants from seed) to ensure that plants will be available in time to be used within the construction works.
Landscape treatments generally	check that designs conform to intent of mitigation measures and agreed designs
Soiling, planting, etc.	monitoring of implementation and maintenance of soiling and planting works and against possible incursion, physical damage, fire, pollution, surface erosion, etc.
Establishment Works	monitoring of implementation of maintenance operations during Establishment Period

5.5.3 In the event of non compliance the responsibilities of the relevant parties is detailed in the Event /Action plan provided on Table 5.5.

Table 5.5
Event / Action Plan for Construction/Operational Phase

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

6. SITE ENVIRONMENTAL AUDIT

6.1 Site Inspections

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

6.1.2 The ET Leader is responsible for formulation of the environmental site inspection, deficiency and action reporting system, and for carrying out the site inspection works. He shall submit a proposal endorsed by IEC on the site inspection, deficiency and action reporting procedures within 21 days of the construction contract commencement to the Contractor for agreement and to the ER for approval.

6.1.3 Regular site inspections shall be carried out at least once per week. The areas of inspection shall not be limited to the environmental situation, pollution control and mitigation measures within the site; it 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:

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

6.1.4 The Contractor shall update the ET Leader with all relevant information of the construction contract for him to carry out the site inspections. The inspection results and its associated recommendations on improvements to the environmental protection and pollution control works shall be submitted to the ER and the Contractor in a site inspection proforma (see Appendix B) 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.

6.1.5 Ad hoc site inspections shall also be carried out by the ET Leader and IEC if significant environmental problems are identified. Inspections may also be required subsequent to receipt of an environmental complaint (an example of the complaint log is provided in Appendix B), or as part of the investigation work, as specified in the Action Plan for environmental monitoring and audit.

6.2 Compliance with Legal and Contractual Requirements

6.2.1 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 with.

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

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

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

6.2.5 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.

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

6.3 Environmental Complaints

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

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

6.3.2 During the complaint investigation work, the Contractor and ER shall cooperate with the ET Leader in providing all the necessary information and assistance for completion of the investigation. If mitigation measures are identified in the investigation, the Contractor shall promptly carry out the mitigation. The ER shall ensure that the measures have been carried out by the Contractor.

6.3.3 A flow chart of the complaint response procedures is shown in Figure 6.1.

6.4 Choice of Construction Method

6.4.1 At times during the construction phase the Contractor may submit method statements for various aspects of construction. This state of affairs would only apply to those construction methods that the EIA has not imposed conditions while for construction methods that have been assessed in the EIA, the Contractor is bound to follow the requirements and

recommendations in the EIA study. The Contractor's options for alternative construction methods may introduce adverse environmental impacts into the project. It is the responsibility of the ET Leader and the ET, in accordance with established standards, guidelines and EIA study recommendation and requirements, to review and determine the adequacy of the environmental protection and pollution control measures in the Contractor's proposal in order to ensure no unacceptable impacts would result. To achieve this end, the ET Leader shall provide a copy of the Proactive Environmental Protection Proforma (see Appendix B) to the IEC for approval. The IEC should audit the review of the construction method and endorse the proposal on the basis of no adverse environmental impacts.

7. REPORTING

7.1 General

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

7.2 Documentation

7.2.1 All documentation is required to be filed in a traceable and systematically manner. 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 EM&A results and findings shall be documented in the respective construction and operation phase EM&A reports prepared by the ET and endorsed by IEC prior to disseminate to the Contractor, ER and the Director of Environmental Protection.

7.2.2 All documentation shall be in paper form and/or electronic form (in the format in agreement) upon request. All documents and data shall be kept at least one year after the completion of the construction contract. All submissions (reports, data, and correspondences etc.) 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.

7.3 Baseline Monitoring Report

7.3.1 One hard copy of the Baseline Monitoring Report shall be verified and certified by the IEC and shall be submitted to EPD four weeks before the commencement of any major construction works that would affect the monitoring results. Additional copies of the Baseline Monitoring Report may be required by EPD. The Baseline Environmental Monitoring Report shall also be submitted to each of the Contractor and the ER. The relevant parties shall be liaised on the exact number of copies they want. The form and content of the report, and the

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

- (a) up to half a page executive summary;
- (b) brief project background information;
- (c) drawings showing locations of the baseline monitoring stations;
- (d) an updated construction programme with milestones of environmental protection/mitigation activities annotated;
- (e) monitoring results (in both hard and diskette copies) together with the following information:
 - (i) monitoring methodology;
 - (ii) name of laboratory and types of equipment used and calibration details;
 - (iii) parameters monitored;
 - (iv) monitoring locations (and depth);
 - (v) monitoring date, time, frequency and duration;
 - (vi) QA/QC results and detection limits;
- (f) details on influencing factors, including:
 - (i) major activities, if any, being carried out on the site during the period;
 - (ii) weather conditions during the period;
 - (iii) other factors which might affect the results;
- (g) 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;
- (h) revisions for inclusion in the EM&A Manual; and
- (i) comments and conclusions.

7.4 Monthly EM&A Reports

7.4.1 The results and findings of all EM&A work required in the Manual shall be recorded in the monthly EM&A reports prepared by the ET leader, collated 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. The time frame for the ET leader's submission to the Engineer shall be agreed with the Engineer.

7.4.2 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.

- 7.4.3 The ET leader shall rectify any comments on the monthly EM&A reports made by EPD within one month of the receipt of the comments, unless otherwise specified by EPD. The ET leader shall also rectify comments on the EM&A reports by the IEC and ER in the time frame agreed with the ER and IEC.

First Monthly EM&A Report

- 7.4.4 The first monthly EM&A report shall include at least but not limited to the following :
- (a) 1-2 pages executive summary, including
 - (i) breaches of AL levels;
 - (ii) complaint log;
 - (iii) notifications of any summons and successful prosecutions;
 - (iv) reporting changes;
 - (v) future key issues.
 - (b) basic project information, including
 - (i) project organisation including key personnel contact names and telephone numbers;
 - (ii) construction programme with fine tuning of construction activities showing the inter-relationship with environmental protection/mitigation measures for the month;
 - (iii) management structure; and
 - (iv) works undertaken during the month.
 - (c) environmental status, including
 - (i) works undertaken during the month with illustrations (such as location of works, percentage fines in the fill material used); and
 - (ii) drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations.
 - (d) summary of EM&A requirements, including
 - (i) all monitoring parameters;
 - (ii) environmental quality performance limits (Action and Limit levels);
 - (iii) Event-Action Plans;
 - (iv) environmental mitigation measures, as recommended in the project EIA study final report;
 - (v) environmental requirements in contract documents.
 - (e) implementation status, including advice on the implementation status of environmental protection and pollution control/mitigation measures including measures for ecological and visual impacts, as recommended in the project EIA study report, summarised in the updated implementation schedule.

- (f) monitoring results in both hard and diskettes copies together with the following information:
 - (i) monitoring methodology;
 - (ii) name of laboratory and types of equipment used and calibration details;
 - (iii) parameters monitored;
 - (iv) monitoring locations;
 - (v) monitoring date, time, frequency, and duration;
 - (vi) weather conditions during the period;
 - (vii) graphical plots of the monitored parameters in the month annotated against;
 - (viii) the major activities being carried out on site during the period;
 - (ix) weather conditions that may affect the results;
 - (x) any other factors which might affect the monitoring results; and
 - (xi) QA/QC results and detection limits.

- (g) report on non-compliance, complaints, notifications of summons and successful prosecutions, including
 - (i) record of all noncompliance (exceedances) of the environmental quality performance limits (Action and Limit Levels);
 - (ii) record of all complaints received (written or verbal) for each media, including locations and nature for complaints investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;
 - (iii) 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, results and summary;
 - (iv) review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures; and
 - (v) description of the actions taken in the event of noncompliance and deficiency reporting and any follow-up procedures relating to earlier noncompliance.

- (h) others, including
 - (i) an account of the future key issues as reviewed from the works programme and work method statements;
 - (ii) advice on the solid and liquid waste management status; and
 - (iii) 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.

Subsequent EM&A Reports

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

- (a) executive summary (1-2 pages), including
 - (i) breaches of AL levels;
 - (ii) complaint log;
 - (iii) notifications of any summons and successful prosecutions;
 - (iv) reporting changes; and
 - (v) future key issues.

- (b) environmental status, including
 - (i) construction programme with fine tuning of construction activities showing the inter-relationship with environmental protection/mitigation measures for the month;
 - (ii) works undertaken during the month with illustrations including key personnel contact names and telephone numbers; and
 - (iii) drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations.

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

- (d) monitoring results in both hard and diskette copies together with the following information:
 - (i) monitoring methodology;
 - (ii) name of laboratory and types of equipment used and calibration details;
 - (iii) parameters monitored;
 - (iv) monitoring locations;
 - (v) monitoring date, time, frequency, and duration;
 - (vi) weather conditions during the period;
 - (vii) graphical plots of the monitored parameters in the month annotated against;
 - (viii) the major activities being carried out on site during the period;
 - (ix) weather conditions that may affect the results;
 - (x) any other factors which might affect the monitoring results; and
 - (xi) QA/QC results and detection limits.

- (e) report on non-compliance, complaints, notifications of summons and successful prosecutions, including
 - (i) record of all noncompliance (exceedances) of the environmental quality performance limits (Action and Limit Levels);
 - (ii) record of all complaints received (written or verbal) for each media, including locations and nature for complaints investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;
 - (iii) 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, results and summary;
 - (iv) review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures; and
 - (v) a description of the actions taken in the event of noncompliance and deficiency reporting and any follow-up procedures relating to earlier noncompliance.
- (f) others, including
- (i) an account of the future key issues as reviewed from the works programme and work method statements; and
 - (ii) advice on the solid and liquid waste management status.
- (g) appendix, including
- (i) AL levels
 - (ii) graphical plots of trends of monitored parameters at key stations over the past four reporting periods for representative monitoring stations annotated against the following:
 - i)* major activities being carried out on site during the period;
 - ii)* weather conditions during the period; and
 - iii)* any other factors which might affect the monitoring result
 - (iii) monitoring schedule for the present and next reporting period;
 - (iv) cumulative statistics on complaints, notifications of summons and successful prosecutions;
 - (v) outstanding issues and deficiencies; and
 - (vi) details of complaints, outstanding issues and deficiencies.

Quarterly EM&A Summary Reports

7.4.6 The quarterly EM&A summary report which should generally be around 5 pages (including about 3 of text and tables and 2 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.

- (a) up to half a page executive summary;
- (b) basic project information including a synopsis of the project organisation, programme, contacts of key management, and a synopsis of work undertaken during the quarter;
- (c) a brief summary of EM&A requirements including:
 - (i) monitoring parameters;

- (ii) environmental quality performance limits (Action and Limit Levels); and
 - (iii) environmental mitigation measures, as recommended in the project EIA study final report;
- (d) 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;
- (e) drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
- (f) graphical plots of the trends of monitored parameters over the past 2 months (the last month of the previous quarter and the present quarter) for representative monitoring stations annotated against:
- (i) the major activities being carried out on Site during the period;
 - (ii) weather conditions during the period; and
 - (iii) any other factors which might affect the monitoring results;
- (g) advice on the solid and liquid waste management status;
- (h) a summary of noncompliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
- (i) a brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures;
- (j) a summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;
- (k) a summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;
- (l) a summary record of 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;
- (m) 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
- (n) proponents contacts and any hotline telephone number for the public to make enquiries.

Final EM&A Summary Report

- 7.4.7 The termination of EM&A programme shall be determined on the following basis:
- (a) completion of construction activities and insignificant environmental impacts of the remaining outstanding construction works;
 - (b) trends analysis to demonstrate the narrow down of monitoring exceedances due to construction activities and the return of ambient environmental conditions in comparison with baseline data;
 - (c) no environmental complaint and prosecution involved.
- 7.4.8 The proposed termination may be required to consult related local community such as village representative/committee and/or District Board and the proposal should be endorsed by the IEC, ER and the project proponent prior to final approval from the Director of Environmental Protection.
- 7.4.9 The final EM&A summary report shall include, inter alia, the following:
- (a) an executive summary;
 - (b) 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;
 - (c) a brief summary of EM&A requirements including:
 - (i) monitoring parameters;
 - (ii) environmental quality performance limits (Action and Limit Levels); and
 - (iii) environmental mitigation measures, as recommended in the project EIA study final report;
 - (d) 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;
 - (e) drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
 - (f) graphical plots of the trends of monitored parameters over the construction period for representative monitoring stations annotated against:
 - (i) the major activities being carried out on Site during the period;
 - (ii) weather conditions during the period;
 - (iii) any other factors which might affect the monitoring results; and

- (iv) the return of ambient environmental conditions in comparison with baseline data;
- (g) compare and contrast the EM&A data with the EIA predictions and annotate with expansions for any discrepancies;
- (h) provide clear-cut decisions on the environmental acceptability of the project with reference to the specific impact hypothesis;
- (i) advice on the solid and liquid waste management status;
- (j) a summary of noncompliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
- (k) a brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures;
- (l) a summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;
- (m) a summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;
- (n) review the monitoring methodology adopted and with the benefit of hindsight, comment on its effectiveness (including cost effectiveness);
- (o) a summary record of notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution legislations, locations and nature of the breaches, investigation, follow-up actions taken and results;
- (p) review the practicality and effectiveness of the EIA process and EM&A programme (e.g. effectiveness and efficiency of the mitigation measures), recommended any improvement in the EM&A programme; and
- (q) a conclusion to state the return of ambient and/or the predicted scenario as per EIA findings.

7.5 **Data Keeping**

7.5.1 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 Leader and be ready for inspection upon request. All relevant information shall be clearly and systematically recorded in the document. The monitoring data shall also be recorded in magnetic media form, and the

software copy can be available upon request. All the documents and data shall be kept for at least one year after completion of the construction contract.

7.6 Interim Notifications of Environmental Quality Limit Exceedances

- 7.6.1 With reference to Event/Action Plans in Tables 2.3, 3.3 and 4.2, when the environmental quality limits are exceeded, the ET leader shall immediately notify the ER, IEC & EPD, as appropriate. The notification shall be followed up with advice to EPD after endorsement of IEC, on the results of the investigation, proposed action and success of the action taken, with any necessary follow-up proposals. A sample template for the interim notifications is shown in Figure 7.1.

END OF TEXT