



Highways Department
Hong Kong

Agreement No. CE 35/95

Widening of Tolo Highway and Traffic Surveillance and Information System

Feasibility Assignment

**ENVIRONMENTAL MONITORING
AND AUDIT MAUAL**

Final

MAUNSELL CONSULTANTS ASIA LTD



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EIA-1163/BC

Agreement No. CE 35/95

Document No. 90896/E7

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AND AUDIT MAUAL**

Final

Maunsell Consultants Asia Ltd.
in association with
Delcan International Corporation
Consultants in Environmental Sciences (Asia) Ltd.
Urbis Travers Morgan Limited

Issue 1
March 1997

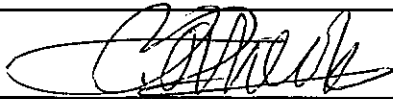
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REPORT NO.	1076
STATUS	Final
DATE OF ISSUE	27 March 1997
APPROVED BY	
	(Director)

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1. INTRODUCTION

Maunsell Consultants Asia Ltd, in partnership with Consultants in Environmental Sciences (Asia) Ltd, Ecosystems Ltd and Urbis Ltd, has been commissioned by Highways Department under Agreement CE35/95 to carry out the feasibility study for the project "Widening of Tolo Highway and Traffic Surveillance and Information System". The project proponent is Highway Department.

1.1 Purpose of the Manual

The purpose of this Environmental Monitoring and Audit (EM&A) Manual is to guide the set up of an EM&A programme to ensure compliance with the Environmental Impact Assessment (EIA) study recommendations, to assess the effectiveness of the recommended mitigation measures and to identify any further need for additional mitigation measures or remedial action. This Manual outlines the monitoring and audit programme of a feasibility study for the widening of Tolo Highway and Traffic Surveillance and Information System. It aims to provide systematic procedures for monitoring, auditing and minimising of the environmental impacts associated with the construction works.

Hong Kong environmental regulations for air and water quality, noise and waste, the Hong Kong Planning Standards and Guidelines, and recommendations in the EIA study report on the project "Widening of Tolo Highway and Traffic Surveillance and Information System" have served as environmental standards and guidelines in the preparation of this Manual.

This Manual contains the following :

- (a) Duties of the *Environmental Team (ET)* 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.

1.2 Background

Tolo Highway connects the New Territories Circular Road at Tai Po (near Hong Lok Yuen) and Tai Po Road near the Shatin racecourse. It runs along Ma Liu Shui, Chinese University, Cheung Shue Tan, Tai Po Kau and Yuen Chau Sai. The project studies the feasibility of upgrading the dual three lanes to dual four lanes standard with hard shoulders and to maintain and improve adjacent cycle ways and footpaths. The sensitive receivers are mainly the residential area in the proximity to the Tolo Highway.

1.3 Environmental Monitoring and Audit Requirements

The EIA study, identified the likely environmental impacts during construction phase, including:

- Noise
- Air quality
- Water quality
- Construction waste

The impacts can be minimized to acceptable levels with the implementation of environmental mitigation measures. However, in order to ensure the compliances, baseline and compliance monitoring for noise, air and water quality has been identified and is described in details in the subsequent sections.

1.4 Project Organization

Due to the early stage of the study, the project organisation and lines of communication with respect to environmental protection works is not available and should be considered in the subsequent study. However, it is recommended that the ET shall not be in any way an associated body of the Contractor. The ET leader shall have relevant professional qualifications, or have sufficient relevant EM&A experience subject to approval of the Engineer Representative (ER) and the Environmental Protection Department (EPD).

Appropriate staff shall be included in the ET, under the supervision of the ET Leader, to fulfil the EM&A duties of the ET Leader specified in this manual. Basically, the duties comprise the following:

- (a) To monitor the various environmental parameters as required in EIA study final report;
- (b) To investigate and audit the Contractors' equipment and work methodologies with respect to pollution control and environmental mitigation, and anticipate environmental issues for proactive action before problems arise;
- (c) To audit and prepare audit reports on the environmental monitoring data and the site environmental conditions; and
- (d) To report on the environmental monitoring and audit results to the Contractor, the ER and the EPD or its delegate.

Appropriate resources shall also be allocated under the Contractor and the ER to fulfil their duties specified in this manual.

1.5 Construction Programme

Similarly, due to the early stage of this project study, a construction programme is not available. Such a programme should be provided by the Contractor to the ET later on. 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.

2. AIR QUALITY

2.1 Air Quality Parameters

Monitoring and audit of the Total Suspended Particulates (TSP) levels shall 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.

1-hour and 24-hour TSP levels should be measured to indicate the impacts of construction dust on air quality. The 24-hour TSP levels shall be measured by following the standard high volume sampling method as set out in the Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B. Upon approval of the ER, 1-hour TSP levels can be measured by direct reading methods which are capable of producing comparable results as that by the high volume sampling method, to indicate short event impacts.

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

2.2 Monitoring Equipment

High volume samplers (HVSs) in compliance with the following specifications shall be used for carrying out the 1-hour and 24-hour 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-hour 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-hour period.

The ET Leader is responsible for provision of the monitoring equipment. He 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.

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.

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 (an example is given in Appendix A).

If the ET Leader proposes to use a direct reading dust meter to measure 1-hour 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-hour sampling. The instrument should also be calibrated regularly, and the 1-hour sampling shall be determined periodically by HVS to check the validity and accuracy of the results measured by direct reading method.

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.

In exceptional situations, the ET Leader may propose alternative methods to obtain representative wind data upon approval from the ER and agreement from EPD.

2.3 Laboratory Measurement / Analysis

A clean laboratory with constant temperature and humidity control, and equipped with necessary measuring and conditioning instruments, to handle the dust samples collected, shall be available for sample analysis, and equipment calibration and maintenance. The laboratory should be HOKLAS accredited.

If a site laboratory is set up or a non-HOKLAS accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment shall be approved by the ER 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.

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-hour and be pre-weighed before use for the sampling.

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.

All the collected samples shall be kept in a good condition for 6 months before disposal.

2.4 Monitoring Locations

Figures 6.1 to 6.3 of the EIA Report show those sensitive receivers. The selection of final monitoring stations should take account of the following criteria, as far as practicable:

- (a) At the site boundary or such locations close to the major dust emission source;
- (b) Close to the sensitive receptors;
- (c) Take into account the prevailing meteorological conditions; and
- (d) The sensitivity to door of the Marine Science Laboratory fish ponds.

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.

2.5 Baseline Monitoring

Baseline monitoring should 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 should also be done at least 3 times per day while the highest dust impact is expected.

During the baseline monitoring, there should not be any construction or dust generation activities in the vicinity of the monitoring stations.

In case of the baseline monitoring cannot be carried out at the designated monitoring locations during the baseline monitoring period, the monitoring at alternative locations which can effectively represent the baseline conditions at the impact monitoring locations should be carried out upon the approval of ER and the agreement with EPD.

Ambient conditions may vary seasonally and shall be reviewed at three monthly intervals. When 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. The revised baseline levels and air quality criteria should be agreed with EPD.

2.6 Impact Monitoring

Impact monitoring should be carried out during construction. For regular impact monitoring, the sampling frequency of at least once in every six-days, shall be strictly observed at all the 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.

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.

In case of non-compliance with the air quality criteria, more frequent monitoring exercise, as specified in the Action Plan in Section 2.7, 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.

2.7 Event and Action Plan for Air Quality

The baseline monitoring results form the basis for determining the air quality criteria, namely Action and Limit levels, for the impact monitoring. Table 2.1 shows the air quality criteria. When exceedance of Action and Limit levels occurs, recommended action to be undertaken to control environmental impacts to acceptable levels. The action plan is shown in Table 2.2.

Table 2.1 Action and Limit Levels for Air Quality

Parameters	Action	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 $\mu\text{g}/\text{m}^3$
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 $\mu\text{g}/\text{m}^3$

Table 2.2 Event/Action Plan for Air Quality

EVENT	ACTION		
	ET	ER	CONTRACTOR
ACTION LEVEL			
1. Exceedance for one sample	<ol style="list-style-type: none"> 1. Identify source 2. Inform ER 3. Repeat measurement to confirm finding 4. Increase monitoring frequency to daily 	<ol style="list-style-type: none"> 1. Notify Contractor 2. Check monitoring data and Contractor's working methods 	<ol style="list-style-type: none"> 1. Rectify any unacceptable practice 2. Amend working methods if appropriate
2. Exceedance for two or more consecutive samples	<ol style="list-style-type: none"> 1. Identify source 2. Inform ER 3. Repeat measurements to confirm findings 4. Increase monitoring frequency to daily 5. Discuss with ER for remedial actions required 6. If exceedance continues, arrange meeting with ER 7. If exceedance stops, cease additional monitoring 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Check monitoring data and Contractor's working methods 4. Discuss with Environmental Supervisor and Contractor on potential remedial actions 5. Ensure remedial actions properly implemented 	<ol style="list-style-type: none"> 1. Submit proposals for remedial actions to ER within 3 working days of notification 2. Implement the agreed proposals 3. Amend proposal if appropriate
LIMIT LEVEL			
1. Exceedance for one sample	<ol style="list-style-type: none"> 1. Identify source 2. Inform ER and EPD 3. Repeat measurement to confirm finding 4. Increase monitoring frequency to daily 5. Assess effectiveness of Contractor's remedial actions and keep EPD and ER informed of the results 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Check monitoring data and Contractor's working methods 4. Discuss with Environmental Team Leader and Contractor potential remedial actions 5. Ensure remedial actions properly implemented 	<ol style="list-style-type: none"> 1. Take immediate action to avoid further exceedance 2. Submit proposals for remedial actions to ER within 3 working days of notification 3. Implement the agreed proposals 4. Amend proposal if appropriate
2. Exceedance for two or more consecutive samples	<ol style="list-style-type: none"> 1. Identify source 2. Inform ER and EPD the causes & actions taken for the exceedances 3. Repeat measurement to confirm findings 4. Increase monitoring frequency to daily 5. Investigate the causes of exceedance 6. Arrange meeting with EPD and ER to discuss the remedial actions to be taken 7. Assess effectiveness of Contractor's remedial actions and keep EPD and ER informed of the results 8. If exceedance stops, cease additional monitoring 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing 2. Notify Contractor 3. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented 4. Discuss amongst Environmental Team Leader and the Contractor potential remedial actions 5. Review Contractor's remedial actions whenever necessary to assure their effectiveness 6. 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 ER 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

2.8 Dust Mitigation Measures

TSP dispersion modelling results predicted that there would be no exceedances of the 1-hour and 24-hour Air Quality Criteria at the representative existing air sensitive receivers provided that maximum 40% of the site area would be operated at any one time and the following proposed mitigation measures are adopted.

Dust suppression measures:

- Watering of open site area every 1.5 hour;
- Control vehicle speed of haulage trucks at 20 km/h;
- Provision of vehicle wheel and body washing stations at exit point of site and public roads;
- Installation of suitable side and tailboard on haulage vehicles; and
- Watering of temporary stockpiles.

The Contractor shall be responsible for the design and implementation of these measures. 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.

The dust modelling results also indicated that future development should be set back 40 metres from the outer edge of hard shoulder to avoid dust impact.

3. NOISE

3.1 Noise Parameters

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, Leq(5 min) shall be employed for comparison with the NCO criteria.

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 Attachment A for reference.

3.2 Monitoring Equipment

As referred to in the Technical Memorandum (TM) issued under the Noise Control Ordinance (NCO), sound level meters in compliance with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications shall be used for carrying out the noise monitoring. Immediately prior to and following each noise measurement the accuracy of the sound level meter shall be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements may be accepted as valid only if the calibration level from before and after the noise measurement agree to within 1.0dB.

Noise measurements should not be made in the presence of fog, rain, wind with a steady speed exceeding 5 m/s or wind with gusts exceeding 10 m/s. The wind speed shall be checked with a portable wind speed meter capable of measuring the wind speed in m/s.

The ET Leader is responsible for the provision 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.

3.3 Monitoring Locations

Monitoring should be carried out at the most affected receivers. Figures 3.1 of the draft EIA report shows those receivers. The final selection of 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.

The status and locations of noise 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 of the proposal.

The monitoring station shall normally be at a point 1 m 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 correct of +3dB(A) shall be made to the free field measurements. 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.

3.4 Baseline Monitoring

The ET Leader shall carry out baseline noise monitoring prior to the commencement of the construction works. The baseline monitoring shall be carried out daily for a period of at least two weeks. A schedule on the baseline monitoring shall be submitted to the ER for approval before the monitoring starts.

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

In exceptional cases, 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 the ER for approval.

3.5 Impact Monitoring

Noise monitoring shall be carried out at all the designated monitoring station. The monitoring frequency shall depend on the scale of the construction activities. The following is an initial guide on the regular monitoring frequency for each station on a per week basis when noise generating activities are underway:

- (a) One set of measurements between 0700-1900 hours on normal weekdays;
- (b) One set of measurements between 1900-2300 hours;
- (c) One set of measurements between 2300-0700 hours of next day; and
- (d) One set of measurements between 0700-1900 hours on holidays.

It should be noted that noise monitoring should focus on (a) as construction work is recommended to be restricted to normal weekdays, between 0700-1900 hours. Only under Option I, when night time construction is necessary, that (b), (c) and (d) measurements would be required for stations closed to Laboratory Bridge.

For the measurements (b), (c) and (d) above, one set of measurements shall at least include 3 consecutive Leq(5 min) results.

In case of non-compliance with the construction noise criteria, more frequent monitoring as specified in the Action Plan in Section 3.6 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.

3.6 Event and Action Plan for Noise

The Action and Limit levels for construction noise are defined in Table 3.1. Should non-compliance of the criteria occurs, action in accordance with the Action Plan in Table 3.2, shall be carried out.

Table 3.1 Action and Limit Levels for Construction Noise

Time Period	Action	Limit
0700-1900 hours on normal weekdays	When one documented complaint is received	75* dB(A)
0700-2300 hours on holidays; and 1900-2300 hours on all other days		60/65/70** dB(A)
2300-0700 hours of next day		45/50/55** dB(A)

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

** to be selected based on Area Sensitivity Rating.

Table 3.2 Event/Action Plan for Construction Noise

EVENT	ACTION	
	ET Leader or ER	Contractor
Action Level	<ol style="list-style-type: none"> 1. Notify Contractor 2. Analyse investigation 3. Require Contractor to propose measures for the analysed noise problem 4. Increase monitoring frequency to check mitigation effectiveness 	<ol style="list-style-type: none"> 1. Submit noise mitigation proposals to Environmental Team Leader/Engineer's Representative 2. Implement noise mitigation proposals
Limit Level	<ol style="list-style-type: none"> 1. Notify Contractor 2. Notify EPD 3. Require contractor to implement mitigation measures Increase monitoring frequency to check mitigation effectiveness 	<ol style="list-style-type: none"> 1. Implement mitigation measures 2. Prove to Environmental Team Leader ER effectiveness of measures applied

3.7 Noise Mitigation Measures

The EIA report has recommended construction noise control and mitigation measures. The Contractor shall be responsible for the design and implementation of these measures. The key measures are:

- (a) Use of quietened equipment for all construction works;
- (b) Construction work to be restricted to normal weekdays, between 0700-1900 hours;
- (c) For Option I, when night time work is involved over several days, for the reprovisioning of Laboratory Bridge, nearby residents should be notified in advance of the planned operations and informed of progress. Residents may be provided with a telephone number contact person whom they could register complaints concerning noise nuisance.

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.

4. WATER QUALITY

4.1 Water Quality Parameters

In order to ensure any deteriorating water quality could be readily detected and timely action be taken to rectify the situation, monitoring for dissolved oxygen (DO), colour, turbidity, suspended solids (SS), biochemical oxygen demand (BOD₅), ammonical nitrogen (NH₃-N) and total phosphate (TP) at designated monitoring stations. Monitoring for pH, SS and oil & grease at the outlets of the sedimentation tank should also be carried out. DO, turbidity and pH should be measured in-situ and the rest parameters determined in a laboratory.

In association with the water quality parameters, some relevant data shall also be measured, such as monitoring location/position, time, water depth, water temperature, weather conditions, sea conditions, tidal stage, and any special phenomena and work underway at the construction site etc. A sample monitoring record sheet is shown in Attachment A for reference.

4.2 Monitoring Equipment

4.2.1 Dissolved Oxygen and Temperature Measuring Equipment

- (a) The instrument should be a portable and weatherproof using a DC power source. It should have cables and sensor. The equipment should be capable of measuring:
 - a DO level in the range of 0-20 mg/l and 0-200% saturation; and
 - a temperature of 0-45 degree Celsius.
- (b) It should have a membrane electrode with automatic temperature compensation complete with a cable.

4.2.2 Turbidity Measurement Instrument

The instrument should be a portable and weatherproof using a DC power source. It should have a photoelectric sensor capable of measuring turbidity between 0-1000 NTU and be complete with a Hach model 2100P or an approved similar instrument.

4.2.3 Colour, NH₃-N and TP Measurement Instrument

A photometer will be required for the colour, NH₃-N and TP measurement. The photometric instrument should be able to determine the concentration of samples by measuring them against known standards at particular wavelength. Sensitivity and accuracy should be checked frequently by testing standard solutions to detect electrical, mechanical, or optical problem in the instrument and its accessories. Suitable ranges and light paths should be referred to the manual, but much reliance must be placed on the knowledge of the analyst.

4.2.4 Sampler

A water sampler is required. It should comprise 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).

4.2.5 Water Depth Detector

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.

4.2.6 Sample Containers and Storage

- (a) Water samples for SS, colour, BOD₅ and NH₃-N analysis should be stored in high density polythene bottles with no preservative added, packed in ice (cooled to 4°C without being frozen), delivered to the laboratory and analysed as soon as possible after collection.
- (b) Water samples for TP measurement should be stored in glass bottles, preserved with 1 ml concentration HCl/L, packed in ice (cooled to 4°C without being frozen), and delivered to the laboratory as soon as possible after collection.
- (c) Water samples for oil & grease measurement should be stored in glass bottles, acidify to pH 2 or lower with 1:1 HCl, packed in ice (cooled to 4°C without being frozen), and delivered to the laboratory as soon as possible after collection.

4.2.7 Monitoring Position Equipment

A digital Global Positioning System (GPS) should be provided and used during monitoring to ensure the monitoring vessel is at the correct location before taking measurements.

4.2.8 Calibration of In-Situ Instruments

pH meter, DO meter and turbidimeter shall be checked and calibrated before use. DO meter and turbidimeter shall be certified by a laboratory accredited under HOKLAS or any other international accreditation scheme, and subsequently re-calibrated at 3 monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes should be checked with certified standard solutions before each use. Wet bulb calibration for a DO meter shall be carried out before measurement at each monitoring location.

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

4.3 Laboratory Measurement / Analysis

Analysis shall be carried out in a HOKLAS or other international accredited laboratory. If a site laboratory is set up or a non-HOKLAS and non-international accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment, analytical procedures, and quality control shall be approved by the DEP. All the analysis shall be witnessed by the ER.

Sample volume and maximum storage time for each analytical parameter carried out in the laboratory are shown below in Table 4.1

Table 4.1 Water Sample Handling Requirements

Analytical Parameter	Sample Volume Taken (ml)	Storage Temperature	Maximum Storage Time After Sampling
Colour	500	4°C	2 days
SS	500	4°C	24 hours
BOD ₅	1000	4°C	6 hours
NH ₃ -N	500	4°C	Analyse as soon as possible
TP	250	4°C	7 days
Oil & Grease	1000	4°C	7 days

The samples shall be analysed in accordance with the APHA Standard Methods for the Examination of Water and Wastewater, 18 the edition, or equivalent method approved by EPD. If in-house or non-standard methods are proposed, details of the method verification may also be required to submit to DEP. In any circumstance, the sample testing should have comprehensive quality assurance and quality control programmes. The laboratory should prepare to demonstrate the programmes to DEP or his representatives when requested.

4.4 Monitoring Locations

4.4.1 Marine Water

Marine water quality monitoring stations should be selected with reference to locations of marine sensitive receivers (Figure 3.2 of the draft EIA Report) together with the construction activities and monitoring programme of Pak Shek Kok project. These stations 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.

Control stations 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.

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 6 m, the mid-depth station may be omitted. Should the water depth be less than 3 m, only the mid-depth station will be monitored. The ET Leader shall seek approval from DEP on all the monitoring stations.

4.4.2 Surface Water

Water quality monitoring should also be undertaken at the outlets of the sedimentation tanks.

4.5 Baseline Monitoring

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 4.1. 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.

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

In exceptional case 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.

4.6 Impact Monitoring

During the course of the marine works, monitoring shall be undertaken once 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.

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 of the marine works.

During the course of the construction works, water sampled at the outlets of the sedimentation tanks shall be undertaken three days per week for pH and SS measurement and once per week for oil and grease analysis.

4.7 Event and Action Plan for Marine Water Quality

Marine water quality criteria, namely Action and Limit levels, are shown in Table 4.2. These criteria should be applied to ensure that any deteriorating water quality could be readily detected. When the monitoring results of the water quality parameters at any designated monitoring stations exceed the water quality criteria, the actions in accordance with the Action Plan in Table 4.3 shall be carried out.

Table 4.2 Action and Limit Levels for Marine 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
Turbidity in NTU (depth-averaged)	95%-ile of baseline data and 120% of upstream control station's turbidity at the same tide of the same day	99%-ile of baseline, 130% of upstream control station's turbidity at the same tide of the same day
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)
Colour in hu (depth-averaged)	95%-ile of baseline data and 120% of upstream control station's colour at the same tide of the same day	99%-ile of baseline, 130% of upstream control station's colour at the same tide of the same day
BOD ₅ in mg/l (depth-averaged)	95%-ile of baseline data and 120% of upstream control station's BOD ₅ at the same tide of the same day	99%-ile of baseline, 130% of upstream control station's BOD ₅ at the same tide of the same day
NH ₄ -N in mg/l (depth-averaged)	95%-ile of baseline data and 120% of upstream control station's NH ₄ -N at the same tide of the same day	99%-ile of baseline, 130% of upstream control station's NH ₄ -N at the same tide of the same day
TP- P in mg/l (depth-averaged)	95%-ile of baseline data and 120% of upstream control station's TP-P at the same tide of the same day	99%-ile of baseline, 130% of upstream control station's TP-P at the same tide of the same day

- Notes:
- 1 "depth-averaged" is calculated by taking the arithmetic means of reading of all three depths.
 - 2 For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.
 - 3 For colour, turbidity, SS, BOD₅, NH₄-N and TP-P, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.
 - 4 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 4.3 Event and Action Plan for Marine Water Quality

Event	ET Leader	Contractor	ER
Action level being exceeded by one sampling day	Repeat in-situ measurement to confirm findings; Identify source(s) of impact; Inform contractor and EPD; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with ER and Contractor; Repeat measurement on next day of exceedance.	Inform the Engineer and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; consider changes of working methods; Propose mitigation measures to ER and discuss with ET and ER; Implement the agreed mitigation measures.	Discuss with ET and Contractor on the proposed mitigation measures; Make agreement on the mitigation measures to be implemented; Assess the effectiveness of the implemented mitigation measures.
Action level being exceeded by more than two consecutive sampling days	Repeat in-situ measurement to confirm findings; Identify source(s) of impact; Inform contractor and EPD; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with ER and Contractor; Ensure mitigation measures are implemented; Prepare to increase the monitoring frequency to daily; Repeat measurement on next day of exceedance.	Inform the Engineer and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; consider changes of working methods; Propose mitigation measures to ER within 3 working days and discuss with ET and ER; Implement the agreed mitigation measures.	Discuss with ET and Contractor on the proposed mitigation measures; Make agreement on the mitigation measures to be implemented; Assess the effectiveness of the implemented mitigation measures.
Limit level being exceeded by one sampling day	Repeat in-situ measurement to confirm findings; Identify source(s) of impact; Inform contractor and EPD; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with ER and Contractor; Ensure mitigation measures are implemented; Increase the monitoring frequency to daily until no exceedance of Limit level.	Inform the Engineer and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; consider changes of working methods; Propose mitigation measures to ER within 3 working days and discuss with ET and ER; Implement the agreed mitigation measures.	Discuss with ET and Contractor 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.
Limit level being exceeded by more than two consecutive sampling days	Repeat in-situ measurement to confirm findings; Identify source(s) of impact; Inform contractor and EPD; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with ER and Contractor; Ensure mitigation measures are implemented; Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days.	Inform the Engineer and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; Consider changes of working methods; Propose mitigation measures to ER within 3 working days and discuss with ET and ER; 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..	Discuss with ET and Contractor 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.

4.8 Event and Action Plan for Surface Water Quality

Since all effluent covered by the TM are required to be licensed, the discharges from the sedimentation tank are required to comply with the effluent standard discharged to Tolo Harbour Coastal Waters shown in Table 4.4.

Table 4.4 Selection of Effluent Standards Discharged into Coastal Waters of Tolo Water Control Zone

Measurement Parameter	Effluent Standard
pH (pH units)	6-9
Suspended solids (mg/l)	30
Oil & Grease (mg/l)	20

Source : EPD Technical Memorandum on Effluent Standards, Table 7

Table 4.5 Event and Action Plan for Surface Water Quality

Event	ET Leader	Contractor	ER
Limit level being exceeded by one sampling day	Repeat in-situ measurement to confirm findings; Identify source(s) of impact; Inform contractor and EPD; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with ER and Contractor; Ensure mitigation measures are implemented; Increase the monitoring frequency to daily until no exceedance of Limit level.	Inform the Engineer and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; consider changes of working methods; Propose mitigation measures to ER within 3 working days and discuss with ET and ER; Implement the agreed mitigation measures.	Discuss with ET and Contractor 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.
Limit level being exceeded by more than two consecutive sampling days	Repeat in-situ measurement to confirm findings; Identify source(s) of impact; Inform contractor and EPD; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with ER and Contractor; Ensure mitigation measures are implemented; Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days.	Inform the Engineer and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; Consider changes of working methods; Propose mitigation measures to ER within 3 working days and discuss with ET and ER; 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..	Discuss with ET and Contractor 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.

4.9 Water Quality Mitigation Measures

The following mitigation measures should be undertaken to minimize the impact on marine water quality during construction:

- (a) Prevent overflow during hydraulic dredging or using sealed grabs for mechanical dredging;
- (b) Ensure that the release of fines to the water body during backfilling operations is limited through careful placing of fill close to the point rather than dumping the material from a holding barge positioned on the surface;
- (c) Drainage from the site should be channelled to a series of sediment traps;
- (d) Provide appropriate effluent treatment facilities at site work areas;
- (e) Fuel, oil and paint should be stored in properly secured containers and kept within bunded areas.

5 WASTE MANAGEMENT

The Contractor is responsible for waste control within the construction site, removal of the waste material produced from the site and to implement any mitigation measures to minimise waste or redress problems arising from the waste from the site. The waste material may include any sewage, waste water or effluent containing sand, cement, silt or any other suspended or dissolved material to flow from the site onto any adjoining land, storm sewer, sanitary sewer, or any waste matter or refuse to be deposited anywhere within the site or onto any adjoining land.

When handling the waste material, the following measures shall be undertaken:

- Construction wastes should be separated into non-inert and inert materials. The former, such as wood, glass, plastic, steel and other metals (including excavated pipelines), should only be disposed of at strategic landfills. The latter, such as concrete, should only be disposed of at a public dump (eg Pak Shek Kok);
- The dredged marine mud should be disposed off at a designated location to be agreed by EPD;
- Chemical and maintenance wastes should be stored on-site in containers (drums and tanks) of suitable design to prevent leakage or spillage under normal conditions of handling, storage and transportation. The contractors should register these waste with EPD as chemical waste producers and such wastes should be collected by authorised collectors to Tsing Yi Chemical Waste Treatment Facility and be disposed of in accordance with the Chemical Waste (General) Regulation;
- Refuse containers such as open skips should be provided at every work site for use by the workforce; and
- Human waste should be discharged into septic tanks provided by the Contractors and be removed regularly by hygiene services' companies.

The Contractor shall also pay attention to the Waste Disposal Ordinance, the Dumping at Sea Ordinance, the Public Health and Municipal Services Ordinance and the Water Pollution Control Ordinance, and carry out the appropriate waste management work. The relevant licence/permit, such as the effluent discharge licence, the chemical waste producer registration, etc. shall be obtained. The Contractor shall refer to the relevant booklets issued by EPD when applying for the licence/permit.

During the site inspections and the document review procedures as mentioned in Sections 6.1 and 6.2 of this manual, the ET Leader shall pay special attention to the issues relating to waste management, and check whether the Contractor has followed the relevant contract specifications and the procedures specified under the laws of Hong Kong.

6 SITE ENVIRONMENTAL AUDIT

6.1 Site Inspections

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.

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

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.

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 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.

Ad hoc site inspections shall also be carried out if significant environmental problems are identified. Inspections may also be required subsequent to receipt of an environmental complaint, or as part of the investigation work, as specified in the Action Plan for environmental monitoring and audit.

6.2 Compliance with Legal and Contractual Requirements

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

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

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

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

After reviewing the document, the ET Leader shall advise the 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.

Upon receipt of the advice, the Contractor shall undertake immediate action to remedial 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

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.

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.

7 REPORTING

7.1 General

Reports can be provided in an electronic medium upon agreeing the format with the ER and EPD. This would enable a transition from a paper/historic and reactive approach to an electronic/real time proactive approach.

7.2 Baseline Monitoring Report

The ET Leader shall prepare and submit a Baseline Environmental Monitoring Report within 10 working days of completion of the baseline monitoring. Copies of the Baseline Environmental Monitoring Report shall be submitted to each of the three parties: the Contractor, the ER and the EPD. The ET Leader shall liaise with the relevant parties on the exact number of copies they want. The format of the report and the format of the baseline monitoring data in magnetic media to be submitted to EPD shall be agreed with EPD.

The baseline monitoring report shall include at least the following:

- (a) Up to half a page executive summary;
- (b) Brief project background information;
- (c) Drawings showing locations of the baseline monitoring stations;
- (d) Monitoring results (in both hard and diskette copies) together with the following information:
 - monitoring methodology;
 - equipment used and calibration details;
 - parameters monitored;
 - monitoring locations (and depth);
 - monitoring date, time, frequency and duration;
- (e) Details on influencing factors, including:
 - major activities, if any, being carried out on the site during the period;
 - weather conditions during the period;
 - other factors which might affect the results;
- (f) Determination of the Action and Limit Levels for each monitoring parameter and statistical analysis of the baseline data;
- (g) Revisions for inclusion in the EM&A Manual; and
- (h) Comments and conclusions.

7.3 Monthly EM&A Reports

The results and findings of all EM&A work required in the Manual shall be recorded in the monthly EM&A reports prepared by the ET Leader. The EM&A report shall be prepared and submitted within 10 working days of the end of each reporting month, with the first report due in the month after construction commences. Each monthly EM&A report shall be submitted to each of the three parties: the Contractor, the ER and the EPD. Before submission of the first EM&A report, the ET Leader shall liaise with the parties on the exact number of copies and format of the monthly reports in both hard copy and electronic medium requirement.

The ET leader shall review the number and location of monitoring stations and parameters to monitor every 6 months or on as needed basis in order to cater for the changes in surrounding environment

and nature of works in progress.

7.3.1 First Monthly EM&A Report

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

- (a) 1-2 pages executive summary;
- (b) Basic project information including a synopsis of the project organisation, programme and management structure, and the work undertaken during the month;
- (c) A brief summary of EM&A requirements including:
 - all monitoring parameters;
 - environmental quality performance limits (Action and Limit levels);
 - Event-Action Plans;
 - environmental mitigation measures, as recommended in the project EIA study final report;
 - environmental requirements in contract documents;
- (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) Monitoring results (in both hard and diskette copies) together with the following information;
 - monitoring methodology
 - equipment used and calibration details
 - parameters monitored
 - monitoring locations (and depth)
 - monitoring date, time, frequency, and duration;
- (g) Graphical plots of trends of monitored parameters over the past four reporting periods for representative monitoring stations annotated against the following:
 - major activities being carried out on site during the period;
 - weather conditions during the period; and
 - any other factors which might affect the monitoring results;
- (h) Advice on the solid and liquid waste management status;
- (i) A summary of noncompliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
- (j) A review of the reasons for and the implications of noncompliance including review of pollution sources and working procedures;
- (k) A description of the actions taken in the event of noncompliance and deficiency reporting and any follow-up procedures related to earlier noncompliance;
- (l) A summary record of all complaints received (written or verbal) for each media, including locations and nature of complaints, liaison and consultation undertaken, actions and follow-up procedures taken and summary of complaints; and
- (m) An account of the future key issues as reviewed from the works programme and work method statements.

7.3.2 Subsequent EM&A Reports

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

- (a) Title Page
- (b) Executive Summary (1-2 pages)
 - breaches of AL levels
 - complaint Log
 - reporting changes
 - future key issues
- (c) Contents Page
- (d) Environmental Status
 - drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations
 - summary of non-compliance with the environmental quality performance limits
 - summary of complaints
- (e) Environmental Issues and Actions
 - review issues carried forward and any follow-up procedures related to earlier non-compliance (complaints and deficiencies)
 - description of the actions taken in the event of noncompliance and deficiency reporting
 - recommendations (should be specific and target the appropriate party for action)
 - implementation status of the mitigatory measures and the corresponding effectiveness of the measures
- (f) Future Key Issues
- (g) Appendix
 - AL levels
 - graphical plots of trends of monitored parameters at key stations over the past four reporting periods for representative monitoring stations annotated against the following:
 - i) major activities being carried out on site during the period;
 - ii) weather conditions during the period; and
 - iii) any other factors which might affect the monitoring results
 - monitoring schedule for the present and next reporting period
 - cumulative complaints statistics
 - details of complaints, outstanding issues and deficiencies

7.4 Quarterly EM&A Summary Reports

The quarterly EM&A summary report which should generally be around 5 pages and contain at least the following information:

- (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:
 - monitoring parameters;
 - environmental quality performance limits (Action and Limit levels); and
 - 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 4 months (the last month of the previous quarter and the present quarter) for representative monitoring stations annotated against;
 - the major activities being carried out on site during the period;
 - weather conditions during the period; and
 - any other factors which might affect the monitoring results;
- (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) 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
- (m) Proponents' contacts and any hotline telephone number for the public to make enquiries.

7.5 Data Keeping

The site document such as the monitoring field records, laboratory analysis records, site inspection forms, etc. are not required to be included in the monthly EM&A reports for submission. However, the document shall be well kept by the ET Leader and be ready for inspection upon request. All relevant information shall be clearly and systematically recorded in the document. The monitoring data shall also be recorded in magnetic media form, and the software copy can be available upon request. The water quality data software format shall be agreed with EPD. All the document 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

With reference to Event/Action Plans in Tables 2.2, 3.2, 4.3 and 4.5, when the environmental quality limits are exceeded, the ET Leader shall immediately notify the ER & EPD, as appropriate. The notification shall be followed up with advice to EPD on the results of the investigation, proposed action and success of the action taken, with any necessary follow-up proposals. A sample template for the interim notifications is shown in Attachment B.

ATTACHMENT A

SAMPLES OF DATA RECORDING
SHEETS FOR DUST, NOISE AND
WATER QUALITY MONITORING

Table A-1 Data Sheet for TSP Monitoring

Monitoring Location		
Details of Location		
Sampler Identification		
Date & Time of Sampling		
Elapsed-time Meter Reading	Start (min.)	
	Stop (min.)	
Total Sampling Time (min.)		
Weather Conditions		
Site Conditions		
Initial Flow Rate, Q_{si}	Pi (mmHg)	
	Ti (°C)	
	Hi (in.)	
	Q_{si} (Std. m ³)	
Final Flow Rate, Q_{sf}	Pf (mmHg)	
	Tf (°C)	
	Hf (in.)	
	Q_{sf} (Std. m ³)	
Average Flow Rate (Std. m ³)		
Total Volume (Std. m ³)		
Filter Identification No.		
Initial Wt. of Filter (g)		
Final Wt. of Filter (g)		
Measured TSP Level ($\mu\text{g}/\text{m}^3$)		

	<u>Name & Designation</u>	<u>Signature</u>	<u>Date</u>
Field Operator :	_____	_____	_____
Laboratory Staff :	_____	_____	_____
Checked by :	_____	_____	_____

Table A-2 Noise Monitoring Field Record Sheet

Monitoring Location		
Description of Location		
Date of Monitoring		
Measurement Start Time (hh:mm)		
Measurement Time Length (min.)		
Noise Meter Model/Identification		
Calibrator Model/Identification		
Measurement Results	L ₉₀ (dB(A))	
	L ₁₀ (dB(A))	
	Leq (dB(A))	
Major Construction Noise Source(s) During Monitoring		
Other Noise Source(s) During Monitoring		
Remarks		

	<u>Name & Designation</u>	<u>Signature</u>	<u>Date</u>
Recorded By :	_____	_____	_____
Checked By :	_____	_____	_____

Table A-3 Water Quality Monitoring Data Record Sheet

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

Name & Designation

Signature

Date

Recorded By : _____

Checked By : _____

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

Attachment B
Sample of Template for Interim
Notifications of Environmental Quality
Limits Exceedances

Table B-2 Sample Template for Interim Notifications of Environmental Quality Limits Exceedances

Incident Report on Action Level or Limit Level Non-compliance

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

Location Plan

Prepared by : _____

Designation : _____

Signature : _____

Date : _____

**Agreement No. CE 35/95
Feasibility Assignment for
Widening of Tolo Highway and
Traffic Surveillance and Information System
Environmental Monitoring and Audit Manual**

Addendum May 1997

CONTENT, add

- 1.6 Review of EM & A Manual
- 3.8 Follow-up Action for development in Area 39, Tai Po and Pak Shek Kok Public Dump Reclamation.

P.2, new S.1.6

- 1.6 Review of EM & A Manual

The EM & A Manual should be reviewed and updated later, near the commencement of construction of the project. In particular, the parameters of water quality monitoring programme may need to revise after some outcomes are available in the extensive water monitoring programme for the Pak Shek Kok Reclamation project.

P.5, S.2.4 1st paragraph, (d). 'to door' to be replaced with 'to dust'.

P.12, new S.3.8

- 3.8 Follow-up Action for developments in Area 39, Tai Po and Pak Shek Kok Public Dump Reclamation.

The noise assessment was carried out on assumption that the proposed GIC sits consisting of 6 storey buildings in Area 39, Tai Po are noise sensitive. During the detailed design stage, HyD will consult with EPD, DPO/STN and DLO/TP on the need of the proposed noise barriers for the planned development. If DPO/STN cannot confirm whether the land uses in the GIC sites in Area 39 are noise sensitive before the commencement of the construction works, the proposed noise barriers shall be built to allow flexibility of future land uses.

The proposed noise barriers for the Pak Shek Kok Public Dump Reclamation Development will be reviewed under the Pak Shek Kok Study carried out by PM/NTN. The final requirements of noise barriers concerning the Pak Shek Kok Public Dump development for incorporation into the Tolo Highway Widening construction project will be discussed and confirmed among PM/NTN, EPD, HyD and other relevant departments.

P.13, S.4.1 1st sentence. After 'dissolved oxygen (DO)', include 'chlorophyll-a'.

P.13, S.4.2.3. Add 'Chlorophyll-a' at beginning of title. Add 'chlorophyll-a' before 'colour, NH₃-N and TP'.

P.14, S.4.2.6(a). Add 'chlorophyll-a' before 'colour, BOD₅'.

P.15, Table 4.1. Include the following line in the Table:

Chlorophyll-a	500	4°C	2 days
---------------	-----	-----	--------

P.15, S.4.3 last paragraph. Replace '18 the' with '18th'.

P.15, S.4.4.1, 1st paragraph. Replace '(Figure 3.2 of the draft EIA Report)' with '(Figure 3.2 of the Final EIA Report)'.

P.16, S.4.4.1 last paragraph. 'from DEP' to be replaced with 'from DEP and AFD'.

P.16, S.4.6, 1st paragraph. Replace 'one per week' with 'three times per week'.

P.17, Table 4.2. For SS, include 'or 50mg/L whichever is the more stringent' after '(e.g. required suspended solids level for concerned sea water intakes)'. Add point 5 at bottom of Table as '5 50 mg/L SS is the limit level required by AFD'.

P.19, new S.4.9.

'4.9 Additional Monitoring During Dredging'

As the sediment is known to be contaminated with lead and zinc (see Appendix C of EIA Report), the following additional monitoring is recommended during the dredging period. During dredging activities, zinc and lead concentrations should be monitored in the water column near to the dredging area. These should be conducted at monitoring stations closest to dredging activities, with results used to ascertain whether the dredging activities are implicated in any alleged fish kills in the two fish culture zones. Zinc and lead analysis in water should be conducted by a HOKLAS accredited laboratory using APHA 18th Ed. Method 3500, or equivalent method acceptable to EPD and AFD, Monitoring for lead and zinc in the water column should also be conducted at a control station representative of the area at the same time.'

