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Territory Development
Department, Hong Kong

新界東拓展處
NEW TERRITORIES EAST
DEVELOPMENT OFFICE

Sha Tin Newtown Stage II Road D15 Linking Lok Shun Path & Tai Po Road

SHA TIN NEW TOWN STAGE II
ROAD D15 LINKING
LOK SHUN PATH & TAI PO ROAD

Final
Environmental Monitoring and Audit (EM&A) Manual

MAUNSELL CONSULTANTS ASIA LTD

in association with

Consultants in Environmental Sciences (Asia) Ltd
Hassell Ltd

EIA/12/4/
/BC

**TERRITORY DEVELOPMENT
DEVELOPMENT, HONG KONG**

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LOK SHUN PATH & TAI PO ROAD**

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AUGUST 1997

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1. INTRODUCTION

Maunsell Consultants Asia Ltd, in association with Consultants in Environmental Sciences (Asia) Ltd and Hassell Ltd, has been commissioned by New Territories East Development Office of the Territory Development Department to undertake an Environmental Impact Assessment of the proposed District Road D15 in Sha Tin.

1.1 Purpose of the Manual

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 Road D15 linking Lok Shun Path and Tai Po Road. 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 quality and noise, the Hong Kong Planning Standards and Guidelines, and recommendations in the EIA study final report on Road D15 linking Lok Shun Path and Tai Po Road 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;
- (g) Requirements of presentation of environmental monitoring and audit data and appropriate reporting procedures.

1.2 Background

The project was initiated by Transport Department in 1993, with the intention of providing an alternative link between Fo Tan Area and the external Trunk Roads such as Tai Po Road. It is considered that such a link will alleviate the traffic congestion at Fo Tan Industrial Area and Fo Tan Interchange, provide an alternative vehicular access in case of emergencies, and possibly reduce the travelling time to/from Fo Tan Area. The link is about 0.5km long, extending from the existing roundabout at Lok Shun Path to the Elevated Access Road at the northern extremity of the KCRC Development over the Ho Tung Lau Depot (Royal Ascot). As this access road joins the Old Tai Po Road some 300 metres further north, a direct link between Old Tai Po Road and Lok Shun Path will be available at the completion of this project. The construction of Road D15 is anticipated to commence in early 1998 for a period of 24 months. The sensitive receivers are the residential area in the proximity to the construction site. The project site is shown in Figure 1.1.

A total number of 26 noise sensitive receivers and 26 air quality sensitive receivers have been selected in the vicinity of the project to assess the impacts of noise and air quality. The location and number of noise and air quality sensitive receivers are summarised in Table 1.1. Details on the spatial distribution of noise and air quality sensitive receivers are given in Figure 3.1 and Figure 4.1 in the Final EIA Report.

Table 1.1 Summary of the Location and Number of Noise and Air Quality Sensitive Receiver

Location	No. of Sensitive Receiver	
	Noise	Air Quality
Ficus Garden	1	NIL
Haywood Villa	1	1
Lok Lo Ha Village	17	17
Royal Ascot	6	8
Jubilee Garden	1	NIL
Total	26	26

Mitigation measures are recommended to alleviate the noise and air quality impacts during construction and operation phase. The following measures are recommended to mitigate the impacts of noise during the construction phase:

- (a) All construction work are restricted to 0700 - 1900 hours on weekdays and Saturdays;
- (b) Temporary purposed-built barriers should be installed along the roadworks boundary fronting the noise sensitive receivers at the onset of construction to screen the anticipated high construction noise;
- (c) Quietened equipment for the construction work should be employed; and

- (d) The number of equipment, procedure and sequence of construction should be arranged in such a way that the noise levels generated from the plants are kept to a minimum.

Vertical noise barriers are recommended as effective mitigation measures to reduce the anticipated noise levels of the noise sensitive receivers to within the limits as stipulated in Hong Kong Planning Standards and Guidelines during the operation phase of the project. The proposed height of the noise barriers are moderately low, ranging from 1.5 metres to 3.5 metres.

Although the result of air quality assessment indicates that exceedance of the guideline level and the statutory Air Quality Objectives during both construction and operation phases of the project is not expected, in order to further reduce the impact from the construction activities during the construction phase, the following mitigation measures are recommended:

- (a) Effective dust suppression equipment and other measures should be installed to ensure the concentration of air borne dust at the site boundary and any nearby sensitive receiver is within the established standard;
- (b) The construction site should be monitored to minimise the fugitive dust emission. Wheel washing facilities should be installed and used by all vehicles leaving the construction site;
- (c) All motorized vehicles should be restricted to a maximum speed of 8 km per hour. Haulage and delivery vehicles should be confined to designated roadway inside the site; and
- (d) In the process of material handling, any material which has the potential to create dust should be treated with water or sprayed with wetting agent.

1.3 Environmental Monitoring and Audit Requirements

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

- Air quality
- Noise

The impact 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 air quality and noise has been identified and is described in details in the subsequent sections.

1.4 Project Organization

The project organisation and lines of communication with respect to environmental protection works is given in Figure 1.2. Environmental works, including monitoring data analysis, proposed mitigation measures and the writing of reports, will be undertaken by ET. 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's 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;
- (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

Figure 1.3 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 programme indicates that the construction of bridges, retaining wall, box culvert extension, and the general road and drainage works are the major activities during the contract period. The most intensive construction will occur in the second year when all the majority construction activities are taking place all over the site. As such, monitoring work should be considered for various activities throughout the construction period.

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 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 data sheet is shown in Figure 2.1.

2.2 Monitoring Equipment

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.

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 as mentioned in Section 2.1.

If the ET Leader 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 of 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.

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-hr 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

The dust monitoring locations are shown in Figures 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.

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.

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

The ET Leader shall carry out baseline monitoring 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-hr TSP samples. 1-hr sampling shall 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 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.

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.

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.

2.6 Impact Monitoring

The ET Leader shall carry out impact monitoring 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-hr TSP monitoring. For 1-hr 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-hr 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 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 2.1 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 2.2.

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
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

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. However, to further reduce the impact from the construction activities, the following proposed mitigation measures are recommended:

- Effective dust suppression equipment and other measures should be installed to ensure the concentration of air borne dust at the site boundary and any nearby sensitive receiver is within the established standard.
- Wheel washing facilities should be installed and used by all vehicles leaving the construction site;
- All motorized vehicles should be restricted to a maximum speed of 8 km per hour. Haulage and delivery vehicles should be confined to designated roadway inside the site; and
- In the process of material handling, any material which has the potential to create dust should be treated with water or sprayed with wetting agent.

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.

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

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 L_{10} and L_{90} shall also be obtained for reference. A sample data record sheet is shown in Figure 3.1 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 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.

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

The noise monitoring locations are shown in Figure 2.2. 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.

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.

The monitoring station shall normally be at a point 1m from the exterior of the sensitive receivers building facade and be at a position 1.2m above 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 +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 0700-1900 hours on holidays.

For the measurements (b) and (c) above, one set of measurements shall at least include 3 consecutive Leq(5 min) results. The night time measurement (between 2300-0700 hours of next day) at all the designated monitoring station is not required. This is because of all the works are scheduled to be carried out during daytime only.

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

** 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. Analyze investigation 3. Require Contractor to propose measures for the analyzed 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 major measures are:

- All construction work are restricted to 0700-1900 hours on weekdays and Saturdays;
- Temporary purposed-built barriers should be installed along the roadworks boundary fronting the NSRs at the onset of construction to screen the anticipated construction noise. The noise barriers are to be remain throughout the construction period;
- Quietened equipment for the construction work should be employed; and
- The number of equipment, procedure and sequency of construction should be arranged in such a way that the noise levels generated from the plants are kept to a minimum.

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. SITE ENVIRONMENTAL AUDIT

4.1 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.

4.2 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 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.

4.3 Environmental Complaints

The existing EPD complaints hotline should be utilised and any complaints received should then be passed on to the ET who should investigate and discuss with the project manager. In addition, an on-site complaint hotline should be set up. 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.

5. REPORTING

5.1 General

The following reporting requirements based upon a paper documented approach. However, the same information can be provided in an electronic medium upon agreeing the format with the ER and EPD. This would enable a transition from a paper/historic and reactive approach to an electronic/real time proactive approach.

5.2 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.

5.3 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. A maximum of 4 copies of 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.

5.3.1 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) A summary of noncompliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
- (i) A review of the reasons for and the implications of noncompliance including review of pollution sources and working procedures;
- (j) A description of the actions taken in the event of noncompliance and deficiency reporting and any follow-up procedures related to earlier noncompliance;
- (k) 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
- (l) An account of the future key issues as reviewed from the works programme and work method statements.

5.3.2 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

5.4 Quarterly EM&A Summary Reports

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 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) A summary of noncompliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
- (h) A brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures;
- (i) A summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;
- (j) A summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;
- (k) 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
- (l) Proponents' contacts and any hotline telephone number for the public to make enquiries.

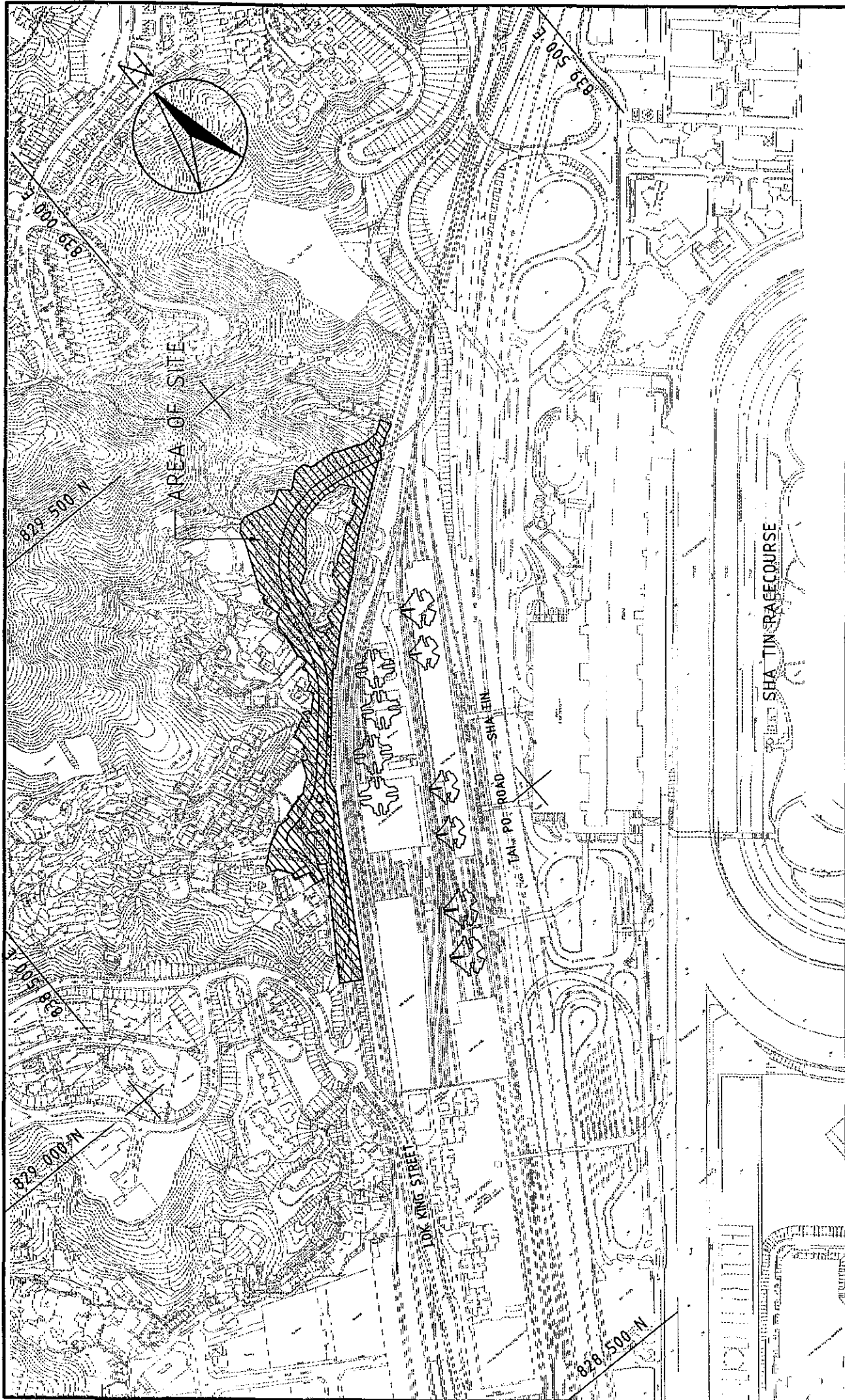
5.5 Data Keeping

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

5.6 Interim Notifications of Environmental Quality Limit Exceedances

With reference to Event/Action Plans in Tables 2.2 and 3.2, 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 Fig.5.1.

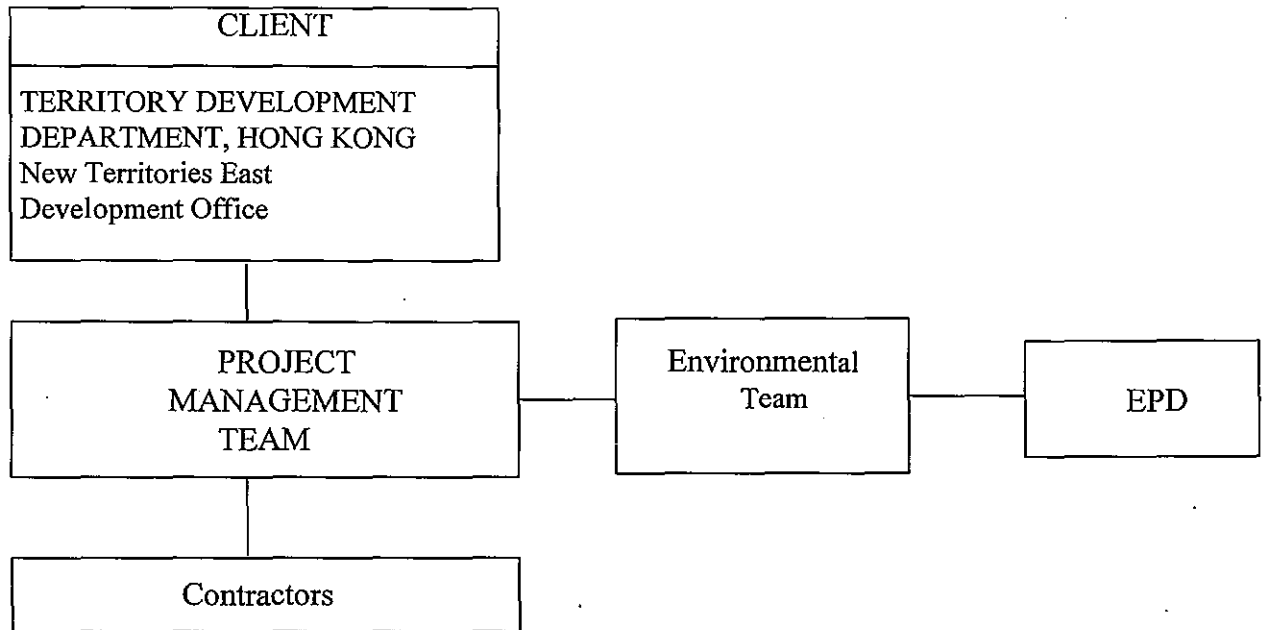
Figures



ROAD D15 LINKING LOK SHUN PATH & TAI PO ROAD -
 ENVIRONMENTAL IMPACT ASSESSMENT
 SITE LOCATION

SCALE:	1:5000	JOB NO.:	63094	FIGURE.:	1.1
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Mausoll
 茂盛(亞洲)工程顧問有限公司



ROAD D15 LINKING LOK SHUN PATH & TAI PO ROAD-
 ENVIRONMENTAL IMPACT ASSESSMENT
 PROJECT ORGANISATION STRUCTURE

Maunsell
 茂盛(亞洲)工程顧問有限公司

JOB NO.
 63094

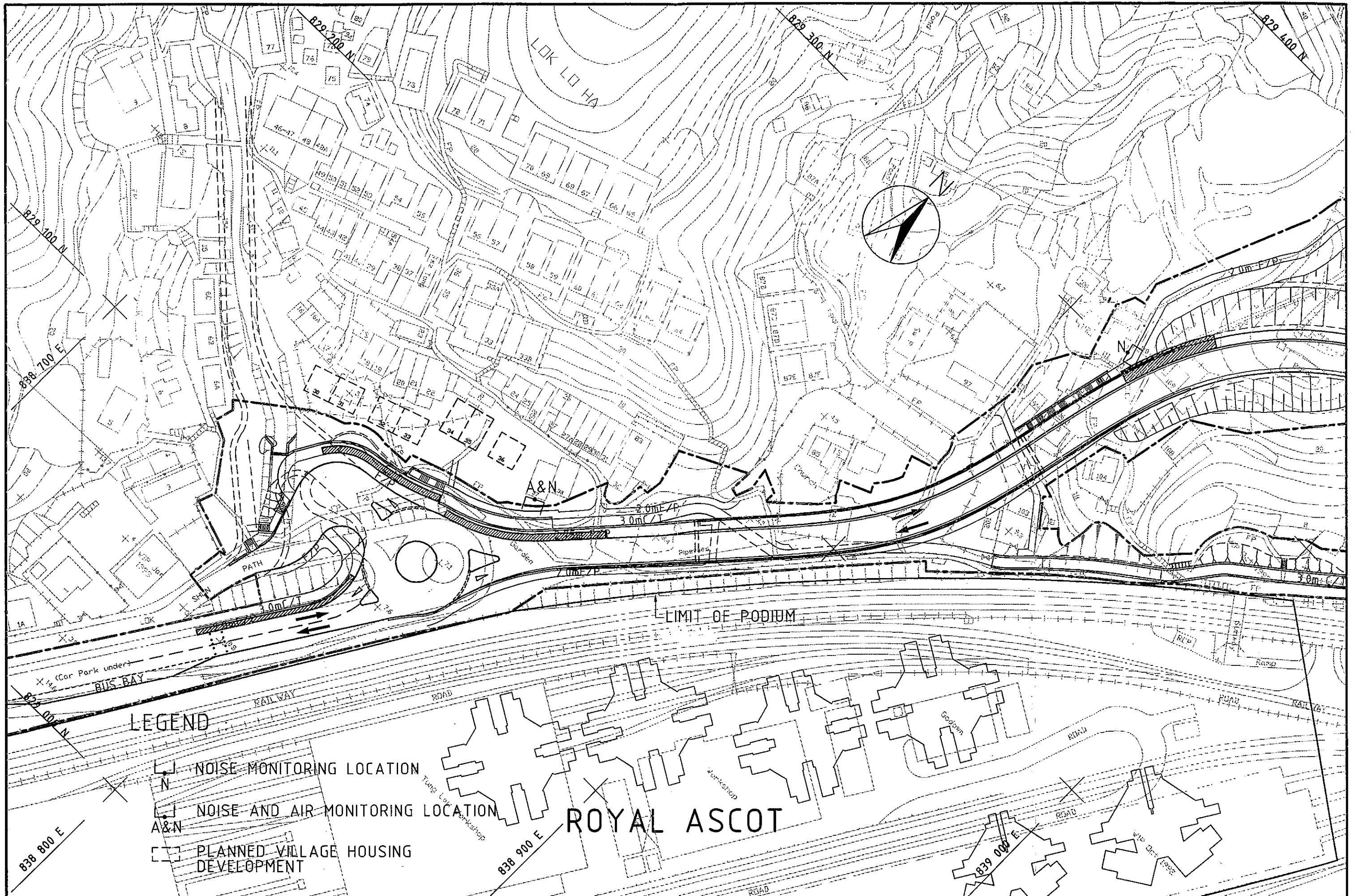
FIGURE:
 1.2

Activities	Year 1												Year 2												
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
General Establishment & Site Clearance	█																								
Bridges A, B, C		█																							
Vertical Noise Barriers																			█						
Retaining Wall					█																				
Box Culvert Extension											█														
General Road & Drainage Works		█																							

Figure 2.1: Data Sheet for TSP Monitoring

Project		ShaTin Road D15 Linking Lok Shun Road & Tai Po Road	
Contract No.			
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, Qsi	Pi (mmHg)		
	Ti (°C)		
	Hi (in.)		
	Qsi (Std. m ³)		
Final Flow Rate, Qsf	Pf (mmHg)		
	Tf (°C)		
	Hf (in.)		
	Qsf (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 (µg/m ³)			

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



LEGEND

- NOISE MONITORING LOCATION
- NOISE AND AIR MONITORING LOCATION
- PLANNED VILLAGE HOUSING DEVELOPMENT

ROAD D15 LINKING LOK SHUN PATH & TAI PO ROAD - ENVIRONMENTAL IMPACT ASSESSMENT
 AIR QUALITY AND NOISE MONITORING LOCATIONS

Maunsell
 茂盛(亞洲)工程顧問有限公司

SCALE: 1:1000	JOB NO.: 63094	FIGURE.: 2.2
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Figure 3.1: Noise Monitoring Field Record Sheet

Project No		ShaTin Road D15 Linking Lok Shun Path & Tai Po Road	
Contract No.			
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			

Name & Designation

Signature

Date

Recorded By :

Checked By :

Figure 5.1 Sample Template for Interim Notifications of Environmental Quality Limits Exceedances

Incident Report on Action Level or Limit Level Non-compliance

Project	ShaTin Road D15 Linking Lok Shun Path & Tai Po Road
Contract No.	
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 : _____