

E.P.D. Library



Highways Department  
New Territories Region

Agreement No. CE 22/96

# Widening of Fo Tan Road and Related Improvement Measures in Fo Tan

**Investigation Assignment**

Volume 2 of 2  
ENVIRONMENTAL MONITORING  
AND AUDIT MANUAL

MAUNSELL CONSULTANTS ASIA LTD



Recycled paper

EIA/139.2/  
bc

EIA/001.2/98

EIA-139.2/bc

Investigation Assignment for  
Widening of Fo Tan Road and  
Related Improvement Measures in Fo Tan

Volume 2 of 2  
ENVIRONMENTAL MONITORING  
AND AUDIT MANUAL

# CONTENTS

Page

1	INTRODUCTION	1
	1.1 Purpose of the Manual	1
	1.2 Background	2
	1.3 Environmental Monitoring and Audit Requirements	2
	1.4 Project Organization	3
	1.5 Construction Programme	5
2	AIR QUALITY	7
	2.1 Air Quality Parameters	7
	2.2 Monitoring Equipment	7
	2.3 Laboratory Measurement/Analysis	8
	2.4 Monitoring Locations	9
	2.5 Baseline Monitoring	9
	2.6 Impact Monitoring	10
	2.7 Event and Action Plan for Air Quality	10
	2.8 Dust Mitigation Measures	12
3	NOISE	15
	3.1 Noise Parameters	15
	3.2 Monitoring Equipment	15
	3.3 Monitoring Locations	15
	3.4 Baseline Monitoring	16
	3.5 Impact Monitoring	16
	3.6 Event and Action Plan for Noise	17
	3.7 Noise Mitigation Measures	17
4	WATER QUALITY	21
	4.1 Water Quality Parameters	21
	4.2 Monitoring Equipment	21
	4.3 Monitoring Locations	22
	4.4 Impact Monitoring	22
	4.5 Event and Action Plan for Surface Water Quality	23
	4.6 Water Quality Mitigation Measures	25
5	SITE ENVIRONMENTAL AUDIT	27
	5.1 Site Inspections	27
	5.2 Compliance with Legal and Contractual Requirements	28
	5.3 Environmental Complaints	28
6	REPORTING	30
	6.1 General	30
	6.2 Baseline Monitoring Report	30
	6.3 Monthly EM&A Reports	30
	6.4 Quarterly EM&A Summary Reports	33
	6.5 Data Keeping	34
	6.6 Interim Notifications of Environmental Quality Limit Exceedances	34

## List of Tables

Table 2.1	Action and Limit Levels for Air Quality	10
Table 2.2	Event/Action Plan for Air Quality	11
Table 2.2	Event/Action Plan for Air Quality (Cont'd)	12
Table 2.3	Data Sheet for TSP Monitoring	13
Table 3.1	Action and Limit Levels for Construction Noise	17
Table 3.2	Event/Action Plan for Construction Noise	17
Table 3.3	Noise Monitoring Field Record Sheet	18
Table 4.1	Water Sample Handling Requirements	22
Table 4.2	Selection of Effluent Standards Discharged into Coastal Waters of Tolo Water Control Zone	23
Table 4.3	Event and Action Plan for Surface Water Quality	24
Table 6.1	Sample Template for Interim Notifications of Environmental Quality Limits Exceedances	35

## List of Figures

Figure 1.1	Fo Tan Road Study Area	5
Figure 1.2	Project Organisation	4
Figure 1.3	Tentative Construction Programme	6
Figure 2.1	Air Quality Sensitive Receivers with the Suggested Dust Monitoring Location	14
Figure 3.1	Construction Noise Sensitive Receivers Locations with suggested Locations for Noise Monitoring	19
Figure 3.2	Construction Noise Sensitive receiver Locations with suggested Locations for Baseline Noise Monitoring	20

## List of Annexes

Annex A	Baseline Monitoring Results for Noise and Dust
Annex B	Legislative Framework (for Dust and Noise)

## 1 INTRODUCTION

CES (Asia) Ltd, working as the environmental sub-consultants of the Maunsell led team was commissioned by Highways Department under Agreement CE22/96 to carry out the Environmental Impact Assessment for the "Widening of Fo Tan Road & Other Related Improvement Measures in Fo Tan" feasibility study.

### 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 the widening of Fo Tan Road and other related improvement measures in Fo Tan. It aims to provide systematic procedures for monitoring, auditing and minimising 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 Fo Tan Road and Other Related Improvement Measures in Fo Tan" 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 impacts;
- (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 with environmental criteria; and
- (g) requirements of presentation of environmental monitoring and audit data and appropriate reporting procedures.

Hereinafter, the term "Engineer" shall refer to the Engineer as defined in the Contract and the Client's Representative (CR), in cases where the Engineer's powers have been delegated to the CR, in accordance with the Contract. The "ET leader", who shall be responsible for and in charge of the ET, shall refer to the person delegated the role of executing the environmental monitoring and audit requirements.

## 1.2 Background

Fo Tan Road is the only road providing access to the Fo Tan Industrial Area and the residential area of Sui Wo. According to the findings in the Working Paper 13 (September 94) of the Shatin and Ma On Shan (STMOS) District Traffic Study commissioned by Transport Department (TD), the critical junctions along Fo Tan Road were overloaded by 10% to 30% in the morning peak hours and by 10% to 20% in the evening peak hours in 1994. The study predicts that upon full development of the Fo Tan area, the Fo Tan Road will be operating beyond its design capacity, and recommends to widen the existing Fo Tan Road as a measure to improve the traffic congestion problem in Fo Tan, Shatin.

The proposed Sui Wo Road extension from Fo Tan Road to Kwei Tei Street will also provide an additional access from Fo Tan Road to the eastern part of the industrial area. The additional entry route would help spread the traffic loading amongst the two critical junctions at Fo Tan Road/Tsung Tau Ha Road and Fo Tan Road/Min Fong Street which are currently overloaded by 10% during the morning peak hour.

At present, traffic accessing the south-eastern part of the Fo Tan industrial area have to use the two junctions at Fo Tan Road/Tsung Tau Ha Road and Fo Tan Road/Min Fong Street for ingress and egress. These two junctions are currently overloaded by 10% during the morning peak hour. The proposed new road linking Tsung Tau Ha Road to Min Fong Street will provide an additional route connecting the north-eastern part and the south-eastern part of the industrial area, thus alleviating the traffic congestion problem currently being experienced at these junctions.

The existing Tat Yip Lane Comprises two cul-de-sacs. Heavy goods vehicles, in particular container trunks, often experience difficulties when reversing in the cul-de-sacs and cause obstructions to other vehicles entering and leaving the adjacent industrial buildings. The proposed extension of Tat Yip Lane to Kwei Tei Street will remove the cul-de-sac on the western half thus alleviating the traffic problems resulting from the reversing of heavy goods vehicles.

In May 1995, TD proposed implementation of the above improvement works to include the Project in the 1996 CWRP RAE for completion within the following five years (2 years for planning and design works plus another 3 years for construction). A tentative scheduling for the construction periods is between 1999 and 2002. The proposed layout of the project is shown in Figure 1.1.

## 1.3 Environmental Monitoring and Audit Requirements

The EM&A programme for this study, as identified in the EIA, involves baseline, impact and compliance monitoring in the areas of:

- Noise
- Air quality
- Water quality

The environmental monitoring and audit requirements recommended in the EIA are detailed in the relevant sections of this report. These are Sections: 2 Air Quality; 3 Noise; 4 Water Quality; and 5 Site Environmental Audit. Impacts at sensitive receivers may be minimized to acceptable levels according to Hong Kong environmental regulations provided environmental monitoring and auditing and environmental mitigation measures are implemented. A summary of the construction phase environmental mitigation measures recommended in the EIA, see below, is further detailed in the

appropriate sections of this report.

**Noise Mitigation:** Use of quietened equipment; restricted hours and appropriate programming of construction work; use of acoustic screen; proper location, operation and placing of noisy equipment;

**Dust Mitigation:** Periodic watering of site area; speed controls for vehicles on unpaved site roads; vehicle wheel and body washing stations at exit point of site and public roads; use of enclosures to contain spreading of dust; use of tarpaulins to cover soil transferred in lorries;

**Water Quality Mitigation:** Prevent overflow during hydraulic or sealed grab mechanical dredging; limit the release of fines to the water body during backfilling; channel drainage to a series of sediment traps; provide appropriate effluent treatment facilities; store fuel, oil and paint in properly secured containers within bunded areas.

As background information, the following summarises the mitigation measures for the operational phase of the widening of Fo Tan Road Project:

**Noise Mitigation** Erection of roadside barriers adjacent to Fo Tan Village (height 2m and 3m); Wo Che Estate (height 5m) and the Technical Institute (height 5m).

**Traffic Emissions Mitigation** There will be compliance with AQOs.

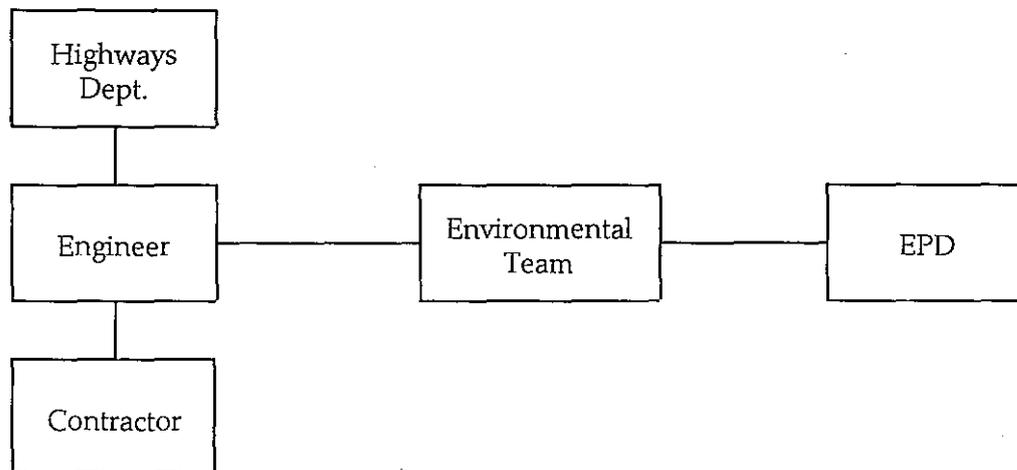
**Water Quality Mitigation** Provision of silt traps to reduce the concentration of silt/sediments in storm water runoff; installation of oil interceptors and other pollution traps at strategic points within the roadway's drainage system to reduce the impact from road run-off that is contaminated with spillage of hazardous materials; in the event a road traffic accident involving the spillage of hazardous/toxic compounds, the spilled materials should be contained and recovered immediately, rather than allowing them to enter the drainage system; and routine inspection and maintenance of the drainage system should be conducted to ensure that sediment traps and other pollutant removal facilities are cleared and in good working order.

**Landscape/Visual Mitigation** Disturbed tree planting should be reinstated on the newly formed slopes, while, while additional tree planting around the housing will enhance visual screening. Additionally, the streetscape should be upgraded. The proposed subways and noise barriers should be co-ordinated in terms of colour and materials to ensure that they project a strong identifiable image for the development. An establishment period and maintenance period for new planting are recommended for inclusion in contract documentation.

#### 1.4 Project Organization

The proposed project organisation and lines of communication with respect to environmental protection works are shown in Figure 1.2.

Figure 1.2 Project Organisation



Based on the organisation chart, the ET will report directly to the Engineer, who will liaise with the Highway Department. The ET leader shall have relevant professional qualifications, or have sufficient relevant EM&A experience subject to approval of the Engineer.

Appropriate staff, including air and noise specialists, 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.

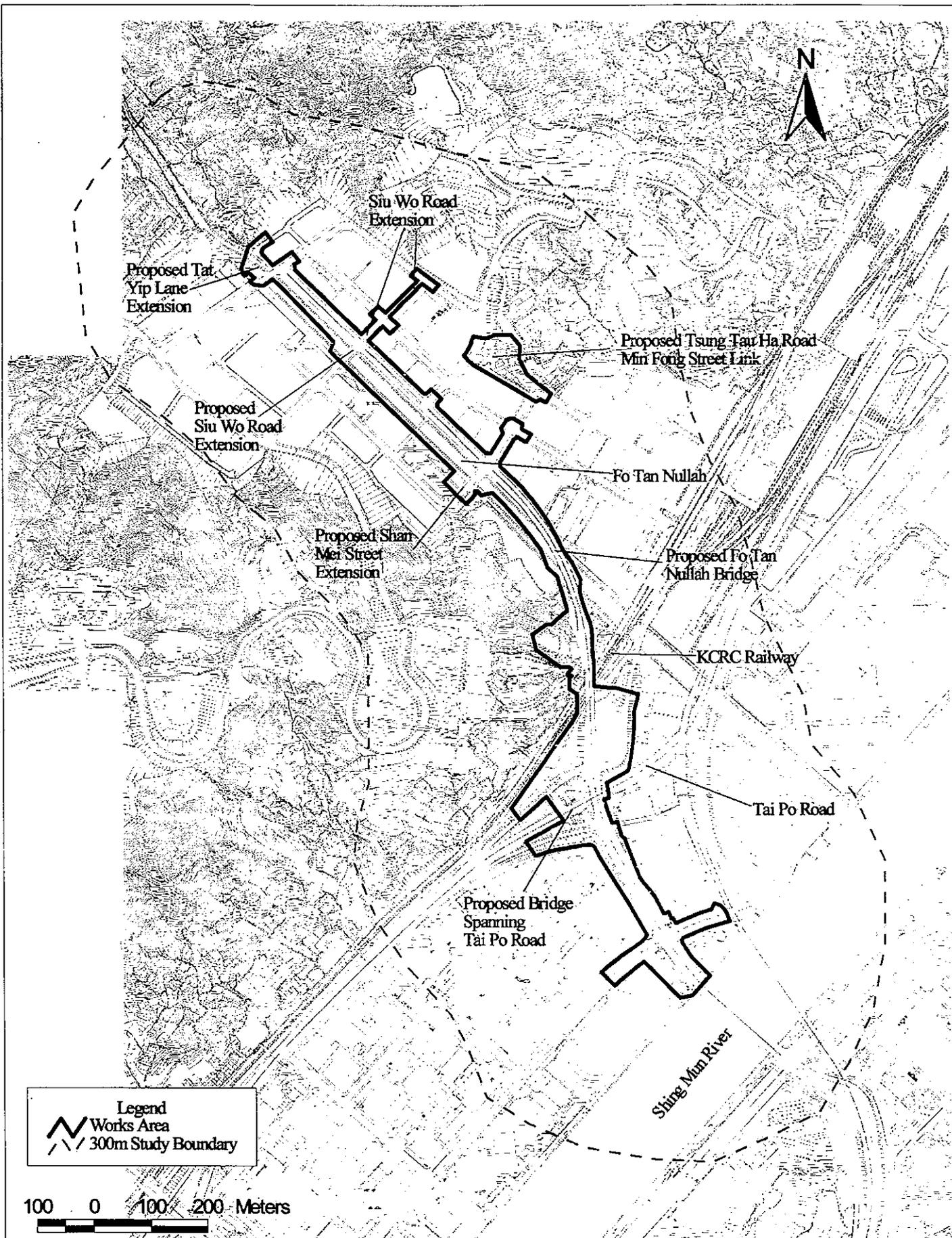
The duties comprise the following:

- (a) to monitor the various environmental parameters as required in the 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 provide audit results to the Engineer.

Appropriate resources shall be allocated by the ET to fulfil duties specified in this Manual.

## 1.5 Construction Programme

A tentative construction programme has been produced by HyD and is shown on Figure 1.3. However, the ET shall request the finalised programme from the Contractor prior to the commencement of any work. The ET leader shall make reference to the actual construction works progress and programme to schedule the EM&A works.



Legend  
 Works Area  
 300m Study Boundary

100 0 100 200 Meters

	TITLE	CES (ASIA) LIMITED			
	Fo Tan Road Layout Area	PROJECT NO.	B160	DATE	September 1997
		DESIGNED	Fanny Lau	DRAWING NO.	Figure 1.1

ID	Task Name	Duration (days)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1	Fo Tan Road - Partial Decking	708	[Task bar]																											
1.1	Temporary Works	287	[Task bar]											[Task bar]																
1.2	Foundation	312	[Task bar]											[Task bar]																
1.3	Column and Retaining Wall	356	[Task bar]											[Task bar]																
1.4	Deck	348	[Task bar]											[Task bar]																
1.5	Surfacing	60	[Task bar]																						[Task bar]					
2	Fo Tan Road - Nullah Bridge	618	[Task bar]																											
2.1	Temporary Works	57	[Task bar]																											
2.2	Piling	119	[Task bar]											[Task bar]																
2.3	Footings at Fo Tan Nullah	126	[Task bar]											[Task bar]																
2.4	Footings outside Fo Tan Nullah	98	[Task bar]											[Task bar]																
2.5	Piers and Abutments	231	[Task bar]											[Task bar]																
2.6	Precast Beams	245	[Task bar]											[Task bar]																
2.7	Erection	37	[Task bar]											[Task bar]																
2.8	Deck	56	[Task bar]											[Task bar]																
2.9	Surfacing	30	[Task bar]																						[Task bar]					
3	KCRC Bridge	436	[Task bar]																											
3.1	Piling	107	[Task bar]											[Task bar]																
3.2	Abutments	144	[Task bar]											[Task bar]																
3.3	Piers	40	[Task bar]											[Task bar]																
3.4	Launching of Deck	168	[Task bar]											[Task bar]																
3.5	Surfacing	30	[Task bar]																						[Task bar]					
4	Shan Mei Street Widening	484	[Task bar]																											
4.1	Demolishing Part of Existing Bridge	55	[Task bar]											[Task bar]																
4.2	Piling	35	[Task bar]											[Task bar]																
4.3	North Abutment	65	[Task bar]											[Task bar]																
4.4	South Abutment	65	[Task bar]											[Task bar]																
4.5	Decking	100	[Task bar]											[Task bar]																
4.6	Surfacing	30	[Task bar]																						[Task bar]					
5	Sui Wo Road Widening	473	[Task bar]																											
5.1	Demolishing Part of Existing Bridge	35	[Task bar]											[Task bar]																
5.2	Piling	35	[Task bar]											[Task bar]																
5.3	North Abutment	65	[Task bar]											[Task bar]																
5.4	South Abutment	65	[Task bar]											[Task bar]																
5.5	Decking	100	[Task bar]											[Task bar]																
5.6	Surfacing	30	[Task bar]																						[Task bar]					
6	Tat Yip Lane Extension	566	[Task bar]																											
6.1	Piling	81	[Task bar]											[Task bar]																
6.2	Ground Beams	35	[Task bar]											[Task bar]																
6.3	Decking	70	[Task bar]											[Task bar]																
6.4	Surfacing	30	[Task bar]																						[Task bar]					

9



TITLE

Tentative Construction Programme

CES (ASIA) LIMITED

PROJECT NO	B160	DATE	August 1997
DESIGNED	Suki Chung	DRAWING NO	Figure 1.3

## 2 AIR QUALITY

### 2.1 Air Quality Parameters

Monitoring and audit of 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.

One-hour and 24-hour TSP levels shall 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). Upon approval of the Engineer, 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 shall be recorded in detail. A sample data sheet is shown in Table 2.3.

### 2.2 Monitoring Equipment

High volume samplers (HVS) in compliance with the following specifications shall be, provided by the ET and shall be used for carrying out the TSP monitoring:

- (a) 0.6-1.7 m<sup>3</sup>/min (20-60 SCFM) adjustable flow range;
- (b) equipped with a timing/control device with  $\pm 5$  minutes accuracy for 24 hours operation;
- (c) installed with elapsed-time meter with  $\pm 2$  minutes accuracy for 24 hours operation;
- (d) capable of providing a minimum exposed area of 406 cm<sup>2</sup> (63 in<sup>2</sup>);
- (e) flow control accuracy:  $\pm 2.5\%$  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 is responsible for provision of the monitoring equipment and 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 shall 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 in the data sheet.

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 Engineer to prove that the instrument is capable of achieving comparable results as 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 Engineer. For installation and operation of wind data monitoring equipment, the following points shall be observed:

- the wind sensors shall be installed on masts at an elevated level 10m above ground so that they are clear of obstructions or turbulence caused by any buildings;
- the wind data shall be captured by a data logger and to be downloaded for processing at least once a month;
- the wind data monitoring equipment shall be re-calibrated at least once every six months; and
- wind direction shall 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 Engineer.

### 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 an independent site laboratory is set up or a non-HOKLAS accredited laboratory is appointed to carry out the laboratory analysis, the laboratory equipment shall be approved by the Engineer and the measurement procedures shall be witnessed by the Engineer. The ET Leader shall provide the Engineer with one copy of the Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50).

Clean filter paper, with no pin holes, of size 8"x10" shall be labelled before sampling. Filter paper shall be conditioned in a humidity controlled chamber for 24-hours and pre-weighed prior to use in any sampler.

After sampling, the filter paper loaded with dust shall be kept in a clean and tightly sealed plastic bag. The filter paper should then be returned to the laboratory for reconditioning in a humidity controlled chamber followed by precision weighing using an electronic balance which is capable of weighing 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 air quality sensitive receivers identified in the EIA study are shown in Figure 2.1. It is recommended that a location in Fo Tan Village is used as the suggested location for dust monitoring. This monitoring location should not be considered contractually binding as there may be practical reasons for changing this when establishing the final locations. It should also be noted that the status and locations of dust sensitive receivers may also change after the issue of this Manual. If such cases exist, the ET Leader shall propose an updated monitoring location and seek approval from the Engineer.

If an alternative monitoring location is proposed the following criteria should be followed:-

- at the site boundary or such location close to the major dust emission source;
- close to the sensitive receptors; and
- take into account the prevailing meteorological conditions.

The ET Leader shall agree with the Engineer 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) 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;
- (c) a minimum of 2 metres of separation from walls, parapets and penthouses is required for rooftop samplers;
- (d) a minimum of 2 metres separation from any supporting structure, measured horizontally is required;
- (e) no furnace or incinerator flue is nearby;
- (f) airflow around the sampler is unrestricted;
- (g) the sampler is more than 20 metres from any dripline;
- (h) any wire fence and gate, to protect the sampler, should not cause any obstruction during monitoring;
- (i) permission must be obtained to set up the samplers and to obtain access to the monitoring stations; and
- (j) a secure supply of electricity is available.

## 2.5 Baseline Monitoring

As part of the EIA study baseline monitoring was carried out in December 1996, the results of which are presented in Annex A. Nevertheless, baseline monitoring shall be required prior to the commencement of any works. This baseline monitoring shall be carried out at the designated monitoring location for 14 consecutive days prior to the commissioning of the construction works to obtain daily 24-hr TSP samples.

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

In case the baseline monitoring cannot be carried out at the identified monitoring location during the baseline monitoring period, monitoring at an alternative location, which can effectively represent the

baseline conditions at the impact monitoring locations, should be carried out upon the approval of the Engineer.

Ambient conditions may vary seasonally and shall be reviewed at quarterly intervals. When the ambient conditions have changed and a rerun of the baseline monitoring is required to obtain updated baseline levels, the monitoring should be scheduled for 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 shall be agreed with the Engineer.

## 2.6 Impact Monitoring

Impact monitoring shall be carried out throughout the construction period. For regular impact monitoring, the sampling frequency of at least once in every six-days, shall be strictly observed at the monitoring station 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 high dust impacts are anticipated.

The specific time to start and stop the 24-hr TSP monitoring shall be clearly defined and strictly followed by the ET for each location.

In the event of non-compliance with the air quality criteria, more frequent monitoring as specified in the Action Plan in Section 2.7 shall be conducted within 24 hours of the recorded exceedance. This additional monitoring shall be continued until excessive dust emissions 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 action and limit levels for air quality. When exceedance of Action and Limit levels occur, recommended action shall 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
1 Hour TSP Level in $\mu\text{g}/\text{m}^3$	For baseline level < 154 $\mu\text{g}/\text{m}^3$ , Action level = average of baseline level plus 30% and Limit level For baseline level > 154 $\mu\text{g}/\text{m}^3$ and baseline level < 269 $\mu\text{g}/\text{m}^3$ , Action level = 350 $\mu\text{g}/\text{m}^3$ For baseline level > 269 $\mu\text{g}/\text{m}^3$ , Action level = 130% of baseline level	500

Table 2.2 Event/Action Plan for Air Quality

Event	Response		
	ET	Engineer	Contractor
<b>ACTION LEVEL</b>			
1 Exceedance for one sample	<ol style="list-style-type: none"> <li>1 Identify source</li> <li>2 Inform Engineer</li> <li>3 Repeat measurement to confirm finding</li> <li>4 Increase monitoring frequency to daily</li> </ol>	<ol style="list-style-type: none"> <li>1 Notify Contractor</li> <li>2 Check monitoring data and Contractor's working methods</li> </ol>	<ol style="list-style-type: none"> <li>1 Rectify any unacceptable practice</li> <li>2 Amend working methods if appropriate</li> </ol>
2 Exceedance for two or more consecutive samples	<ol style="list-style-type: none"> <li>1 Identify source</li> <li>2 Inform Engineer</li> <li>3 Repeat measurements to confirm findings</li> <li>4 Increase monitoring frequency to daily</li> <li>5 Discuss with Engineer for remedial actions required</li> <li>6 If exceedance continues, arrange meeting with Engineer</li> <li>7 If exceedance stops, cease additional monitoring</li> </ol>	<ol style="list-style-type: none"> <li>1 Confirm receipt of notification of failure in writing</li> <li>2 Notify Contractor</li> <li>3 Check monitoring data and Contractor's working methods</li> <li>4 Discuss with Environmental Supervisor and Contractor on potential remedial actions</li> <li>5 Ensure remedial actions properly implemented</li> </ol>	<ol style="list-style-type: none"> <li>1 Submit proposals for remedial actions to Engineer within 3 working days of notification</li> <li>2 Implement the agreed proposals</li> <li>3 Amend proposal if appropriate</li> </ol>
<b>LIMIT LEVEL</b>			
1 Exceedance for one sample	<ol style="list-style-type: none"> <li>1 Identify source</li> <li>2 Inform Engineer</li> <li>3 Repeat measurement to confirm finding</li> <li>4 Increase monitoring frequency to daily</li> <li>5 Assess effectiveness of Contractor's remedial actions and keep the Engineer informed of the results</li> </ol>	<ol style="list-style-type: none"> <li>1 Confirm receipt of notification of failure in writing</li> <li>2 Notify Contractor</li> <li>3 Check monitoring data and Contractor's working methods</li> <li>4 Discuss with Environmental Team Leader and Contractor potential remedial actions</li> <li>5 Ensure remedial actions properly implemented</li> </ol>	<ol style="list-style-type: none"> <li>1 Take immediate action and avoid further exceedance</li> <li>2 Submit proposals for remedial actions to Engineer within 3 working days of notification</li> <li>3 Implement the agreed proposals</li> <li>4 Amend proposal if appropriate</li> </ol>

Table 2.2 Event/Action Plan for Air Quality (Cont'd)

Event	Response		
	ET	Engineer	Contractor
2 Exceedance for two or more consecutive samples	1 Identify source	1 Confirm receipt of notification of failure in writing	1 Take immediate action to avoid further exceedance
	2 Inform Engineer of the causes and actions taken for the exceedance	2 Notify Contractor	2 Submit proposals for remedial actions to Engineer within 3 working days of notification
	3 Repeat measurement to confirm findings	3 Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented	3 Implement the agreed proposals
	4 Increase monitoring frequency to daily	4 Discuss amongst Environmental Team Leader and the Contractor potential remedial actions	4 Resubmit proposals if problem still not under control
	5 Investigate the causes of exceedance	5 Review Contractor's remedial actions whenever necessary to assure their effectiveness	5 Stop the relevant portion of works as determined by the Engineer until the exceedance is abated.
	6 Arrange meeting with the Engineer to discuss the remedial actions to be taken	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	
	7 Assess effectiveness of Contractor's remedial actions and keep the Engineer informed of the results		
	8 Engineer informed of the results If exceedance stops, cease additional monitoring		

## 2.8 Dust Mitigation Measures

The Contractor shall be responsible for the design and implementation of dust suppression measures such as:

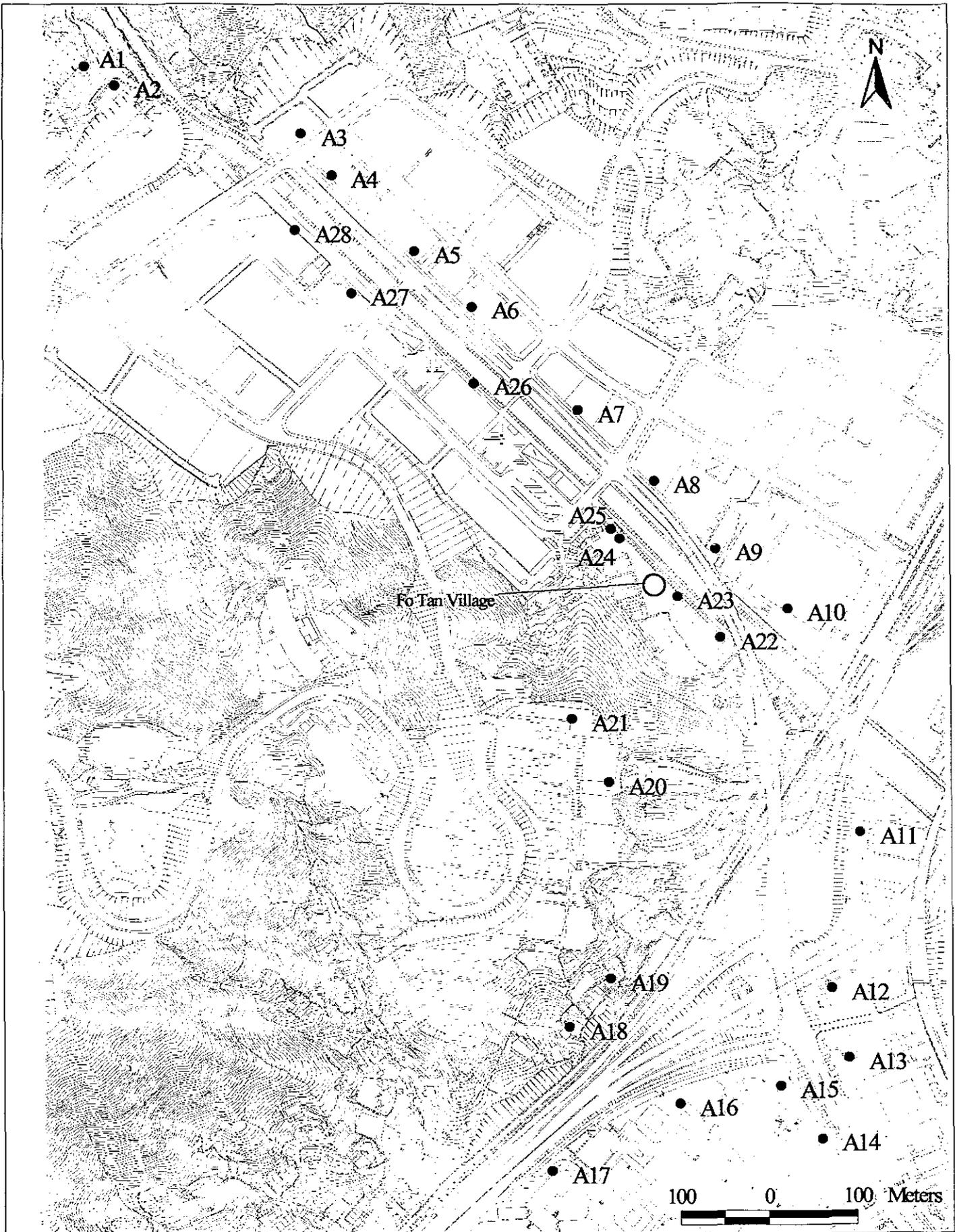
- Periodic watering of open site area;
- Imposition of speed controls for vehicles on unpaved areas, 8 kmh<sup>-1</sup> being the limit recommended by EPD;
- If practical, implementation of vehicle wheel and body washing; and
- Deployment of tarpaulin to cover soil which is transported in lorries to and from the work area.

If the above measures are not sufficient to restore the air quality to acceptable levels the ET Leader, will advise the Contractor on alternative mitigation measures.

Table 2.3 Data Sheet for TSP Monitoring

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, Qsi	Pi (mmHg)
	Ti (°C)
	Hi (in.)
	Qsi (Std. m <sup>3</sup> )
Final Flow Rate, Qsf	Pf (mmHg)
	Tf (°C)
	Hf (in.)
	Qsf (Std. m <sup>3</sup> )
Average Flow Rate (Std. m <sup>3</sup> )	
Total Volume (Std. m <sup>3</sup> )	
Filter Identification No.	
Initial Wt. of Filter (g)	
Final Wt. of Filter (g)	
Measured TSP Level (µg/m <sup>3</sup> )	

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



	TITLE	CES (ASIA) LIMITED			
	<b>Air Quality Sensitive Receivers (Buildings) with Suggested Dust Monitoring Locations</b>	PROJECT NO.	B160/final/ EM&A.01	DATE	August 1997
		DESIGNED	Fanny Lau	DRAWING NO.	Figure 2.1

### 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. Should monitoring be required for any other time periods, Leq(5 min) shall be measured 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 Table 3.3 for reference.

#### 3.2 Monitoring Equipment

Sound level meters, which comply with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications and acoustic calibrators shall be provided by the ET and used for the monitoring of site activities related to this Contract. The accuracy of the sound level meter shall be checked using an acoustic calibrator generating a known sound pressure level at a known frequency, immediately prior to and following each noise measurement. Measurements may be accepted as valid only if the calibration level from before and after the noise measurement are accurate to within 1.0dB.

Noise measurements should not be made in the presence of fog, rain, wind with a steady speed exceeding  $5\text{ms}^{-1}$ , or wind with gusts exceeding  $10\text{ms}^{-1}$ . The wind speed shall be checked with a portable anemometer capable of measuring the wind speed in  $\text{ms}^{-1}$ .

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 sensitive receivers identified in EIA study are shown in Figure 3.1. Any of these locations would be suitable for noise monitoring. Details of the recommended monitoring schedule are give in section 3.5. Monitoring at these stations should be undertaken when there are noisy construction activities ongoing. These monitoring locations should not be considered to be contractually binding. Should the ET find that there are practical reasons for changing these the details should be presented to the Engineer for agreement. The status and locations of noise sensitive receivers may change after issuing this Manual. Any alternative monitoring location proposed should be chosen based on whether it is close to the major site activities which are likely to have noise impacts.. Care should be taken to avoid disturbance to the occupants during monitoring.

The monitoring station shall normally be at the sensitive receivers building facade. If there is a problem with access to the normal monitoring position, an alternative position may be chosen, and a correction to the measurements shall be made. For reference, a correction of +3 dB(A) shall be made to the free field measurements. The ET Leader shall agree with the Engineer on the monitoring position and the corrections adopted. Once the positions for the monitoring stations have been agreed, the baseline monitoring and the impact monitoring shall be carried out at the same positions.

corrections adopted. Once the positions for the monitoring stations have been agreed, the baseline monitoring and the impact monitoring shall be carried out at the same positions.

### 3.4 Baseline Monitoring

As part of the EIA study baseline noise monitoring was carried out in December 1996, the results of which are presented in Annex 1. Nevertheless, further baseline monitoring shall be required prior to the commencement of any works. The ET Leader shall carry out baseline noise monitoring, at all of the sensitive receiver locations indicated in Figure 3.1, prior to the commencement of the construction works relevant to this Contract, the locations of which are to be agreed with the Engineer. It is recommended that a noise monitoring station should be established at the following 6 locations (see Figure 3.2):

- a village house, Fo Tan (next to the nullah);
- Sha Tin Technical Institute;
- a high rise block of Wo Che Estate (ground floor and roof top therefore counted as two locations);
- Wo Che Estate School; and
- the school adjacent to Tai Po Road.

The baseline monitoring shall be carried out daily for a period of at least two weeks and a schedule of the baseline monitoring shall be submitted to the Engineer for approval before the monitoring starts. This monitoring shall include the following:-

- 2 measurements of Leq(30 min) during the time period 0700-1900 (i.e. 30 minutes x 2 occasions x 6 receiver locations = 6 hours total monitoring time)
- 3 consecutive measurements of Leq (5 min) during the period 1900 - 2300 (i.e. 15 minutes x 6 receiver locations = 1.5 hours total monitoring time)
- 3 consecutive measurements of Leq (5 min) during the period 2300- 0700 (i.e. 15 minutes x 6 receiver locations = 1.5 hours total monitoring time)

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

### 3.5 Impact Monitoring

Noise monitoring shall be carried out, for one 30 minute period three times per week on separate days (i.e. 30 minutes x 2 locations x 3 times per week = 3 hours per week) when there is ongoing construction activity, at a minimum of two locations. These two locations shall be chosen according to which are closest to ongoing construction activities. Additionally, noise monitoring (Leq (30 min)) shall be carried out at the two schools in the vicinity during the school examination periods. The ET Leader shall liaise with the school's personnel and the Examination Authority to ascertain the exact dates and times of all examination periods during the course of the contract.

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 continue until the recorded noise levels are rectified or proved to be unrelated to the construction activities.

of the criteria occur, the Action Plan, in Table 3.2., shall be implemented.

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

### 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 measures recommended in the EIA, such as:

- Use of quietened equipment and screening for all construction works whenever appropriate;
- Construction work to be restricted to normal weekdays, between 0700-1900 hour;
- When night time work is involved, nearby residents should be notified in advance of the planned operations and informed of progress. Residents shall be provided with a telephone number/contact person with whom they can register complaints concerning noise nuisance;
- Proper location, operation and placing of noisy equipment; and

planned operations and informed of progress. Residents shall be provided with a telephone number/contact person with whom they can register complaints concerning noise nuisance;

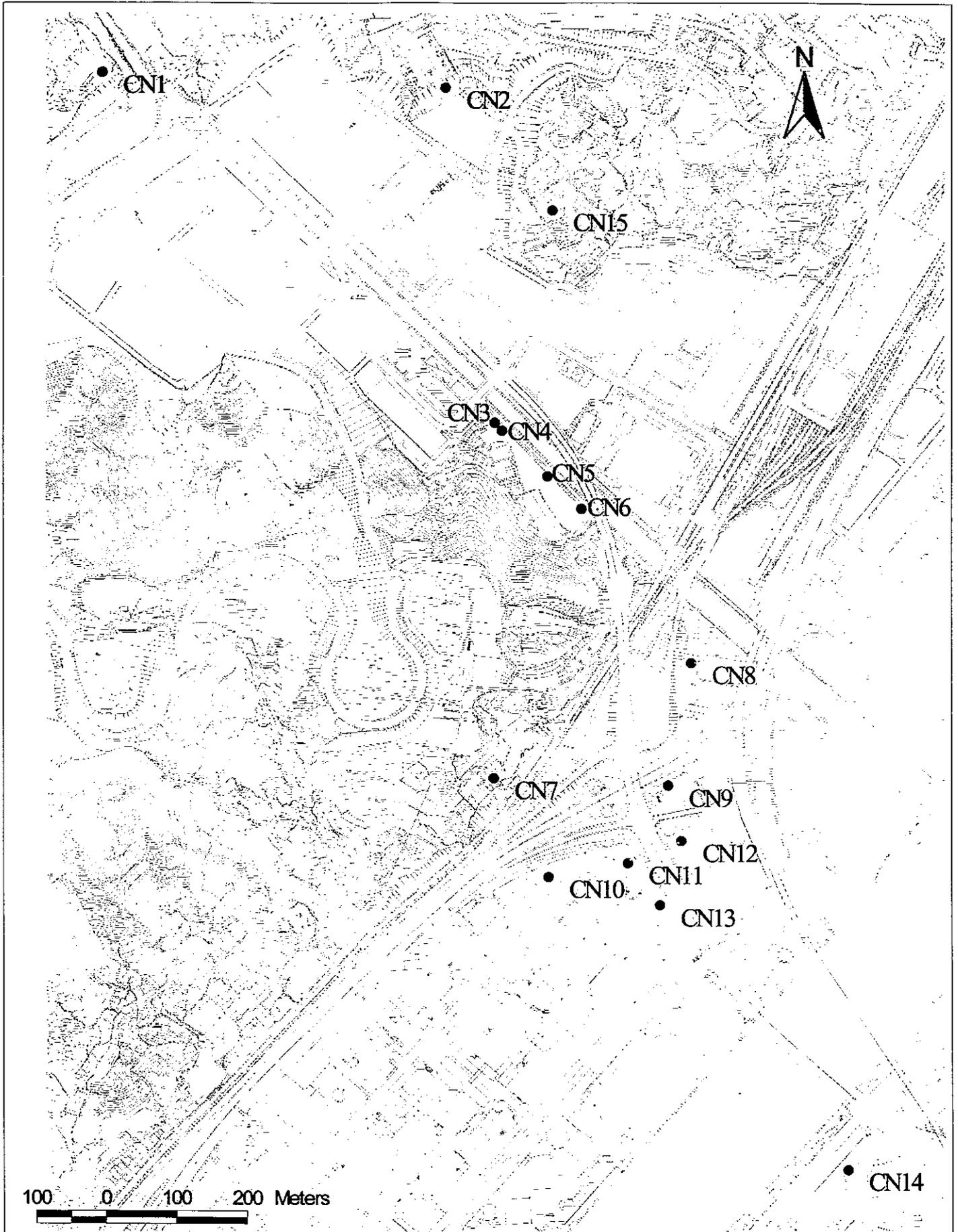
- Proper location, operation and placing of noisy equipment; and
- Proper programming of construction activities.

If the above measures are not sufficient to restore the construction noise quality to an acceptable level the ET Leader will advise the Contractor on other mitigation measures.

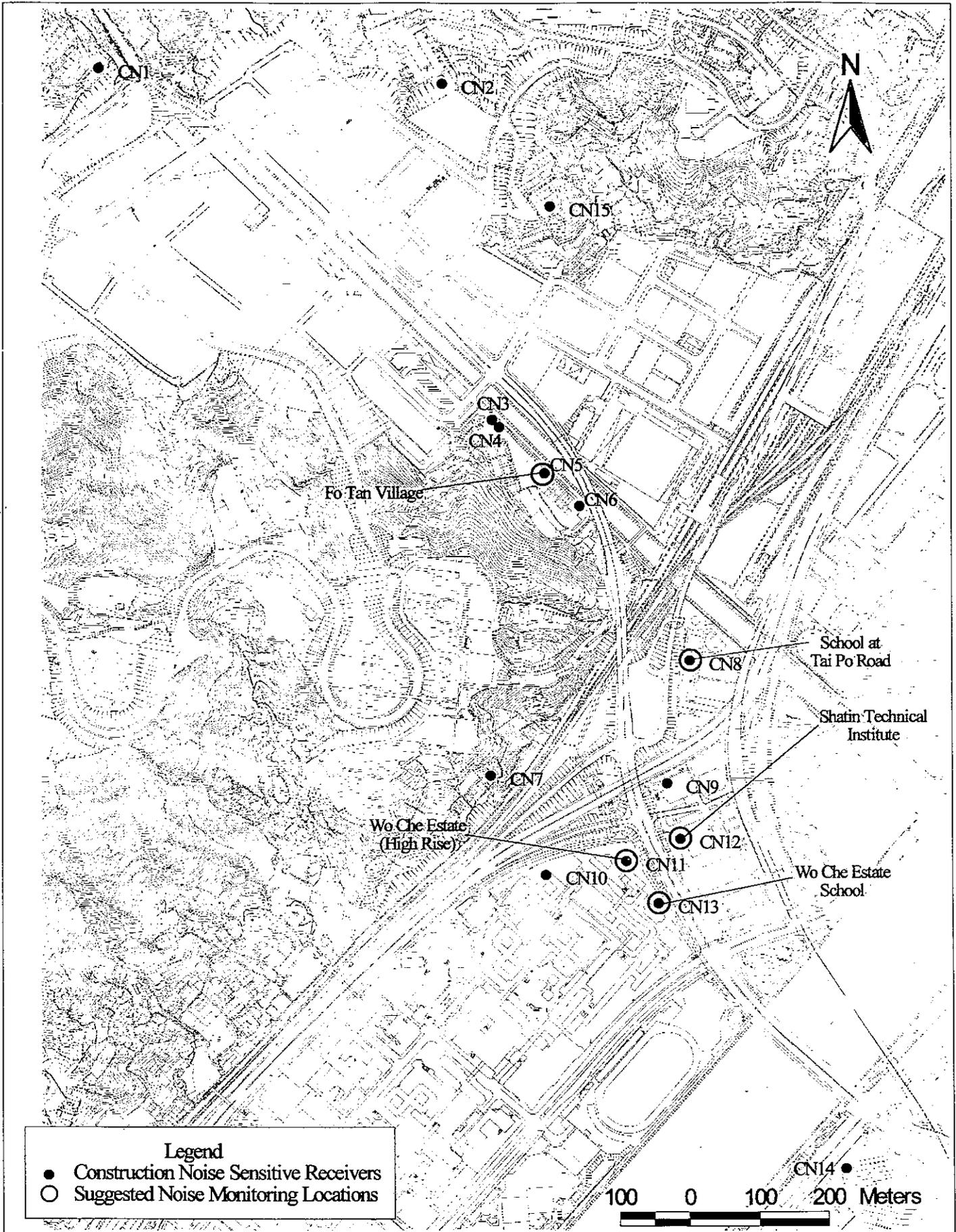
Table 3.3 Noise Monitoring Field Record Sheet

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 <sub>90</sub> (dB(A))
	L <sub>10</sub> (dB(A))
	Leq (dB(A))
Major Construction Noise Source(s) During Monitoring	
Other Noise Source(s) During Monitoring	
Remarks	

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



	TITLE	CES (ASIA) LIMITED			
	Construction Noise Sensitive Receiver Locations	PROJECT NO.	B160	DATE	September 1997
		DESIGNED	Fanny Lau	DRAWING NO.	Figure 3.1



	<b>TITLE</b> Construction Noise Sensitive Receiver Locations with Suggested Locations for Baseline Noise Monitoring	<b>CES (ASIA) LIMITED</b>		
		<b>PROJECT NO.</b> B160final\EM&A.01	<b>DATE</b> August 1997	
		<b>DESIGNED</b> Fanny Lau	<b>DRAWING NO.</b> Figure 3.2	

## 4 WATER QUALITY

### 4.1 Water Quality Parameters

Monitoring for dissolved oxygen (DO), temperature, turbidity, suspended solids (SS), shall be undertaken at designated monitoring stations. The purpose of which is to ensure that any deterioration in water quality can be readily detected and timely action can be taken to resolve any problems. Also monitoring for temperature, pH, SS and oil & grease at the outlets of sedimentation tanks should be carried out. It should be noted that DO, temperature, turbidity and pH should be measured in-situ and the remaining parameters assayed in a laboratory.

In association with the water quality parameters, other relevant data shall also be measured, such as monitoring location/position, time, weather conditions, and any special phenomena and description of work underway at the construction site etc.

### 4.2 Monitoring Equipment

The following equipment and facilities shall be provided by the ET and used for the monitoring of water quality impacts:

#### 4.2.1 Dissolved Oxygen and Temperature Measuring Equipment

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

#### 4.2.3 Sample Containers and Storage

- (a) Water samples for SS analysis should be stored in high density polythene bottles with no preservative added, packed in ice (cooled to 4°C without being frozen), delivered to the laboratory, and analysed as soon as possible after collection.
- (b) Water samples for oil & grease measurement should be stored in glass bottles, acidified 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.

#### 4.2.4 Calibration of In-Situ Instruments

All pH meters, DO meters and turbidimeters shall be checked and calibrated prior to use. DO meters and turbidimeters shall be calibrated by a laboratory accredited under HOKLAS or any other international accreditation scheme, and subsequently re-calibrated at 3 monthly intervals throughout

all stages of the water quality monitoring. Responses of sensors and electrodes shall be checked with certified standard solutions before each use. Wet bulb calibrations for all DO meters shall be carried out before measurement at each monitoring location.

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

#### 4.2.5 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 or 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 Engineer.

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
SS	500	4°C	24 hours
Oil & Grease	1000	4°C	7 days

Each sample shall be analysed in accordance with the APHA Standard Methods for the Examination of Water and Wastewater, 18th edition, or an equivalent method approved by the Engineer. If in-house or non-standard method is proposed, details of the method verification may be required to be submitted to the Engineer. In any circumstance, the sample testing shall comply with a comprehensive quality assurance and quality control programme. The laboratory should be prepared to demonstrate the quality programmes to the Engineer when requested.

#### 4.3 Monitoring Locations

##### 4.3.1 Surface Water

Water quality monitoring should be undertaken at all discharge points from the works area, which are normally outlets of the sedimentation tanks or desilting pits. The actual number of monitoring stations depends on the number of discharge points and may vary as construction proceeds.

#### 4.4 Impact Monitoring

During the course of the construction works, water samples at the discharge points shall be collected three days per week and tested for pH and SS, and sampled once per week for oil and grease analysis.

## 4.5 Event and Action Plan for Surface Water Quality

All effluent subject to control by the TM are required to be licensed. Therefore, the discharges shall be required to comply with the effluent standard of effluent discharged into Tolo Harbour Coastal Waters and is shown in Table 4.2.

Table 4.2 Selection of Effluent Standards Discharged into Coastal Waters of Tolo Water Control Zone

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

Source: Technical Memorandum on Effluent Standards, Table 7

Table 4.3 Event and Action Plan for Surface Water Quality

Event	ET Leader	Contractor	Engineer
Limit level being exceeded by one sampling day	1 Repeat in-situ measurement to confirm findings;	1 Inform the Engineer and confirm notification of the non-compliance in writing;	1 Discuss with ET and Contractor on the proposed mitigation measures;
	2 Identify source(s) of impact;	2 Rectify unacceptable practice;	2 Request Contractor to critically review the working methods;
	3 Inform contractor;	3 Check all plant and equipment;	3 Make agreement on the mitigation measures to be implemented; and
	4 Check monitoring data, all plant, equipment and Contractor's working methods;	4 Consider changes of working methods;	4 Assess the effectiveness of the implemented mitigation measures.
	5 Discuss mitigation measures with Engineer and Contractor;	5 Propose mitigation measures to Engineer within 3 working days and discuss with ET and Engineer; and	
	6 Ensure mitigation measures are implemented; and	6 Implement the agreed mitigation measures.	
	7 Increase the monitoring frequency to daily until no exceedance of Limit level.		
Limit level being exceeded by more than two consecutive sampling days	1 Repeat in-situ measurement to confirm findings;	1 Inform the Engineer and confirm notification of the non-compliance in writing;	1 Discuss with ET and Contractor on the proposed mitigation measures;
	2 Identify source(s) of impact;	2 Rectify unacceptable practice;	2 Request Contractor to critically review the working methods;
	3 Inform contractor;	3 Check all plant and equipment;	3 Make agreement on the mitigation measures to be implemented;
	4 Check monitoring data, all plant, equipment and Contractor's working methods;	4 Consider changes of working methods;	4 Assess the effectiveness of the implemented mitigation measures; and
	5 Discuss mitigation measures with Engineer and Contractor;	5 Propose mitigation measures to Engineer within 3 working days and discuss with ET and Engineer;	5 Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the work until no exceedance of Limit level.
	6 Ensure mitigation measures are implemented; and	6 Implement the agreed mitigation measures; and	
	7 Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days.	7 As directed by the Engineer, to slow down or to stop all or part of the construction activities.	

#### 4.6 Water Quality Mitigation Measures

The Practice Note for Professional Persons with regard to site drainage (ProPECC PN 1/94) advises that the following mitigation measures should be undertaken, where applicable, to minimize the impact on water quality during construction:

- Construction of the foundations for the deck above the nullah, and its related flow diversion works, should be carried out carefully to prevent contaminants from entering the Nullah. Potential impact from activities that would not be protected by sheet piles should be reduced by a stringent programme and careful timing of the activities. It is recommended to shorten the duration of these activities as much as possible in order to mitigate the impacts;
- For site areas that are close to the Nullah and are not enclosed by sheet piles, it is recommended to construct a silt fence along the boundary of the nullah to trap any silts/sediments from accidentally entering into the waters of the nullah;
- Before commencing any demolition works, all sewer and drainage connections should be sealed to prevent debris, soil, sand etc. from entering public sewers/drains;
- Site surface runoff should be settled to remove sand/silt before it is discharged into the existing storm drains. It is recommended that the sand/silt removal facilities (silt traps, sediment basins) and oil interceptors should be carefully planned to ensure that they would be installed at appropriate locations to capture all surface water generated on site. It is also recommended that, where necessary, temporary catchpits and perimeter channels be constructed in addition to the existing channel system within the site prior to the site formation works and earthworks;
- Wastewater generated from concreting, cleaning of works and similar activities should not be discharged into the stormwater drains. All storm catch basins/inlets, if any, receiving stormwater runoff from construction areas should be covered with wire mesh filters, which have on their upper surface crushed stone, in order to prevent sediment from entering inlet structure and to reduce potential sediment loading to the receiving waters. It is recommended this wastewater should be discharged into foul sewers, after the removal of settleable solids, and pH adjustment as necessary. All sewage discharges from the study area should meet the TM standards and approval from EPD through the licensing process is required;
- Grease traps should be provided with sufficient retention time for canteen effluent;
- Sand traps, oil interceptors and other pollution prevention installations should be properly cleaned and maintained;
- Open stockpiles should be covered with tarpaulin or similar materials to avoid weather erosion which may wash fines into stormwater during the wet season, and prevent dust arisings during the dry season;
- Any wash-water from the wheel washing basins located at each site exit should have sand and silt settled out before discharging into storm drains; and

- All fuels should be stored in bunded areas such that spillage can be easily collected;

With the above mitigation measures properly undertaken, the potential water quality impact of the scheme should be local and minimal.

## 5 SITE ENVIRONMENTAL AUDIT

### 5.1 Site Inspections

Site inspections provide a direct means to trigger and enforce specified environmental protection and pollution control measures. The Engineer, ET and Contractor shall cooperate by following a site inspection procedure. The deployment of a routine set inspection procedure will assist in checking the, implementation of the appropriate environmental protection and pollution control mitigation measures, and the existence of deficiencies that will trigger the action and limit requirements.

The ET Leader is responsible for the formulation of the environmental site inspection, establishment of the deficiency and action reporting system, and for carrying out the site inspection works. The proposal for site inspection shall be submitted to the to the Engineer for approval within 21 days of the construction contract commencement and will include details of the site inspection logistics, and the deficiency and action reporting procedures.

Site inspections shall be carried out at least once per week and the areas of inspection shall not be limited to the environmental situations, pollution control and mitigation measures within the site. The inspection shall also review the environmental situations outside the site area, which are 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:

- EIA recommendations on environmental protection and pollution control mitigation measures;
- works progress and programme;
- individual works methodology proposals (which shall include proposals of associated pollution control measures);
- the contract specifications on environmental protection;
- the legal framework regarding relevant environmental protection and pollution control requirements; and
- previous site inspection information.

The ET shall request from the Contractor all relevant information relating to the construction contract in order for him to carry out the site inspections effectively. The inspection results and associated recommendations on improvements to the environmental protection and pollution control works shall be submitted to the Engineer and Contractor within 24 hours. Thus ensuring that all parties are informed of any deteriorating environmental condition so that immediate action can be taken.

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

## 5.2 Compliance with Legal and Contractual Requirements

In addition to the environmental protection and pollution control laws in Hong Kong there are contractual environmental protection and pollution control requirements 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 Engineer for approval shall be sent to the ET Leader for vetting to check 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 ensure that relevant environmental laws have not been violated, and any foreseeable potential for violating the laws can be prevented.

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

After reviewing the document, the ET Leader shall advise the Engineer 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 advise the Contractor and the Engineer accordingly.

Upon receipt of the advice, the ET shall advise the Contractor (with the agreement of the Engineer) to undertake immediate action to remedy the situation. The Engineer 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.

## 5.3 Environmental Complaints

Complaints shall be referred to the ET Leader who shall initiate the complaint investigation procedure. The Complaints Procedure, actioned by the ET Leader shall include the following:

- log complaint and date of receipt onto a complaint database;
- investigate the complaint to determine its validity, and to assess whether the source of the problem is due to works activities;
- if a complaint is valid and due to site activities, identify the source of the problem;
- identify mitigation measures if required and advise the Contractor accordingly;
- review and check the Contractor's response to the recommended mitigation measure;

- investigate all stages of remedial work and update relevant parties on the resultant situation;
- if the complaint was referred by EPD, inform EPD on the status of the complaint investigation and the follow-up action within the time frame assigned by EPD;
- undertake additional monitoring and audit to verify the situation if necessary, and continue with mitigation and monitoring until the ET Leader is satisfied that the complaint will not recur;
- report the investigation results and the subsequent actions to the source of complaint or report to the complainant directly, whichever is the most appropriate. (If the source of the complaint is EPD, the results should be presented within the time frame assigned by EPD); and
- record the complaint, investigation details, the subsequent actions and the outcome in the monthly EM&A reports.

During the complaint investigation procedure, it is recommended that the Contractor and Engineer should 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 ET shall promptly advise the Contractor to carry out the mitigation. The Engineer shall enforce all remedial requirements to ensure that the measures have been carried out by the Contractor.

## 6 REPORTING

### 6.1 General

Report presentation methods shall be agreed with the Engineer, which may be in the format of an electronic medium.

### 6.2 Baseline Monitoring Report

A Baseline Environmental Monitoring Report shall be prepared and submitted by the ET Leader within 10 working days of completion of the baseline monitoring. Copies of the Baseline Environmental Monitoring Report shall be submitted to each of the two parties: the Contractor, and the Client Department. The ET Leader shall liaise with the relevant parties on the exact number of copies required.

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); and
  - 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; and
  - 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.

### 6.3 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 the Client Department and the Contractor. 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.

The ET leader shall review, every 6 months or on an as needed basis, the number and location of monitoring stations and the parameters monitored. This is to ensure incorporation of any changes in the surrounding environment and nature of works in progress.

### 6.3.1 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;
- (l) a summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);

- (j) a review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures;
- (k) a description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance;
- (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.

### 6.3.2 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 action and limit levels
  - Complaint Log
  - Reporting Changes
  - Future potential 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 key 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) Anticipated Future Key Issues

## (g) Appendix

- Action and Limit levels
- Graphical plots of trends of monitored parameters at key stations over the past four reporting periods for representative monitoring stations annotated against the following:
  - 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

## 6.4 Quarterly EM&amp;A Summary Reports

The quarterly EM&A summary report which should generally be around 5 pages in total 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 non-compliance (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.

#### 6.5 Data Keeping

Site documents 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 documents 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 documents. The monitoring data shall also be recorded in magnetic media form, and the software copy available upon request. All the documents and data shall be kept for at least one year after completion of the construction contract.

#### 6.6 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 Engineer. The notification shall be followed up with information regarding the outcome of the investigation; proposed action; and the success of the action taken, with any necessary follow-up proposals. A sample template for the interim notifications is shown in Table 6.1.

**Table 6.1 Sample Template for Interim Notifications of Environmental Quality Limits Exceedances**

Interim Notifications of Environmental Quality Limits Exceedances	
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	

Prepared by : \_\_\_\_\_

Designation : \_\_\_\_\_

Signature : \_\_\_\_\_

Date : \_\_\_\_\_

## ANNEX A

### BASELINE MONITORING FOR NOISE AND DUST

#### 1 BASELINE NOISE MONITORING

##### 1.1 Noise Monitoring Locations

The locations of the monitoring stations were selected such that they would give a good representation of the noise levels of Noise Sensitive Receivers in the vicinity by interpolation. The locations of these stations are marked N1, N2, N3 and N4 and are presented in Figure A1. The sampling locations were exposed to ambient traffic noise and general activities.

##### 1.2 Instrumentation and Calibration

Baseline measurements were conducted using a Brüel & Kjær (B&K) 2236 integrating sound level meter. The sound level meters were calibrated with a B&K Type 4231 sound level calibrator with a sound pressure level 93.8 dB at 1 kHz before and after each measurement, ensuring that the noise measurements agreed within 1 dB. Noise measurements were taken in terms of the A-weighted equivalent continuous sound pressure level ( $L_{eq}$ ) over a period of 30 minutes for the day time and evening readings. The sound level meters were supported at a position of 1.2m above ground by a tripod.

##### 1.3 Monitoring Schedule

Baseline noise monitoring was conducted as part of the EIA study and were conducted from the 3 December 1996 to 15 December 1996. In each sampling day four  $L_{eq}$  (30 minute) readings were taken in the day time period (0700-1900) and two 30 minute readings were taken in the evening period (1900-2300).

##### 1.4 Results

Baseline noise measurements were mainly influenced by road traffic noise from Fo Tan Road and village activities. The monitoring results are presented in Table A1, A2, A3 and A4.

Table A1 Baseline Noise Monitoring Results for Station N1 (Fo Tan Village)

Date	Time Period	Noise Level (Leq (30 minutes), dB(A))
3 Dec 1996	Day	77.4
	Day	77.1
	Day	76.8
	Day	77.1
	Evening	72.7
	Evening	72.6
4 Dec 1996	Day	80.2
	Day	76.6
	Day	75.3
	Day	76.8
	Evening	68.5
	Evening	71.9
5 Dec 1997	Day	76.3
	Day	76.3
	Day	76.4
	Day	76.4
	Evening	70.8
	Evening	70.5
6 Dec 1997	Day	76.7
	Day	76.4
	Day	76.8
	Day	76.5
	Evening	72.8
	Evening	72.8

Table A2 Baseline Noise Monitoring Results for Station N2

Date	Time Period	Noise Level (Leq (30 minutes), dB(A))
11 Dec 1996	Day	76.9
	Day	77.0
	Day	77.2
	Day	77.1
	Evening	77.6
	Evening	77.8
12 Dec 1996	Day	76.8
	Day	77.3
	Day	76.9
	Day	77.4
	Evening	73.4
	Evening	74.0
13 Dec 1997	Day	77.3
	Day	77.0
	Day	77.1
	Day	77.2
	Evening	78.0
	Evening	77.9

Table A3 Baseline Noise Monitoring Results for Station N3 (Shatin Technical Institute)

Date	Time Period	Noise Level (Leq (30 minutes), dB(A))
7 Dec 1996	Day	74.4
	Day	75.1
	Day	74.9
	Day	74.7
	Evening	72.7
	Evening	72.6
8 Dec 1996	Day	70.5
	Day	72.6
	Day	72.9
	Day	73.1
	Evening	69.3
	Evening	70.0
9 Dec 1997	Day	78.0
	Day	77.9
	Day	78.3
	Day	77.7
	Evening	73.4
	Evening	73.6
10 Dec 1997	Day	76.5
	Day	77.3
	Day	77.4
	Day	75.8
	Evening	69.6
	Evening	69.3

Table A4 Baseline Noise Monitoring Results for Station N4 (Building Adjacent to the Wo Che Estate School)

Date	Time Period	Noise Level (Leq (30 minutes), dB(A))
14 Dec 1996	Day	76.8
	Day	77.0
	Day	76.9
	Day	76.7
	Evening	73.4
	Evening	73.6
15 Dec 1996	Day	77.3
	Day	77.4
	Day	77.2
	Day	77.3
	Evening	75.8
	Evening	76.0

## 2 BASELINE DUST MONITORING

### 2.1 Instrumentation and Calibration

One GMWS-2310 ACCU-VOL high volume sampler with associated equipment, calibration kit and shelter in accordance with *Part 50 of Chapter 1 appendix B of Title 40 of the Code of Federal Regulations of the USA* was used for dust (Total Suspended Particulates (TSP)) levels determination.

### 2.2 Methodology

One monitoring location at Fo Tan Village was chosen. The major potential air quality impact during the construction phase will be dust arising from haul road emissions, open site erosion, excavation and filling operations. Baseline air quality monitoring was carried out as part of the EIA study, well before any construction activities were started. The TSP levels were measured by "High Volume Method for Total Suspended Particulates" as described by the United States Environmental Protection Agency in *10 CFR Part 50*.

The sampling filters were weighed on an analytical balance (after moisture calibration in the desiccator) both before and after sampling to determine the net dust weight. The total air volume sampled, corrected to standard conditions, were determined from the measured flow rates and duration of the sampling period. Ambient air TSP concentrations were then calculated from the mass

of the collected particles divided by the volume of air sampled, corrected to standard conditions. Totals were expressed in micrograms per cubic metre.

### 2.3 Monitoring Schedule

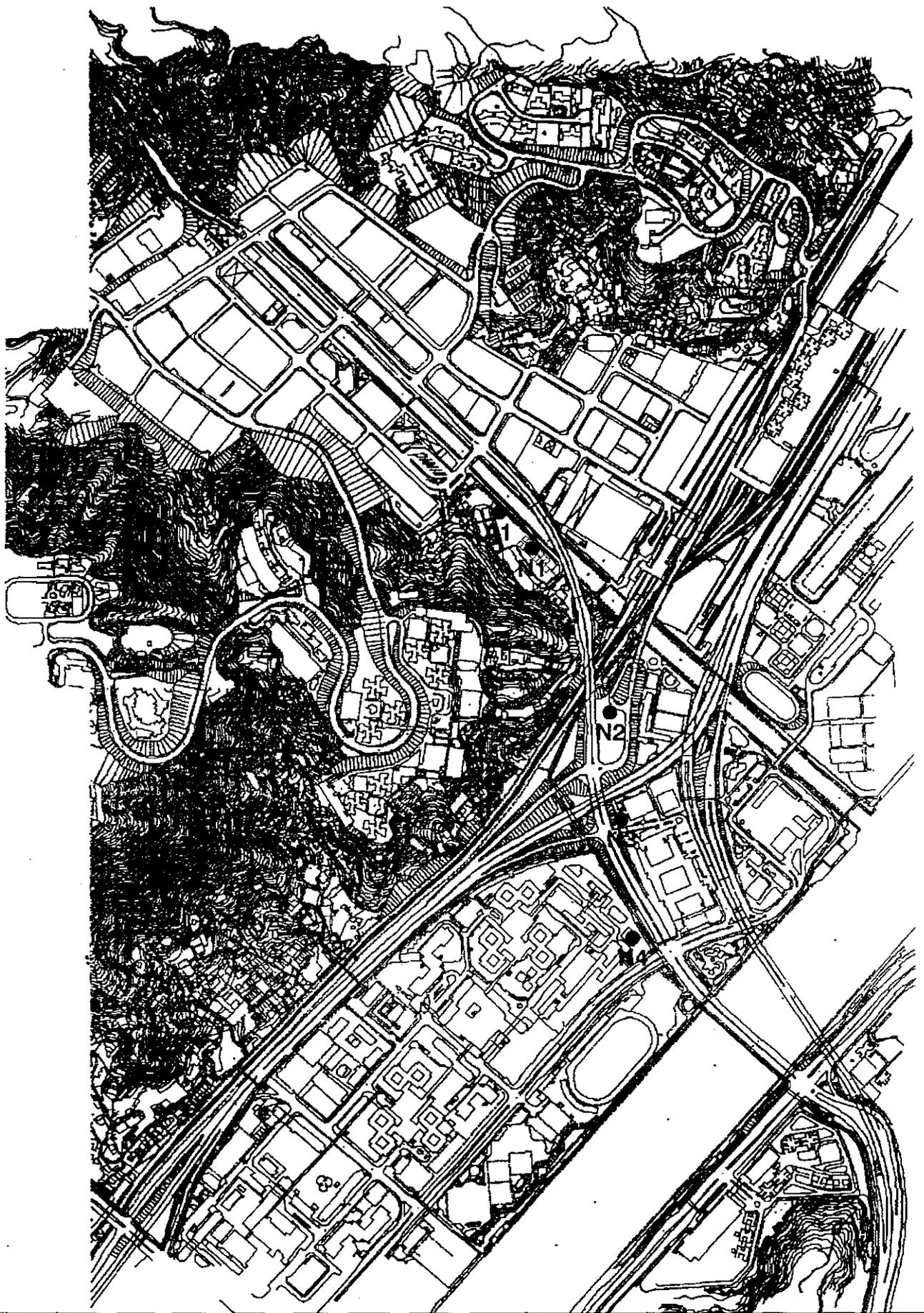
Monitoring was carried out over a 24-hour period from 4 December 1996 to 18 December 1996.

### 2.4 Results

TSP levels were measured at one location for 24-hour periods on 14 dates, the results are presented in Table A5.

Table A5 TSP ( $\mu\text{gm}^{-3}$ ) recorded during Baseline Monitoring

Date	TSP $\mu\text{gm}^{-3}$
4/4/97	156
5/4/97	158
6/4/97	133
7/4/97	159
8/4/97	113
9/4/97	107
10/4/97	91
11/4/97	168
12/4/97	152
13/4/97	131
14/4/97	121
15/4/97	123



環  
科

C  
E  
S

TITLE

Baseline Noise and Air Quality Monitoring Locations

CES (ASIA) LIMITED			
PROJECT NO	B160\final\EM&A.01	DATE	August 1997
DESIGNED	Suki Chung	DRAWING NO	Figure A.1

**ANNEX B**  
**BASELINE MONITORING LEGISLATIVE FRAMEWORK**

**1 Construction Noise**

The Noise Control Ordinance provides for the control of construction noise. Assessment procedures and standards are set out in two Technical Memoranda associated with the NCO: the *Technical Memorandum on Noise from Construction Work other than Percussive Piling* and the *Technical Memorandum on Noise from Percussive Piling*.

Under the existing provisions, there is no legal restriction on noise generated by construction activities (other than percussive piling) between the hours of 07.00 and 19.00 on normal weekdays. However, EPD's Practice Note for Professional Persons PN 2/93 sets a non-statutory daytime noise limit of 75 dB(A)  $L_{eq}$  (30 min) at the facades of dwellings, and 70 dB(A) at the facades of schools (65 dB(A) during examinations).

**2 Construction Dust**

The Air Pollution Control Ordinance (APCO) provides powers for controlling air pollutants from a variety of stationary and mobile sources, including fugitive dust emissions from construction sites. It encompasses a number of Air Quality Objectives (AQO) which stipulate concentrations for a range of pollutants. The AQO for total suspended particulates (TSP) which are relevant to this study are tabulate in Table B1.

Table B1 Hong Kong Air Quality Objectives

Air Pollutant	Maximum Average Concentration ( $\mu\text{gm}^{-3}$ ) <sup>1</sup>		
	1-Hour	24-Hour <sup>2</sup>	Annual <sup>3</sup>
TSP	500 <sup>4</sup>	260	80

<sup>1</sup> Measured at 298 K and 101.325 kPa.

<sup>2</sup> Not to be exceeded more than once per year.

<sup>3</sup> Arithmetic mean.

<sup>4</sup> Not AQO.

In addition to the above established legislative controls, it is generally accepted that an hourly average TSP concentration of 500  $\mu\text{gm}^{-3}$  should not be exceeded. Such a control limit is particularly relevant to construction work and has been imposed on a number of construction projects in Hong Kong in the form of contract clauses.

For construction dust, it is standard practice to use a TSP limit in air over a 1-hour period of 500  $\mu\text{gm}^{-3}$ . The maximum acceptable TSP concentration averaged over a 24-hour period is 260  $\mu\text{gm}^{-3}$ , as defined in the Air Quality Objectives (AQOs).