香港地下鐵路公司
Mass Transit Railway Corporation

Feasibility Study and Preliminary Design for

Tseung Kwan O Extension
Quarry Bay Congestion Relief Works

Tseung Kwan O Extension
Draft Detailed Environmental Impact Assessment Report R9T
Volume III: EM&A Manual

July 1997

Maunsell

in association with

MVA
Parsons Brinckerhoff
Urbis
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Design Research Unit
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Prepared by: ERM

Reviewed by: S Laister (Discipline Manager)

signed:

date: 4 August 1997

Reviewed by: S A Robinson (Team Leader)

signed:

date: 4 August 1997

FINAL REPORT

Mass Transit Railway Corporation

Tseung Kwan O Extension DEIA : *Environmental Monitoring and Audit Manual*

31 July 1997

Reference C1365/45474

For and on behalf of ERM-Hong Kong, Ltd

Approved by: _____

Position: Deputy Managing Director

Date: 31/7/97

CONTENTS:

1 INTRODUCTION

1.1 Purpose of the Manual

1.1.1 The preparation of this Environmental Monitoring and Audit (EM&A) Manual has been undertaken as part of the Preliminary Design Stage of the Tseung Kwan O Extension (TKE) works and is based on the findings of the *Tseung Kwan O Extension Detailed Environmental Impact Assessment, Maunsell et al, July 1997* (DEIA). The Manual provides details of dust and noise monitoring requirements, audit recommendations for air quality, noise, water quality, ecology and waste management, and the mitigation measures set out in the DEIA. Hong Kong environmental regulations, planning and standards guidelines as well as recommendations from the DEIA have been used as environmental standards for the preparation of the Manual.

1.1.2 The purpose of the EM&A Manual is to provide information, guidance and instruction to personnel charged with environmental responsibilities and undertaking environmental monitoring works. It aims to provide systematic procedures for monitoring, auditing and minimising the environmental impacts arising from the construction works associated with the TKE.

1.1.3 Information concerning the range of construction activities to be undertaken for the TKE will increase as the construction programme advances and the EM&A requirements will need to be reviewed and revised as appropriate. The EM&A Manual shall serve to document the progress of the EM&A requirements and shall be updated and reissued as necessary.

1.2 Background

The MTRC Tseung Kwan O Extension

1.2.1 MTRC are proposing to build a new railway line, principally to serve the new town of Tseung Kwan O to the east of Kowloon and to provide improved public transport in the area. The TKE will provide links from the existing Kwun Tong Line at Lam Tin Station and the Hong Kong Island Line at Quarry Bay and North Point. The new line will run eastward via Yau Tong, Tiu Keng Leng, Tseung Kwan O and Hang Hau to Po Lam (see *Figure 1.2a*). The Government's *Railway Development Strategy Report* of December 1994, identified the need for the line to serve the Tseung Kwan O Development Area which is expected to develop a population of 250,000 by 2001 and 450,000 by 2011.

1.2.2 The proposed railway will run south-east from Lam Tin to Yau Tong and north-east from the Eastern Harbour Crossing to Yau Tong, before entering a tunnel section running north-east through Ng Kwai Shan (Black Hill), to Tiu Keng Leng. The line will continue in the same general direction through Tseung Kwan O to Hang Hau in a cut-and-cover tunnel before turning north-west for the final section to Po Lam running at ground level.

1.2.3 The construction programme for TKE is planned to commence in March 1998 with a completion date of December 2001. The construction sites will follow the alignment with the main works areas at the station sites and the tunnel vent building. The Ng Kwai Shan (Black Hill) tunnel will be the only works area without continuous surface works.

The TKE EFS and DEIA

1.2.4 Maunsell Consultants in association with ERM Hong Kong and others, were commissioned by the Mass Transit Railway Corporation (MTRC) to undertake the Feasibility Study and Preliminary Design for the TKE. During the initial stages of the Study, ERM Hong Kong produced the *Tseung Kwan O Extension Environmental Feasibility Study Report (R8T), Maunsell Consultants (Asia) Ltd, February 1996* (EFS) to determine the environmental constraints which could affect the feasibility of the railway.

1.2.5 The EFS showed that, with appropriate mitigation, all identified potentially adverse impacts could be controlled to within the established standards and guidelines. The findings of the EFS were used by the Study Team during the preliminary design stage of the TKE to develop effective construction and operational measures to limit the effects of those potential adverse environmental impacts identified in the EFS.

1.2.6 Subsequently, ERM has taken the findings of the EFS, using the more developed output of the *MTRC Tseung Kwan O Extension Final Preliminary Design, Maunsell et al, May 1996* (MN9T) to produce a Detailed Environmental Impact Assessment (DEIA). The DEIA will be used to establish the environmental performance criteria to be applied during the construction and operation of the TKE, which will be included in the tender requirements for the Detailed Design Consultancy (DDC). The Ng Kwai Shan (Black Hill) tunnel contract will not be let as a DDC but as a Design and Construct agreement.

1.2.7 The DEIA comprises three volumes:

- *Volume I*, the Executive Summary, briefly explains how the DEIA was carried out and describes the findings of the Main Report, concentrating on the potential adverse impacts and proposed mitigation measures;
- *Volume II*, the Main Report, provides the findings of the DEIA: defining the environmental performance criteria applicable to the TKE; identifying and quantifying the likely impacts of the construction and operation of TKE and developing appropriate mitigation measures to control any adverse impacts; and
- *Volume III*, this document, the initial version of the EM&A Manual.

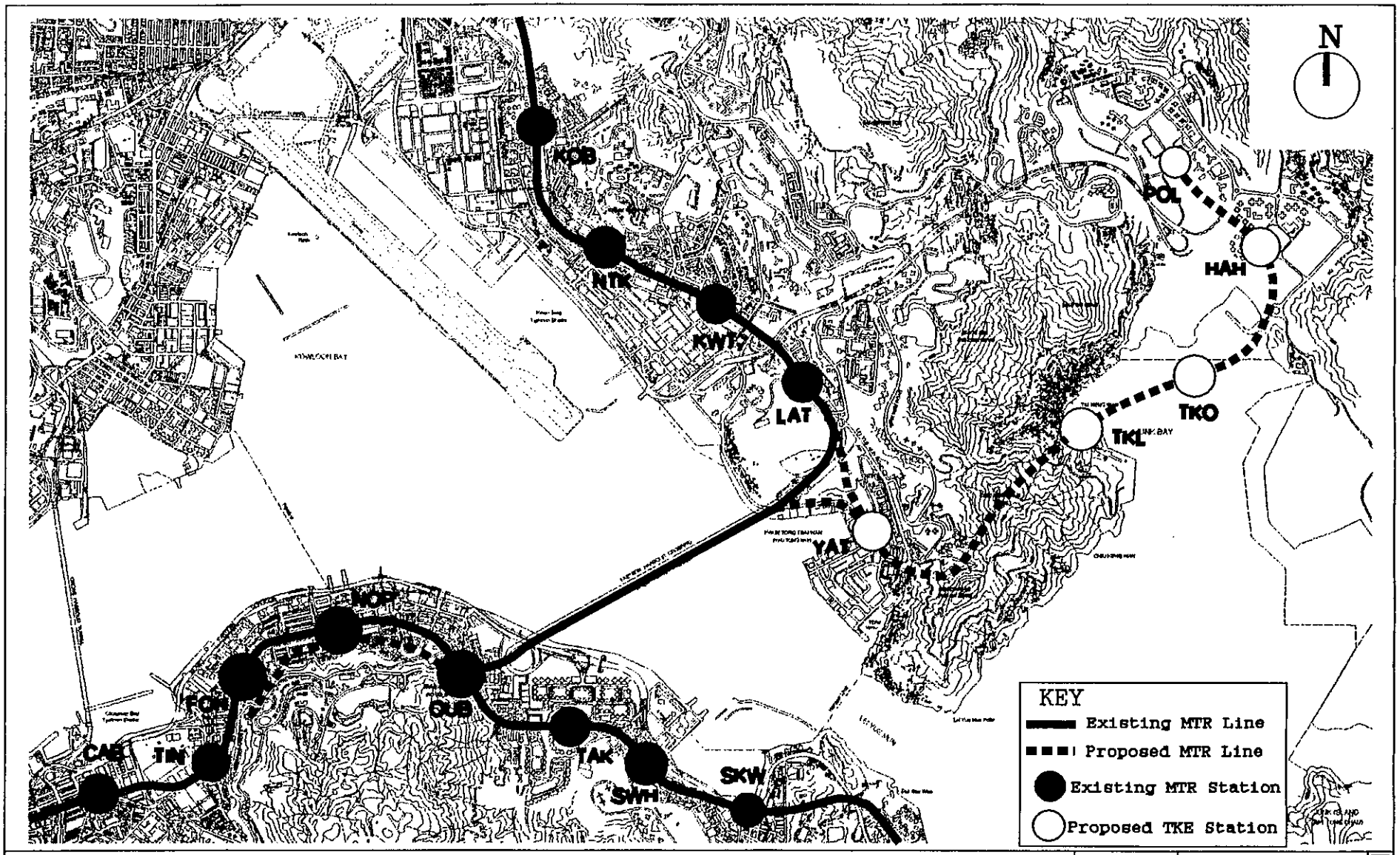
1.2.8 The DEIA was used to establish the environmental performance criteria to be included in the tender requirements for the Design and Construct Consultancies for the TKE and applied during the EM&A programme.

1.3 Environmental Monitoring and Audit

General

1.3.1 The overall objectives of the TKE EM&A programme are as follows:

- to monitor the performance of the project and to provide an early indication if any of the environmental mitigation measures, identified in this report and/or implemented by the contractors, fail to meet the established standards and guidelines, particularly the environmental protection criteria identified in the DEIA;
- to take remedial action if unexpected problems or unacceptable impacts arise;
- to provide a data base against which the short or long term environmental effects associated with the TKE may be determined;



TSEUNG KWAN O EXTENSION PROPOSED ALIGNMENT

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- to provide data to enable environmental audits to be undertaken; and
- to verify the environmental impacts predicted in the TKE DEIA.

1.3.2 The TKE DEIA identified that monitoring would only be necessary for dust and noise impacts during the construction of the TKE. No water sensitive receivers were predicted to be affected during either the construction or operation of the TKE as any potential impacts on the local drainage system will be controlled by the requirements of wastewater discharge licences. Ecological and waste management issues are not considered likely to give rise to adverse impacts during the TKE construction works. The DEIA recommendations for water quality, ecology and waste management mitigation shall be audited through inspections carried out by the environmental team. Dust and noise impacts during the operation of the TKE will be audited against the appropriate pollution control legislation and licence requirements.

1.3.3 The MTRC is undertaking a Qualitative Risk Assessment (QRA) prior to the construction of the new tunnels near Lam Tin Station. Should the QRA identify the need for further landfill gas or leachate monitoring during the tunnel construction, the programme and methodology will be incorporated in subsequent versions of the EM&A Manual.

1.3.4 Selected TKE project staff will be charged with environmental responsibilities and will form the Environmental Team (ET) for the TKE construction phase; the ET will be responsible for the monitoring and audit functions of the EM&A. The Engineers Representative (ER) shall be the MTRC Construction Manager who shall ensure that the ET is provided with sufficient resources and support to carry out the full scope of services described in this Manual. In respect of the TKE EM&A requirements, both the ET and ER shall operate under the guidance of the MTRC Corporate Environmental Manager (ENM).

1.3.5 The monitoring of impacts will be undertaken by the ET at identified sensitive receivers near the TKE worksites where the highest noise and dust levels have been predicted in the DEIA.

1.3.6 The remainder of *Section 1* details the core elements of the EM&A procedure and provides project specific information and guidelines for setting up the EM&A. *Sections 2 and 3* provide details of the dust and noise monitoring requirements, compliance assessment and recommended mitigation measures while *Section 4* describes the role of auditing of the TKE Project. *Annex A* provides the preliminary schedule for the implementation of mitigation measures and *Annex B* provides a preliminary list of the necessary monitoring equipment.

Action and Limit Levels

1.3.7 Action and Limit levels (A/L) are defined levels of impact derived from baseline monitoring activities. The A/L Levels are quantitatively defined in later sections of the manual, however are broadly described below:

- *Action Level:* The level of environmental conditions beyond which there is a clear deterioration of the ambient environment which may require remedial actions to prevent environmental quality from exceeding the *Limit Level.*

- *Limit Level:* Statutory and/or agreed contract limits as stipulated in relevant pollution control ordinances established by EPD and others. If these levels are exceeded, works should not continue without appropriate remedial actions being implemented.

Event Contingency Plans

1.3.8 The purpose of the Event Contingency Plans (ECPs) is to provide, in association with the monitoring and audit activities, procedures for ensuring that if any significant environmental incident occurs, the cause is quickly identified and remedied and that the risk of a similar event recurring is reduced. This also applies to the exceedance of agreed A/L criteria measured on a day to day basis by environmental monitoring activities. Specific ECPs for dust and noise impact are contained in *Sections* 2 and 3 respectively.

Reporting

1.3.9 Monthly, Bi-annual and Annual EM&A Reports will be produced as part of the EM&A programme, exact details of the frequency, distribution and deadlines shall be finalised with EPD prior to the commencement of the works.

Enquiries, Complaints and Requests for Information

1.3.10 Enquiries, complaints and requests for information can be expected from a wide range of individuals including members of the public, government departments, the media and community groups. The majority of correspondence is likely to be received directly by the site offices and shall be directed to the ER.

1.3.11 All complaints shall be reported to the ENM who shall follow MTRC procedures for handling, investigating, and storing such information. A summary of the procedures is as follows:

- registering of the received complaint into the complaint database (or similar paper-based system);
- investigate the complaint to determine its validity and assess whether the source of the problem is associated with TKE construction activities;
- if the complaint is valid and due to the TKE works, agree the contractor's mitigation measures with the ER and advise the Contractor;
- review the Contractor's response on the agreed mitigation measures and the updated situation; and
- undertake additional monitoring and audit to verify the situation, if necessary, and ensure that events that generated the complaint do not recur.

1.3.12 In the case of complaints received from the EPD, MTRC will provide an interim report within 72 hours of the receipt of the complaint by the ENM. The interim report will include the status of the complaint investigation and follow-up action. In all cases, regardless of the source, full details of the complaint, investigation and subsequent actions will be included in the Monthly Report.

1.4 Project Organisation

General

1.4.1 The three main parties in the TKE EM&A process will be the Contractor, the ER and the ET. It is anticipated that the ER for the works will be the relevant MTRC Construction Manager supervising the site. Appropriate staff shall be included in the ET to fulfill the EM&A duties outlined in this Manual.

Roles and Responsibilities of Key Staff

Environmental Manager

1.4.2 Dr Glenn Frommer is the MTRC Corporate Environmental Manager (ENM). Included in the corporate role is responsibility for all environmental aspects of the Corporation's construction and operational works, including the TKE EM&A.

Engineers Representative

1.4.3 The ER shall be MTRC Construction Manager of the TKE Project. Reporting directly to the MTRC Project Manager, the ER shall:

- monitor the Contractor's compliance with contract specifications, including aiding and enforcing the effective and timely implementation of mitigation measures and general EM&A procedures on site and within the Contractor's organisation;
- instruct the contractor to follow the agreed EM&A protocols or those in the contract specifications in the event of exceedances, complaints or requests for action from the ET;
- ensure the allocation of adequate resources to the ET in order to carry out the agreed scope of EM&A works.

The relationship between the various parties is shown in *Figure 1.4a.*

Environmental Team Leader and Team Members

1.4.4 The ET Leader shall be responsible for the implementation and management of the TKE EM&A programme and the timely production and quality of the EM&A outputs. The ET Leader will report directly to the ENM on project environmental matters. The ET shall be responsible for:

- the development of systematic and efficient procedures and records to undertake the EM&A scope of works as set out in the EM&A Manual or as may be required and agreed with other parties;
- the registration and storage of all data relating to the EM&A;
- the review and verification of information developed through the EM&A with the TKE DEIA and other relevant standards or references;
- the determination and prescription of the required protocols for air and noise monitoring and auditing activities;

- the undertaking of site inspections and environmental monitoring at the agreed locations;
- compliance with the agreed ECPs in the case of exceedances; and
- identification of specific issues of non-compliance within the guidelines of the EM&A study and recommendations and follow up to ensure that these are met.

1.4.5 A list of key project staff and their contact numbers are shown below.

Contact Persons

1.4.6 *Tables 1.4a-c* below, list the contact persons for the MTRC Corporate Environmental Team, the MTRC Project ET and the EPD staff with responsibility for the TKE Project.

Table 1.4a Corporate Environmental Team

Name	Title	Telephone	Fax
Dr Glenn Frommer	Environmental Manager	2993 3543	2993 2225
Kam Chan	Environmental Engineer	2993 3745	2993 2225
Project Environmental Hotline	xxxxxxxx	xxxx xxxx	xxxx xxxx

Table 1.4b Project Environmental Team

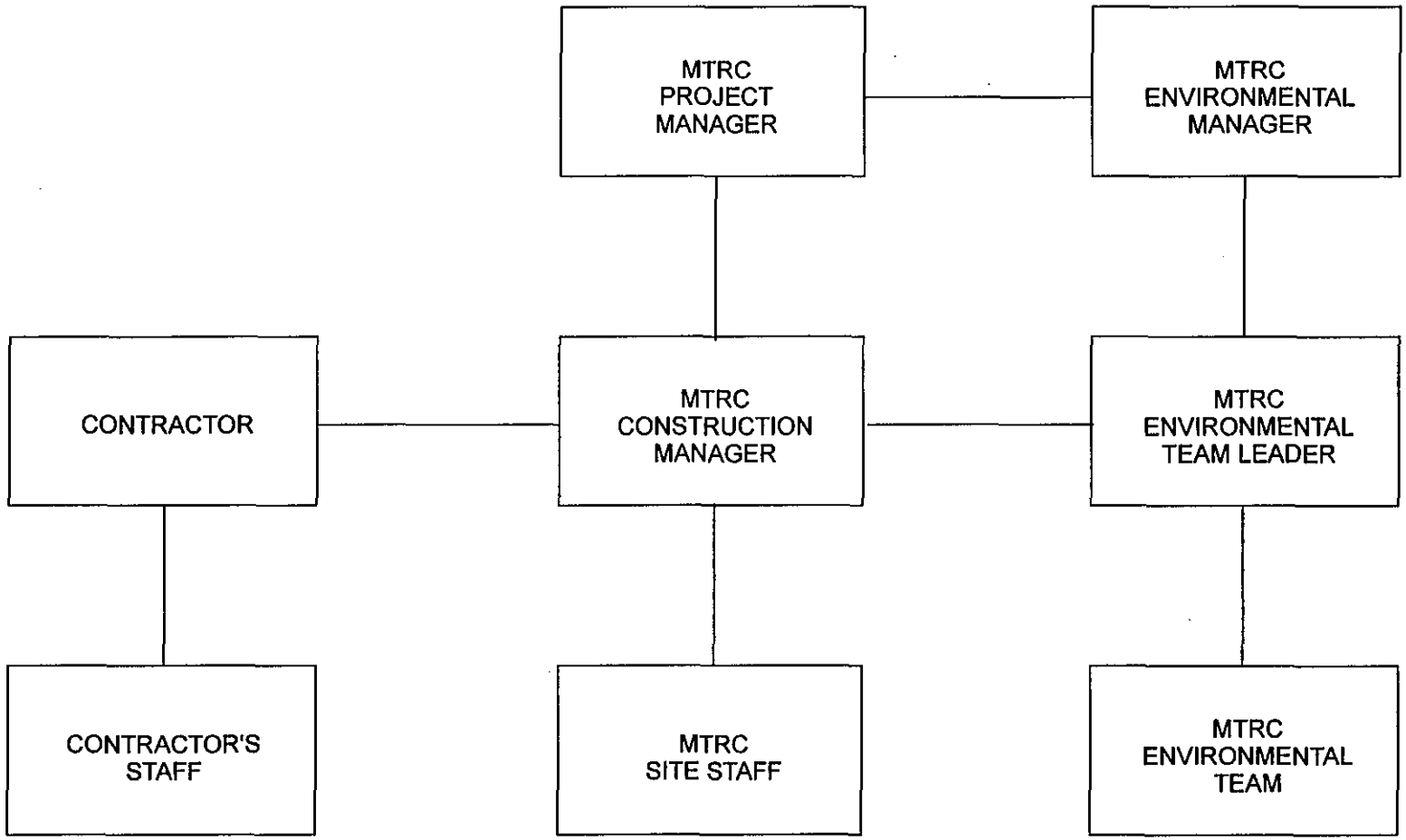
Name	Title	Telephone	Fax
xxxxxxxx	ET Leader	xxxx xxxx	xxxx xxxx
xxxxxxxx	ET Member	xxxx xxxx	xxxx xxxx
xxxxxxxx	ET Member	xxxx xxxx	xxxx xxxx

Table 1.4c Environmental Protection Department

Name	Group	Telephone	Fax
xxxxxxxx	Monitoring and Audit	xxxx xxxx	xxxx xxxx
xxxxxxxx	Air Quality	xxxx xxxx	xxxx xxxx
xxxxxxxx	Noise	xxxx xxxx	xxxx xxxx

1.5 Construction Programme

1.5.1 The scheduling of the DEIA recommended mitigation measures in relation to the construction programme will be established once the Contractor's work programme and methodology are established. The outline for a preliminary mitigation implementation checklist, which will be incorporated in the audit protocols, is included in *Annex A*.



EM & A COMMUNICATIONS NETWORK

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FIGURE No. 1.4a

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1.6 General Guidelines For The Selection of Monitoring Stations

1.6.1 During the DEIA, air and noise sensitive receivers were identified using plans of the area and building usage information. For the purposes of the EM&A, this general identification will be followed up with a detailed examination of the sensitive receivers, surrounding buildings and landscape to enable the selection of monitoring stations which will be representative of the DEIA identified receivers.

1.6.2 The primary objective in the identification of a suitable monitoring station for dust or noise is that the selected location accurately reflects likely levels of impact at the most affected sensitive receivers. Usually, this amounts to selecting an appropriate site on the premises of the identified sensitive receiver (ie roof, parapet, flagpole, etc) or, if this is impractical, at an appropriate alternation location such as a nearby building which will accurately reflect the impacts at the identified sensitive receiver. Apart from the geographic location, selection of suitable monitoring locations requires several other factors to be satisfied including easy or unrestricted access 24 hours a day, a reliable power supply, security and safety. Permission from the building owner or management company must also be sought in order to install a monitor and undertake monitoring which may involve compensation for power consumption.

1.6.3 Where it is not possible or practical to monitor at the identified sensitive receiver and alternate monitoring locations are proposed, the following options should first be considered:

- for dust; at the site boundary, on top of the perimeter hoarding or locations close to the site; and,
- for noise; as close as possible to the identified sensitive receivers; street level monitoring should be a last resort near busy roads.

2 AIR QUALITY MONITORING

2.1 Introduction

2.1.1 In this section, the requirements, methodology, equipment, monitoring locations and mitigation measures for the monitoring and audit of dust impacts from the construction of the TKE are presented.

2.2 Air Quality Parameters

2.2.1 Monitoring and audit of dust in the form of Total Suspended Particulates (TSP) shall be undertaken by the ET to ensure that deteriorating air quality can be readily detected and timely action taken to remedy its cause. 24-hour TSP levels shall be measured to indicate the extent of construction dust impacts on sensitive receivers. 1-hour TSP levels shall be monitored in response to complaints, exceedances or under other circumstances as directed by the ET Leader.

2.2.2 Concurrent with the undertaking of 24-hour and 1-hour TSP monitoring, the recording of wind conditions in the vicinity of the construction sites shall also be undertaken. The measurement of wind speed and direction may enable the environmental team to distinguish between site and external sources of dust during the evaluation of TSP monitoring results.

2.3 Methodology and Criteria

2.3.1 The impact of fugitive dust on ambient air pollution depends on the quantity, as well as the drift potential of the dust particles injected into the atmosphere. Large dust particles will settle out near the source and particles that are 30-100 μm in diameter are likely to undergo impeded settling. These particles, depending on the extent of atmospheric turbulence, would settle within a distance of 100 m from the source. The main dust impact will arise from fine particles of a diameter less than 30 μm, measured as Total Suspended Particulates (TSP), dispersed over greater distances from the sources. TSP levels will, therefore, be monitored to evaluate the dust impact during the construction phase of the TKE.

2.3.2 24-hour TSP concentrations shall be measured by the *High Volume Method for Total Suspended Particulates, Part 50 Chapter 1 Appendix B, Title 40 of the Code of Federal Regulations of the USEPA.*

2.3.3 TSP is sampled by drawing air through a conditioned, pre-weighed filter paper inside a High Volume Air Sampler (HVS) at a controlled rate. After sampling, the filter paper with retained particles is collected and returned to the laboratory for drying in a desiccator followed by accurate weighing. TSP levels are calculated from the ratio of the mass of particulates retained on the filter paper to the total volume of air sampled over the time period. The drying and analysis of HVS samples normally takes about two days to complete.

2.3.4 Due to the lengthy delay between sampling time and result availability for 24-hour sampling, 1-hour TSP sampling may also be conducted. 1-hour TSP levels, while assessed under different criteria, are considered to be indicative of forthcoming 24-hour

results conducted on the same day. In this way expedient remedial actions, should they be required, may be undertaken based on the 1-hour data, before the 24-hour results become available.

2.3.5 1-hour sampling, providing real time airborne particulate measurement, can be undertaken using a direct reading dust meter such as the MIE Data-Ram Portable Real Time Aerosol Monitor (MIE). The MIE uses optical sensors to analyse the incoming airstream providing real time readout of particulate concentrations. Despite the advantages of using a real time monitor to measure particulate concentrations such as in response to dust complaints, results are not comparable with 24-hour HVS data. Therefore, if the use of a direct reading monitor is agreed for 1-hour TSP sampling both baseline and impact monitoring must be carried out by the direct reading method.

2.3.6 No comparisons between direct reading and physically measured (HVS) data shall be attempted except that, where the direct reading method for 1-hour TSP sampling is used, the measured TSP concentrations shall be regarded as indicative of the 24-hour TSP results and the actions specified in this Manual shall be implemented.

2.3.7 The criteria against which air quality shall be assessed are the statutory Hong Kong Air Quality Objective (AQO) for daily TSP of 260 $\mu g\ m^{-3}$ and the non-statutory EPD recommended 1-hour TSP limit of 500 $\mu g\ m^{-3}$.

2.4 Monitoring Equipment

Air Quality

2.4.1 The flow rate of each HVS will be calibrated using an orifice calibrator. Initial calibration will be conducted upon installation and prior to commissioning. Thereafter, calibration shall be conducted bi-monthly using one point flow rate calibration. Five point calibration will be carried out every six months. The transfer standard shall be traceable to the internationally recognised primary standard and be calibrated annually.

2.4.2 Equipment shall be maintained in calibration at all times and recalibration will be carried out in accordance with the requirements stated in the manufacturers operating manual or as described above whichever is the more stringent.

2.4.3 Prior to the commencement of dust monitoring, appropriate checks shall be made to ensure that all equipment and necessary power supply are in good working order. The samplers, equipment and shelters shall be installed and maintained so as to be transferable between monitoring stations and to meet the agreed conditions of the building occupant or owner as appropriate.

Wind Conditions

2.4.4 Wind speed and direction shall be monitored with a wind speed and direction sensor (R M Young Model 05103 or similar) connected to a data logger (R M Young Model 26700 or similar). Wind speed and direction information recorded by the data logger shall be down loaded at the conclusion of the 24-hour monitoring session for analysis along with the TSP information.

2.4.5 Wind sensors shall be installed on masts at least 10 m above ground level or above the height of the dust monitor so that they are clear of obstructions or turbulence caused by buildings. The wind data monitoring equipment shall be kept in a good state of repair

in accordance with the manufacturers recommendations and maintained in proper working order with sufficient spare equipment available in the event of breakdown to maintain the planned monitoring programme.

Positioning

2.4.6 Guidelines for the positioning of the HVSs are contained in the *USEPA Title 40 of the Code of Federal Regulations Part 50*. When positioning HVSs, the following points should be noted:

- support must be provided to the HVS against overturning during gusty wind, particularly when sited close to the edge of a building;
- samplers should not be placed less than 2 m apart;
- the distance between the sampler and any obstacle (such as a building) must be at least twice the height that the obstacle protrudes above the sampler;
- a minimum of 2 m separation between walls, parapets and the like and the monitor should be observed for rooftop samplers;
- no furnace, incinerator flue or building vent should be nearby;
- airflow around the sampler should be unrestricted and any wire fence or gate installed to protect the sampler should not obstruct the monitoring; and,
- the sampler should be more than 20 m from the dropline.

2.4.7 In general, the higher the elevation at which a dust monitor is placed, the less likely the measured result will reflect actual levels of dust being generated. The positioning of the dust monitor should also take into account, as far as reasonably practical, the expected meteorological conditions (eg wind direction) likely to exist during the period of construction work.

2.4.8 To maximise the efficiency of the monitoring work, advantage may be gained by selecting air, noise and weather monitoring stations at a singular location where possible rather than at separate locations. This also provides for better utilization of human resources by minimising total travel time between monitoring stations.

2.5 Laboratory Measurement and Analysis

2.5.1 The preparation and analysis of HVS filter papers shall be undertaken by a HOKLAS accredited laboratory. The laboratory should have constant temperature and humidity control and be equipped with necessary measuring and conditioning instruments to handle the dust samples collected. The laboratory should be available for filter paper preparation and sample analysis, equipment calibration and maintenance.

2.5.2 Labelled filter papers shall be conditioned in a humidity controlled chamber for over 24 hours and be pre-weighed before use. After sampling, the filter paper loaded with dust shall be kept in a clean and tightly sealed plastic bag. The filter paper shall be returned to the laboratory for reconditioning in the humidity controlled chamber before accurate weighing by an electronic balance with a readout down to 0.1 mg. The balance shall be regularly calibrated against a traceable standard.

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

2.6 Monitoring Locations

2.6.1 Air Sensitive Receivers (ASRs) have been identified in the vicinity of the construction sites during the course of the TKE DEIA. The locations where it is recommended that air quality monitoring is undertaken during the construction works are listed below in *Table 2.6a* and shown in *Figures 2.6a-d.* Monitoring stations shall be set up in the vicinity of these locations using the guidelines presented in *Section 1.6;* the exact location and direction of monitoring equipment to be agreed with the ER and the EPD.

Table 2.6a Location of Air Sensitive Receivers

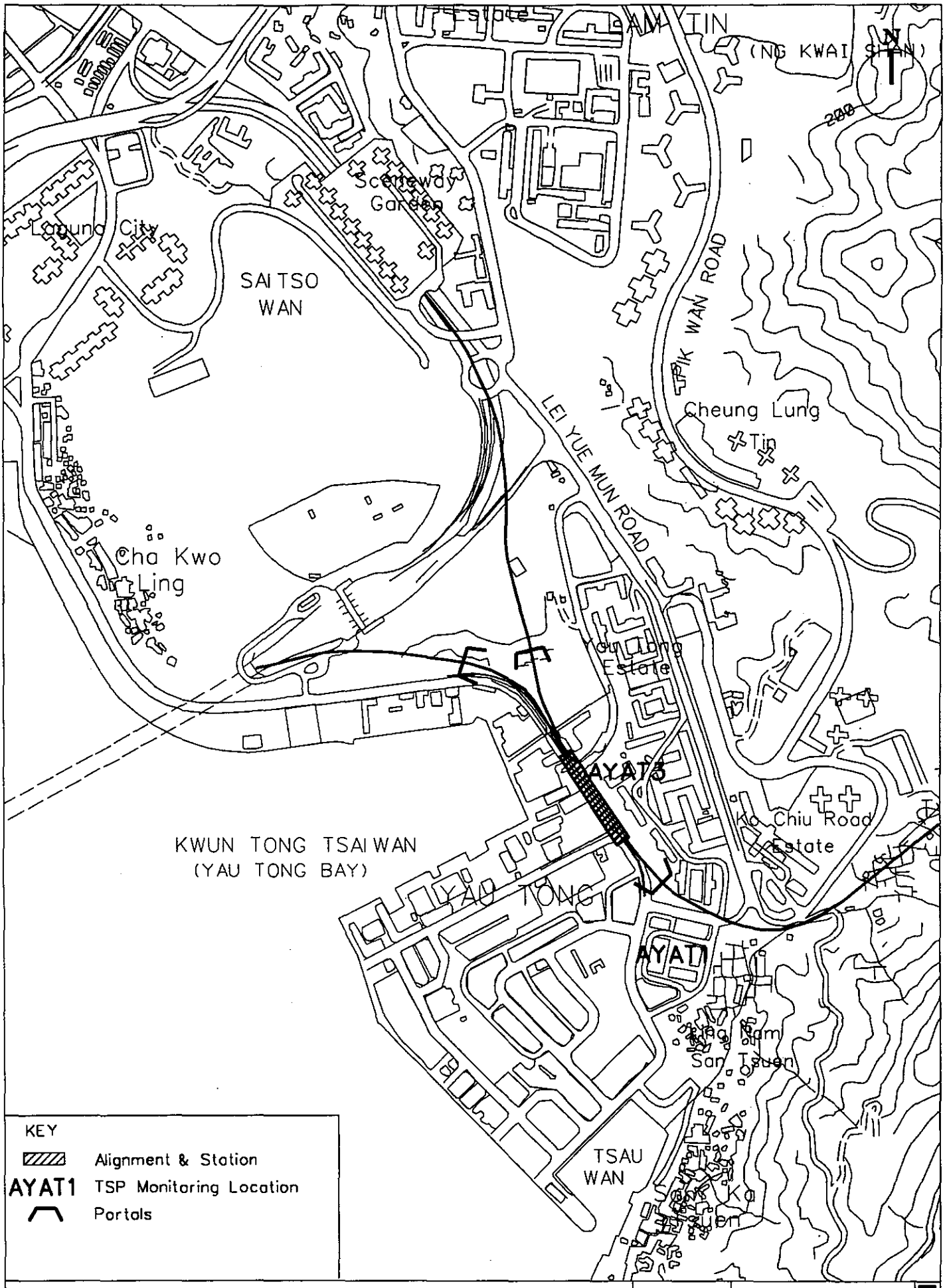
Site Name	ASR Location
Yau Tong (station and alignment)	AYAT1 - Yau Tong Centre AYAT3 - St Antonius Primary School
Tiu Keng Leng (station and Alignment)	None required
Tseung Kwan O Town Centre (station and alignment)	ATKO4 - School, Area 56 ATKO7 - PSPS/HOS, Area 65
Hang Hau (station and alignment)	AHAH1 - Block E, Chung Man Court AHAH3 - Residential development, Area 37c AHAH5 - School, Area 37d AHAH8 - On Ning Garden
Po Lam (station and alignment)	APOL4 - Small household block APOL10 - School, Area 24

2.7 Baseline Monitoring

2.7.1 MTRC shall provide and install sufficient numbers of HVSs and MIEs to complete the necessary 24-hour and 1-hour baseline sampling at the agreed monitoring locations before the commencement of any site works which may affect the monitoring results. A preliminary list of the necessary monitoring equipment is provided in *Annex B.*

2.7.2 In exceptional cases only or when insufficient baseline data or questionable results are obtained, the EPD's agreement on an appropriate set of data to be used as a baseline reference should be sought. It should be pointed out, however, that the exercising of this option may lead to some disadvantage to the Contractor given the limited coverage of the EPD air monitoring network which would form the basis for any agreement. Therefore, every effort shall be made to complete and ensure the quality of the baseline monitoring within the required period. Details of the baseline, Action and Limit TSP levels will be reported prior to the commencement of impact monitoring.

2.7.3 24-hour baseline monitoring shall be carried out for a continuous period of at least two weeks with daily measurements taken at all the agreed monitoring locations. General meteorological conditions (wind speed and direction, precipitation, air pollution index, etc) and notes regarding any significant adjacent dust producing sources shall also be recorded throughout the baseline monitoring period. 1-Hour TSP sampling using the agreed instrument shall also be undertaken at least three times per day during normal working hours (0700-1900) concurrently with the 24-hour TSP baseline sampling.



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YAU TONG – TSP MONITORING LOCATIONS

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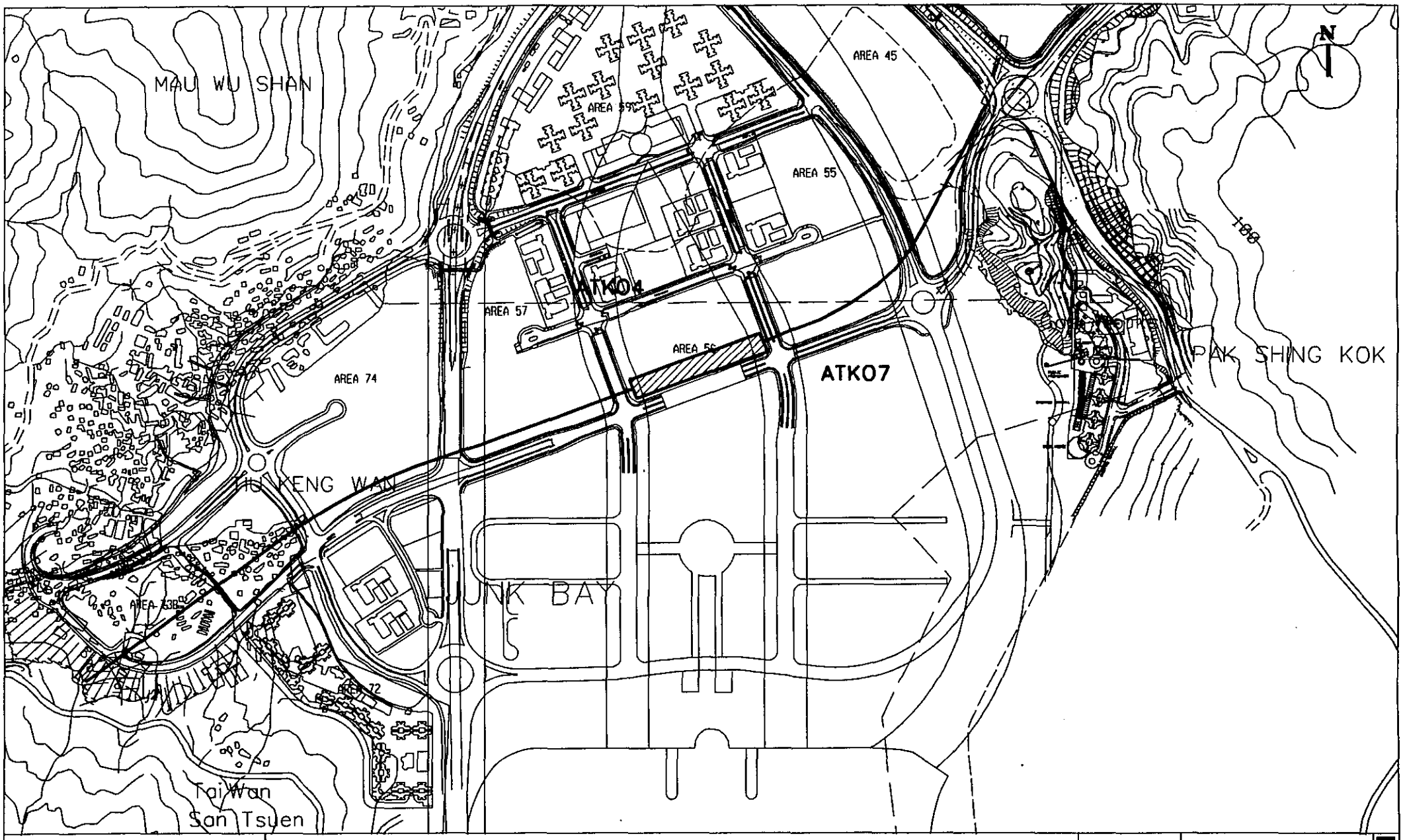

Key

Alignment & Station

ATKO1 TSP Monitoring Location

TSUENG KWAN O CENTRE: TSP MONITORING LOCATIONS

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FIGURE No. 2.6b

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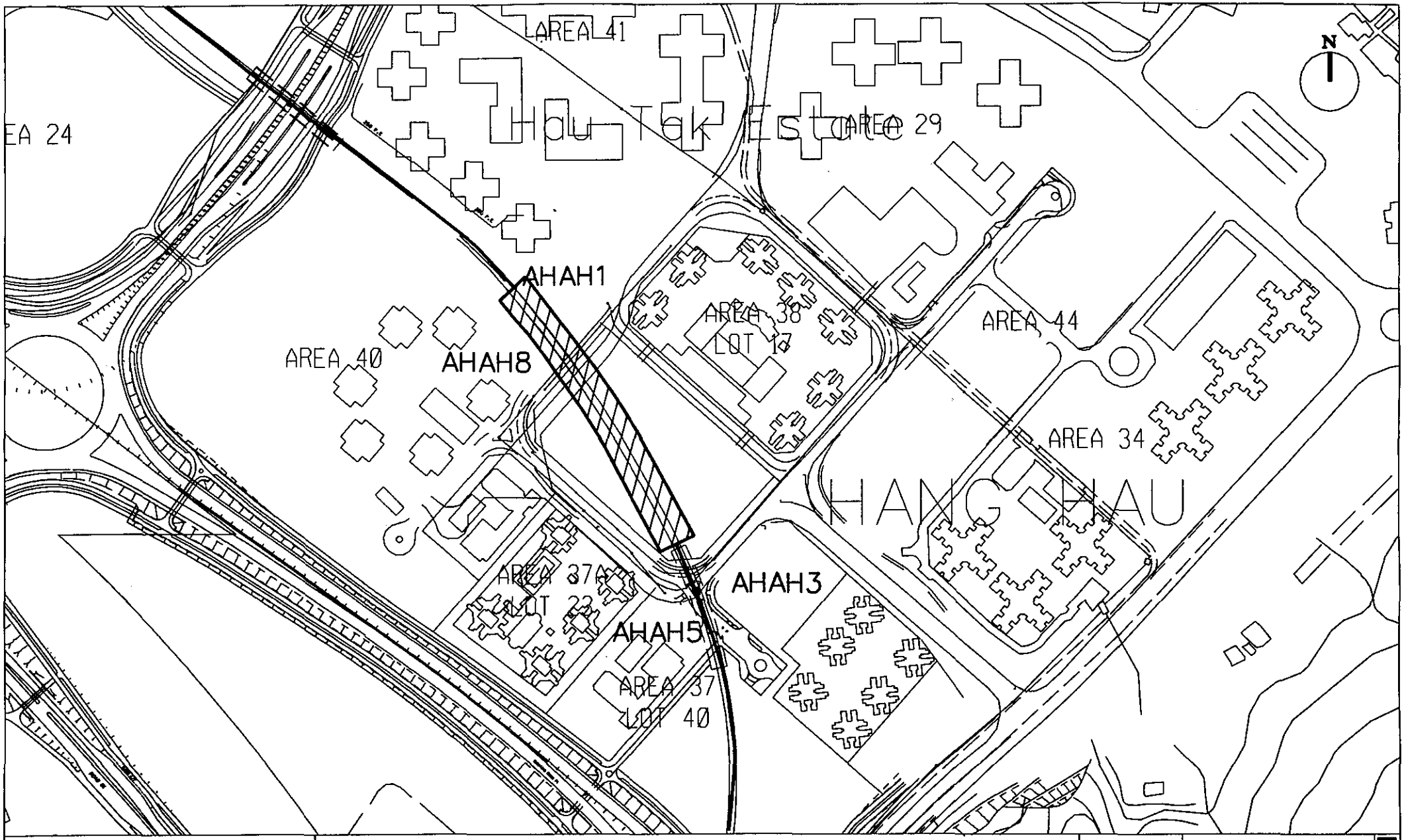

Key

Alignment & Station

AHAH1 TSP Monitoring Location

HANG HAU: TSP MONITORING LOCATIONS

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FIGURE No. 2.6c

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Key

Alignment & Station

APOL1 TSP Monitoring Location

PO LAM: TSP MONITORING LOCATIONS

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FIGURE No. 2.6d

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2.7.4 Ambient conditions may vary seasonally and therefore baseline checking of dust levels shall be carried out every six months at all the agreed monitoring locations. On these occasions or in other instances when the ET believes ambient conditions may have changed, baseline checking shall be carried out when construction activities are not taking place or when the contractor's activities are not generating dust in the proximity of the monitoring stations. Detailed notes shall be provided by the monitoring personnel as to significant dust producing sources during the baseline checking periods. The baseline monitoring activities will provide data for the determination of the appropriate A/L levels which shall be agreed with the EPD.

2.8 Impact Monitoring

2.8.1 A monthly schedule of monitoring activities shall be drawn up by the ET and agreed with the ER two weeks prior to the commencement of the scheduled monitoring period. Regular 24-hour impact monitoring shall be carried out throughout the duration of the construction works at a frequency of at least once every six days at all monitoring stations.

2.8.2 In cases of non-compliance with the air quality criteria, additional monitoring as specified in the ECP shall be conducted within 24 hours of the results being obtained. The additional monitoring shall be continued until the excessive dust emission or the deterioration in air quality abates.

2.8.3 Regular 1-hour monitoring will not be undertaken for this Project. The resources that would have been required for this work, will instead be utilised for pro-active site inspections to prevent the deterioration of mitigation measures and thus avoid 1-hour exceedances. The ET will undertake frequent visual inspections of each site, both in response to the onset of potentially dusty activities, and also at random. Site conditions and the status of mitigation measures will be checked and the ER will be advised immediately of any actual or potential failings of the mitigation measures and the necessary actions required to make them effective. Observations during site inspections and any subsequent follow-up actions will be included in the monthly EM&A Reports. The frequency and scope of the site inspections will be agreed with the EPD once the Contractor's Environmental Management Plan is available.

2.9 Compliance Assessment

2.9.1 The A/L Levels provide an appropriate framework for the interpretation of monitoring results. The air quality monitoring data shall be checked against the agreed A/L Levels as listed in *Tables 2.9a* and *2.9b*.

Table 2.9a Derivation of Action and Limit Levels for 24-Hour Air Quality Monitoring

Level	Total Suspended Particulates ($\mu g\ m^{-3}$)
Baseline	Derived from physical measurements prior to construction commencing
Action	For baseline <108 $\mu g\ m^{-3}$, average of 130% of baseline and the Limit level 108< baseline >154, 200 $\mu g\ m^{-3}$ For baseline >154 $\mu g\ m^{-3}$, 130% of baseline level
Limit	AQO for TSP: 260 $\mu g\ m^{-3}$ averaged over 24 hours

Table 2.9b Derivation of Action and Limit Levels for 1-hour Air Quality Monitoring

Level	Total Suspended Particulates
Baseline	Derived from physical measurements prior to construction commencing
Action	For baseline <154 μg m^{-3}, average of 130% of baseline and the Limit level 154< baseline >269, 350 μg m^{-3} For baseline >269 μg m^{-3}, 130% of baseline level
Limit	500 μg m^{-3}

2.10 Event Contingency Plan

2.10.1 The principle on which the Event Contingency Plan (ECP) is based is the prescription of procedures and actions associated with the measurement of defined levels of air pollution recorded by the environmental monitoring process and defined in the tables above. In cases where exceedance of these criteria occurs, the ET, ER and the Contractor shall strictly observe the relevant actions of the ECP shown in *Table 2.10a.*

Table 2.10a Event Contingency Plan for Air Quality

Exceedance	Action: ET Leader	Action: ER	Action: Contractor
ACTION LEVEL	Repeat measurement to confirm findings. Identify the source(s) of impact.	Confirm receipt of notification of exceedance and notify Contractor.	Submit proposals for remedial actions to ER within three working days of notification.
	Inform ER in writing. Discuss remedial actions required with ER.	Check monitoring data trends and Contractor's working methods.	Amend proposals if required by the ER.
	Increase monitoring frequency to assess efficacy of remedial measures.	Remind the Contractor of his contractual obligations and discuss remedial actions to be implemented.	Implement the remedial actions immediately upon instruction from the CM.
	If exceedence continues, arrange meeting with ER to review implementation and identify further appropriate mitigation measures. If exceedence stops, cease additional monitoring.	Assess the efficacy of remedial actions and keep the Contractor informed.	Liaise with the ER to optimise the effectiveness of the agreed mitigation.

Exceedance	Action: ET Leader	Action: ER	Action: Contractor
LIMIT LEVEL	Repeat measurement to confirm findings.	Confirm receipt of notification of exceedance and notify Contractor.	Take immediate action to avoid further exceedence.
	Identify the source(s) of impact. Inform ER and EPD in writing.	Check monitoring data trends and Contractor's working methods.	Submit proposals for remedial actions to ER within three working days of notification.
	Discuss remedial actions required with ER. Increase monitoring frequency to assess efficacy of remedial measures.	Discuss with Contractor the remedial actions to be implemented.	Amend proposals if required by the ER. Implement remedial actions immediately upon instruction from the ER.
	If exceedence continues, arrange meeting with ER to identify further appropriate mitigation measures. If exceedence stops, cease additional monitoring.	Assess the efficacy of remedial actions and keep the Contractor informed.	Liaise with the ER to optimise the effectiveness of the agreed mitigation.

2.11 Air Quality Mitigation Measures

2.11.1 The DEIA has recommended dust control mitigation measures to avoid exceedances of the TSP criteria at the sensitive receivers around the worksites at Yau Tong, Hang Hau and Po Lam. Typical dust control measures for materials handling and vehicle movements are listed below. The contractor shall be responsible for the design and implementation of all mitigation measures.

Drilling and Blasting

- where breaking of rock/concrete is required, watering should be implemented to control dust, water sprays should be used during the handling of excavated material at the site and at active cuts, excavation and fill sites where dust is likely to be generated; and
- blasting operations should be well arranged and take appropriate precautions to minimize dust generation, such as the use of blast nets, canvas covers and watering the work site to increase the water content of the blasted material;

Materials Handling

- heights from which excavated materials are dropped should be controlled to the minimum practical to limit the fugitive dust generation from unloading;
- all stockpiles of aggregate or spoil of more than 50 m^3 should be enclosed or covered and water applied in dry or windy conditions;

Vehicle Dust

- effective water sprays should be used on the site to dampen potential dust emission sources such as unpaved areas used by site traffic and active construction areas;
- vehicles transporting materials that have the potential to generate dust should have

properly fitting side and tail boards;

- materials transported by vehicles should be covered, with the cover properly secured and extended over the edges of the side and tail boards;
- materials should also be dampened, if necessary, before transportation,
- on-site vehicle speeds should be controlled to reduce dust re-suspension and dispersion by traffic within the sites;
- wheel washing facilities should be provided at the exit of the site to prevent dusty material from being carried off-site on vehicles and deposited on public roads; and

Excavation

- to minimise dust emissions, the amount of soil exposed and the dust generation potential should be kept as low as possible, this can be accomplished by surface compaction, temporary fabric covers, minimising the extent of exposed soil and the prompt re-vegetation of completed earthworks.

2.11.2 If the above measures are insufficient to maintain the air quality within the established criteria, the Contractor shall discuss additional mitigation measures with the ET Leader and implement these on agreement with the ER.

2.11.3 Auditing of the timely and effective implementation of the above mitigation measures shall be the responsibility of the ET and is discussed further in *Section 6*.

3 NOISE IMPACT MONITORING

3.1 Introduction

3.1.1 In this section, the requirements, methodology, equipment, monitoring locations and mitigation measures for the monitoring and audit of noise impacts from the construction of the TKE are presented.

3.2 Noise Parameter

3.2.1 The appropriate parameter for measuring construction noise impacts shall be the equivalent A-weighted sound pressure level (L_{Aeq}) measured in decibels (dB).

3.3 Methodology and Criteria

3.3.1 Noise level measurements shall be carried out by suitably qualified personnel using the methodology set out in Section 3 of the *Technical Memorandum on Noise from Construction Work other than Percussive Piling*.

3.3.2 The criteria against which the recorded noise levels shall be assessed refers to the noise level 1.0 m from the nearest part of the building façade and at a height approximately 1.2 m above the ground or at that height which has the least obstructed view of the construction activity in relation to the receiver.

3.3.3 Whilst the *Noise Control Ordinance* (NCO) does not provide for the statutory control of construction activities occurring on weekdays during normal working hours (i.e. Monday to Saturday 07.00-19.00, excluding Public Holidays), a voluntary daytime limit of $L_{Aeq, 30\ min}$ 75 dB for residential premises (*Practice Note for Professional Persons - ProPecc PN2/95*) was proposed in the TKE DEIA and agreed with EPD as the appropriate criterion. For educational establishments, a level of 70 dB(A) has been proposed and this would be further reduced to 65 dB(A) during examination periods. On all days during the evening (19.00-23.00) and night-time (23.00-07.00) and Sundays and Public Holidays (07.00-23.00), the statutory noise limit shall be applied.

3.4 Monitoring Equipment

3.4.1 Sound level meters and pistonphone calibrators shall comply with the *International Electrotechnical Commission Publications 651:1979 (Type 1)* and *804:1985 (Type 1)* specifications as referred to in the TM. The sound level meters shall be supplied and used with the manufacturers recommended wind shield and mounted on a tripod.

3.4.2 The calibration of the sound level meters and their respective pistonphone calibrators shall be carried out in accordance with the manufacturer's requirements. The sound level meters and analysers, including the calibrators, shall be verified by the manufacturers once every two years to ensure they perform to the same level of accuracy as stated in the manufacturers specifications.

3.4.3 The equipment shall be kept in a good state of repair in accordance with the manufacturers recommendations and maintained in proper working order with

sufficient spare equipment available in the event of breakdown to maintain the planned monitoring programme.

3.4.4 Calibrated hand-held wind speed anemometers shall also be supplied by MTRC for the measurement of wind speeds during noise monitoring periods.

3.5 Monitoring Locations

3.5.1 Noise Sensitive Receivers (NSRs) have been identified in the vicinity of the construction sites during the course of the TKE DEIA. Those where it is recommended that noise quality monitoring is undertaken are listed below in *Table 3.5a* and shown in *Figures 3.5a-d*. Monitoring stations shall be set up in the vicinity of these locations using the guidelines presented in *Section 1.6* as appropriate; the exact location and direction of monitoring equipment to be agreed with the ER and the EPD.

Table 3.5a Location of Noise Sensitive Receivers

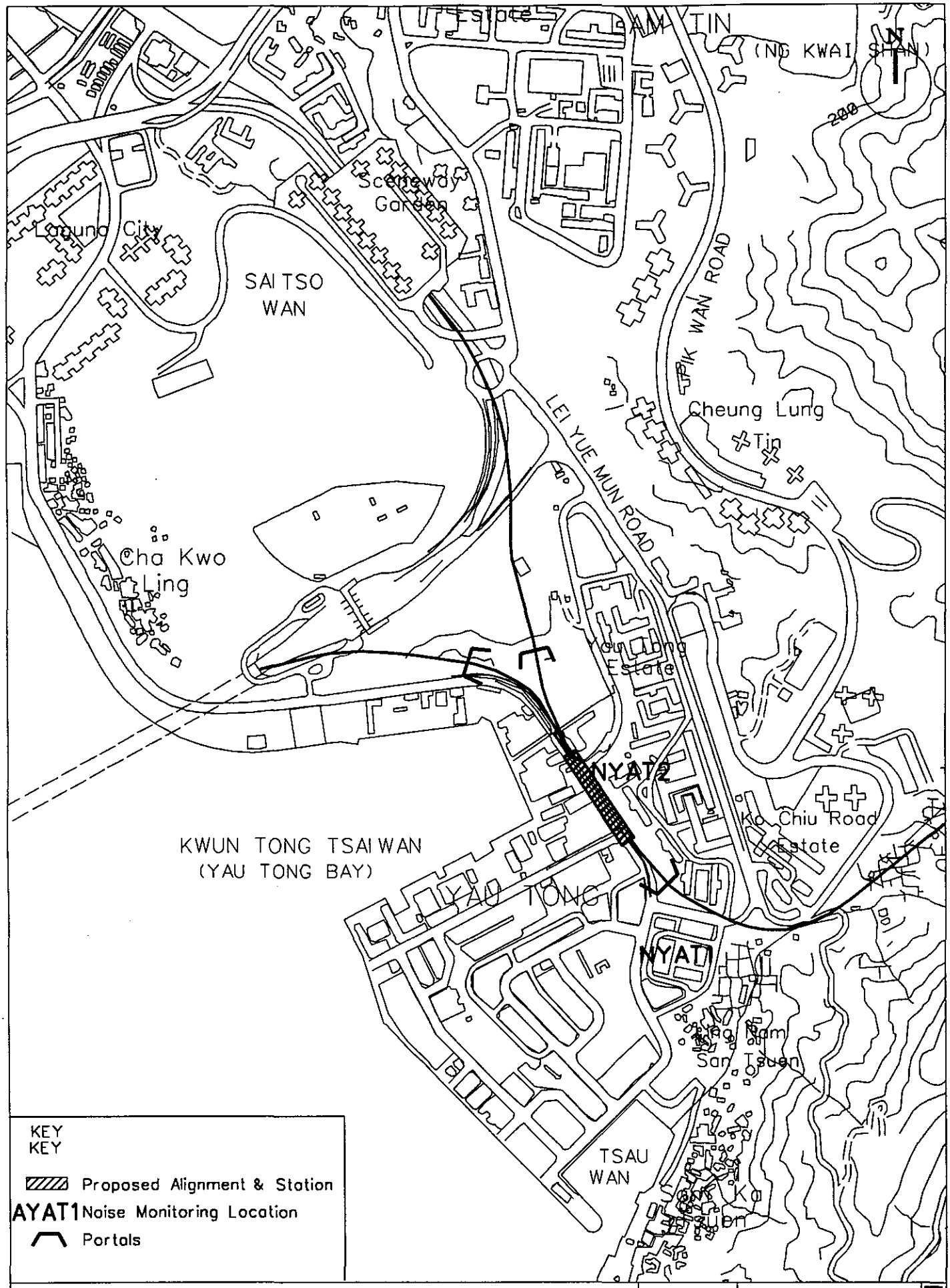
Site Name	NSR Location
Yau Tong (station and alignment)	NYAT1 - Yau Tong Centre NYAT2 - St Antonius Primary School
Tiu Keng Leng (station and Alignment)	None Required
Tseung Kwan O Town Centre (station and alignment)	NTKO3 - School, Area 57 NTKO5 - PSPS/HOS, Area 67
Hang Hau (station and alignment)	NHAH1 - Block E, Chung Man Court NHAH6 - Residential development, Area 37c NHAH9 - School, Area 37d
Po Lam (station and alignment)	NPOL5 - Residential development, Area17 NPOL7 - Residential development, Area19

3.6 Baseline Monitoring

3.6.1 MTRC shall provide and install sufficient numbers of noise meters and support equipment to complete the necessary baseline sampling at the agreed monitoring locations before the commencement of any site works which may affect the monitoring results. A preliminary list of the required monitoring equipment is provided in *Annex B*.

3.6.2 The methodology used to undertake the baseline noise level survey will be determined by the type of equipment provided to site staff. Additional aspects to consider when selecting an appropriate methodology are the monitoring location access, security and power arrangements. Two baseline methodologies are detailed below.

3.6.3 General meterological conditions, including a measurement of wind speed shall be recorded for each baseline measurement. Where the steady wind speed exceeds 5 m s^{-1} or gusts above 10 m s^{-1}, or in the presence of fog or rain or evidence thereof, measurements shall be treated as invalid and repeated as soon as possible.



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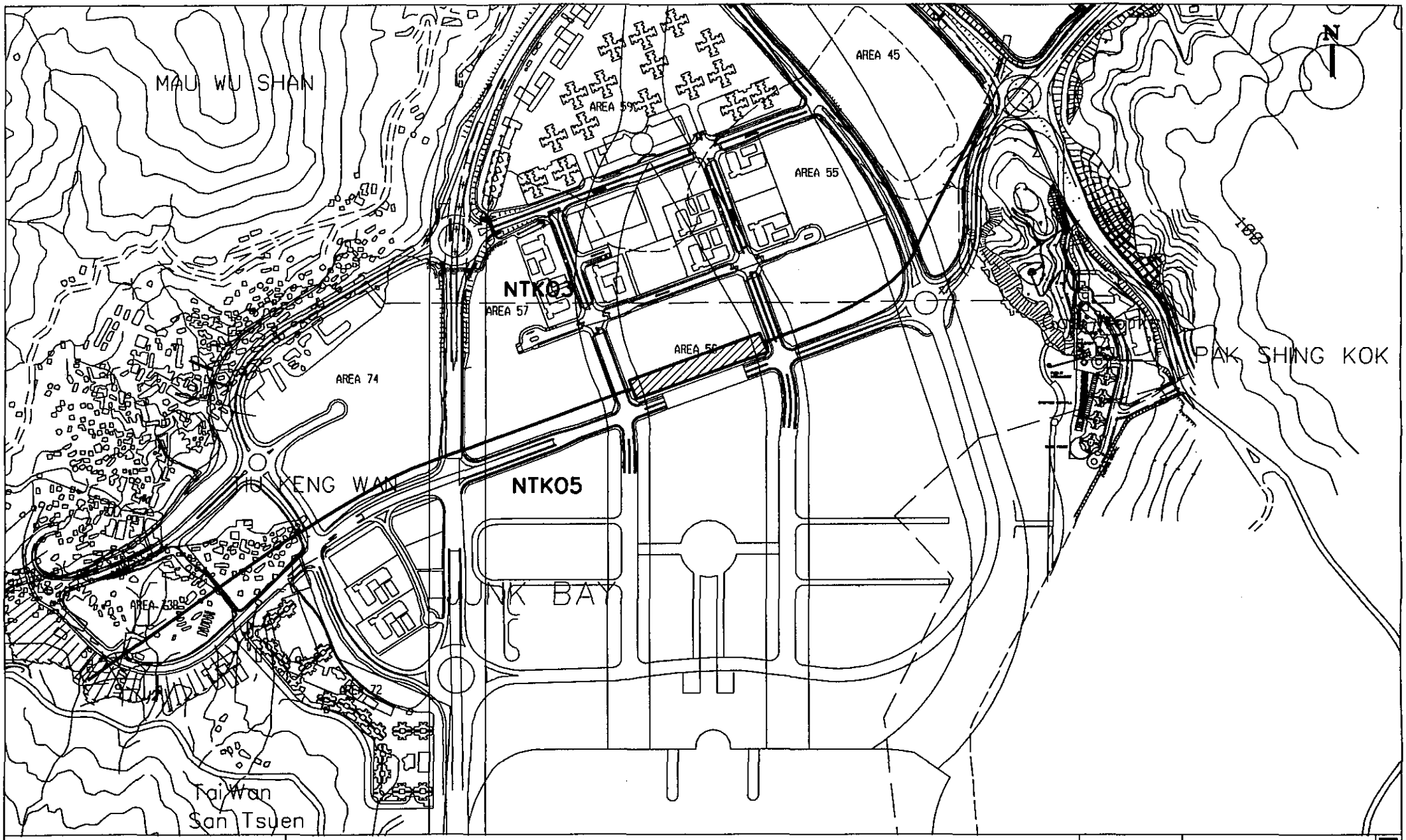
YAU TONG – NOISE MONITORING LOCATIONS

DATE:	FIGURE No.
JULY 97	3.5a
SCALE: NTS	

Maunsell



Key

Alignment & Station

NTK01 Noise Monitoring Location

TSUENG KWAN O CENTRE: NOISE MONITORING LOCATIONS

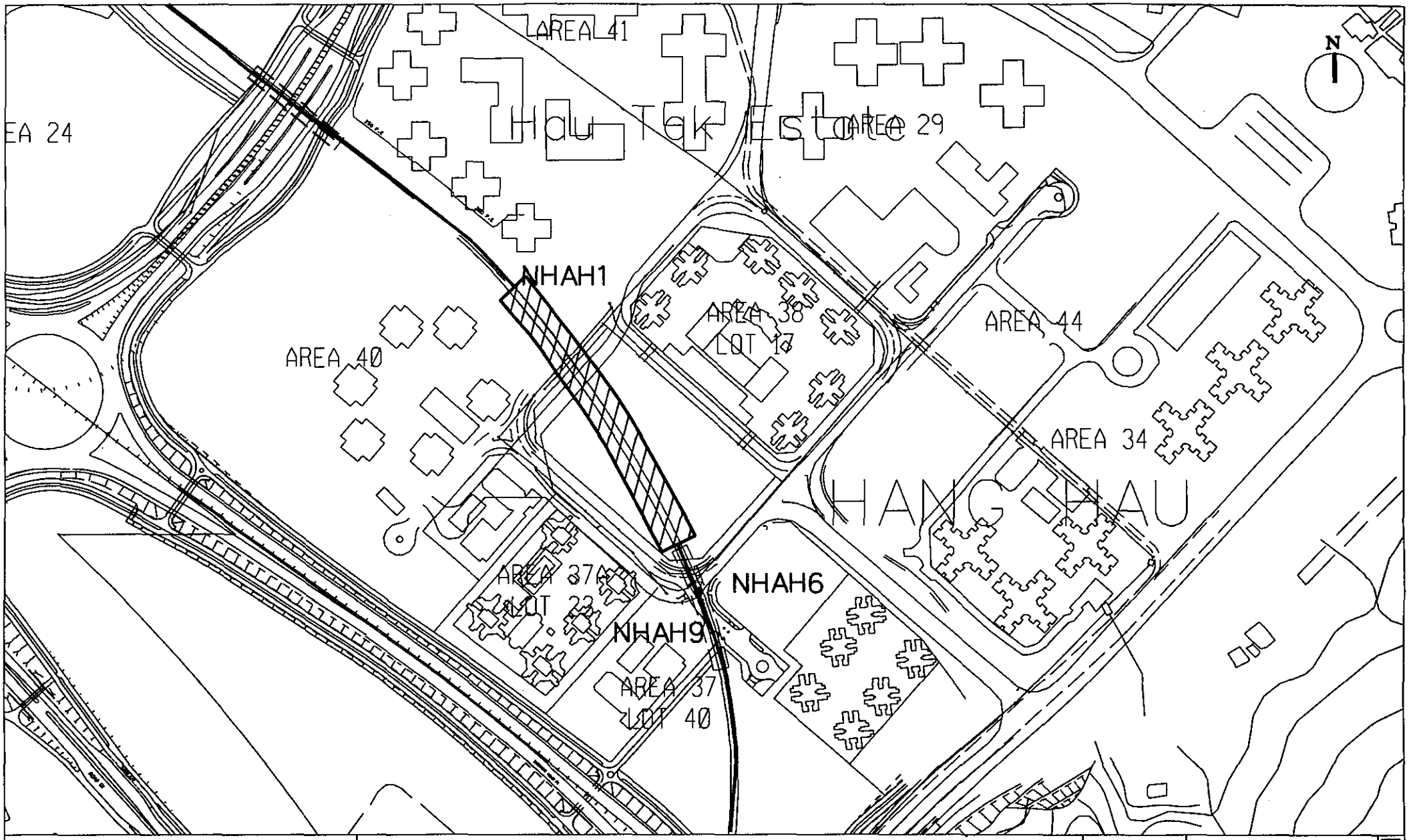
MAUNSELL CONSULTANTS ASIA LTD

DATE: JULY 97

SCALE: NTS

FIGURE No. 3.5b

Maunsell



Key

Alignment & Station

NHAH1 Noise Monitoring Location

HANG HAU: NOISE MONITORING LOCATIONS

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DATE: JULY 97

SCALE: NTS

FIGURE No. 3.5c

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Key

Alignment & Station

NPOL1 Noise Monitoring Location

PO LAM: NOISE MONITORING LOCATIONS

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DATE: JULY 97

FIGURE No. 3.5d

SCALE: NTS

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Preferred Methodology

3.6.4 To obtain fully satisfactory baseline results, a waterproof sound level meter and noise data logger should be used. Baseline noise levels shall be measured over two consecutive 7-day calendar weeks at a minimum logging interval of 15 minutes. The quantities L_{Aeq}, L_{10} and L_{90} shall be recorded at the specified interval. The survey period shall be selected prior to the commencement of construction activities and so as to avoid other atypical noise sources. The proper functioning of the logger shall be ensured during this period and shall be visited for a period not less that one hour every two days to ensure its continued operation and to identify and record specific noise sources audible at the monitoring location. The calibration of the logger kit shall be in accordance with the manufacturers recommendations. Measurements shall be recorded to the nearest 0.1 dB.

Noise "Sampling"

3.6.5 An appropriate alternative methodology under conditions where access to the monitoring location is constrained, the method of noise "sampling" may be approved. It should be acknowledged at the outset that the accuracy of this method lies in the total number of samples taken and the spread of the samples taking throughout than monitoring period. An appropriate minimum standard is considered to be the taking of five samples during each noise period over a five day period which is to include one Sunday. Additional samples may be requested based on the results and convergence of previous baseline monitoring efforts. As with the preferred methodology, L_{Aeq}, L_{10} and L_{90} shall be recorded at the specified intervals and the survey period shall be selected prior to the commencement of construction activities and so as to avoid other atypical noise sources.

3.6.6 In order to confirm that typical conditions prevail throughout the survey period, observations of noise sources and weather conditions shall be made and reported on all monitoring occasions or at the minimum specified interval.

3.6.7 Checking for changes in the baseline noise levels shall be carried out by taking "sample" noise measurements every six months when no noisy TKE construction activities are in progress. On other occasions, the monitoring staff shall note any operational construction equipment or other activities, arising from either the Contractor or any other sources noted to be emitting "dominant", "audible" or "noticeable" noise levels during the time of the measurement for the analysis and audit process.

3.6.8 The baseline monitoring results, agreed with EPD, will be used in conjunction with the A/L Levels to determine the validity of complaints, the significance of impact monitoring results and the requirements for action under the ECP.

3.7 Impact Monitoring

3.7.1 During normal construction working hours (07.00-19.00 Monday to Saturday excluding Public Holidays), monitoring of $L_{Aeq,\ 30\ min}$ noise levels (as six consecutive $L_{Aeq,\ 5\ min}$ readings) shall be carried out at the agreed monitoring locations once every six days in accordance with the methodology in the TM. If restricted hours works are undertaken, monitoring of $L_{Aeq\ 15\ min}$ noise levels (as three consecutive $L_{Aeq,\ 5\ min}$ readings) shall be carried out at the agreed monitoring stations at the same frequency as specified for normal working hours.

3.7.2 In relation to the monitored noise levels, other noise sources such as road traffic may make a significant contribution to the overall noise environment. The ER shall therefore interpret the results of noise monitoring activities in the light of such influencing factors where such factors were not present during the baseline monitoring period. All measurements shall be recorded to the nearest 0.1 dB.

3.8 Compliance Assessment

3.8.1 The A/L Levels provide an appropriate framework for the interpretation of monitoring results. The noise impact monitoring data shall be checked against the agreed A/L Levels as listed in *Table 3.8a*.

Table 3.8a Action and Limit Levels for Construction Noise dB(A)

Time Period	Action	Limit
07.00-19.00 on normal weekdays;	When one documented complaint is received	75 [1]
19.00-23.00 on any day and 07.00-23.00 on Sundays and holidays;	When one documented complaint is received	70
23.00-07.00 on any day	When one documented complaint is received	55

[1] For educational establishments the limit level shall be 70, reduced to 65 during examination periods.

3.8.2 To account for cases where ambient noise levels identified by baseline monitoring approach or exceed the stipulated Limit Level prior to commencement of construction, an Exceedance Level may be defined and agreed with EPD, which incorporates the baseline noise level and the identified construction Limit Level. The Exceedance Level will, therefore, be greater than the Limit Level and represent the maximum acceptable noise level at a specific monitoring station. Correction factors for the effects of acoustic screening and/or architectural features of NSRs may also be applied for, from the EPD, as specified in the TM.

3.8.3 For the purposes of compliance checking, after taking into account any adjustments agreed with EPD, comparison with either the Limit or Exceedance Level shall represent the governing criteria for noise impact assessment of the TKE EM&A.

3.9 Event Contingency Plan

3.9.1 The principle on which the ECP is based is the prescription of procedures and actions associated with the measurement of defined levels of noise impact recorded by the environmental monitoring process and defined in the tables above. In cases where a complaint is received or an exceedance of these criteria is measured, the ET, ER and the Contractor shall strictly observe the relevant actions of the ECP shown in *Table 3.9a*.

Table 3.9a Event Contingency Plan for Construction Noise

Exceedance Event	Action: ET Leader	Action: ER	Action: Contractor
ACTION LEVEL	Undertake measurement to establish validity of complaint.	Confirm receipt of notification of complaint and notify Contractor if proven.	Submit proposals for remedial actions to ER within three working days of notification.
	Identify the source(s) of the complaint.	Check monitoring data trends and Contractor's working methods.	Amend proposals if required by the ER.
	Inform ER in writing. Discuss remedial actions required with ER.	Remind the Contractor of his contractual obligations and discuss remedial actions to be implemented.	Implement the remedial actions immediately upon instruction from the ER.
	Increase monitoring frequency to assess efficacy of remedial measures.	Assess the efficacy of remedial actions and keep the Contractor informed.	Liaise with the ER to optimise the effectiveness of the agreed mitigation.
	If exceedence continues, arrange meeting with ER to review implementation and identify appropriate mitigation measures.	Inform complainant of actions taken.	
	If exceedence stops, cease additional monitoring.		
LIMIT LEVEL	Repeat measurement to confirm findings.	Confirm receipt of notification of exceedance and notify Contractor.	Take immediate action to avoid further exceedence.
	Identify the source(s) of impact.	Check monitoring data trends and Contractor's working methods.	Submit proposals for remedial actions to ER within three working days of notification.
	Inform ER and EPD in writing. Discuss remedial actions required with ER.	Discuss with Contractor the remedial actions to be implemented.	Amend proposals if required by the ER.
	Increase monitoring frequency to assess efficacy of remedial measures.	Assess the efficacy of remedial actions and keep the Contractor informed.	Implement remedial actions immediately upon instruction from the CM.
	If exceedence continues, arrange meeting with ER to identify appropriate mitigation measures.		Liaise with the ER to optimise the effectiveness of the agreed mitigation.
	If exceedence stops, cease additional monitoring.		

3.10 Noise Impact Mitigation Measures

3.10.1 Recommendations for noise mitigation measures to reduce impacts have been specified in the DEIA as a combination quiet plant, noise barriers and plant noise performance specifications. The suggested performance specification requires the Contractor to incorporate 'quiet' or silenced plant, or reduced plant inventories for specific

construction activities so that noise levels at nearby NSRs are controlled to within established limits.

3.10.2 The following forms of mitigation are generally recommended for each construction site.

Good Site Practice

3.10.3 Good site practice and noise management procedures are:

- only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme;
- silencers or mufflers on construction equipment should be utilised and should be properly maintained during the construction programme; and
- whenever practicable, mobile plant should be sited as far away from NSRs as possible.

3.10.4 Other good site practice and noise management can considerably reduce the impact of construction site activities procedures which are:

- machines and plant (such as trucks) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
- plant known to emit noise strongly in one direction, should, where practicable, be orientated so that the noise is directed away from nearby NSRs;
- material stockpiles and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities.

Selecting Quiet Plant and Working Methods

3.10.5 Quiet plant is defined as powered mechanical equipment (PME) whose actual sound power level is less than the value specified in the TM for the same type of equipment. Reductions of up to 7 dB(A) for silenced PME can be achieved in practice.

3.10.6 Whilst various types of silenced equipment can be found in Hong Kong, the DEIA found that the benefits achievable in this way will also depend on the details of the Contractor's chosen methods of working. It was therefore, both preferable and more practical to recommend overall plant noise performance specifications to allow the Contractor some flexibility in selecting plant to suit his needs.

3.10.7 The plant noise performance levels have been established in the DEIA, however, the Contractor may be able to revise his methodology to further reduce construction noise levels. The finalised levels will be incorporated into a later version of this Manual.

Construction of Moveable Noise Barriers

3.10.8 The DEIA recommended movable noise barriers of 3-5 m in height and of a superficial surface density of at least 10 kg m^{-2}, located close to particular types of plant, as listed below, could give a reduction of up to 5 dB(A) from screening effects (estimated in accordance with the TM). Site perimeter barriers would generally be ineffective in reducing noise levels at NSRs since many NSRs are close to activity work sites and

would overlook the barriers. Certain types of PME, such as generators and compressors, can be completely enclosed giving a reduction of 10 dB(A) or more.

3.10.9 Plant that could benefit from mobile noise barriers include:

- backhoe breaker;
- crane;
- mini backhoe;
- generator;
- compressor; and
- excavator.

3.10.10 The use of 3 m high movable barriers with skid footing and a small cantilevered upper portion, located within a few metres of static plant and within 5 m of mobile plant are generally recommended for all worksites, particularly during the initial site clearance and exposed structure phases. It is also recommended that exposed rock drilling is restricted to the shortest period practicable.

Restricting Plant Teams

3.10.11 In general, the numbers of particular items of plant should be left to the choice of the Contractor allowing flexibility in the choice of working methodologies. However, in combination with the selection of quiet plant, limiting plant numbers would further reduce noise levels.

4 ENVIRONMENTAL AUDITING

4.1 Introduction

4.1.1 The DEIA has identified noise and dust emissions as the key potential impacts associated with the construction of the TKE. Other potential impacts, including those on water quality, waste and amenity, are amenable to mitigation subject to the effective implementation of recommended measures. The environmental auditing programme will focus on the regular assessment of the effectiveness of management systems, practices and procedures in ensuring that the required mitigation measures are routinely implemented and maintained.

4.2 Audit Protocols

4.2.1 The auditing of onsite environmental performance will be undertaken on the basis of criteria and methodologies contained within an Audit Protocol developed in advance of the commencement of construction works.

4.2.2 The criteria against which the audits will be undertaken will be derived from the environmental protection clauses within the Contractual Documentation and those parts of the Contractor's method statement which address the recommendations of the DEIA. In addition, the management systems established by the onsite Project management team to monitor the Contractor's compliance with Contractual requirements will be included within the audit protocols.

4.2.3 The audit protocols will be developed in conjunction with the MTRC Site Safety Audits and will be outlined in the revised EM&A Manual. The protocols will include the auditing of the following activities:

- the allocation of responsibility for fulfilling environmental requirements and the effectiveness of lines of communication with regard to environmental issues;
- compliance with procedures established to enable an effective response to environmental incidents, exceedances or non-compliances;
- the extent and accuracy of record-keeping related to environmental performance indicators;
- the effectiveness of staff training in ensuring high levels of awareness with regard to environmental requirements; and
- the effectiveness of environmental management activities.

4.2.4 The protocols will comprise checklists of auditable requirements and will be amended, over the lifetime of the construction phase, to focus on areas of frequent non-compliance and to reflect the potential impacts associated with specific activities within the construction programme.

4.3 Audit Reporting

4.3.1 The findings of site audits will be made known to site staff at the time of the audit to enable the rapid resolution of identified non-compliances. Non-compliances, and the corrective actions undertaken, will also be reported in the monthly EM&A Report.

5 REPORTING

5.1 Introduction

5.1.1 The primary reporting function, undertaken within the EM&A programme will be the issuance of formal exceedance notifications, corrective actions and ongoing feedback between the EM&A Team and the Corporation. Reporting will be driven by the results of the monitoring and audit programme and will be recorded through written correspondence, audit reports and minutes and notes of meetings.

5.1.2 In addition, periodic reviews of the EM&A process will be prepared and circulated to relevant personnel within the Corporation's Project Team as a means of gauging site staff and contractor performance. The periodic reviews will comprise Monthly, Biannual and Annual EM&A Reports; these Reports will be copied to the EPD for comment. The exact details of the frequency, distribution and deadlines shall be finalised with EPD prior to the commencement of the works.

5.2 Baseline Monitoring Report

5.2.1 The EM&A Manual will contain full details of the monitoring locations, equipment and protocols to be applied to the TKE EM&A. The Baseline monitoring results and proposals for the A/L level parameters will be presented in the form of a draft Report which will be submitted to the EPD for agreement. The draft Report will be supported by the baseline monitoring data in electronic format, along with information from the EM&A Manual covering monitoring locations, equipment and protocols.

5.2.2 The agreed baseline Report will not be reissued as a stand alone Report, however, the appropriate information will be incorporated in the EM&A Manual and reported in the first Monthly Report

5.3 Monthly EM&A Reports

5.3.1 Monthly EM&A Reports shall be prepared and submitted to the EPD within 10 working days of the end of each reporting month, the first report will be submitted in the month after construction works commence. The report shall include (but not be limited to) the following elements:

- Executive Summary highlighting breaches of agreed criteria, complaints, reporting changes and future key issues;
- basic project information;
- brief account of construction activities;
- monitoring results together with details of locations, dates, times, parameters monitored, etc;
- interpretation of the significance of monitoring results and explanation of influencing factors;
- graphical plots of monitored trends over the past four reporting periods;
- description of recommendations and/or actions taken, or outstanding, in the event of non-compliances or deficiencies, including site inspections and audits;
- review of the implementation status and effectiveness of environmental protection works in relation to non-compliances and deficiencies and the mitigation measures

recommended in the DEIA report;
- summary of complaints, investigation results and any follow-up actions; and
- future key issues.

5.4 Bi-annual and Annual Reports

5.4.1 In addition to the Monthly Reports, Bi-annual and Annual Reports will be issued which will provide a general overview of the progress of the Project EM&A to date.

5.4.2 The Bi-annual and Annual Reports will document the findings of the audit of air, noise and water quality monitoring results by contract, referring first to baseline conditions and then impact results. Graphs of the monitoring trends will be included to indicate the performance for impact control for each media over the reporting period.

5.4.3 A performance evaluation of the period monitoring results will review the roles of site staff, both MTRC and the Contractors, to the environment, based on NOE communications and enacted mitigation measures.

5.4.4 A summation of the main findings and recommendations to further improve the environmental performance of the Project will be included, as appropriate, in the conclusions.

5.5 Data Keeping

5.5.1 All documents and records, in both paper and electronic format, pertaining to the TKE EM&A will be retained as part of the Project files and will be subject to appropriate data handling procedures.

5.6 Interim Notifications of Environmental Quality Limit Exceedances

5.6.1 Interim notifications of exceedances of Limit Levels, which will include the status of the investigation and follow-up actions, will be issued to the EPD within 24 hours of the identification of an exceedance. The Monthly Reports will carry all available details concerning measured exceedances and complaints, their causes and those steps taken to control impacts and prevent their recurrence.

Annex A

Preliminary Mitigation Implementation Checklist

Preliminary Mitigation Implementation Checklist

IMPACT	MITIGATION MEASURE	IMPLEMENTATION STATUS				
		YAT	TKL	TKO	HAH	POL
AIR	Stockpiles greater than 50 m^3 enclosed, covered or dampened.					
	Haul roads paved and regularly watered.					
	Wheel washing facilities operational at all site entrances.					
NOISE	Plant well maintained and serviced regularly.					
	Silencers or mufflers on construction equipment properly fitted and maintained.					

KEY:

Y = Mitigation measures currently implemented on site.
N = Mitigation measures not implemented on site.
P = Mitigation measures partially implemented on site.
N/A = Not Applicable.
U = Unconfirmed. Further investigations necessary.
E = No exceedances at this location, and therefore mitigation measures unnecessary.

Annex B

Preliminary Monitoring Equipment List

Preliminary Monitoring Equipment List

Description	Serial No.	Date of Purchase	Calibrate Date	Personnel	Status	Owner
Hi-vol Sampler						
Hi-vol Sampler						
Hi-vol Sampler						
Hi-vol Sampler						
Hi-vol Sampler						
Hi-vol Sampler						
Hi-vol Sampler						
Hi-vol Sampler						
Hi-vol Sampler						
Hi-vol Sampler						
Hi-vol Sampler						
MIE DataRam						
MIE DataRam						
MIE DataRam						
MIE DataRam						
MIE DataRam						

Preliminary Monitoring Equipment List

Description	Serial No.	Date of Purchase	Calibrate Date	Personnel	Status	Owner
MIE DataRam						
Wind-speed Indicator						
Wind-speed Indicator						
Wind-speed Indicator						
05305 Wind Monitor - AQ						
05305 Wind Monitor - AQ						
05305 Wind Monitor - AQ						
B&K 2236 SLM						
B&K 2236 SLM						
B&K 2236 SLM						
B&K 2236 SLM						
B&K 2236 SLM						
B&K 2236 SLM						

Preliminary Monitoring Equipment List

Description	Serial No.	Date of Purchase	Calibrate Date	Personnel	Status	Owner
B&K 4231 Calibrator						
B&K 4231 Calibrator						
B&K 4231 Calibrator						
B&K 4231 Calibrator						
B&K 4231 Calibrator						
B&K 4231 Calibrator						
486 Subnotebook						
486 Subnotebook						
486 Subnotebook						
486 Subnotebook						
486 Subnotebook						
26700 Programmable Translator						
26700 Programmable Translator						
26700 Programmable Translator						
26700 Programmable Translator						

Preliminary Monitoring Equipment List

Description	Serial No.	Date of Purchase	Calibrate Date	Personnel	Status	Owner
26700 Programmable Translator						
8388 QT 12M/HP Mast Unit						
8388 QT 12M/HP Mast Unit						
8388 QT 12M/HP Mast Unit						
26725 Hand Held Anemometer						
26725 Hand Held Anemometer						
26725 Hand Held Anemometer						
26725 Hand Held Anemometer						
26725 Hand Held Anemometer						

Annex C

Responses to Comments on Draft Report

C1365/TKO/QBE/JKC/55445
26 February 1997

Response to Comments
TKO/QBE DEIAs TKE/QBR EM&A Manuals - Revised Draft

No.	Department	Reference	Comments	Consultants' Response
1.	EPD/Alex H K Tang 25 February 1997	An(5) to EP1/G/72 VI	General (i) Basically, we have no objection that the regular site inspections, including the checking of compliance with legal and contractual requirements, to be undertaken by MTRC site staff. However, we consider that these activities should fall within the EM&A scope and thus you should clearly define the relationships between the MTRC site staff and the ET, ER and contractor with respect to the EM&A works and describe the control mechanism in the EM&A Manual. You may wish to refer to the Section 6.1 & 6.2 of our EM&A Generic Manual.	*Section 1.3.3* sets out the relationships and the roles of individuals are defined in *Section 1.4*. Control mechanisms will be established through individual contracts clauses which must remain confidential until after the award of contract.
			(ii) The "Notify EPD" step was totally missed out in the Event Contingency Plans for Air, Noise and Water Monitoring which was not acceptable. Please revise.	The EPD will be advised of exceedances through the reporting procedures described in *Section 5*.
			(iii) The Waste Management EM&A works should be included in the Manuals.	The DEIAs identified noise, dust and (for TKE) water quality as the only elements requiring monitoring and audit. *Section 1.3.2* of the EM&A Manuals clearly state that, *inter alia*, waste management mitigation measures will be audited during regular site inspections. These inspections will be undertaken in conjunction with the MTRC Site Safety Inspections (as described in *Section 5.2*), these procedures will be determined prior to the commencement of construction works.

No.	Department	Reference	Comments	Consultants' Response
			(iv) The Preliminary Risk Qualitative Assessment Report has identified the need to monitor ground water and landfill gas before the Qualitative Risk Assessment is undertaken. I noted that they are not covered in this EM&A Manual. I believe that the proposed monitoring programme will be contained in a separate document. Please confirm or clarify. Moreover, if the Qualitative Risk Assessment later identify the need for further EM&A works on the ground water and/or landfill gas to be undertaken, then those works should be properly fed into this EM&A Manuals.	As a result of the Preliminary Risk Qualitative Assessment, monitoring of possible lanfill gas and leachate will be undertaken prior to the Qualitative Risk Assessment which will be completed prior to the commencement of the construction works. Should the QRA identify the need for further landfill gas or leachate monitoring during the construction programme, the methodology will be incorporated in subsequent versions of the EM&A Manual.
			(v) Section 1.3.1 - The Manual indicates that project staff will form the Environmental Team for the construction phase. I presume that the ET will act independently of ER and Contractor for the required EM&A works.	As stated in *Section 1.4.2*, the ET is under the direct responsibility of the ENM and, therefore, independent of both the ER and the Contractor.
			(vi) Section 1.3.11 - Besides your proposed procedures for the environmental complaints, you should also include the procedures if the complaint is transferred from EPD and the recording/reporting procedures. Moreover, you should add the following sentences to the end of Section 1.3.11 "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 Contactor." A flow chart showing the complaint response procedures should be included.	As stated in *Section 1.3.11*, all complaints, whatever their source, will be dealt with through the established MTRC complaints procedure. All the elements requested in the additional sentences are already contained in *Section 1.3.11*.
			(vi) Last sentence of Section 6.1.2 of TKE (5.1.2 of QBR) shall read as: ".... The exact details of the frequency and distribution shall be finalized with EPD prior to the commencement of the work."	Whilst it is desirable that agreement is reached with the EPD before the commencement of the works, it is not possible for the initiation of the construction contracts to be constrained by delays in the approval of the EM&A programme. The text will be amended to state "*Whenever possible*, the exact details of the frequency and distribution shall be finalized with EPD prior to the commencement of the work."

No.	Department	Reference	Comments	Consultants' Response
			(vii) First paragraph of section 6.2 of TKE 95.2 of QBR) shall read as "The EM&A Manual ... which will be submitted to the EPD for Agreement prior to the commencement of work. The draft Report ..."	Please see previous response.
			(viii) Add the following sentence to the beginning of Section 6.3 of TKE (5.3 of QBR): "The monthly EM&A reports shall be prepared and submitted to EPD within 10 working days of the end of each reporting month, with the first report due in the month after construction commences."	The text will be amended as requested.
			(ix) Section 6.6 of TKE (5.6 of QBR) - The current practice is that EPD shall be notified within 24 hours after Limit level is exceeded. Amendment to this section as follows is thus required. "When the environmental quality limits are exceeded, the ET Leader shall immediately notify the ER and 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. the monthly report will carry all available details concerning measured exceedances, their causes and those steps taken to control impacts and prevent their recurrence."	Responses to comments on the notification procedure have been made above, as with reporting procedures established for the LAR EM&A, notification will be through the monthly reports.
			Air Quality (x) Section 2.2.1 - Monitoring of 1-hour TSP levels is necessary to provide an early indication of failure of dust mitigation measure and should be included in the regular impact monitoring. Please note that you have already pointed this in Section 2.3.4. Therefore, the last sentence of Section 2..2.1 should be amended as "1-hour TSP levels shall also be monitored to give an early indication of failure of dust mitigation measures."	Experience during the LAR EM&A and on other projects has shown that the measurements obtained from 1-hour dust monitoring are of little value in determining potential failures in mitigation measures. Indeed, the resources necessary for 1-hour monitoring can be applied to far greater effect in site inspections and the direct checking of mitigation measures. Sections 2.3.4 and 2.3.5 refer to the use of 1-hour monitoring in the event of an exceedance or complaint.

No.	Department	Reference	Comments	Consultants' Response
			(xi) Section 2.4 - The calibration of direct reading dust meter for 1-hour TSP levels monitoring should also be addressed here (under the sub-heading "Air Quality"), if results of HVS are proposed to be used for checking the validity and accuracy of the results from the direct reading method, the statement in Section 2.3.6 "no comparisons between direct readings ...." should also be revised accordingly.	The results from the HVS cannot be used to check the direct meter readings. As it is not possible to determine what type of direct reading meter will be used for this Project, *Section 2.4.2* will be revised to state "All equipment..." this will cover any type of direct reading meter which may be selected.
			(xii) Section 2.8 - The sampling frequency for 1-hour TSP monitoring should be included under this section.	No regular 1-hour sampling is proposed.
			Water Quality (Refer to TKE EM&A Manual only) (xiii) The consultants shall include construction schedule, classification of mud to be dredged, depth of trench, quantity of mud to be dredged and source of fill material for our consideration.	This information is not available at this time, it will be included once the detailed reclamation methodology has been developed by the selected contractor.
			(xiv) First para. of Section 4.3 shall read as: "...For the purpose of evaluating water quality against the specified WQOs, depth-averaged values for surface, middle and bottom levels shall be sued except DO for which the values obtained shall be surface and middle levels depth-averaged. The value of bottom level DO shall be assessed individually. In..."	The text will be amended as advised.
			(xv) First para. of Section 4.5 shall read as: "Analysis of ...Water samples of about 1000 ml shall be collected at monitoring stations for carrying out laboratory SS determination. The detection limit shall be 1 mg/L or better. The SS determination work ..."	The text will be amended as advised.

No.	Department	Reference	Comments	Consultants' Response
			(xvi) Section 4.6 - Figure 4.6a indicated that the WSD's Cha Kwo Ling pumping station and Dairy Farm Ice Factory intake are located within the proposed reclaimed area. You shall confirm and advise whether these intakes will be relocated. The consultant shall also amend the SS requirement to 10 mg/L for SWD pumping station intakes. In addition, WSD's Yau Tong seawater pumping station shall be identified as a water sensitive receiver and should be monitored. Water quality monitoring locations shall thus be revised as per the attached sketch. In addition, water quality shall be monitored at both inside and outside of the slit screens for the monitoring stations number 1 to 3. The suggested locations are marked in the enclosed figure 4.6a.	Both intakes will be relocated after the seawall is built. Noted. *Table 4.9a* will be amended. Agreed. Water quality monitoring locations, as shown in *Table 4.6a* and *Figure 4.6a* will be amended.
			(xvii) Last sentence of first para. of Section 4.8 shall read as: "For the purpose of evaluating water quality, the values obtained from surface, middle and bottom levels shall be depth-averaged except DO for which surface and middle levels shall be used. The value of bottom level DO shall be assessed individually."	The text will be amended as advised.
			(xviii) Add the following paragraph to the end of Section 4.8: "Upon completion of all marine work, a post project monitoring shall be carried out for four weeks in the same manner as the impact monitoring."	The text will be amended as advised.
			(xix) Action and Limit levels for SS and Turbidity in Table 4.9a shall be amended. (Refer to original fax for details)	The text will be amended as advised.
			(xx) Followings in Table 4.10a shall be amended. (Refer to original fax for details)	The text will be amended as advised.

No.	Department	Reference	Comments	Consultants' Response
			(xxi) The comments relating to the water quality issues in the EM&A manual are based on the following mitigation measures which shall be included in Section 4.11. Should the mitigation measures deviate, the EM&A manual needs to be reviewed accordingly. - sealed garb will be sued for dredging. - maximum dredging rate will be limited to 78 m^3/hour - sea wall will be completed prior to filling. - silt screens will be provided at SWD's Cha Kwo Ling pumping station, WSD's Yau Tong pumping station and Dairy Farm Ice Factory intake to protect the intake water quality. - collect all floating refuse trapped inside the seawall and silt screens.	Agreed. The text will be reviewed and amended as advised.

C1365/RTC/60331
15 May 1997

Response to Comments
TKE/QBR EM&A Manuals

No.	Department	Reference	Comments	Consultants' Response
1	EPD/Alex H K Tang/ 30 April 1997	An(5) to EP1/G/72	I refer to your above quoted fax dated 10.3.97 and have the following further comments on your responses: Item (i) - I am still quite confused with the relationship between the MTRC's site staff and other parties. Are they fall within the ER or the ET? Please provide a flow diagram in the EM&A manual to illustrate the communication flows between different parties including MTRC, EPD, ENM, ER, ET, Contractor (and MTRC's site staff?)	A communications flow diagram will be include in the EM&A Manual and the text of Section 1.4 will be amended accordingly. Both are enclosed, the amended text is underlined.
			Item (ii) - Notification of exceedances through regular reports are not acceptable. When the environmental quality limits are exceeded, EPD shall be notified immediately. 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. Please add the "Notify EPD" step into the Event Contingency Plans.	The MTRC will undertake to provide the EPD with notifications of exceedances of the Limit Levels within 72 hours. Details of the follow-up actions will continue to be provided through the regular Monthly Reports. (See *Tables 2.10a* and *3.9a* and *Section 5.6.*)
			Item (vi) - Please add the following three bullets into the complaints handling procedures (ie Section 1.3.11): • if the complaint is transferred from EPD, submit interim report to EPS on status of the complaint investigation and follow-up action within the time frame assigned by EPD;	MTRC will undertake to provide an interim response to the EPD within 72 hours of the receipt of the complaint by the ENM. Full details of the complaint, investigation and subsequent actions will be included in the Monthly Report. (See *Section 1.3.12.*)
			• report the investigation results and the subsequent actions to the source of complaint for responding to complainant (If the source of complaint is EPS, the results should be reported within the time frame assigned by EPD.);	See above.
			• record the complaint, investigation, the subsequent actions and the results in the monthly EM&A reports.	See above.

No.	Department	Reference	Comments	Consultants' Response
			Item (ix) - See my comment on item (ii) above. Please revise Section 5.6 of QBR and Section 6.6 of TKE to include the notification to EPD.	Both Manuals will be revised accordingly.
			Item (x) - Both QBR and TKE will involve substantial construction works in urban area and the 1-hour TSP monitoring results are particularly good indicators representing the construction dust impacts to the sensitive receivers. Therefore, regular 1-hour TSP monitoring shall be conducted.	As agreed at the Meeting between T Tsang & A Tang of EPD, G Frommer of MTRC and J Cawley of ERM at the EPD offices on 15 May 1997, 1-hour dust monitoring will not be undertaken. Instead, the staff resources that would have been required for 1-hour monitoring will be utilised to provide more frequent visual inspections of all the sites to prevent the failure of mitigation measures with a quicker and more flexible response to the checking of dusty activities. The underlined amended text (*Section 2.8.3*) is enclosed.
			Item (xii) - See my comment on item (x). The sampling frequency for 1-hour TSP monitoring should be included in Section 2.8.	Please see previous comment.
			I also refer to your revised noise and air quality monitoring locations. On the understanding that one marked location represent both noise and air monitoring stations, I have no problem with the proposed locations in Quarry Bay and North Point. However, in Fortress Hill, a monitoring location should be placed at the Kingsfield Garden as previously proposed in the EM&A manual. For the Pak Fuk Road site, an additional monitoring location should be placed at the Teaching Centre facing the worksite. The marked-up figures are enclosed for your easy reference.	Monitoring locations have been revised as advised, copies of the relevant *Figures* are enclosed.

C1365/RTC/jkc/63009
11 June 1997

Response to Comments
TKE/QBR EM&A - Dust Monitoring and Reporting

No.	Department	Reference	Comments	Consultants' Response
1.	EPD/Alex HK Tang/ 27 May 97	An(5) to EP1/G/72 VIII	I refer to your above referenced fax dated 19.5.97 and your subsequent faxes dated 21.5.97 & 22.5.97 regarding the responses to our comments on the captioned EM&A manuals. I still have the following comments: Item (i) - It is clearly stated in para. 2.8.3 that ET will undertake site inspection and check whether the mitigation measures are properly implemented. Therefore, the 1st bullet in para. 1.4.3 (ER's responsibilities) should be put under 1.4.4 (ET's responsibilities).	The overall responsibility for the site inspections lies with the ER, therefore, his responsibilities are correctly detailed. The ET will undertake the site inspections and the fifth bullet point in S.1.4.4 will be amended to read "the undertaking of site inspections and environmental monitoring at the agreed locations;"
			Item (ii) - At the meeting on 15.5.97, we only agreed that reporting of noise exceedance in North Point Sites before the enclosures were in place and after their demolition could be made on every third day in view of the MTRC's concerns about the anticipated noise exceedance during that periods. However, other than this exceptional situation, EPD will be notified as in prevailing way (ie within 24 hours) for exceedances. Also, 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. Please revise the EM&A manuals accordingly.	The MTRC have undertaken to advise the EPD of all exceedances within 72 hours and to report all follow-up actions in the Monthly Reports. At the meeting on 15 May is was clearly stated by the MTRC that opportunities to improve reporting through the development of an electronic system were under consideration but that the system was still under development and the Corporation could not commit to any unproven system. *It has subsequently been agreed that the EPD will be advised of exceedances within 24 hours.*
			Item (vi) - Your response is not acceptable, MTRC agreed at the meeting on 15.5.07 to provide "interim report" to EPD within 72 hours if the complaint is transferred from EPD. The interim report should include the status of the complaint investigation and follow-up action. Please add the three bullets, as stipulated in my previous comments, into the complaint handling procedures (ie Section 1.3.11).	As stated at the meeting on 15 May, the MTRC will use it's established complaints procedure to deal with all complaints received which may relate to the QBR. In addition, they have also undertaken to respond to any complaint from the EPD within 72 hours and provide them with all relevant information at that time. In order to clarify the wording of the EM&A Manual, the word "response" will be replaced with "report".
			Item (ix) - See my comment on item (ii) above and revise Section 5.6 of QBR and Section 6.6 of TKE accordingly.	Please see our previous response.

No.	Department	Reference	Comments	Consultants' Response
			Item (x) - Please note that we only agreed at the meeting to consider your written proposal for the replacement of the 1-hour TSP monitoring. I am seeking advice from my colleagues in EM&A sections to consider your justification and will provide our views to you in due course.	Noted.
			Item (xii) - See my comments in item (x).	Please see our previous response.
2.	EPD/ Alex H K Tang/ 2 June 1997	An(5) to EP1/G/72 VII	I refer to your above referenced fax dated 22.5.97. In my previous letter dated 27.5.97, I agreed to provide our views on the 1-hour TSP monitoring issue separately. I am now writing to advise you that your proposal of replacing the 1-hour TSP monitoring by intensified site inspections is acceptable subject to: (i) the frequency and intensity of site inspections are well defined and accepted by us; (ii) observations during site inspections and any subsequent follow-up action are properly reported. I also understood that the 1-hour TSP monitoring will be undertaken when there is any compliant or exceedance of 24-hour TSP limit level. Would you please propose the frequency and intensity of site inspections for our agreement and amend relevant sections of the EM&A manuals accordingly.	The details of the frequency and intensity of the site inspections can only be determined once the Environmental Management Plan has been submitted by the Contractor. Once this is available the EM&A Manual can be updated accordingly.