KCRC GSA-021

LIGHT RAIL TRANSIT ALTERATIONS EIA

Final EM&A Manual

Tin Shui Wai Phase 4 Rail Extension

Ove Arup & Partners Hong Kong Ltd

ARUP

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1 INTRODUCTION

1.1 Purpose of the Manual

1.1.1.1 The purpose of this Environmental Monitoring and Audit (EM&A) Manual is to guide the setup of an EM&A programme to ensure compliance with the Environmental Impact Assessment (EIA) study recommendations, to assess the effectiveness of the recommended mitigation measures, and to identify any further need for additional mitigation measures or remedial action.

1.1.1.2 This Manual outlines the monitoring and audit programme to be undertaken for the construction of Tin Shui Wai Phase 4 Rail Extension. It aims to provide systematic procedures for monitoring, auditing and minimising of the environmental impacts associated with the construction and operational activities.

1.1.1.3 Relevant information in the Hong Kong environmental regulations, EPD's generic EM&A manual, and recommendations in the EIA study report on Tin Shui Wai Phase 4 Rail Extension have been used to set up this Manual.

1.1.1.4 This Manual contains the following :

a) Responsibilities of the Contractor, the Engineer or Engineer's Representative (ER), Environmental Team (ET) with respect to the environmental monitoring and audit (EM&A) requirements during construction;

b) Information on project organization and programming of construction activities for the project;

c) Requirements with respect to the construction schedule and the necessary environmental monitoring and audit programme to track the varying environmental impact;

d) Full details of the methodologies to be adopted, including all field, laboratory and analytical procedures, and details on quality assurance;

e) Definition of Action and Limit levels;

f) Establishment of event and action plans;

g) Requirements of reviewing pollution sources and working procedures required in the event of non-compliance of the environmental criteria and complaints;

h) Requirements for review of EIA predictions, implementation of mitigation measures, and the effectiveness of the environmental protection and pollution control measures adopted;

i) Requirements of the Environmental Management Plan for Contractor; and

j) Requirements of presentation of environmental monitoring and audit data and appropriate reporting procedures.

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

1.2 Background

1.2.1.1 The existing Light Rail (LR) system was introduced to serve residents of Tuen Mun and Yuen Long in September 1988 with an initial network of 24km, 6 routes and 41 stops. To cater for the continual development and population growth of the Northwest New Territories, the LR had further expanded in Tuen Mun and Tin Shui Wai in stages since early 1990s. In March 1995, Phase 3 of Tin Shui Wai Extension, the last portion of the existing LR extension works, was put into passenger service. The whole LR network now comprises 32 km of double track, 8 routes and 57 stops. The average daily patronage in 1998 was 350,000, including 37,000 on LR feeder bus.

1.2.1.2 The proposed light railway extension starts from the West Rail Tin Shui Wai (TIS) Station, runs across Tin Fuk Road at Junction C and extends along Tin Shing Road to Stop 500 at Tin Wing Road. The proposed alignment is approximately 1.5km and has 5 stops. Rectifier station R14 is located about 70m to the east of Junction C. The project site is shown in Appendix 1.

1.2.1.3 The track in Tin Shui Wai Phase 4 is on ballast and at-grade for most of the sections, except on the concrete viaduct across Junction C (i.e. the junction between Tin Fuk Road and Tin Shing Road). Direct fixation will be used in the concrete viaduct.

1.2.1.4 Most of the nearby residential buildings are 30 – 40 storeys high and with openable windows. Commercial buildings are provided with sealed glazing. Some of the schools are provided with air conditioning. A detailed description of these developments is given in Appendix 2 of the main EIA report. A summary of the nearest developments is listed in Table 1.1:

Road	Developments along alignment
Tin Fuk Road	• Residential blocks (e.g. Tin Yiu Estate) • Schools (e.g. QE School Old Student's Association Primary School)
Tin Shing Road	• Residential blocks (e.g. Tin Yiu Estate, Kingswood Villa) • Schools (e.g. Tin Shui Wai Catholic Primary School) • Commercial buildings • Parks (e.g. Tin Shui Wai Park)

Table 1.1 : Summary of Developments along Alignment

1.3 Description of EIA Study

1.3.1.1 Ove Arup & Partners (OAP) was commissioned by Kowloon Canton Railway Corporation (KCRC) as the EIA Consultant for the Light Rail Transit (LRT) works for Tin Shui Wai Phase 4 Extension.

1.3.1.2 An application (No EAB-17/1998) for an EIA study brief under section 5(1) of the Environmental Impact Assessment (EIAO) was submitted by KCR on 19 October 1998 with a project profile (No. PP-026/1998). The project profile covers a designated project under the EIAO by virtue of the Section A.2 of the Schedule 2, Part 1 of the EIAO. Pursuant to section 5(7)(a) of EIAO, EPD issued a study brief (ref: EIA Study Brief No: ESB-017/1998) to KCR to conduct the necessary EIA study. An Environmental Monitoring and Audit Manual is therefore produced as part of the Study Brief requirement.

1.4 Environmental Monitoring & Audit Requirements

Detailed EIA assessment has been reported in the Final EIA report. A summary of the recommendation and the implementation schedule is attached in Appendix 2 for reference.

1.5 Project Organisation

For the LRT alteration projects, an organisation consisting of Environmental Manger (EM), Contractor's Environmental Team (ET), Engineer's Representative (ER) and Contractor should be formed to take the responsibilities of the environmental protection matters. The project organisation and lines of communication with respect to environmental protection works are shown in Figure 1.1. The responsibilities of respective parties are detailed in the following sub-sections.

1.5.1 Environmental Manager

The Environmental Manager is responsible for:

- The broad supervision of the EM&A Study Programme, its members and the timely production and quality of outputs;
- Provide guidance to KCRC personnel in their dealings with the Contractor's Environmental Team; and
- Meeting the agreed objectives and deadlines as set out in this Manual.

1.5.2 Contractor's Environmental Team

The duties of the Contractor's Environmental Team are:

- To monitor the various environmental parameters as required by this EM&A Manual;
- To follow up and close out of the non-compliance actions;
- To investigate and audit the Contractor's equipment and work methodologies with respect to pollution control and environmental mitigation and to anticipate environmental issues that may require mitigation before the problem arises;
- To audit and prepare audit reports on the environmental monitoring data and the site environmental conditions; and
- To report the environmental monitoring and audit results to the Contractor and the Engineer.

1.5.3 Engineer/Engineer's Representative

The Engineer's Representative (ER), shall appoint an appropriate member of the resident site staff, who shall:

- Monitor the Contractor's compliance with contract specifications, including the effective implementation and operation of the environmental mitigation measures;
- Instruct the Contractor to follow the agreed protocols or those in the Contract Specifications in the event of exceedances or complaints; and
- Comply with the agreed Event Contingency Plan in the event of any exceedance.

1.5.4 Contractor

Employ an Environmental Team (ET) to undertake monitoring, laboratory analysis and reporting of EM&A:

- Work within the scope of the construction contract and other tender conditions with respect to environmental requirements; and
- Operate and strictly adhere to the guidelines of the Environmental Management Plan (EMP) developed by their project staff.

1.6 Construction Programme

1.6.1.1 It is planned to start the construction work by late 2000. The construction period would last for approximately for 3 years and would overlap with the construction work for the section of West Rail near Tin Shui Wai.

1.6.1.2 The tentative works programme for the project is to be finalised by Detailed Design Consultant. The ET Leader shall make reference to the actual works progress and programme during the construction stage to schedule the EM&A works, and the Contractor shall provide the respective information to the ET Leader for formulating the EM&A schedule.

1.7 Structure of the EM&A Manual

The structure of this EIA report is outlined below for easy reference:

Section	Title	Aims
1	Introduction	An introduction of the background information and the layout of the EM&A Manual
2	Air Quality	Outline the requirements, methodology, equipment, monitoring locations, criteria for dust monitoring
3	Noise	Outline the requirements, methodology, equipment, monitoring locations, criteria for noise monitoring
4	Water Quality	Outline the requirements, methodology, equipment, monitoring locations, criteria for water quality monitoring
5	Waste Management	List the information reviewed in this EIA study
6	Landscape and Visual Impact	List the information reviewed in this EIA study
7	Heritage Resources	List the information reviewed in this EIA study
8	EMS Requirement	Present recommendations for EMS requirement
9	Site Environmental Audit	Present the requirement and recommendations for site environmental audit
10	Reporting	Present the requirement and recommendations for reporting

Appendices	Description
1	Site Plan
2	Implementation Schedule
3	Sample Data Sheets of Monitoring
4	Proposed Monitoring Locations

2 AIR QUALITY

2.1 Air Quality Monitoring Requirements

In this section, the requirements, methodology, equipment, monitoring locations, criteria and protocols for the monitoring and audit of air quality impacts during the construction of the Project are presented.

2.2 Air Quality Parameters

2.2.1.1 Monitoring and audit of the Total Suspended Particulate (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.

2.2.1.2 1-hour and 24-hour TSP levels should be measured to indicate the impacts of construction dust on air quality. The TSP levels shall be measured by following the standard high volume sampling method as set out in the Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B. Upon approval by the ER, 1-hour TSP levels can be measured by direct reading methods which are capable of producing comparable results as that by the high volume sampling method, to indicate short event impacts.

2.2.1.3 All relevant data including temperature, pressure, weather conditions, elapsed-time meter reading for the start and stop of the sampler, identification and weight of the filter paper, and other special phenomena and work progress of the concerned site etc. shall be recorded down in details. A sample data sheet is shown in Appendix 3.

2.3 Monitoring Equipment

2.3.1.1 High volume sampler (HVS) in compliance with the following specifications shall be used for carrying out the 1-hr and 24-hr TSP monitoring:

a) 0.6-1.7 m^3/min (20-60 SCFM) adjustable flow range;

b) equipped with a timing/control device with +/- 5 minutes accuracy for 24 hours operation;

c) installed with elapsed-time meter with +/- 2 minutes accuracy for 24 hours operation;

d) capable of providing a minimum exposed area of 406 cm^2 (63 in^2);

e) flow control accuracy: +/- 2.5% deviation over 24-hr sampling period;

f) equipped with a shelter to protect the filter and sampler;

g) incorporated with an electronic mass flow rate controller or other equivalent devices;

h) equipped with a flow recorder for continuous monitoring;

i) provided with a peaked roof inlet;

j) incorporated with a manometer;

k) able to hold and seal the filter paper to the sampler housing at horizontal position;

l) easy to change the filter; and

m) capable of operating continuously for 24-hr period.

2.3.1.2 The ET Leader is responsible for provision of the monitoring equipment. He shall ensure that sufficient number of HVSs with an appropriate calibration kit are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. The HVSs shall be equipped with an electronic mass flow controller and be calibrated against a traceable standard at regular intervals. All the equipment, calibration kit, filter papers, etc. shall be clearly labeled.

2.3.1.3 Initial calibration of dust monitoring equipment shall be conducted upon installation and thereafter at bi-monthly intervals. The transfer standard shall be traceable to the internationally recognised primary standard and be calibrated annually. The calibration data shall be properly documented for future reference. All the data should be converted into standard temperature and pressure condition.

2.3.1.4 The flow-rate of the sampler before and after the sampling exercise with the filter in position shall be verified to be constant and be recorded down in the data sheet as mentioned in Appendix 3.

2.3.1.5 If the ET Leader proposes to use a direct reading dust meter to measure 1-hr TSP levels, he shall submit sufficient information to the ER to prove that the instrument is capable of achieving a comparable result as that the HVS and may be used for the 1-hr sampling. The instrument should also be calibrated regularly, and the 1-hr sampling shall be determined periodically by HVS to check the validity and accuracy of the results measured by direct reading method.

2.3.1.6 Wind data monitoring equipment shall also be provided and set up at conspicuous locations for logging wind speed and wind direction near to the dust monitoring locations. The equipment installation location shall be proposed by the ET Leader and agreed with the ER. For installation and operation of wind data monitoring equipment, the following points shall be observed:

a) the wind sensors should be installed on masts at an elevated level 10m above ground so that they are clear of obstructions or turbulence caused by the buildings;

b) the wind data should be captured by a data logger and to be downloaded for processing at least once a month;

c) the wind data monitoring equipment should be re-calibrated at least once every six months; and

d) wind direction should be divided into 16 sectors of 22.5 degrees each.

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

2.4 Laboratory Measurement/Analysis

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

2.4.1.2 If a site laboratory is set up or a non-HOKLAS accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment shall be approved by the ER and the measurement procedures shall be witnessed by the ER. The ET Leader shall provide the ER with one copy of the Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B for his reference.

2.4.1.3 Filter paper of size 8"x10" shall be labeled before sampling. It shall be a clean filter paper with no pin holes, and shall be conditioned in a humidity controlled chamber for over 24-hr and be pre-weighed before use for the sampling.

2.4.1.4 After sampling, the filter paper loaded with dust shall be kept in a clean and tightly sealed plastic bag. The filter paper is then returned to the laboratory for reconditioning in the humidity controlled chamber followed by accurate weighing by an electronic

balance with a readout down to 0.1 mg. The balance shall be regularly calibrated against a traceable standard.

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

2.5 Monitoring Locations

2.5.1.1 The dust monitoring locations are shown in Appendix 4. The status and locations of dust sensitive receivers may change after issuing this manual. If such cases exist, the ET Leader shall propose updated monitoring locations and seek approval from ER and agreement from EPD on the proposal.

ASR ID	Figure Number in Appendix 4	Description
MA2	GSA021/03/D03/001	Yiu Foo House, Tin Yiu Estate
MA6	GSA021/03/D03/001	TWGH's Kwok Yat Wai College
MA10	GSA021/03/D03/002	Yau Hong House
MA15	GSA021/03/D03/002	The Church of Christ In China Hong Kong Council Fong Yan Wah school
MA33	GSA021/03/D03/004	Queen Elizabeth School Old Student's Association Secondary School

Table 2.1: Description of Air Monitoring Locations

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

a) at the site boundary or such locations close to the major dust emission source;

b) close to the sensitive receptors; and

c) take into account the prevailing meteorological conditions.

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

a) a horizontal platform with appropriate support to secure the samplers against gusty wind should be provided;

b) no two samplers should be placed less than 2 meter apart;

c) the distance between the sampler and an obstacle, such as buildings, must be at least twice the height that the obstacle protrudes above the sampler;

d) a minimum of 2 metres separation from walls, parapets and penthouses is required for rooftop samplers;

e) a minimum of 2 metres separation from any supporting structure, measured horizontally is required;

f) no furnace or incinerator flue is nearby;

g) airflow around the sampler is unrestricted;

h) the sampler is more than 20 metres from the drip-line;

i) any wire fence and gate, to protect the sampler, should not cause any obstruction during monitoring;

j) permission must be obtained to set up the samplers and to obtain access to the monitoring stations; and

k) a secured supply of electricity is needed to operate the samplers.

2.6 Baseline Monitoring

2.6.1.1 The ET Leader shall carry out baseline monitoring at all of the designated monitoring locations for at least 14 consecutive days prior to the commencement of the construction works to obtain daily 24-hr TSP samples. 1-hour sampling shall also be done at least 3 times per day while the highest dust impact is expected.

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

2.6.1.3 In case the baseline monitoring cannot be carried out at the designated monitoring locations during the baseline monitoring period, the ET Leader shall carry out the monitoring at alternative locations which can effectively represent the baseline conditions at the impact monitoring locations. The alternative baseline monitoring locations shall be approved by the ER and agreed with EPD.

2.6.1.4 In exceptional case, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall liaise with EPD to agree on an appropriate set of data to be used as a baseline reference and submit to ER for approval.

2.6.1.5 Ambient conditions may vary seasonally and shall be reviewed at every three months. If the ET Leader considers that the ambient conditions have been changed and a repeat

of the baseline monitoring is required to be carried out for obtaining the updated baseline levels, the monitoring should be at times when the contractor's activities are not generating dust, at least in the proximity of the monitoring stations. Should change in ambient conditions be determined, the baseline levels and, in turn, the air quality criteria, should be revised. The revised baseline levels and air quality criteria should be agreed with EPD.

2.7 Impact Monitoring

2.7.1.1 The ET Leader shall carry out impact monitoring during the course of the Works. For regular impact monitoring, the sampling frequency of at least once in every six-days, shall be strictly observed at all the monitoring stations for 24-hr TSP monitoring. For 1-hr TSP monitoring, the sampling frequency of at least three times in every six-days should be undertaken when the highest dust impact occurs.

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

2.7.1.3 In case of non-compliance with the air quality criteria, more frequent monitoring exercise, as specified in the Action Plan in Section 2.8, shall be conducted within 24 hours after the result is obtained. This additional monitoring shall be continued until the excessive dust emission or the deterioration in air quality is rectified.

2.8 Event and Action Plan For Air Quality

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

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

Table 2.2 Action and Limit Levels for Air Quality

EVENT	ACTION		
	ET	ER	CONTRACTOR
ACTION LEVEL			
1. Exceedance for one sample	*1. Identify source* *2. Inform ER* *3. Repeat measurement to confirm findings* *4. Increase monitoring frequency to daily*	*1. Notify Contractor* *2. Check monitoring data and Contractor's working methods*	*1. Rectify any unacceptable practice* *2. Amend working methods if appropriate*
2. Exceedance for two or more consecutive samples	*1. Identify source* *2. Inform ER* *3. Repeat measurements to confirm findings* *4. Increase monitoring frequency to daily* *5. Discuss with ER for remedial actions required* *6. If exceedance continues, arrange meeting with ER* *7. If exceedance stops, cease additional monitoring*	*1. Confirm receipt of notification of failure in writing* *2. Notify Contractor* *3. Check monitoring data and Contractor's working methods* *4. Discuss with Environmental Supervisor and Contractor on potential remedial actions* *5. Ensure remedial actions properly implemented*	*1. Submit proposals for remedial actions to ER within 3 working days of notification* *2. Implement the agreed proposals* *3. Amend proposal if appropriate*

EVENT	ACTION		
	ET	ER	CONTRACTOR
LIMIT LEVEL			
1.Exceedance for one sample	*1. Identify source* *2. Inform ER and EPD* *3. Repeat measurement to confirm findings* *4. Increase monitoring frequency to daily* *5. Assess effectiveness of Contractor's remedial actions and keep EPD and ER informed of the results*	*1. Confirm receipt of notification of failure in writing* *2. Notify Contractor* *3. Check monitoring data and Contractor's working methods* *4. Discuss with Environmental Team Leader and Contractor potential remedial actions* *5. Ensure remedial actions properly implemented*	*1. Take immediate action to avoid further exceedance* *2. Submit proposals for remedial actions to ER within 3 working days of notification* *3. Implement the agreed proposals* *4. Amend proposal if appropriate*
2.Exceedance for two or more consecutive samples	*1. Identify source* *2. Inform ER and EPD the causes & actions taken for the exceedances* *3. Repeat measurement to confirm findings* *4. Increase monitoring frequency to daily* *5. Investigate the causes of exceedance* *6. Arrange meeting with EPD and ER to discuss the remedial actions to be taken* *7. Assess effectiveness of Contractor's remedial actions and keep EPD and ER informed of the results* *8. If exceedance stops, cease additional monitoring*	*1. Confirm receipt of notification of failure in writing* *2. Notify Contractor* *3. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented* *4. Discuss amongst Environmental Team Leader and the Contractor potential remedial actions* *5. Review Contractor's remedial actions whenever necessary to assure their effectiveness* *6. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated*	*1. Take immediate action to avoid further exceedance* *2. Submit proposals for remedial actions to ER within 3 working days of notification* *3. Implement the agreed proposals* *4. Resubmit proposals if problem still not under control* *5. Stop the relevant portion of works as determined by the ER until the exceedance is abated*

Table 2.3 Event/Action Plan for Air Quality

2.9 Dust Mitigation Measures

2.9.1.1 The EIA report has recommended dust control and mitigation measures. The Contractor shall be responsible for the design and implementation of these measures:

a) Use of regular watering to reduce dust from exposed site surfaces, at least twice daily with complete coverage, particularly during dry weather;

b) Use of frequent watering for particular dusty operation at site close to the site boundary and sensitive receivers;

c) Use of side enclosure and covering of any aggregate or dusty material storage to reduce emission. Where it is impracticable owing to frequent access and usage, watering should be adopted to reduce the fugitive emission. Open stockpiles should be avoided, covered or placed far away from sensitive receivers;

d) Use of movable barrier between the site and air sensitive receiver;

e) Use of tarpaulin to cover all dusty loads for vehicle transported to, from and between different sites;

f) Use of vehicle wheel and body washing facilities at the site exit point;

g) Use of wind shield and dust extractor at the loading and unloading point;

h) Use of speed control for vehicles on dusty site area.

2.9.1.2 If the above measures are not sufficient to restore the air quality to acceptable levels upon the advice of ET Leader, the Contractor shall liaise with the ET Leader on some other mitigation measures, propose to ER for approval, and implement the mitigation measures.

3 NOISE

3.1 Noise Monitoring Requirement

In this section, the requirements, methodology, equipment, monitoring locations, criteria and protocols for the monitoring and audit of noise impacts during the construction of the Project are presented.

3.2 Noise Parameters

3.2.1.1 The construction noise level shall be measured in terms of the A-weighted equivalent continuous sound pressure level (Leq). $Leq_{(30\ min)}$ shall be used as the monitoring parameter for the time period between 0700-1900 hours on normal weekdays. For all other time periods, $Leq_{(5\ min)}$ shall be employed for comparison with the NCO criteria.

3.2.1.2 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 Appendix 3 for reference.

3.3 Monitoring Equipment

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

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

3.3.1.3 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 labeled.

3.4 Monitoring Locations

3.4.1.1 The noise monitoring locations are shown in Appendix 4 and Table 3.1. The status and locations of noise sensitive receivers may change after issuing this manual. If such cases exist, the ET Leader shall propose updated monitoring locations and seek approval from ER and agreement from EPD of the proposal.

NSR ID	Figure Number in Appendix 4	Description
MN6	GSA021/03/D03/001	TWGH's Kwok Yat Wai College
MN10	GSA021/03/D03/002	Yau Hong House
MN15	GSA021/03/D03/002	The Church of Christ In China Hong Kong Council Fong Yan Wah school
MN33	GSA021/03/D03/004	Queen Elizabeth School Old Student's Association Secondary School

Table 3.1: Description of Noise Monitoring Locations

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

a) at locations close to the major site activities which are likely to have noise impacts;

b) close to the noise sensitive receivers (N.B. For the purposes of this section, any domestic premises, hotel, hostel, temporary housing accommodation, hospital, medical clinic, educational institution, place of public worship, library, court of law, performing art centre should be considered as noise sensitive receiver); and

c) for monitoring locations located in the vicinity of the sensitive receivers, care should be taken to cause minimal disturbance to the occupants during monitoring.

3.4.1.3 The monitoring station shall normally be at a point 1m from the exterior of the sensitive receivers building facade and be at a position 1.2m above the ground. If there is problem with access to the normal monitoring position, an alternative position may be chosen, and a correction to the measurements shall be made. For reference, a correction of +3dB(A) shall be made to the free field measurements. The ET Leader

shall agree with the ER on the monitoring position and the corrections adopted. Once the positions for the monitoring stations are chosen, the baseline monitoring and the impact monitoring shall be carried out at the same positions.

3.5 Baseline Monitoring

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

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

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

3.6 Impact Monitoring

3.6.1.1 During normal construction working hour (0700-1900 Monday to Saturday), monitoring of $L_{Aeq,\ 30min}$ noise levels (as six consecutive $L_{Aeq,\ 5min}$ readings) shall be carried out at the agreed monitoring locations once every week in accordance with the methodology in the TM. If restricted hours works are undertaken, monitoring of $L_{Aeq,15min}$ noise levels (as three consecutive $L_{Aeq,\ 5min}$ readings shall be carried out at the agreed monitoring stations at the same frequency as specified for normal working hours.

3.6.1.2 In relation to the monitored noise levels, other noise sources such as road traffic may make a significant contribution to the overall noise environment. Therefore, the results of noise monitoring activities will take into account such influencing factors which were not present during the baseline monitoring period. All measurements shall be recorded to the nearest 0.1dB.

3.6.1.3 If a school exists near the construction activity, noise monitoring shall be carried out at the monitoring stations for the schools during the school examination periods. The ET Leader shall liaise with the school's personnel and the Examination Authority to

ascertain the exact dates and times of all examination periods during the course of the contract.

3.6.1.4 In case of non-compliance with the construction noise criteria, more frequent monitoring as specified in the Action Plan in Section 3.7 shall be carried out. This additional monitoring shall be continued until the recorded noise levels are rectified or proved to be irrelevant to the construction activities.

3.7 Event and Action Plan for Noise

The Action and Limit levels for construction noise are defined in Table 3.2. Should non-compliance of the criteria occur, action in accordance with the Action Plan in Table 3.3, shall be carried out.

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

Remarks: ** 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 Action and Limit Levels for Construction Noise

EVENT	ACTION	
	ET Leader or ER	Contractor
Action Level	*1. Notify Contractor* *2. Analyse investigation* *3. Require Contractor to propose measures for the analysed noise problem* *4. Increase monitoring frequency to check mitigation effectiveness*	*1. Submit noise mitigation proposals to Environmental Team Leader/Engineer's Representative* *2. Implement noise mitigation proposals*
Limit Level	*1. Notify Contractor* *2. Notify EPD* *3. Require contractor to implement mitigation measures* *4. Increase monitoring frequency to check mitigation effectiveness*	*1. Implement mitigation measures* *2. Prove to Environmental Team Leader ER effectiveness of measures applied*

Table 3.3 Event/Action Plan for Construction Noise

3.8 Noise Mitigation Measures and Recommendation

3.8.1 Noise Mitigation Measures for Construction Phase

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

a) Using quieter powered mechanical equipment

b) only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme;

c) machines and plant (such as trucks, cranes) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;

d) plant known to emit noise strongly in one direction, where possible, be orientated so that the noise is directed away from nearby NSRs;

e) silencers or mufflers on construction equipment should be properly fitted and maintained during the construction works;

f) mobile plant should be sited as far away from NSRs as possible and practicable;

g) material stockpiles, mobile container site office and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities;

h) A rigorous EM&A programme should be undertaken, and should focus on those NSRs of particular concern, in order to identify and rectify any problems at the earliest possible stage;

i) Construction activities should be programmed so that parallel operation of several sets of equipment close to a given receiver is avoided unless essential. Controlling the hours of working, the duration of working and considering the likely consequences of any lengthening of work periods;

j) Intermittent noisy activities should be scheduled to minimise exposure of nearby NSRs to high levels of construction noise. For example, noisy activities can be scheduled at times when dwellings are likely to be unoccupied. Prolonged operation of noisy equipment close to dwellings should be avoided; and

k) scheduling of construction works outside school examination period to less intrusive periods would definitely reduce the noise impacts on the NSRs.

3.8.1.2 If the above measures are not sufficient to restore the construction noise quality to an acceptable levels upon the advice of ET Leader, the Contractor shall liaise with the ET Leader on some other mitigation measures, propose to ER for approval, and carry out the mitigation measures.

3.8.1.3 Details of implementation schedule for the construction work is presented in the EIA main report.

3.8.2 Recommendations for Operational Phase

3.8.2.1 The findings of operational noise assessments in the EIA indicate that there would not be any adverse impacts on the neighbouring NSRs. It is not required to implement specific noise mitigation measures for the proposed LRT Works. However, the following recommendations should be implemented during the design and operational stages of the proposed works.

- The railway operator should ensure that the worst-case noise level of 65 dB(A) Lmax at 25m from straight and well maintained ballast track is always achieved.
- The Detailed Design Consultant should ensure that the structure re-radiated noise from viaduct structure is at least 10dB(A) below the noise criteria of 65 dB(A) Lmax at 25m, at 50kph.
- The Detailed Design Consultant should ensure that the noise level at 2m from the transformer bays in the rectifier would be less than 66dB(A).
- The Detailed Design Consultant should orientate the open side of transformer bays in rectifier station to face away from the nearest NSRs, and preferably facing onto a main road, if practicable.
- The Detailed Design Consultant should conduct a detailed review on ventilation systems in the rectifier stations to determine the need for any noise attenuation (eg silencers, acoustic louvres etc).

4 WATER QUALITY

4.1 Water Quality Monitoring Requirement

4.1.1.1 In this section, the requirements, methodology, equipment, monitoring locations, criteria and protocols for the monitoring and audit of water quality impacts during the construction of the Project are presented.

4.1.1.2 The EIA assessment has indicated that the nearest water sensitive receivers are Tin Shui Wai Nullah and fish/duck ponds near the southern section of the extension, which are more than 100m away from the construction site. The disturbance to water quality is likely to be temporary and minor. The potential impact will be originated from surface run-off.

4.2 Water Quality Parameters

4.2.1.1 Monitoring of suspended solids (SS) in mg/L shall be carried out by the ET to ensure that any deteriorating water quality could be readily detected and timely action be taken to rectify the situation. SS should be determined in laboratory.

4.2.1.2 A sample monitoring record sheet is shown in Appendix 3 for reference.

4.3 Monitoring Equipment

4.3.1 Suspended Solids

4.3.1.1 A water sampler comprises a transparent PVC cylinder, with a capacity of not less than 2 litres, and can be effectively sealed with latex cups at both ends. The sampler should have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth (e.g. Kahlsico Water Sampler or an approved similar instrument).

4.3.1.2 Water samples for suspended solids measurement should be collected in high density polythene bottles, packed in ice (cooled to 4 degree C without being frozen), and delivered to the laboratory as soon as possible after collection.

4.4 Laboratory Measurement/Analysis

4.4.1.1 Analysis of suspended solids shall be carried out in a HOKLAS or other international accredited laboratory. Water samples of about 500 ml shall be collected at the monitoring stations for carrying out the laboratory SS determination. The SS determination work shall start within 24 hours after collection of the water samples. The SS determination shall follow APHA 19ed 2540D or equivalent methods subject to approval of EPD.

4.4.1.2 If a site laboratory is set up or a non-HOKLAS and non-international accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment, analytical procedures, and quality control shall be approved by the EPD. The ET Leader shall provide the ER with one copy of the relevant chapters of the "Standard Methods for the Examination of Water and Wastewater" updated edition and any other relevant document for his reference.

4.5 Monitoring Locations

The water quality monitoring locations should be set at all discharge points to be determined by the contractors. Due to the nature of work programmes, the discharge points may change from time to time. The actual number of monitoring stations will depend on the number of discharge points at a time. The ET Leader shall propose and update monitoring locations and must seek approval from the EM and EPD.

4.6 Impact Monitoring

During the course of the construction works, water quality monitoring should be carried out at the discharge points once per week. The monitoring parameters should include laboratory analysis for SS.

4.7 Event and Action Plan for Surface Water Quality

4.7.1.1 Any effluent subjected to control by the TM and should therefore be complied with the effluent standard for the coastal waters of Deep Bay Water Control Zone. The key concern is SS with a discharge standard of 50 mg/L for a discharge rate of less than or equal to 1000m^3/day, and 25 mg/L for a discharge rate of more than 1000m^3/day.

4.7.1.2 Should the monitoring results of the water quality parameters at any designated monitoring stations indicate that the water quality criteria are exceeded, the actions in accordance with the Action Plan in Table 4.1 shall be carried out.

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

Event	*ET Leader*	*Contractor*	*ER*
	frequency to daily until no exceedance of Limit level for two consecutive days.	*or to stop all or part of the marine work or construction activities.*	*down or to stop all or part of the construction work until no exceedance of Limit level.*

Table 4.1 Event and Action Plan for Water Quality

4.8 Water Quality Mitigation Measures

4.8.1.1 The EIA report has recommended water quality control and mitigation measures. The Contractor shall be responsible for the design and implementation of these measures.

4.8.1.2 The impacts arisen by the track runoff could be minimised by the adoption of the practices outlined in ProPECC PN1/94 "Construction Site Drainage". Some of the key mitigation measures are listed as follows:

a) Provide a perimeter channels to intercept storm-runoff from the outside site. These should be constructed in advance of earth works;

b) Sand/silt removal facilities such as sand traps, silt traps and sediment basins should be provided and these facilities should be properly and regularly maintained;

c) Careful programming of the works to minimise soil excavation works during rainy seasons;

d) Open stockpiles of construction materials on site should be covered with tarpaulin or similar fabric during rainstorms; and

e) Portable chemical toilets and sewage holding tanks are recommended to handle the construction sewage generated by workers from both the construction areas and dispersed along the alignment. A licensed contractor should provide appropriate and adequate portable toilets and responsible for appropriate disposal and maintenance.

4.8.1.3 If the above measures are not sufficient to restore the water quality to an acceptable levels upon the advice of the ET Leader, the Contractor shall liaise with the ET Leader on some other mitigation measures, propose to ER for approval, and carry out the mitigation measures.

5 WASTE MANAGEMENT

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

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

a) Provide on-site waste separation facilities;

b) Provide storage areas for construction and demolition material;

c) Separate public fill and construction & demolition (C&D) wastes and dispose to appropriate locations;

d) Store chemical waste separately and engage licensed chemical contractors to dispose of the waste; and

e) Provide on-site refuse collection point.

5.1.1.3 The implementation schedule of mitigation measures is presented in Appendix 2.

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

5.1.1.5 During the site inspections and the document review procedures as mentioned in Sections 9 of this manual, the ET Leader shall pay special attention to the issues relating to waste management, and check whether the Contractor has followed the relevant contract specifications and the procedures specified under the laws of Hong Kong.

6 LANDSCAPE AND VISUAL IMPACT

6.1.1.1 The EIA report has identified that the proposed Phase 4 extension will be located in planned reserved constructed as part of the road infrastructure development of the New Town. There will be no disturbance of other land uses or landscape features to construct the LRT extension.

6.1.1.2 The appearance of the extension will be similar to those portions of track already in use throughout Tin Shui Wai. Amenity planning in raised planters flanking the majority of the route will provide safe segregation from road users and pedestrians as well as help screen views from adjacent properties. Landscape and visual impacts will not be anticipated.

6.1.1.3 The landscape and visual mitigation proposals comprise a combination of preventive measures to protect the existing landscape resources, e.g. careful alignment of temporary diversions to avoid mature trees and woodland as well as planting to designated LRT reserves. To ensure these impact mitigation measures are carried out satisfactorily the following environmental monitoring and audit recommendations are proposed.

6.1.1.4 A Landscape Master Plan should be formulated by the Detailed Design Consultant and obtained relevant Government Department approval before construction work commences.

6.1.1.5 Carefully detailing the use of forms, colour and finishes of external appearance of all above-ground structures should be carried out by the Detailed Design Consultant so that they are visually integrated into the surrounding landscape as much as practical.

6.1.1.6 Baseline Survey: To establish an accurate record of the locations of existing mature trees which may be affected by the scheme a detailed tree survey will be carried out covering the designated contract works area. The survey shall comply with the current Government guidelines for tree survey works, i.e. Works Branch Technical Circular No. 24/94. The survey should be carried out at commencement of the detail design stage to permit fine-tuning of temporary track alignments to avoid any unnecessary tree felling. All trees to be retained, transplanted or felled shall be clearly identified on site and on corresponding record survey plans. Tree felling applications shall be made

on the basis of the tree survey to the relevant government departments in advance of any site formation works or felling.

6.1.1.7 Construction Phase Audit: The Contractors should implement tree and shrub planting within the railway reserve to soften the visual impact of the viaduct and make use of climbing plants to soften the appearance of viaduct column. Trees identified for protection or transplanting shall be identified at the outset of the construction contract and all approved protection measures such as hoarding and fencing shall be in place prior to any excavation or site formation works. The tree felling, transplanting, protection and new planting works shall be carried out by a Government approved landscape contractor. Regular monthly site inspections for the duration of the contract shall be made by the Supervising Officer to ensure that all protection measures are well maintained, there is no damage to retained trees and the new planting complies with the design of the landscape mitigation measures.

6.1.1.8 Operation Phase Audit: Upon completion the landscape contractor shall carry out the maintenance and establishment works to all planted areas for the period specified in the landscape contract, i.e. typically 12 months. The maintenance works shall comply strictly with the relevant Government General Specification for Soft Landscape Works. The key tasks to ensure the proper plant establishment will include inter alia:

- Regular watering, weeding and fertilising of all tree planting and areas of grass reinstatement.
- Regular grass cutting for reinstated areas
- Firming up of trees after periods of strong winds
- Regular checks for and eradication of pests, fungal infection etc.
- Pruning of dead or broken branches
- Prompt replacement of dead plants and regrassing of failed areas of grass.

6.1.1.9 The supervising officer will make regular inspections (at intervals specified in the contract) of the planted areas during the establishment period to ensure the intended mitigation of landscape and visual impacts is achieved. That is, the trees planted create the desired screen and where required understorey shrub planting provides a fully vegetated cover to match the original design intention.

7 CULTURAL HERITAGE

7.1.1.1 The proposed new alignment is full within the well-developed area and surrounded by different private and public estate such as Kingswood Villas and TinYiu Estate. In accordance with the AMO's record, a historic building (Deemed Monumnet) named Tsui Shing Lau Pagoda is located at 40 meters south of the proposed new Tin Shui Wai Light Rail/West Rail interchange. This deemed monument was also mentioned in West Rail Final Assessment Report.

7.1.1.2 The impacts caused by the operation and construction of West Rail on the Pagoda has been fully addressed in the West Rail Final Environmental Assessment Report. Given that the vibration caused by LRT would be comparatively less than that from West Rail, it is anticipated that the additional impacts caused by the operation and construction of the proposed LRT works will be insignificant. The mitigation measures to be implemented by the West Rail Contractor is considered to be adequate.

7.1.1.3 The assessment has concluded that the construction and operation of the proposed LRT works would not have adverse impacts on archaeological, cultural and heritage aspects. However, it is still considered necessary for the Contractor to implement the following recommendations (similar to those for West Rail viaduct sections) during the construction phases of the viaduct structures:

a) The Contractor, when conducting the archaeological evaluation during construction phase, should adopt a minimum 5% sampling strategy for the support columns of the viaduct. The selected column footings should be pre-excavated prior to the onset of construction activities in order to retrieve sufficient information to assess the impact of the railway; and

b) If pre-excavation of selected columns is not possible, the mitigation strategy should be the posting of an archaeological watching brief, although the "watch and stop" may have implications on the construction programme of the columns. The watching brief may need to be extended to cover a larger sample if positive results are gained.

c) The archaeological evaluation and watching brief should be conducted by a qualified archaeologist, who should be licensed by the Antiquities Authority before the evaluation or watching brief takes place. This licensing procedure is a statutory

requirement stated in Sections 12 and 13 in the Antiquities and Monuments Ordinance (Cap. 53).

d) The contractor should inform AMO the time schedule of the archaeological evaluation or watching brief and notify AMO two weeks prior to the commencement of the evaluation or watching brief so as to allow AMO to arrange the on-site monitoring.

e) Vibration monitoring of structure at Pagoda in Tin Shui Wai should be conduced during the period of LRT construction works in order to take account of possible adverse cumulative effects on West Rail and LRT projects.

7.1.1.4 The effectiveness of Contractor's implementation and maintenance of this precautionary measure will be monitored as part of the ongoing site audit programme.

8 ENVIRONMENTAL MANAGEMENT SYSTEM REQUIREMENT

8.1 Environmental Management Plans (EMP)

8.1.1.1 For the effective implementation of the mitigation measures, monitoring and remedial requirements presented in the EIA, EM&A and Implementation Schedule (IS), a systematic Environmental Management Plans (EMP) shall be set up by the Contractor. KCRC will audit against the EMP and advise the necessary remedial actions required. These remedial actions shall be enforced by the Engineer through contractual means.

8.1.1.2 The EMP will require the Contractor (together with it's sub-contractors) to define in details how to implement the recommended mitigation measures in order to achieve the environmental performance defined in the Hong Kong Environmental Legislation and the EIA documentation.

8.1.1.3 In the first instance, each Tenderer shall prepare a skeletal EMP for submission as part of the tendering process; the skeletal EMP will demonstrate the determination and commitment of the organisation and indicate how the environmental requirements laid out in the available EIA documentation will be met. It is a clear indication to all Tenderers of the Corporation's commitment to the minimisation and management of environmental impacts. Upon Contract Award, the successful Tenderer shall be required to submit a draft EMP for the approval of the Engineer and a final version prior to the commencement of the works.

8.1.1.4 Under the EMP, the Contractor is recommended to define the significant environmental aspects for each construction activities, identify the legal requirements need to comply with, setup an objective and target in order to achieve the requirements. The environmental management programme shall be formulated. The structure and responsibilities of each operation team leaders shall be identified. Appropriate training shall be provided to both management and working levels in order to meet the specified performance. Channels of communication, document control, operational control and emergency procedure shall be listed out in details in the EMP. The checking and corrective action procedures, together with the Contractor's management review procedure shall be elaborated. This requirement shall be put down as the tender requirement.

8.1.1.5 The environmental performance review programme comprises the regular assessment of the effectiveness of the EMPs. Specifically it shall ensure that the environmental aspects are correctly identified, site practices and procedures are being followed, reliable internal audit work are in placed, and environmental standards are maintained.

8.1.1.6 The criteria against which the reviews will be conducted shall be derived from:

- The approaches, procedures and commitments given by the Contractor in the EMP;
- The clauses contained within the Contractual Documentation; and
- Those parts of the Contractor's Method Statements which relate to the minimisation of environmental impacts

8.1.1.7 The review of on-site environmental performance shall be undertaken by KCRC through a systemic checklist and audit trail once the project commences. Objective evidence shall be inspected in the following areas:

- The identification and evaluation of significant environmental aspects;
- The consequent objectives and targets;
- The performance monitoring, measuring, reporting and review against the objective and targets;
- The effectiveness of the environmental management activities;
- The speed and effectiveness of response to complaints; and
- The way to handle frequent non-compliance.

8.2 Construction Method Statement

In case the Contractor would like to adopt a different construction method or implementation schedule, it is required to submit details of methodology and equipment proposed to use to the Engineer for approval before the commencement of the work. These changes in construction method will need to be reflected in a revised EMP or the Contractor will be required to demonstrate the manner in which the existing EMP should accommodate the proposed changes. For the designated project, a Further Permit from EPD may be necessary from the contractor before commencement of any construction activities.

8.3 Contractual Documentation

8.3.1.1 The EMP places a contractual responsibility for on-site environmental management with the Contractor. The contractual documentation would generally comprise appropriate extracts from the EIA report, EM&A Manual and Environmental Permit.

The typical elements in the relevant statutory environmental standards shall be included in the General Clauses, whereas the site-specific environmental impacts and mitigation measures shall be detailed in the Specific Clauses of the Contract.

8.3.1.2 The contractual documentation shall also define appropriate contractual mechanisms to ensure compliance with environmental requirements. The mechanisms shall include provisions for suspending works pending the remediation of persistent environmental problems. The inclusion of environmental performance milestone payments shall be considered by the Corporation as a means of enhancing the environmental performance and encouraging the Contractor to meet the contractual obligations.

8.4 ISO14001 Environmental Management System Applied to the Future Extension

8.4.1.1 With reference to the available information from LRT, Engineering Department of the KCRC Light Rail Division has been accredited by the Hong Kong Quality Assurance Agency (HKQAA) for the ISO14000 certification. Since November 1988, a systematic Environmental Management System has already been implemented and functioned well for sections including design, repairs and maintenance of rolling stock, infrastructure, buildings, plant and equipment of KCRC's light rail system.

8.4.1.2 KCRC has committed to comply with all the relevant environmental legislation and other KCRC corporate requirements. Significant Environmental Aspects (SEAs) have been identified for both the existing and future operation. Operational noise, water quality impact and waste are items of the SEAs.

8.4.1.3 Objectives and targets have already been formulated to review and control of all the SEAs. These objectives and targets will be strictly applied to the new Tin Shui Wai Phase 4 Extension.

8.4.1.4 Similar to the current system, an environmental management program will be set up. The structure and responsibilities of each operation team leaders will be further elaborated to include the new extension.

8.4.1.5 Appropriate training will be provided to both management and working levels in order to meet the specified performance. Channels of communication, document control, operational control and emergency procedure will be listed out in details in the Environmental Manual and corresponding Operational Instructions.

8.4.1.6 The checking and corrective action procedures will be elaborated in detail to ensure that the operation is conformed to the design specifications. Corrective action and remedial measurement will be taken place to minimise any potential impact.

8.4.1.7 Annual Environmental Review will be carried out by the management board to assess the overall environmental performance.

9 SITE ENVIRONMENTAL AUDIT

9.1 Site Inspection

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

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

9.1.1.3 Regular site inspections shall be carried out at least once per week. The areas of inspection shall not be limited to the environmental situation, pollution control and mitigation measures within the site; it should also review the environmental situation outside the site area which is likely to be affected, directly or indirectly, by the site activities. The ET Leader shall make reference to the following information in conducting the inspection:

a) the EIA recommendations on environmental protection and pollution control mitigation measures;

b) works progress and programme;

c) individual works methodology proposals (which shall include proposal on associated pollution control measures);

d) the contract specifications on environmental protection;

e) the relevant environmental protection and pollution control laws; and

f) previous site inspection results.

9.1.1.4 The Contractor shall update the ET Leader with all relevant information of the construction contract for him to carry out the site inspections. The inspection results and its associated recommendations on improvements to the environmental protection and pollution control works shall be submitted to the ER and the Contractor within 24 hours, for reference and for taking immediate action. The Contractor shall follow the procedures and time-frame as stipulated in the environmental site inspection, deficiency and action reporting system formulated by the ET Leader to report on any remedial measures subsequent to the site inspections.

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

9.2 Compliance with Legal and Contractual Requirement

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

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

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

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

9.2.1.5 After reviewing the document, the ET Leader shall advise the ER and the Contractor of any non-compliance with the contractual and legislative requirements on

environmental protection and pollution control for them to take follow-up actions. If the ET Leader's review concludes that the current status on licence/permit application and any environmental protection and pollution control preparation works may not cope with the works programme or may result in potential violation of environmental protection and pollution control requirements by the works in due course, he shall also advise the Contractor and the ER accordingly.

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

9.3 Environmental Complaints

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

a) log complaint and date of receipt onto the complaint database;

b) investigate the complaint to determine its validity, and to assess whether the source of the problem is due to works activities;

c) if a complaint is valid and due to works, identify mitigation measures;

d) if mitigation measures are required, advise the Contractor accordingly;

e) review the Contractor's response on the identified mitigation measures, and the updated situation;

f) if the complaint is transferred from EPD, submit interim report to EPD on status of the complaint investigation and follow-up action within the time frame assigned by EPD;

g) undertake additional monitoring and audit to verify the situation if necessary, and review that any valid reason for complaint does not recur;

h) report the investigation results and the subsequent actions to the source of complaint for responding to complainant (If the source of complaint is EPD, the results should be reported within the time frame assigned by EPD); and

i) record the complaint, investigation, the subsequent actions and the results in the monthly EM&A reports.

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

9.3.1.3 A flow chart of the complaint response procedures is shown in Figure 9.1.

10 REPORTING

10.1 General

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

10.2 Baseline Monitoring Report

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

10.2.1.2 The baseline monitoring report shall include at least the following:

a) up to half a page executive summary;

b) brief project background information;

c) drawings showing locations of the baseline monitoring stations;

d) monitoring results (in both hard and diskette copies) together with the following information:
   - monitoring methodology
   - equipment used and calibration details
   - parameters monitored
   - monitoring locations (and depth)
   - monitoring date, time, frequency and duration

e) details on influencing factors, including:
   - major activities, if any, being carried out on the site during the period
   - weather conditions during the period

- other factors which might affect the results

f) determination of the Action and Limit Levels for each monitoring parameter and statistical analysis of the baseline data;

g) revisions for inclusion in the EM&A Manual; and

h) comments and conclusions.

10.3 Monthly EM&A Reports

10.3.1.1 The results and findings of all EM&A work required in the Manual shall be recorded in the monthly EM&A reports prepared by the ET Leader. The EM&A report shall be prepared and submitted within 10 working days of the end of each reporting month, with the first report due in the month after construction commences. A maximum of 4 copies of each monthly EM&A report shall be submitted to each of the three parties: the Contractor, the ER and the EPD. Before submission of the first EM&A report, the ET Leader shall liaise with the parties on the exact number of copies and format of the monthly reports in both hard copy and electronic medium requirement.

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

10.3.2 First Monthly EM&A Report

10.3.2.1 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, summarized 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
- any other factors which might affect the monitoring results;

h) advice on the solid and liquid waste management status;

i) 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.

10.3.3 Subsequent EM&A Reports

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

a) Title Page;

b) Executive Summary (1-2 pages)

- Breaches of AL levels
- Complaint Log
- Reporting Changes

- Future key issues;

c) Contents Page;

d) Environmental Status
   - Drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations
   - Summary of non-compliance with the environmental quality performance limits
   - Summary of complaints;

e) Environmental Issues and Actions
   - Review issues carried forward and any follow-up procedures related to earlier non-compliance (complaints and deficiencies)
   - Description of the actions taken in the event of noncompliance and deficiency reporting
   - Recommendations (should be specific and target the appropriate party for action)
   - Implementation status of the mitigation measures and the corresponding effectiveness of the measures;

f) Future Key Issues; and

g) Appendix;
   - AL levels
   - Graphical plots of trends of monitored parameters at key stations over the past four reporting periods for representative monitoring stations annotated against the following:
     i) major activities being carried out on site during the period
     ii) weather conditions during the period
     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

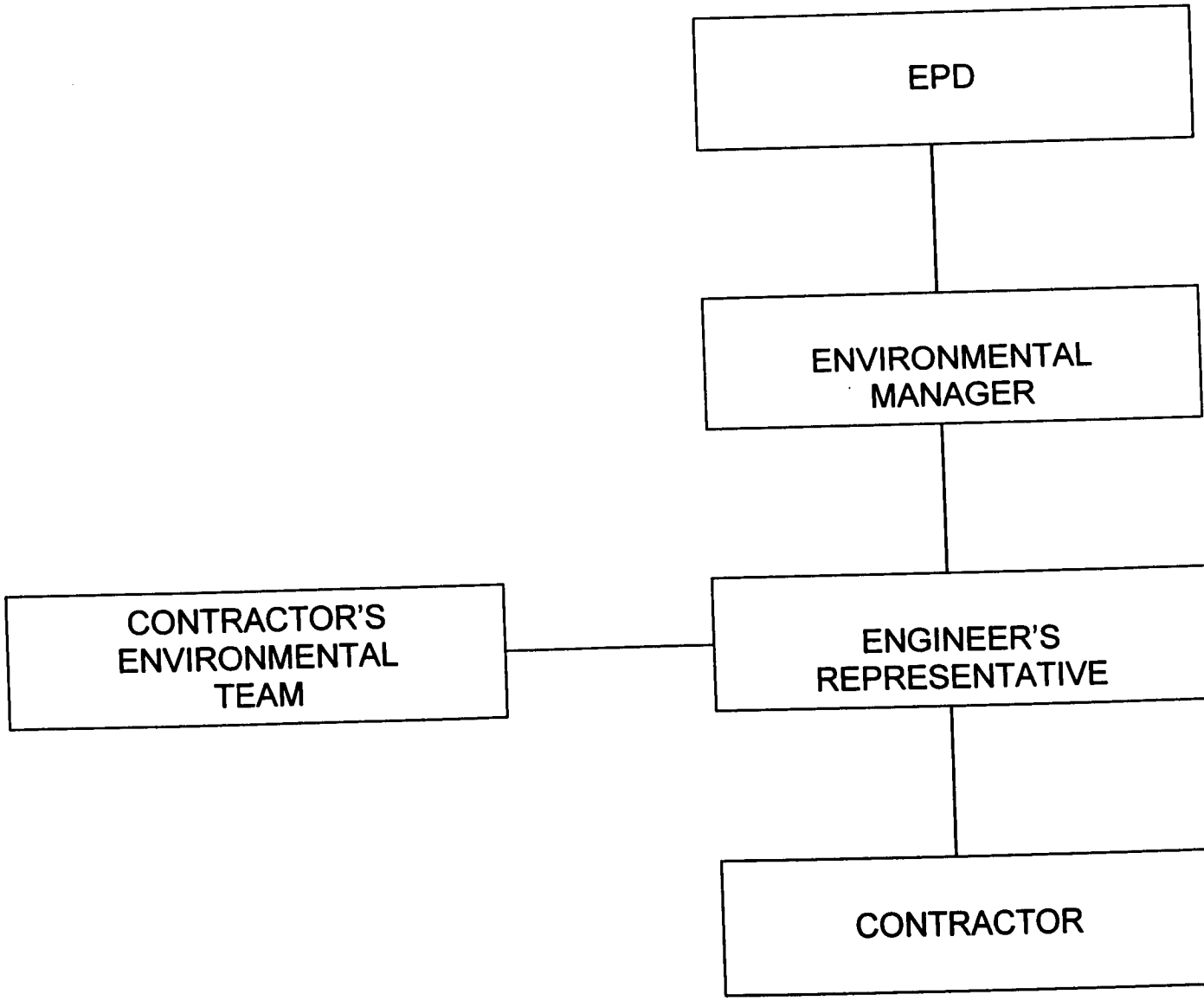
10.4 Data Keeping

The site document such as the monitoring field records, laboratory analysis records, site inspection forms, etc. are not required to be included in the monthly EM&A reports for submission. However, the document shall be well kept by the ET Leader and be ready for inspection upon request. All relevant information shall be clearly and systematically recorded in the document. The monitoring data shall also be recorded

in magnetic media form, and the software copy can be available upon request. The water quality data software format shall be agreed with EPD. All the documents and data shall be kept for at least one year after completion of the construction contract.

10.5 Interim Notification of Environmental Quality Limit Exceedances

With reference to Event/Action Plans in Tables 2.3, 3.3 and 4.1, when the environmental quality limits are exceeded, the ET Leader shall immediately notify the ER & EPD, as appropriate. The notification shall be followed up with advice to EPD on the results of the investigation, the proposed action and any necessary follow-up proposals in case of exceedance. A sample template for the interim notifications is shown in Appendix 3.



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Project Organisation

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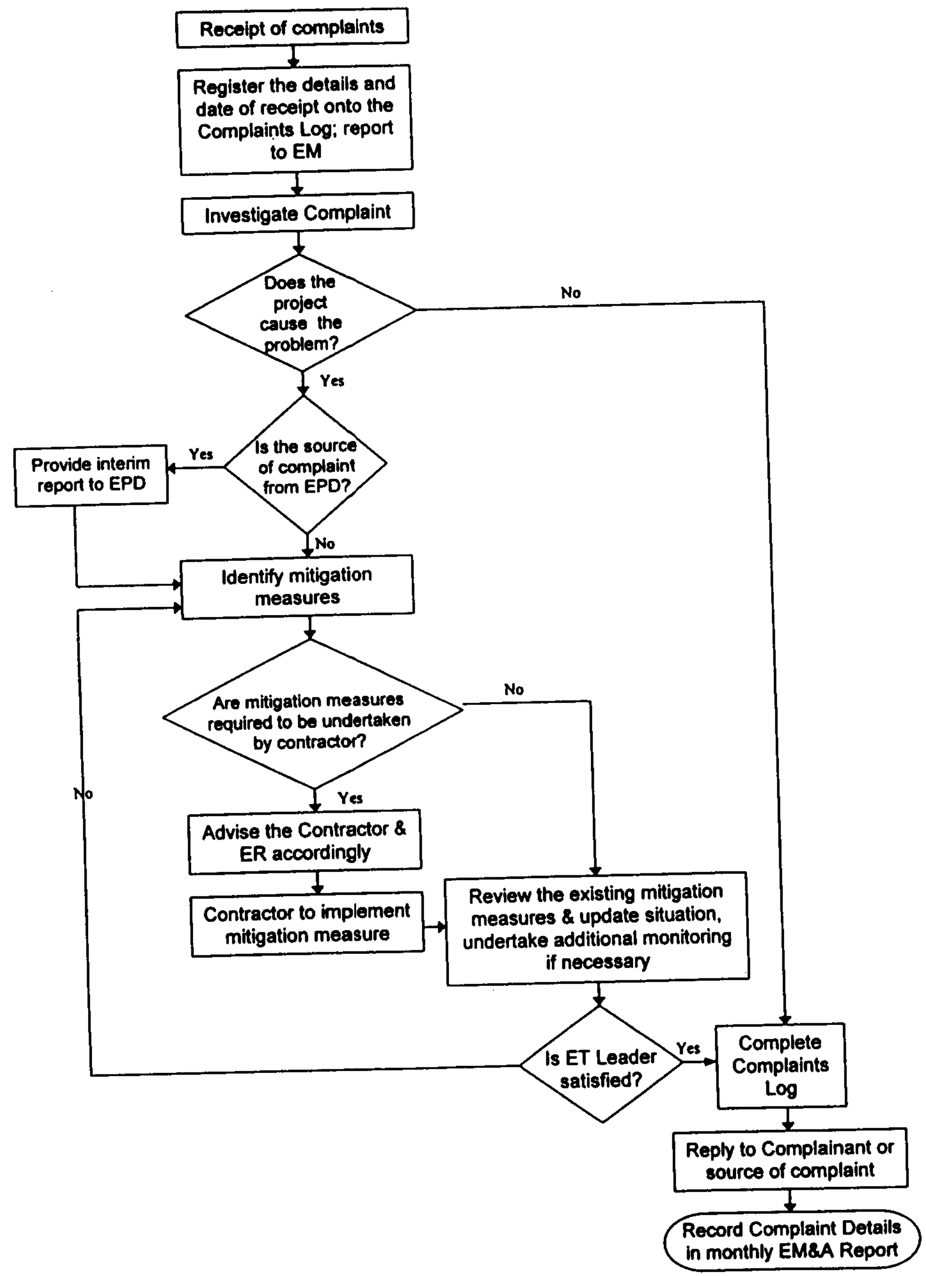
Figure 1.1



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DATE	28 Jul 99

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Complaint Response Procedure

Figure 9.1

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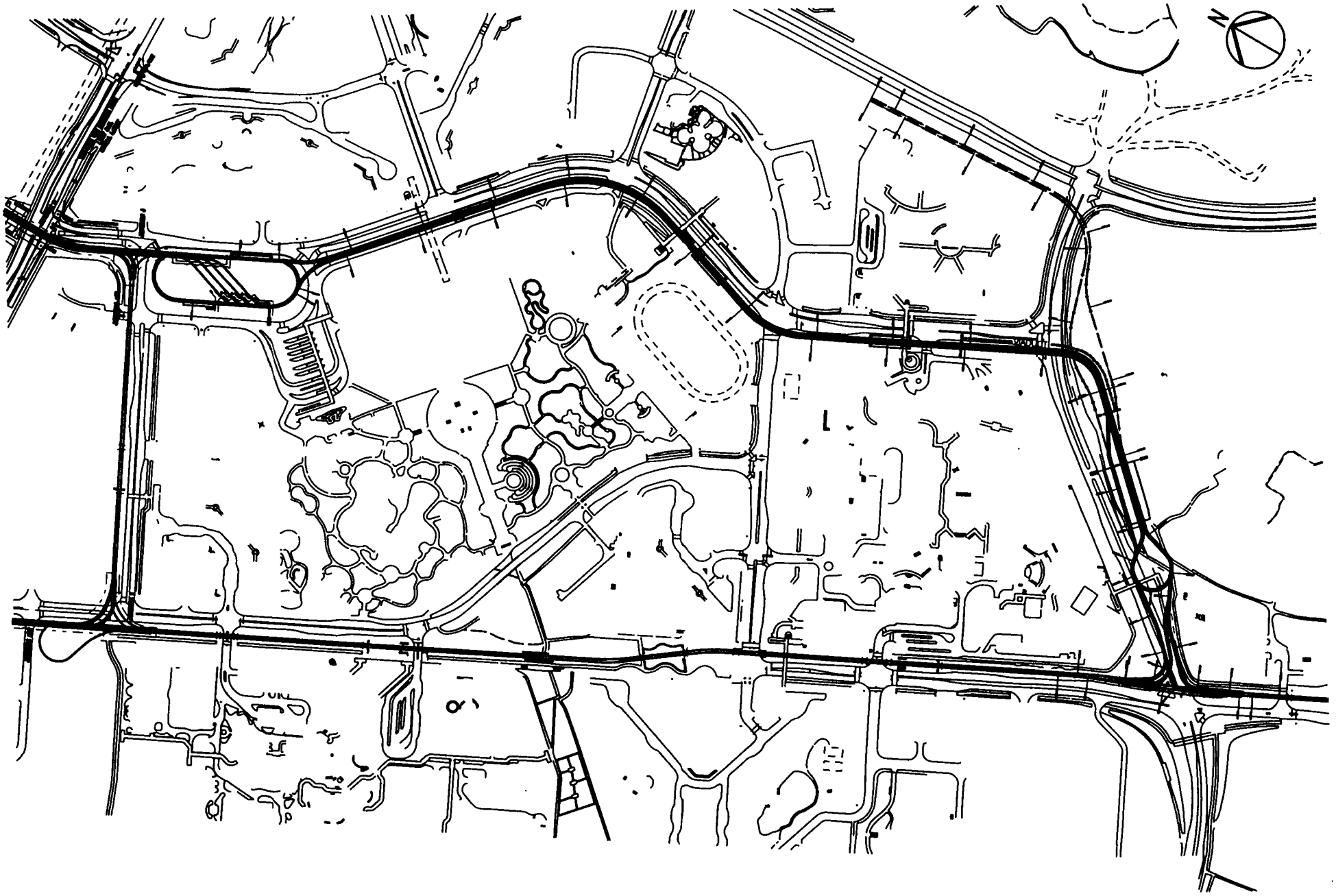
Appendix 1: SITE PLANS



Tin Shui Wai Phase 4

APPENDIX 2: IMPLEMENTATION SCHEDULE

Implementation Schedule of Recommended Mitigation Measures (TSW Phase 4)

Parameters	Mitigation Measures/ Preventive Actions	Responsibility	Implementation Stage*		
			Design	Const	Oper
Air Quality (A) Construction Dust Impact	1) The contractor is obliged to follow the procedures and requirements given in the Air Pollution Control (Construction Dust) Regulation - Use of regular watering to reduce dust from exposed site surfaces and unpaved roads, at least twice daily with complete coverage - Use of frequent watering for particular dusty construction areas close to the site boundary and sensitive receivers - Side enclosure and covering of any aggregate or dusty material storage piles - Open stockpiles should be avoided or covered - Provision of temporary or movable barriers between the site and sensitive receivers - Use of tarpaulin to cover all dusty material on the transport vehicle - Use of vehicle wheel and body washing facilities at all exit locations - Use of wind shield or extractor at the loading and unloading areas - Speed control of max 15kph at unpaved road section - Position of all plant at the maximum separation distance from receiver if possible	Mitigation measures shall be generally applied by Contractor at all work sites throughout the construction phase		✓	
	2) Detailed Design Consultant (DDC) to incorporate the controlled measures into the Particular Specification (PS) for the civil work. The PS should also draw the contractor's attention to the relevant latest Practice Notes issued by EPD	To be incorporated in the PS by the Detailed Design Consultant	✓		
Water Quality (A) Construction Phase - water	1) Follow the site practices outlined in ProPECC PN 1/94 as far as practicable in order to minimise surface runoff and the chance of erosion, and to reduce any suspended solids prior to discharge	Mitigation measures shall be generally applied by Contractor at all work sites throughout the construction phase		✓	
	2) All fuel/oil tanks and chemical storage tanks/areas should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank, to prevent spilled fuel oils from reaching the receiving water bodies				
	3) Adequate maintenance of drainage systems to prevent flooding and overflowing				
	4) Wheel washing facilities should be implemented and regularly cleaned and maintained				
	5) Oil interceptors should be provided in the drainage system downstream of any oil/fuel pollution sources. The oil interceptors should be emptied and cleaned regularly to prevent the release of oils and grease into the storm water drainage system after accidental spillage				
	6) Use of sediment/silt traps				
	7) All temporary and permanent drainage pipes and culverts provided to facilitate runoff should be adequately designed for the controlled release of storm flows. All these measures should be regularly inspected and maintained in good order				
	8) Portable chemical toilets and sewage holding tanks are recommended to handle the construction sewage generated by workers from both the construction areas and dispersed along the alignment. A licensed contractor should provide appropriate and adequate portable toilets and is responsible for appropriate disposal and maintenance				

Implementation Schedule of Recommended Mitigation Measures (TSW Phase 4)

Parameters	Mitigation Measures/ Preventive Actions	Responsibility	Implementation Stage*		
			Design	Const	Oper
(A) Construction Phase - water	9) Detailed Design Consultant (DDC) to incorporate the controlled measures into the Particular Specification (PS) for the civil work. The PS should also draw the contractor's attention to the relevant latest Practice Notes issued by EPD	To be incorporated in the PS by the Detailed Design Consultant	✓		
(B) Operational Phase - water	1) Detailed Design Consultant (DDC) to provide detailed design of the oil interceptors/sub-soil drainage system, and to incorporate the controlled measures into the Particular Specification (PS). The PS should also draw the contractor's attention to the relevant latest TM and Practice Notes issued by EPD	DDC to provide detailed design and to incorporate the specifications in the PS	✓		
	2) The sewage discharge from the toilets in the terminus shall be designed to discharge to the nearby public sewers.				
	3) Provide a surface water drainage system in order to collect the track runoff. Where oil and lubricating fluids could be spilt, the track drainage channels discharge should pass through oil/grit interceptors/chambers, or a sub-soil drainage system to remove oil, grease and sediment before being pumped to the public stormwater drainage system	Mitigation measures shall be provided by LRT for all the LRT extension works			✓
	4) Silt traps and oil interceptors should be cleaned and maintained regularly. The efficiency and performance of these facilities are highly dependent on regular cleaning and maintenance				
	5) Oily contents of the oil interceptors should be transferred to an appropriate disposal facility, or to be collected for reuse, if possible				
Noise Impact (A) Construction Noise - General	1) use of good site practices to limit noise emissions by considering the following: - Selection of quiet plants which complied with the BS 5228 Part 1 or TM Standards - Use of 3.5m high hoarding along the site boundary, and permanent or movable noise barrier to screen noise at ground level zone. For high-rise Noise Sensitive Receivers, cantilevered top cover should be considered. The surface density of these barriers and hoarding need to be not less than 7kg/m^2. - Delocalization of equipment and/or local reduction of number of plant items - Limiting the operating time of construction equipment on site and use of smaller equipment - scheduling of construction works outside school examination periods in critical areas. If feasible, try to avoid cumulative and concurrent noisy activities within the Phase 4 and Reserve Zone. - Well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme - Machines and plant (such as trucks, cranes) 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, where possible, be orientated so that the noise is directed away from nearby NSRs - Silencers or mufflers on construction equipment should be properly fitted and maintained during the construction works	Noise mitigation measures shall be generally applied by Contractor at all work sites throughout the construction phase		✓	

Implementation Schedule of Recommended Mitigation Measures (TSW Phase 4)

Parameters	Mitigation Measures/ Preventive Actions	Responsibility	Implementation Stage*		
			Design	Const	Oper
(A) Construction Noise - General	- Mobile plant should be sited as far away from NSRs as possible and practicable - Material stockpiles, mobile container site office and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities	Mitigation measures shall be generally applied by Contractor at all work sites throughout the construction phase		✓	
(B) Construction Noise - Specific	1) Adoption of quiet plant, noise barrier, delocalization of equipment, and limiting the operation time of construction equipment should be applied to sections close to TWGH's Kwok Yat Wai College	Mitigation measures to be reviewed and implemented by Contractor carrying on works for sections closed to these receivers		✓	
	2) Adoption of quiet plant, noise barrier, and equipment delocalization should be applied to critical areas closed to Queen Elizabeth Primary School, Yau Tai House, Yiu Fung House, Fong Yun Wah School and Queen Elizabeth Secondary School.				
	3) Adoption of quiet plant, and noise barrier should be applied to critical areas closed to Yiu Foo House, Yiu Man House, Yiu Yat House, Yiu Hong House, 3-storey residential blocks close to Kwok Yat Wai College, Tse Yan House, Tsz Ping House, buddhist To Chi Fat She Yeung Yat Lam Memorial School, Tain Shui Wai Catholic Primary School, Kenswood Court and Lynwood Court.				
	4) Further review of the construction method should be carried out by contractor. Considerations should be focussed on: - The availability of detailed plans or work areas and locations of plant (as opposed to gazetted work boundaries) will enable the Contractor to reduce the amount of uncertainty in the distance corrections applied to source noise levels used in this assessment. - The layout of worksites should be critically reviewed and judiciously planned in order to make best use of existing features which may be able to provide screening of NSRs from plant noise eg site offices, site containers, etc. - To determine specific SWL measurement of typical plant proposed to be used, particularly those activities that have been identified to be noisy or cause exceedances above daytime noise criteria. These 'actual' levels may then be able to be used in place of the values in the TM-CW. - Use of smaller PME with lower SWL, e.g. smaller excavator, lorry to replace dump truck, where practicable. - Practicality/cost-effectiveness of portable, full noise barriers for sections of works identified in this report. - Sequential operation of a limited number of plant items in every 30-minute interval. For example, only excavator and vibratory roller are used in every 30-minute interval while only grader and dump truck are used in the next consecutive 30-minute period, where practicable; and				

Implementation Schedule of Recommended Mitigation Measures (TSW Phase 4)

Parameters	Mitigation Measures/ Preventive Actions	Responsibility	Implementation Stage*		
			Design	Const	Oper
(B) Construction Noise - Specific	- Use of limiting the operational period of other PME, where appropriate and practicable, as a last resort in order to meet the noise criteria. As an example, if PME could be operated for only 10 minutes out of any 30 minute period, a reduction of 5dB(A) could be achieved	Mitigation measures to be reviewed and implemented by Contractor carrying on works for sections closed to these receivers		✓	
(C) Operational Noise	1) KCRC operator to ensure that the 65 dB(A) Lmax at 25m from straight and well maintained ballast track is always achieved.	KCRC LRT operation section to review and implement the EMS system			✓
	2) The Detailed Design Consultant should ensure that the structure re-radiated noise from viaduct structure is at least 10dB(A) below the noise criteria of 65 dB(A) Lmax at 25m, at 50kph.	DDC to review the design and incorporate the mitigation measures where feasibile	✓		
	3) The Detailed Design Consultant should ensure that the noise level at 2m from the transformer bays in the rectifier would be less than 66dB(A).				
	4) The Detailed Design Consultant should orientate the open side of transformer bays in rectifier station to face away from the nearest NSRs, and preferably facing onto a main road, if practicable.				
	5) The Detailed Design Consultant should conduct a detailed review on ventilation systems in the rectifier stations to determine the need for any noise attenuation (eg silencers, acoustic louvres etc).				
Waste Management (A) General - waste	1) The following waste management hierarchy should be considered in general: - Avoidance and minimisation (not generating waste through changing or improving practices and design); - Reuse of materials, thus avoiding disposal (generally with only limited reprocessing);	To be reviewed and applied by Contractor and LRT operators whenever practicable		✓	✓
	- Recovery and recycling, thus avoiding disposal (although reprocessing may be required); and - Treatment and disposal, according to relevant regulations, guidelines and good practice.	To be reviewed and applied by Contractor and LRT operators whenever practicable		✓	✓
(B) Construction Phase - waste	1) Storage, Collection and Transportation - Handle and store wastes in a manner which ensures that they are held securely without loss or leakage, thereby minimising the potential for pollution; - Use waste collectors authorised or licensed to collect the specific category of waste; - Remove wastes in a timely manner; - Maintain and clean waste storage areas regularly; - Minimise windblown litter and dust during transportation by either covering trucks or transporting wastes in an enclosed container;	To be reviewed and applied by Contractor whenever practicable		✓	

Implementation Schedule of Recommended Mitigation Measures (TSW Phase 4)

Parameters	Mitigation Measures/ Preventive Actions	Responsibility	Implementation Stage*		
			Design	Const	Oper
(B) Construction Phase - waste	- Obtain the necessary waste disposal permits from the appropriate authorities, if they are required, in accordance with the Waste Disposal Ordinance (Cap 354), Waste Disposal (Chemical Waste) (General) Regulation (Cap 354) and the Land (Miscellaneous Provisions) Ordinance (Cap 28); - Dispose of waste at licensed sites; - Develop procedures such as a ticketing system to facilities, tracking of loads, particularly for chemical waste, and to ensure that illegal disposal of waste does not occur; and - Maintain records of the quantities of wastes generated, recycled and disposed.	To be reviewed and applied by Contractor whenever practicable		✓	
	2) Excavated Material - Transport to the Western Section of WR for reuse, if practicable; - Transport to other land formation sites in the Tuen Mun and Yuen Long areas for reuse; - Transport to public filling areas.				
	3) Construction and Demolition Material - Careful design, planning and good site management can minimise over-ordering and waste materials such as concrete, mortars and cement grouts. The design of formwork should maximise the use of standard wooden panels so that high reuse levels can be achieved. Alternatives such as steel formwork or plastic fencing should be considered to increase the potential for reuse.				
(B) Construction Phase - waste	- The contractor should recycle as much as possible of the construction waste on-site. Proper segregation of wastes on site will increase the feasibility of recycling certain components of the waste stream by recycling contractors. Concrete and masonry can be used as general fill and steel reinforcement bars can be used by scrap steel mills. Different areas should be designated for such segregation and storage wherever site conditions permit. - On-site sorting and segregation facility of all type of wastes is considered as one of the best practice in waste management and hence, should be implemented in all projects generating construction waste. The sorted public fill and construction & demolition (C&D) waste should be disposed to public filling areas and landfills, respectively. - The handling and disposal of bentonite slurries should be undertaken in accordance with ProPECC PN 1/94 .	To be reviewed and applied by Contractor whenever practicable		✓	
	4) Chemical Waste - Chemical waste that is produced, as defined by Schedule 1 of the Waste Disposal (Chemical Waste) (General) Regulation, should be handled in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.				

Implementation Schedule of Recommended Mitigation Measures (TSW Phase 4)

Parameters	Mitigation Measures/ Preventive Actions	Responsibility	Implementation Stage*		
			Design	Const	Oper
(B) Construction Phase - waste	- Containers used for the storage of chemical wastes should be suitable for the substance they are holding, resistant to corrosion, maintained in a good condition, and securely closed; have a capacity of less than 450 liters unless the specification has been approved by the EPD; and display a label in English and Chinese in accordance with instructions prescribed in Schedule 2 of the regulation. - The storage area for chemical wastes should be clearly labelled and used solely for the storage of chemical waste; enclosed on at least 3 sides; have an impermeable floor and bunding of sufficient capacity to accommodate 110% of the volume of the largest container or 20 % of the total volume of waste stored in that area, whichever is the greatest; have adequate ventilation; covered to prevent rainfall entering; and arranged so that incompatible materials are adequately separated. - Disposal of chemical waste should be via a licensed waste collector; be to a facility licensed to receive chemical waste, such as the Chemical Waste Treatment Centre which also offers a chemical waste collection service and can supply the necessary storage containers; or be to a reuser of the waste, under approval from the EPD.	To be reviewed and applied by Contractor whenever practicable		✓	
	5) General Refuse - Contractor to remove general refuse from the site, separately from construction and chemical waste, on a daily or every second day basis to minimise odour, pest and litter impacts. - Office wastes can be reduced through recycling of paper if volume is large enough to warrant collection. Participation in a local collection scheme should be considered if one is available. - Training should be provided to workers about the concepts of site cleanliness and appropriate waste managemnet procedure, including reduction, reuse and recycling of wastes.	To be reviewed and applied by Contractor whenever practicable		✓	
(C) Operational Phase - waste	1) General Refuse and Industrial Waste - General refuse will be mainly generated from the daily activities of LRT stops of the Phase 4 Extension. The LRT stops of the new extension should be included in the current LRT Waste Management Plan. As mentioned in the current LRT Waste Management Plan, at least 2 general garbage bins should be provided for each passenger stop, and the refuse should be collected by licensed contractor twice per day. The small quantity of industrial waste generated can be collected together with general refuse.	To be reviewed and applied by LRT operation staff whenever practicable			✓

Implementation Schedule of Recommended Mitigation Measures (TSW Phase 4)

Parameters	Mitigation Measures/ Preventive Actions	Responsibility	Implementation Stage*		
			Design	Const	Oper
(C) Operational Phase - waste	2) Chemical Waste - Chemical waste is produced, as defined by Schedule 1 of the Waste Disposal (Chemical Waste) (General) Regulation, and should be handled and disposed of in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Waste. For mitigation measures, the guidelines covered under the construction phase mitigation of chemical wastes should be referred.	To be reviewed and applied by LRT operation staff whenever practicable			✓
Landscape & Visual	1) The Detailed Design Consultant (DDC) to carry out a Baseline Detailed tree survey to establish a record of the locations of existing mature trees. All trees to be retained, transplanted or felled shall be identified on site and on survey plan.	DDC to carried out at commenencement of the detailed design Stage	✓		
	2) A Landscape Master Plan should be formulated and submitted to Govt Department for approval	Detailed Design Consultant to prepare and implement the plan before construction work commence	✓		
	3) The Contractor to carry out Tree Survey Audit and to ensure all approved protection measures are in place prior to any excavation or site formation works. Regular monthly site inspections shall be made by the Supervising Officer.	To conduct at the outset of the construction contract		✓	
	4) The Contractor to make conservation of topsoil.	Throughout the construction phase		✓	
	5) Hoarding to works area boundary to protect adjacent operation	Generally applied by Contractor at all work sites		✓	
	6) Planting to planter reserves alongside LRT alignment	To be implemented by Territory Development Department (TDD) and maintained by Highway Department (planter walls) and Regional Services Department (softworks).		✓	✓
	7) The Government Contractor shall carry out the maintenance and establishment works to all planted areas for the period specified in the Landscape contract (typically 12 months). Regular monthly site inspections shall be made by the Supervising Officer.	To conduct upon competion of the construction contract			✓
Cultural Heritage	1) The Contractor, when conducting the archaeological evaluation during construction phase, should adopt a minimum 5% sampling strategy for the support columns of the viaduct. The selected column footings should be pre-excavated prior to the onset of construction activities in order to retrieve sufficient information to assess the impact of the railway.	Precautionary measures shall be generally applied by Contractor at all work sites prior to and throughout the construction phase		✓	
Construction Phase	2) If pre-excavation of selected columns is not possible, the mitigation strategy should be the posting of an archaeological watching brief, although the "watch and stop" may have implications on the construction programme of the columns. The watching brief may need to be extended to cover a larger sample if positive results are gained.	Precautionary measures shall be generally applied by Contractor at all work sites prior to and throughout the construction phase		✓	

Implementation Schedule of Recommended Mitigation Measures (TSW Phase 4)

Parameters	Mitigation Measures/ Preventive Actions	Responsibility	Implementation Stage*		
			Design	Const	Oper
Cultural Heritage - Construction Phase	3) Vibration monitoring of structure at Pagoda in Tin Shui Wai should be conduced during the period of LRT construction works.	Precautionary measures shall be generally applied by Contractor at all work sites prior to and throughout the construction phase		✓	
	4) The archaeological evaluation and watching brief should be conducted by a qualified archaeologist, who should be licensed by the Antiquities Authority before the evaluation or watching brief takes place. This licensing procedure is a statutory requirement stated in Sections 12 and 13 in the Antiquities and Monuments Ordinance (Cap. 53).	Precautionary measures shall be generally applied by Contractor at all work sites prior to and throughout the construction phase		✓	

Note:

* The recommended noise mitigation measures are developed based on the conceptual layout plan and subject to refinement in the detailed design stage. Reassessment are necessary when there are changes in design.

Alternative measures which are proven to have equivalent or higher performance are acceptable. The overall compliance rate should be comparable to that of the conceptual layout.

APPENDIX 3: SAMPLE DATA SHEETS OF MONITORING

Sample Template for Interim Notifications of Environmental Quality Limits Exceedances

Incident Report on Action Level or Limit Level Non-compliance

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

SAMPLE

Location Plan

Prepared by :

Designation :

Signature :

Date : _____

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^3)	
Final Flow Rate, Qsf	Pf (mmHg)	
	Tf (C)	
	Hf (in.)	
	Qsf (Std. m^3)	
Average Flow Rate (Std. m^3)		
Total Volume (Std. m^3)		
Filter Identification No.		
Initial Wt. of Filter (g)		
Final Wt. of Filter (g)		
Measured TSP Level ($\mu g/m^3$)		

SAMPLE

Name & Designation Signature Date

Field Operator :
Laboratory Staff :
Checked by :

Noise Monitoring Field Record Sheet

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

SAMPLE

Name & Designation Signature Date

Recorded By :

Checked By :

Water Quality Monitoring Data Record Sheet

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

SAMPLE

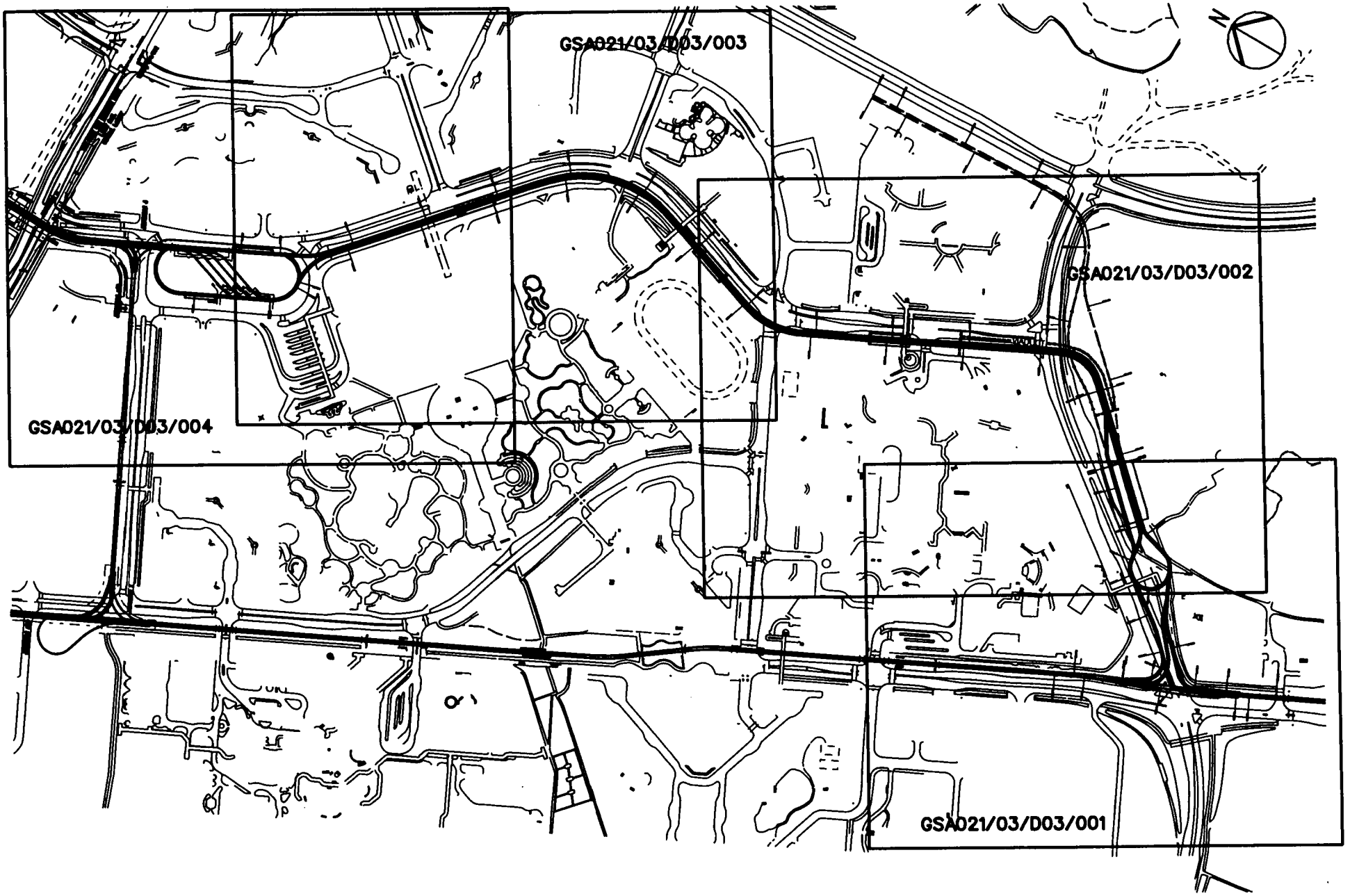
Name & Designation Signature Date

Recorded By :

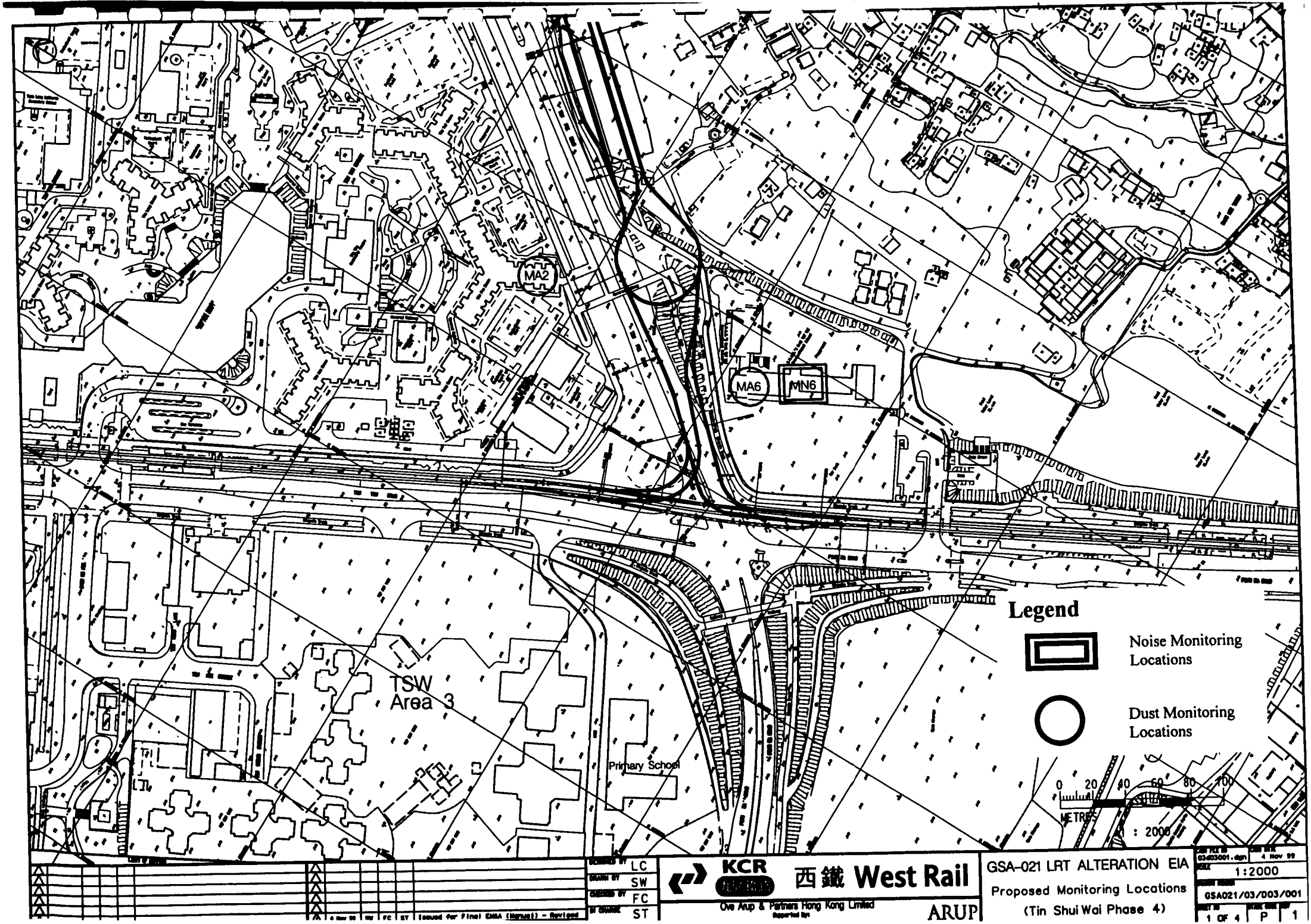
Checked By :

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

APPENDIX 4: PROPOSED MONITORING LOCATIONS



Tin Shui Wai Phase 4



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DRAWN BY SW
CHECKED BY FC
BY DIRECTOR ST

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GSA-021 LRT ALTERATION EIA

Proposed Monitoring Locations

(Tin Shui Wai Phase 4)

CAD FILE ID 03-003001.dgn
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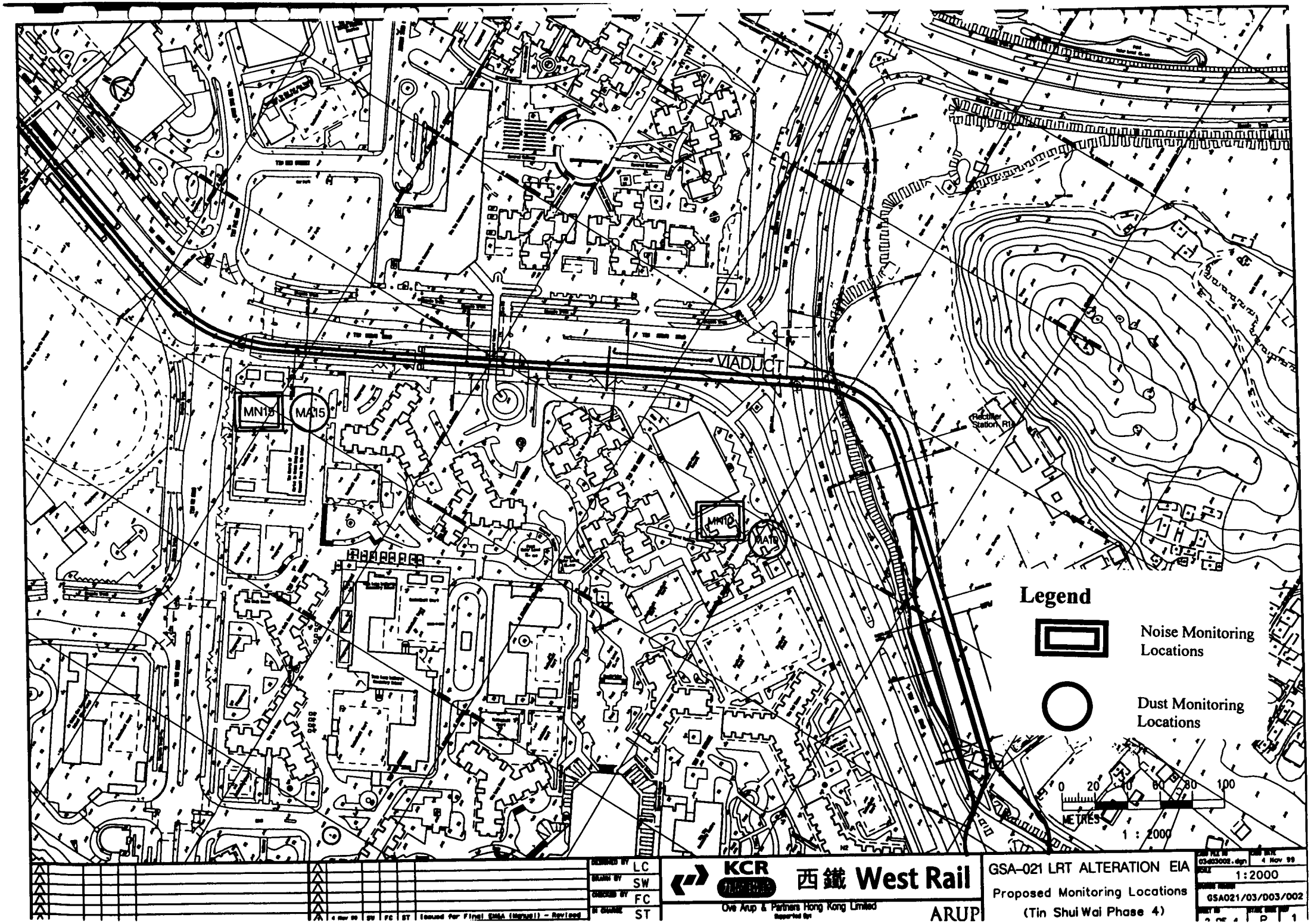
DRAWING NUMBER GSA021/03/D03/001
SHEET No 1 OF 4
STATUS P
REVISION 1



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CHECKED BY	FC
APPROVED BY	ST

4 Nov 99 SW FC ST Issued for Final EIAA (Manual) - Revised

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GSA-021 LRT ALTERATION EIA

Proposed Monitoring Locations

(Tin Shui Wai Phase 4)

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SCALE	1:2000
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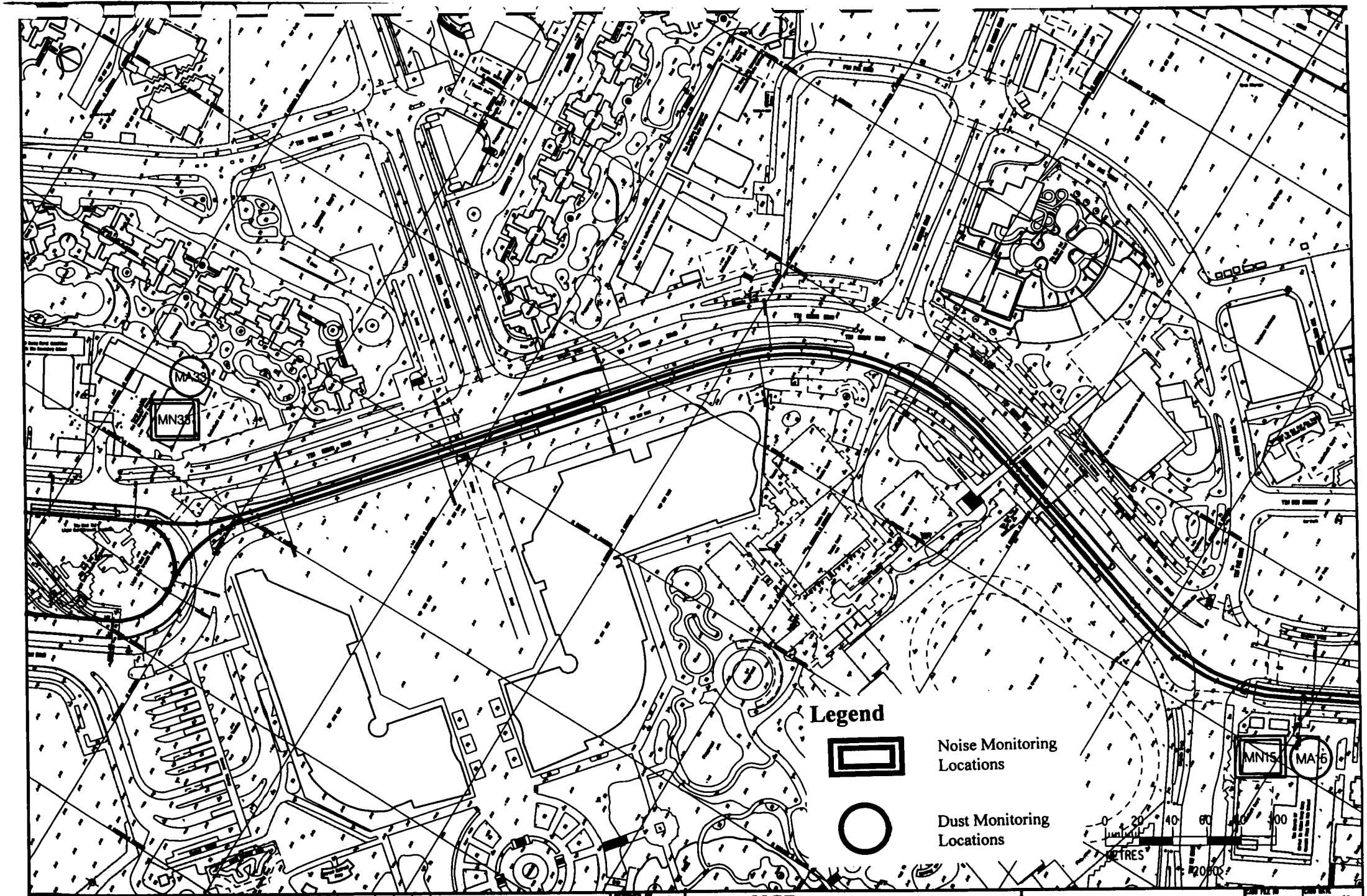

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GSA-021 LRT ALTERATION EIA

Proposed Monitoring Locations

(Tin Shui Wai Phase 4)

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DATE	4 Nov 99
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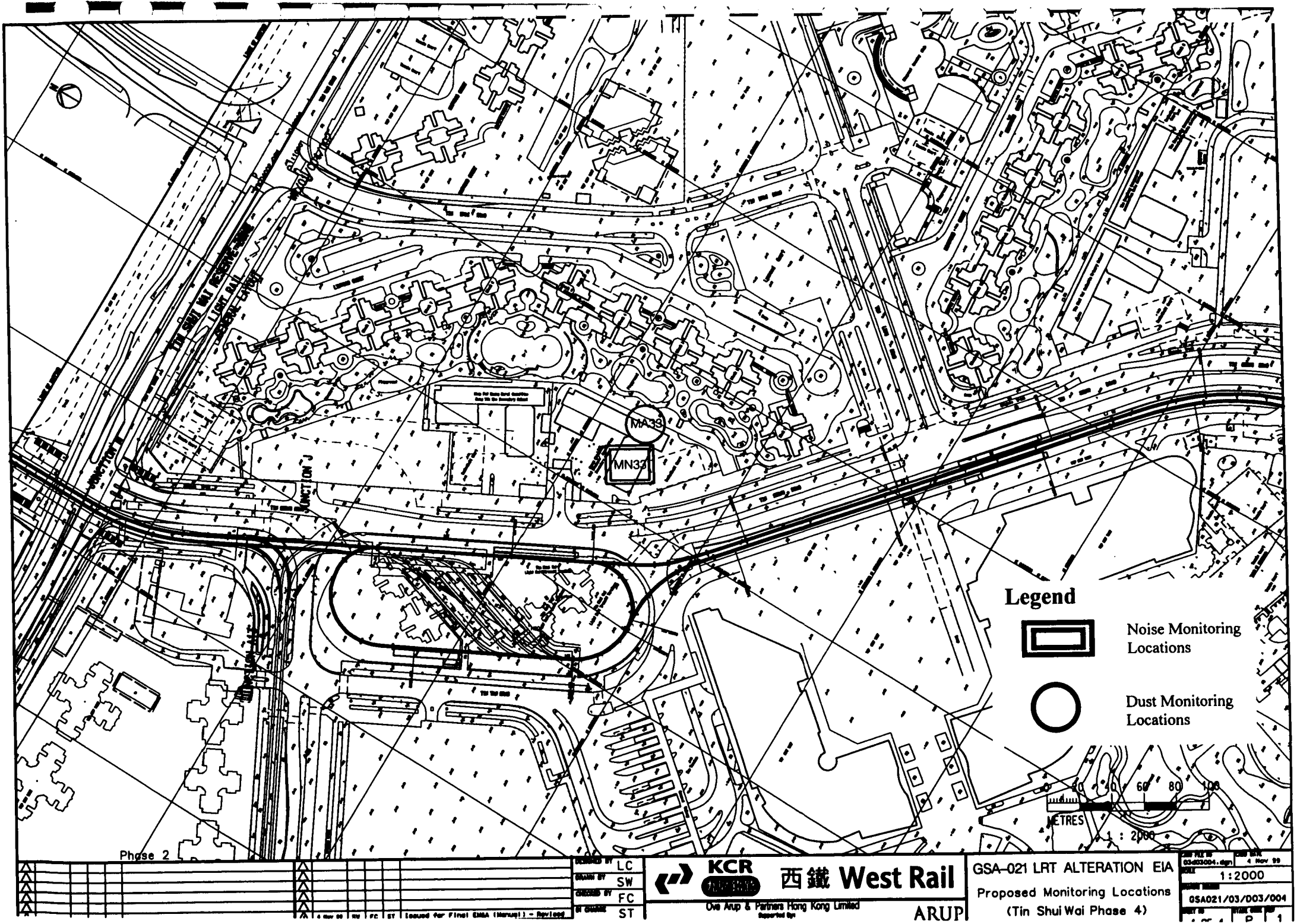
STAGE SUBMISSION	P 1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MN32
Legend
Noise Monitoring Locations
Dust Monitoring Locations
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METRES
1 : 2000
Phase 2
LC
SW
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GSA-021 LRT ALTERATION EIA
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