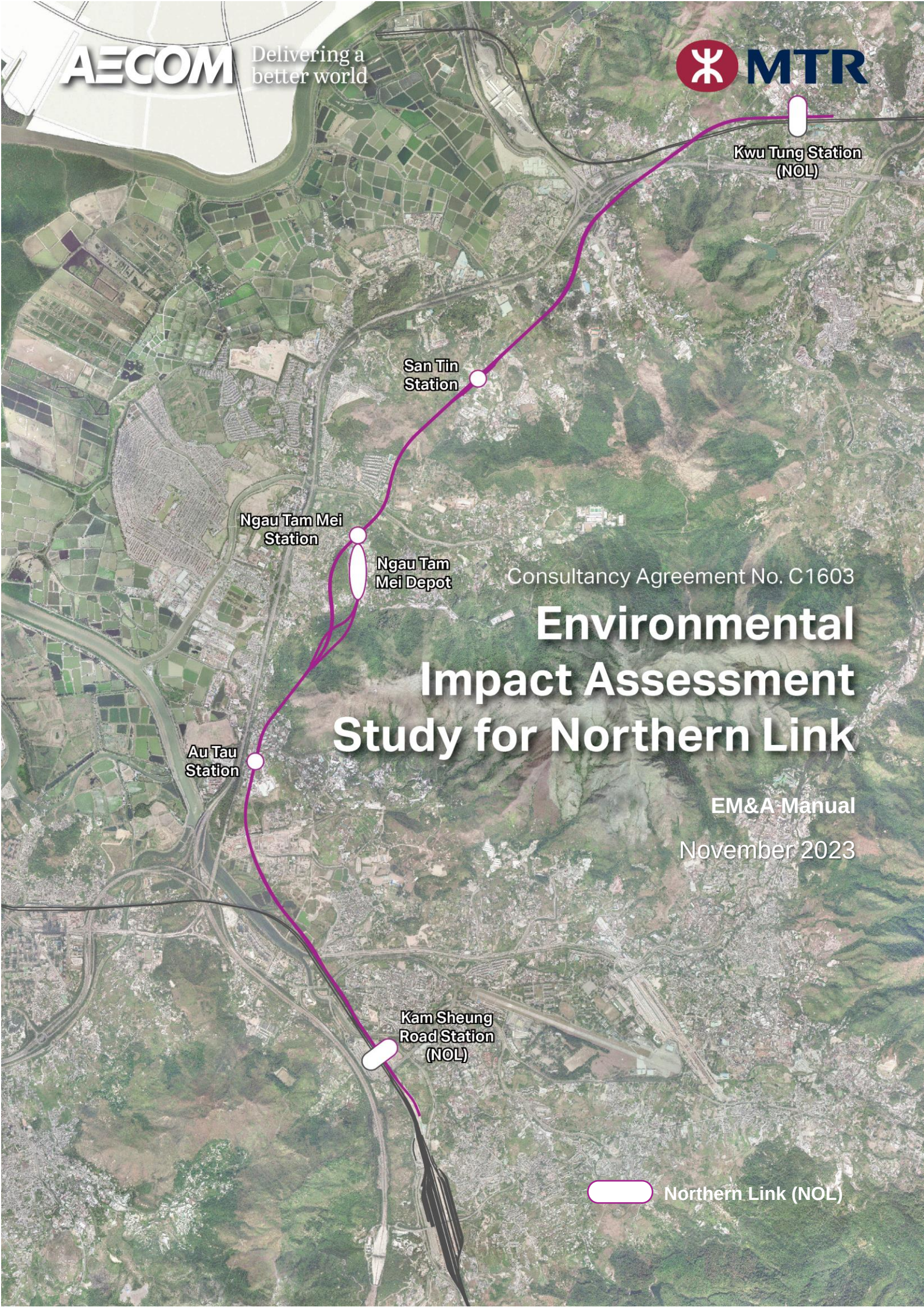

Consultancy Agreement No. C1603

Environmental Impact Assessment Study for Northern Link

EM&A Manual

November 2023

AGREEMENT NO. C1603

ENVIRONMENTAL IMPACT ASSESSMENT STUDY FOR NORTHERN LINK

Environmental Monitoring and Audit Manual

November 2023

Reviewed by: _____ 24 November 2023
Angela Tong

Approved by: _____ 24 November 2023
Freeman Cheung

AECOM ASIA COMPANY LIMITED

TABLE OF CONTENTS

LIST OF TABLES

LISTS OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

The following abbreviations shall have the meaning hereby assigned to them except when the context of this Manual otherwise requires:

Abbreviations	Full Title
AAA	Alert, Alarm and Action
AFCD	Agriculture, Fisheries and Conservation Department
A/L	Action and Limit
AMO	Antiquities and Monuments Office
ANL	Acceptable Noise Level
ANR	Ardeid Night Roost
ASR	Area Sensitivity Rating
ASRs	Air Sensitive Receivers
AUT	Au Tau
C&D	Construction and Demolition
CAP	Contamination Assessment Plan
CAR	Contamination Assessment Report
CHRs	Cultural Heritage Resources
CNMP	Construction Noise Management Plan
CNP	Construction Noise Permit
EAL	East Rail Line
EAP	Emergency Access Point
EEP	Emergency Egress Point
EIA	Environmental Impact Assessment
EIAO-TM	Technical Memorandum on Environmental Impact Assessment Process
EM&A	Environmental Monitoring and Audit
EP	Environmental Permit
EPD	Environmental Protection Department
ER	Engineer's Representative
ET	Environmental Team
ETL	Environmental Team Leader
FNAR	Fixed Noise Audit Report
FNMP	Fixed Noise Sources Management Plan
FSP	Fine Suspended Particulates
GBNSRs	Ground-borne Noise Sensitive Receivers
GW-TM	Technical Memorandum on Noise from Construction Work other than Percussive Piling
HOKLAS	Hong Kong Laboratory Accreditation Scheme
HVS	High Volume Sampler
IEC	Independent Environmental Checker
IF	Influencing Factor
IND-TM	Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites
KSR	Kam Sheung Road
KTU	Kwu Tung
LMCSL	Lok Ma Chau Spur Line
MNL	Measured Noise Level
NAP	Noise Assessment Point

Abbreviations	Full Title
NCO	Noise Control Ordinance
NOL	Northern Link
NSR	Noise Sensitive Receiver
NTM	Ngau Tam Mei
NTD	Ngau Tam Mei Depot
PME	Powered Mechanical Equipment
QA/QC	Quality Assurance/Quality Control
RAP	Remediation Action Plan
RDS-2014	Railway Development Strategy 2014
RR	Remediation Report
RSP	Respirable Suspended Particulates
SAIs	Site of Archaeological Interests
SAT	San Tin
SI	Site Investigation
TBM	Tunnel Boring Machine
TM	Technical Memorandum
TML	Tuen Ma Line
VB	Ventilation Building
WMP	Waste Management Plan
WPCO	Water Pollution Control Ordinance

1 INTRODUCTION

1.1 Project description

1.1.1 The Northern Link (NOL) (hereinafter referred to as "the Project") is one of the seven railway schemes recommended to be taken under in the Railway Development Strategy 2014 ("RDS-2014"). The Project will be a heavy underground railway line with a route length of about 10.7km between Kam Sheung Road (KSR) Station on the Tuen Ma Line (TML) and Kwu Tung (KTU) Station on the Lok Ma Chau Spur Line (LMCSL) of East Rail Line (EAL). The key elements of the Project (**Figure Nos. C1603/C/NOL/ACM/M50/301** to **304** refer) as assessed in this Environmental Impact Assessment (EIA) Report are listed below:

- Construction and operation of 10.7km underground railway line between KSR(NOL) Station and KTU(NOL) Station;
- Construction and operation of five new stations, namely KSR(NOL) Station, Au Tau (AUT) Station, Ngau Tam Mei (NTM) Station, San Tin (SAT) Station and KTU(NOL) Station;
- Construction and operation of associated railway facilities, including ancillary buildings such ventilation shafts/buildings, Emergency Access Point (EAP) and Emergency Egress Point (EEP);
- Construction and operation of a depot at NTM area; and
- Enabling works to the south of KSR Station for potential southern extension, to the north of SAT Station for potential bifurcation to Lok Ma Chau Loop and Huanggang Port and to the east of KTU(NOL) Station for potential extension to Ping Che areas.

1.1.2 A temporary explosive magazine site for overnight storage of explosives that will be used for construction of tunnel/adits/railway facilities is proposed at Tai Shu Ha in Yuen Long. This magazine site was formerly used for the construction of the High Speed Rail (Hong Kong Section) (HSR) (formerly named as "the Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL)") and the Liantang/Heung Yuen Wai Boundary Control Point (BCP) project. This site will be decommissioned upon completion of construction works of the Project.

1.2 Purpose of the Manual

1.2.1 The purpose of this Environmental Monitoring and Audit (EM&A) Manual is to guide the set-up of an EM&A programme to check on compliance with the Environmental Impact Assessment (EIA) Study recommendations of the Project, to assess the effectiveness of the recommended mitigation measures, and to identify any further need for additional mitigation measures or remedial actions.

1.2.2 This Manual, which outlines the monitoring and audit programme for the Project, aims to provide systematic procedures for monitoring, auditing and minimising environmental impacts associated with the construction and operational activities of the Project.

1.2.3 Hong Kong environmental regulations have served as environmental standards and guidelines in the preparation of this Manual. In addition, this Manual has been prepared in accordance with the requirements stipulated in Annex 21 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM).

1.2.4 This Manual contains the following information:

- Responsibilities of the Contractor, the Engineer or Engineer's Representative (ER), the Environmental Team (ET), and the Independent Environmental Checker (IEC) with respect to the environmental monitoring and audit requirements during the course of the Project;
- Project organization for the EM&A works;
- The basis for, and description of the broad approach underlying the EM&A programme;
- Details of the methodologies to be adopted, including all field laboratories and analytical procedures, and details on quality assurance and quality control programme;
- The rationale on which the environmental monitoring data will be evaluated and interpreted;
- Definition of Action and Limit (A/L) levels;
- Establishment of Event and Action plans;
- Requirements for reviewing pollution sources and working procedures required in the event of non-compliance with the environmental criteria and complaints; and
- Requirements for presentation of environmental monitoring and audit data and appropriate reporting procedures.

1.2.5 This Manual is a dynamic document that should be reviewed regularly and updated as necessary during the construction and operational of the Project. The Contractor should regularly review the mitigation measures and project implementation schedule in **Appendix B** with respect to the design developments and construction methodology.

1.3 Project Organisation

1.3.1 The roles and responsibilities of the various parties involved in the EM&A process and the organisational structure of the organisations who are responsible for implementing the EM&A programme are outlined below. The proposed project organisations and lines of communication with respect to environmental protection works are shown in **Appendix A**.

Engineer or Engineer's Representative (ER)

1.3.2 The Engineer is responsible for overseeing the construction works and for ensuring that the works are undertaken by the Contractor in accordance with the specification and contractual requirements. The duties and responsibilities of the Engineer with respect to EM&A may include:

- Supervise the Contractor's activities and ensure that the requirements in this Manual are fully complied with;
- Inform the Contractor when action is required to reduce environmental impacts in accordance with the Event and Action Plans;
- Participate in joint site inspections and audits undertaken by the ET;
- Comply with the agreed Event and Action Plans in the event of any exceedance; and
- Adhere to the procedures for carrying out exceedance and complaint investigations.

The Contractor

1.3.3 The Contractor should report to the ER. The duties and responsibilities of the Contractor are:

- Implement the EIA recommendations and requirements;
- Strictly adhere to the guidelines and requirements in this Manual;
- Provide assistance to the ET in carrying out relevant environmental monitoring and auditing, and investigation related to complaints and non-compliance (**Section 15** of this Manual refers);
- Participate in the site inspections undertaken by ET, and undertake corrective action(s);
- Provide information / advice to ET regarding works activities which may contribute, or be continuing to the generation of adverse environmental condition(s);
- Submit proposals on mitigation measures in case of exceedances of A/L levels, in accordance with the Event and Action Plans as detailed in this Manual;
- Implement measures to reduce environmental impacts where A/L levels are exceeded until the events are resolved; and
- Adhere to the procedures for carrying out environmental complaint investigation in accordance with **Section 15** of this Manual.

Environmental Team (ET)

1.3.4 The ET should conduct the EM&A programme and ensure the Contractor's compliance with the Project's environmental performance requirements during construction. The ET should be an independent party from the IEC and the Contractor.

1.3.5 An ET should be established before the commencement of construction of the Project. The ET should be led and managed by the ET Leader (ETL). The ETL should possess at least 7 years of experience in EM&A and/or environmental management. The ET should monitor the mitigation measures implemented by the Contractor on a regular basis to ensure the compliance with the intended aims of the measures. The duties and responsibilities of the ET are:

- Set up all the required environmental monitoring stations;
- Monitor the various environmental parameters and implementation of environmental mitigation measures as required in this Manual;
- Review construction programme and methodology and comment as necessary;
- Carry out regular and ad hoc site inspections to investigate and audit the Contractor's site practice, equipment and work methodologies with respect to pollution control and environmental mitigation measures, and anticipate environmental issues for proactive and practicable action before problems arise;
- Analyse the EM&A data, review the success of EM&A programme to confirm the adequacy of mitigation measures implemented and the validity of the EIA predictions, and to identify any adverse environmental impacts arising and report EM&A results to the Contractor, IEC, and the ER;
- Liaise with IEC on all environmental performance matters, and timely submission of all relevant EM&A proforma for IEC's approval;

- Audit the relevant document(s)/record(s) and prepare reports on the environmental monitoring data and the site environmental conditions;
- Review the proposals of remedial measure from the Contractor and recommend suitable mitigation measures in the case of exceedances of A/L levels, in accordance with the Event and Action Plans;
- Advise the Contractor on environmental improvement, awareness, enhancement matters, etc., on site;
- Follow up and close out non-compliance actions;
- Submit the EM&A report(s) to the Project Proponent and the Environmental Protection Department (EPD) timely; and
- Adhere to the procedures for carrying out environmental complaint investigation in accordance with **Section 15** of this Manual.

Independent Environmental Checker (IEC)

1.3.6 An IEC should be employed by the ER / Project Proponent before commencement of construction of the Project. The IEC should advise the ER on environmental issues related to the Project. The IEC should possess at least 7 years of experience in EM&A and/or environmental management. The IEC should be an independent party from the ET and the Contractor. The duties and responsibilities of the IEC are:

- Review and audit at not less than monthly intervals in an independent, objective and professional manner in all aspects of the EM&A programme;
- Validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations, monitoring procedures and locations of sensitive receivers;
- Audit the EIA recommendations and requirements against the status of implementation of environmental protection measures on site;
- Review the effectiveness of environmental mitigation measures and project environmental performance;
- On as-needed basis, verify and certify the environmental acceptability of the Environmental Permit (EP) holder's construction methodology (both temporary and permanent works), relevant design plans and submissions under the EP;
- Carry out random sample check and audit on monitoring data and sampling procedures, etc;
- Conduct random site inspection;
- Verify the investigation results of environmental complaint cases and the effectiveness of corrective measures;
- Verify EM&A report that has been certified by the ETL; and
- Provide feedback on the audit results to the ET, the ER or the Project Proponent according to Event and Action Plans in this Manual.

1.4 Structure of the Manual

1.4.1 Following this introductory section, the remainder of this Manual is set out as follows:

- Section 2 – Sets out EM&A requirement for air quality;
- Section 3 – Sets out EM&A requirement for airborne noise;
- Section 4 – Sets out EM&A requirement for ground-borne noise;
- Section 5 – Sets out EM&A requirement for water quality;

- Section 6 – Details auditing requirement for sewerage and sewage treatment implications;
- Section 7 – Details auditing requirement for waste management implications;
- Section 8 – Details auditing requirement for land contamination;
- Section 9 – Sets out EM&A requirement for terrestrial and aquatic ecology;
- Section 10 – Sets out EM&A requirement for fisheries;
- Section 11 – Details auditing requirement for landscape and visual;
- Section 12 – Details auditing requirement for cultural heritage;
- Section 13 – Details auditing requirement for hazard to life;
- Section 14 – Describes scope and frequency of environmental site audits and sets out the general requirements of the EM&A programme; and
- Section 15 – Details the EM&A reporting requirements.

2 AIR QUALITY

2.1 Introduction

2.1.1 Potential air quality impacts arising from the construction phase of the Project were assessed in the EIA Report. The major dusty construction activities of the Project would mainly be related to construction dust from site clearance, site formation, demolition works, excavation works, tunnelling works (e.g. tunnel boring machine (TBM), cut-and-cover, drill-and-blast and mining), backfilling, spoil handling, vehicle movement, haul road within works sites/works areas and wind erosion of the exposed site area.

2.1.2 No adverse air quality impact from construction of the Project would be anticipated with the implementation of dust suppression measures as stipulated under Air Pollution Control (Construction Dust) Regulation (Cap 311R) and EPD's Recommended Pollution Control Clauses for Construction Contracts. Nonetheless, dust monitoring is recommended during the construction phase to ascertain that there would be no adverse dust impacts on the nearby sensitive receivers. Monitoring of Fine Suspended Particulates (FSP) and Respirable Suspended Particulates (RSP) is recommended to ensure the proper implementation of measures and the compliance of AQOs during the construction of NOL.

2.1.3 No adverse air quality impact is expected during the operational of the Project with the deployment of emission free electric powered rail system. Hence, no air quality monitoring and site inspections are required during operational phase.

2.1.4 This section presents the requirements, methodology, equipment, monitoring locations and criteria for the monitoring and audit of construction dust impact during the construction phase of the Project.

2.2 Monitoring Parameters and Equipment

2.2.1 For regulatory purpose, the RSP and FSP levels should be measured by the mean of air sensor such that variation in dust impact on a real-time basis could be observed and any dusty activities occurring in the concerned area can be identified. Weather data including temperature, relative humidity, pressure, wind spend, wind direction should also be monitored simultaneously with air sensor. Other special phenomena and work progress of the concerned site, etc., should also be recorded in detail during monitoring period.

2.2.2 An air sensor to be employed should meet the purpose of the monitoring which are PM_{10} and $PM_{2.5}$ concentrations in the ambient in the context. It should be capable of detection of PM_{10} and $PM_{2.5}$, while size specification would be optional subject to the environmental management strategy of the site. The installation and operating procedures of the instrument should be followed by the operating manual supplied by the instrument manufacturer. The ET should propose the instrument model and seek approval from IEC. The ET should follow the operation manual to ensure the normal operation of the instrument.

2.2.3 Air sensor network which comprises one or more sensors should be employed near works sites/works areas of the Project to capture the worst cumulative impact from particulates concentration. Generally, air sensor should be placed at least 1.5 metres above ground, and away from any obstruction, vegetation or emission source which would interfere with the measurement. Other factors of the monitoring location, such as security, availability of power supply, reliable communication (cellular, Wi-Fi, etc.), should also be considered.

2.2.4 To ensure the measurements are of acceptable air quality, the ET should calibrate the monitoring equipment regularly. However, air sensor cannot be calibrated in the same way as standard method. Instead, the performance of sensor is checked by a process called collocation which places the sensors near a transfer standard and operating them simultaneously under the same conditions. Instead of adjusting the physical setting of an air sensor, which is often not possible, correction of raw data or response produced by a sensor is carried out to better match the reference monitor data by applying a scaling factor to the raw data.

2.2.5 Air sensors would be installed at off-site while frequent mounting and dismounting may not be practical in some situations. A collocation strategy should be developed to check the performance of off-site sensors. One of the strategies is called Transfer Standard (TS), which involves a separate air sensor, as capable of the air sensors on the field, to be collocated with an PM reference monitor and determine its performance characteristics. Federal Reference Method (FRM) or Federal Equivalent Method (FEM) PM monitor maintained at the accredited laboratories or research institutes are the PM reference monitors available in Hong Kong. The collocation of TS with PM reference monitor should last at least seven days. The TS is usually left collocated with PM refence monitor when not being moved around the sensor network.

2.2.6 Right before each on-site calibration, the TS itself needs to be calibrated. The TS with known performance characteristics will visit each air sensor on the field for collocation. During collocation, the TS should be placed near the subject sensor (<1m if practicable) so that both devices would be monitoring under the same environment, i.e. the same pollution sources and weather conditions. The TS should be first warmed up for 30 – 60 minutes and then left running with the subject sensor for the collocation period (at least three hours). The measurements from the subject sensor and TS during the collocation period will be statistically analysed.

2.2.7 The response of the sensor should be adjusted if its performance during on-site calibration does not meet the following evaluation criteria. For each device, data below its detection limit will be excluded.

Tier 1: Correlation

- The minute average measurements from the two devices when subject to linear regression should have a coefficient of determination (R^2)>0.7. The regression line slope should be between 0.75 to 1.25. If these criteria are not met due to narrow range of PM concentration (>30 μg/m^3 and >25μg/m^3 as recommended span range for RSP and FSP, respectively) during the collocation period, Tier 2 will apply.

Tier 2: Root Mean Squared Error

- The root mean squared error of the sensor minute average measurements should be <8 μg/m^3 for RSP and <5 μg/m^3 for FSP.

2.2.8 On-site checking of the monitoring equipment should be conducted by ET according to **Appendix C**. The collocation of TS and each air sensor on the field should be carried out every month. If a sensor repeated failed in 2 or 3 consecutive collocations, the sensor should be checked or maintained to improve its performance, or it should be replaced.

2.2.9 Wind data monitoring equipment should also be provided and set up at conspicuous locations for logging wind speed and wind direction close to/or at the dust monitoring

locations. The equipment installation location should be proposed by the ET and agreed with the ER and the IEC. For installation and operation of wind data monitoring equipment, the following points should be observed.

- The wind data should be captured by a data logger. The data recorded in the data logger shall be downloaded for analysis simultaneously;
- The wind data monitoring equipment should be re-calibrated at least once every six months; and
- Wind direction should be divided into 16 sectors of 22.5 degrees each.

2.2.10 Before commencing the air monitoring, the ET should formulate air monitoring plan with air sensor and submit to IEC to seek their feedback and consent. The plan should include but not limited to the followings:

- Details on the pollutants and environmental parameters to be monitored;
- Describe the equipment and measurement method to be used;
- Address the criteria for placing air sensors;
- Discuss the monitoring locations selected and rationale;
- Describe the criteria for selecting air sensors and test to determine if they are working properly;
- Determine the collocation location and establish the calibration and/or collocation and data correction methods;
- Identify types of data that may be used in the data analysis, including nearby reference monitor data, weather data, etc.
- List the procedures to maintain and operate air sensors, including site visits, routine maintenance, emergency maintenance, daily data review, periodic collocations, etc.; and
- Describe the data checking and reporting requirements.

2.2.11 The ET is responsible for the provision of the monitoring equipment and should provide sufficient number of air sensors for the field work and TS for carrying out continuous impact monitoring and ad-hoc monitoring or collocation.

2.2.12 If the ET proposes alternative dust monitoring equipment / methodology after the approval of this Manual, agreement from the IEC should be sought. The instrument should also be calibrated monthly following the requirements specified by the equipment manufacturers.

2.3 Dust Monitoring Stations

2.3.1 The tentative locations of the air sensors are listed in **Table 2.1** and are illustrated in **Figure Nos. C1603/C/NOL/ACM/M62/201 to C1603/C/NOL/ACM/M62/209**. The actual locations would be subject to site constraints and the ET should agree with IEC on the position of the air sensor for installation taken into account the considerations detailed in **Section 2.2.3**.

Table 2.1 Proposed Dust Monitoring Stations

Monitoring Station No.(1)	ASR ID in EIA Report	ASR Description
KSR_AM01(2)	KSR-PA01	Planned Public Housing in Kam Tin South Development (Site 1)

Monitoring Station No.[1]	ASR ID in EIA Report	ASR Description
KSR_AM02[2]	KSR-PA03	Planned GIC site in Kam Tin South Development (Site 6)
KSR_AM03[2]	KSR-PA02	Planned GIC site in Kam Tin South Development (Site 1)
KSR_AM04[2]	KSR-PA04	Grand Mayfair (Planned)
KSR_AM05	KSR-A04	Chui Yee Garden
SMA_AM01	SMA-A02	Park Yoho
SMA_AM02	SMA-A04	Au Tau Fisheries Office, Agriculture, Fisheries and Conservation Department (AFCD)
AUT_AM01	AUT-PA03	Planned Public Housing in Sha Po Housing Development
AUT_AM02	AUT-A06	Mo Fan Heung
PWA_AM01	PWA-A01	Village House
LHA_AM01	LHA-A04	Village House
LHA_AM02	LHA-A01	Village House
NTM_AM01	NTM-A01	Village House
NTM_AM02	NTM-A04	Village House
NTM_AM03	NTM-A13	Village House
NTM_AM04	NTM-A03	Hongtai Home for the Aged Limited
NTM_AM05	NTM-A14	Yau Tam Mei Tsuen
NTM_AM06	NTM-A11	Yau Tam Mei Tsuen
SAT_AM01[3]	SAT-A12	Wah Sang Yuen
SAT_AM02[3]	SAT-A01	Christian New Life Association
SAT_AM03[2]	SAT-PA01	Planned Development (STLMC DN)
SAT_AM04[3]	SAT-A13	Village House
SAT_AM05[3]	SAT-A16	Village House
SAT_AM06[3]	SAT-A04	Hung Yat Farm
SAT_AM07	SAT-A03	Shek Wu Wai
SAT_AM08	SAT-A06	Shun Sum Yuen Farm
SAT_AM09	SAT-A05	Shek Wu Wai
KLA_AM01[3]	SAT-A09	Farmers' Cooperative
KLA_AM02[3]	SAT-A10	Village House
KTA_AM01[3]	KTU-A03	Open Storage at Kwu Tung Road
PAA_AM01[3]	KTU-A02	Village Meeting Place
PAA_AM02	KTU-A05	Village House
PAA_AM03[2]	KTU-PA05	Planned Development (KTN NDA)
KTU_AM01[2]	KTU-PA01	Planned Development (KTN NDA)

Monitoring Station No.(1)	ASR ID in EIA Report	ASR Description
KTU_AM02(2)	KTU-PA03	Planned Development (KTN NDA)
KTU_AM03(2)	KTU-PA02	Planned Development (KTN NDA)
KTU_AM04(2)	KTU-PA04	Planned Development (KTN NDA)

Notes:
(1) RSP and FSP impact monitoring should be conducted at the monitoring stations when there are Project-related major construction activities including site formation, excavation, tunnelling works (e.g. mucking out of TBM, cut-and-cover, drill-and-blast and mining) or piling works being undertaken within a radius of 500m from the monitoring stations.
(2) Monitoring should be commenced when site access is allowed after the population intake of the planned development.
(3) Monitoring will not be necessary if the proposed location is demolished/resumed under other project.

2.3.2 The status and locations of air monitoring locations may change after this Manual is issued. In such case, the ET should propose alternative monitoring locations and seek agreement from the IEC and EPD.

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

- Monitoring at ASRs close to the major site activities which are likely to have air quality impacts;
- Monitoring as close as possible to the ASRs as defined in the EIAO-TM;
- Assurance of minimal disturbance to the occupants and working under a safe condition during monitoring; and
- Take into account the prevailing meteorological conditions.

2.3.4 The ET shall agree with the IEC on the position of the instrument. When positioning the instrument, the following points shall be noted:

- a horizontal platform with appropriate support to secure the instrument against gusty wind shall be provided;
- general housekeeping, cleaning works and other preventative maintenance activities such as checking the operating status of individual monitoring equipment should be carried out to ensure the proper operation of the system;
- to ensure representative sampling, the inlet of the instrument should not be obstructed by nearby objects;
- any wire fence and gate, to protect the instrument, should not cause any obstruction during monitoring;
- no furnace or incinerator flue is nearby;
- airflow around the instrument is unrestricted;
- permission must be obtained to set up the instrument and to obtain access to the monitoring stations; and
- a secured supply of electricity is needed to operate the samplers.

2.3.5 Subject to site conditions and monitoring results, the ET, with IEC and EPD endorsement, may decide whether the monitoring locations should be removed / relocated during the construction phase.

2.4 Impact Monitoring

2.4.1 The ET should carry out hourly impact monitoring continuously with air sensor networks during major construction activity of the Project being undertaken within a radius of 500m from the monitoring stations. The daily averages of RSP and FSP are to be determined and reported in monthly EM&A Report, together with the hourly RSP data. The impact monitoring programme is summarised in **Table 2.2.**

2.4.2 The monthly collocation schedule should be drawn up by the ET one month prior to the commencement of the scheduled construction period. Before commencement of the collocation, the ET should inform the IEC such that the IEC can conduct an on-site audit.

Table 2.2 Summary of Construction Dust Monitoring Programme

Monitoring Period	Duration	Sampling Equipment	Sampling Parameter	Frequency
Impact Monitoring	Throughout the construction phase(1)	Air Sensor Network	1-hour RSP, and 24-hour RSP and FSP	Continuous (Results to be reported once in Monthly EM&A Report)

Note:
(1) Impact monitoring should be conducted at the monitoring stations for 1-hour RSP, and 24-hour RSP and FSP monitoring when there are Project-related major construction activities being undertaken within a radius of 500m from the monitoring stations.

2.5 Event and Action Plan

2.5.1 The air quality criteria for the impact monitoring should refer to the relevant AQOs. The ET should compare the impact monitoring results with air quality criteria set up for 1-hour RSP, 24-hour RSP and FSP. **Table 2.3** shows the current air quality criteria, namely A/L levels. The A/L levels may be subject to changes based on the prevailing AQOs implemented at the time of the impact monitoring.

Table 2.3 Current Action and Limit Levels for Impact Monitoring

A/L Level	Parameter	Criteria
Action Level	1-hour RSP level	150 μg/m^3
Limit Level	24-hour RSP level (Rolling average)	100 μg/m^3
	24-hour FSP level (Rolling average)	50 μg/m^3

2.5.2 The Event and Action Plan prescribes procedures and actions associated with the outcome of the comparison of air quality monitoring data recorded and the agreed A/L levels. In the cases where exceedances of these A/L levels occur, the ET, the IEC, the ER and the Contractor should strictly observe the relevant actions of the respective Event and Action Plan listed in **Table 2.4**.

2.6 Mitigation Measures

2.6.1 Site-specific dust mitigation measures recommended in the EIA Report include watering on active works sites / works areas, exposed areas and haul roads, good site practices and dust suppression measures stipulated in Air Pollution Control (Construction Dust) Regulation. Details of the mitigation measures are presented in **Appendix B**. The Contractor should be responsible for the design and implementation of these measures.

Table 2.4 Event and Action Plan for Construction Dust Monitoring

EVENT	ACTION			
	ET	IEC	ER	CONTRACTOR
ACTION LEVEL				
Exceedance for one 1-hour RSP concentration	1. Notify IEC and ER; 2. Check the monitoring data and error messages to confirm if the performance of the monitoring equipment is normal; 3. If exceedance is confirmed, identify source(s), investigate the causes of exceedance and propose remedial measures; and 4. Assess effectiveness of Contractor's remedial measures and keep IEC, and ER informed of the results until exceedance stops.	1. Check monitoring data submitted by the ET; 2. Check Contractor's working method; 3. Discuss with ET, ER and Contractor on possible remedial measures; 4. Advise the ET and ER on the effectiveness of the proposed remedial measures; and 5. Supervise implementation of remedial measures.	1. Confirm receipt of notification of exceedance in writing. 2. Notify Contractor; 3. In consultation with ET and IEC, agree with the Contractor on the remedial measures to be implemented; and 4. Ensure the proposal for remedial measures are properly implemented.	1. Identify source(s) of exceedance, and discuss with ER, ET and IEC on possible remedial measures; 2. Implement remedial measures; and 3. Amend working methods if appropriate.
Exceedance for two or more consecutive 1-hour RSP concentration	1. Notify IEC and ER; 2. Check the monitoring data and the performance of monitoring equipment (refer to **Appendix C**) to confirm if the performance of the monitoring equipment is normal; 3. If exceedance is confirmed, identify source(s), investigate the causes of exceedance and propose remedial measures; 4. Discuss with IEC, ER and Contractor on possible remedial measures required; and	1. Check monitoring data submitted by the ET; 2. Check Contractor's working method and verify the performance of the monitoring equipment to be checked by ET (refer to **Appendix C**); 3. Discuss with ET, ER and Contractor on possible remedial measures; 4. Review and advise the ET and ER on the effectiveness of the proposed remedial measures; and 5. Supervise Implementation of remedial measures.	1. Confirm receipt of notification of exceedance in writing; 2. Notify Contractor; 3. In consultation with the ET and IEC, agree with the Contractor on the proposal for remedial measures to be implemented; and 4. Ensure the proposal for remedial measures are properly implemented.	1. Identify source(s) of exceedance and discuss with ER, ET and IEC on possible remedial measures; 2. Submit a proposal for remedial measures to ER, IEC and ET within two working days of notification of exceedance for agreement; 3. Implement the agreed proposals; and 4. Amend proposal as appropriate.

EVENT	ACTION			
	ET	IEC	ER	CONTRACTOR
	5. Assess effectiveness of Contractor's remedial measures and keep IEC, and ER informed of the results until exceedance stops; and 6. Notify EPD if the exceedance is confirmed to be related to the Project.			
LIMIT LEVEL				
Exceedance for one 24-hour rolling average RSP concentration record and/or one 24-hour rolling FSP concentration record	1. Notify IEC, ER and Contractor and EPD; 2. Check the monitoring data and the performance of the monitoring equipment (refer to **Appendix C**); 3. If exceedance is confirmed, identify source(s), investigate the causes of exceedance and propose remedial measures; 4. Discuss with IEC, ER and Contractor on possible remedial measures required; and 5. Assess effectiveness of Contractor's remedial measures and keep IEC, ER and EPD informed of the results until exceedance stops. 6. Notify EPD if the exceedance is confirmed to be related to the Project.	1. Check monitoring data submitted by the ET; 2. Check Contractor's working method; and verify the performance of the monitoring equipment to be checked by ET (refer to **Appendix C**); 3. Discuss with the ET, ER and Contractor on possible remedial measures; 4. Advise the ET and ER on the effectiveness of the proposed remedial measures; 5. Review Contractors' remedial measures whenever necessary to assure their effectiveness and advise ET and ER accordingly; and 6. Supervise implementation of remedial measures.	1. Confirm receipt of notification of exceedance in writing; 2. Notify Contractor; 3. In consultation with the ET and IEC, agree with the Contractor on the proposal for remedial measures to be implemented; 4. Ensure the proposal for remedial measures properly implemented. 5. If exceedance continues, identify what portion of the work is responsible and instruct the Contractor to stop that portion of work until exceedance is abated.	1. Identify source(s) and discuss with ER, ET and IEC on possible remedial measures; 2. Take immediate action to avoid further exceedance; 3. Submit a proposal for remedial measures to ER, ET and IEC within two working days of notification for agreement; 4. Implement the agreed proposals; 5. Review and resubmit proposals if the problem is still not under control. 6. Stop the relevant portion of works as determined by ER until exceedance is abated.

3 AIRBORNE NOISE

3.1 Introduction

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

3.2 Construction Noise

Noise Parameters

3.2.1 The construction noise level should be measured in terms of the A-weighted equivalent continuous sound pressure level (L_{eq}). $L_{eq\ 30min}$ should be used as the monitoring parameter for the time period between 0700 and 1900 hours on normal weekdays.

3.2.2 Supplementary information for data auditing and statistical results such as L_{10} and L_{90} should also be obtained for reference. A sample data record sheet is shown in **Appendix D** for reference.

Monitoring Equipment and Methodology

3.2.3 As referred to the requirements of the Technical Memorandum (TM) issued under the NCO, sound level meters in compliance with the International Electrotechnical Commission Publications 651:1979 (Type 1) and 804:1985 (Type 1) specifications should be used for carrying out the noise monitoring. Immediately prior to and following each noise measurement, the accuracy of the sound level meter should 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 difference between calibration levels obtained before and after the noise measurement is less than 1.0 dB(A).

3.2.4 Noise measurements should be made in accordance with standard acoustic principles and practices in the relation to weather conditions. Noise measurements should not be made in fog, rain, wind with a steady speed exceeding 5 m/s or wind with gusts exceeding 10 m/s. The wind speed should be checked with a portable wind speed meter capable of measuring the wind speed in m/s.

3.2.5 The ET is responsible for the provision of the monitoring equipment and should ensure that sufficient noise measuring equipment and associated instrumentation are available for carrying out the regular impact monitoring and ad hoc monitoring. All the equipment and associated instrumentation should be clearly labelled.

Noise Monitoring Stations

3.2.6 Based on the findings of EIA Report, the designated locations for construction noise monitoring are listed in **Table 3.1** and are shown in **Figure Nos. C1603/C/NOL/ACM/M62/301** to **307**.

Table 3.1 Noise Monitoring Stations during Construction Phase

Monitoring Station ID	Noise Assessment Point (NAP ID) in EIA Report	NSR Description	Construction Activity	Figure No. (with prefix of C1603/C/NOL/ACM/)
Existing Noise Sensitive Receivers[1]				
NM2	SMR-E1	Tower 8B, Park Yoho	• Retaining Walls and Site Formation Works • Cofferdam Works • Foundation Works • Reinforced concrete (RC) Works • Tunnelling Works by TBM	M62/303
NM3	AUT-E2	26 Mo Fan Heung	• Diaphragm wall (D-wall), Piling and Excavation	M62/303 & 304
NM4	POW-E3	169 Pok Wai	• Preliminary Works • Retaining Walls and Bored Pile Walls • Cofferdam Works • Foundation Works	M62/304
NM5	NTM-E1	Hongtai Home for the Aged Limited	• D-wall, Piling and Excavation • RC Structures	M62/305
NM6	SAT-E4	89 Shek Wu Wai	• Site Clearance, Preparation and Monitoring • Road Works	M62/306
NM7	SAT-E2	Temporary Structure near Shek Wu Wai San Tsuen	• Site Clearance, Preparation and Monitoring • Road Works • Diaphragm wall (D-wall), Piling and Excavation	M62/306

Monitoring Station ID	Noise Assessment Point (NAP ID) in EIA Report	NSR Description	Construction Activity	Figure No. (with prefix of C1603/C/NOL/ACM/)
Planned Noise Sensitive Receivers[1][2]				
NM1	KSR-P2	Planned G/IC Site at Kam Tin South Housing Development	• D-wall, Piling and Excavation • RC Works	M62/302
NM8	KTU-P6	Planned Housing Development at Kwu Tung North NDA	• Excavation and Structural Works • ABWF, BS, Systemwide EM&A Installations, SATs & SIT	M62/307
NM9	KTU-P8	Planned Housing Development at Kwu Tung North NDA	• Ground Investigation and Foundation Works • Excavation and Structural Works • Tunnelling Works by TBM	M62/307

Notes:
(1) Impact noise monitoring should be conducted at the monitoring stations when there are Project-related corresponding construction activities being undertaken within a radius of 300m from the monitoring stations.
(2) Monitoring should commence when access is granted after the population intake of the planned development.

3.2.7 The status and location of noise sensitive receivers (NSRs) may change after approval of this Manual. In such case, and if changes to the monitoring locations are considered necessary, the ET should propose alternative monitoring stations and seek approval from the ER and agreement from the IEC on the proposal. If alternative monitoring stations are proposed, these stations should be chosen based on the following criteria:

- Monitoring at locations close to the major site activities of the Project that are likely to arise noise impacts;
- Monitoring as close as possible to the most affected NSRs; and
- Assurance of minimal disturbance to the occupants and working under a safe condition during monitoring in the vicinity of the NSRs.

3.2.8 The monitoring station should normally be at a point 1m from the exterior of the noise sensitive facade and be at a position 1.2m above ground. If there is a problem with access to the normal monitoring position, an alternative position should be chosen, and a correction to the measurement results should be made. For reference, a correction of +3dB(A) should be made to free-field measurements. The ET should agree with the IEC on the monitoring position and the corrections adopted.

Baseline Monitoring

3.2.9 Given that there would be various concurrent projects along NOL alignment, baseline monitoring in the absence of construction activities would not be feasible. In addition, the Action and Limit Levels of construction noise monitoring (**Table 3.2** refers) are not based on the baseline noise environment and thus baseline monitoring is considered not necessary.

Impact Monitoring

3.2.10 During normal construction working hours (0700-1900 Monday to Saturday), monitoring of $L_{eq, (30min)}$ noise levels should be carried out at the agreed monitoring locations once every week in accordance with the methodology in the TM issued under NCO.

3.2.11 In the case of non-compliance with the construction noise criteria, more frequent monitoring, as specified in Event and Action Plan in **Table 3.3**, should be carried out. This additional monitoring should be continued until the recorded noise levels show that the non-compliance is rectified or proved to be irrelevant to the Project-related construction activities.

3.2.12 The monthly schedule of the impact monitoring programme should be drawn up by the ET at least 2 weeks prior to the commencement of the scheduled construction period. Before commencing impact monitoring, the ET should inform the IEC of the impact monitoring programme such that the IEC can conduct on-site audit.

Action and Limit Levels

3.2.13 The ET should compare the airborne construction noise monitoring results with noise criteria. **Table 3.2** shows the noise criteria, namely A/L Levels to be used.

Table 3.2 Action and Limit Levels for Airborne Construction Noise Impact Monitoring

Time Period	Action Level	Limit Level
0700 - 1900 hours on normal weekdays (1)	When one documented complaint is received	75 dB(A) (2)

Notes:
(1) If works are to be carried out during restricted hours, the conditions stipulated in the construction noise permit issued by the Noise Control Authority have to be followed.
(2) Limit level of 75 dB(A) for dwelling, 70 dB(A) for schools and 65 dB(A) during school examination periods.

Event and Action Plan

3.2.14 Should non-compliance of the noise criteria occur, actions in accordance with the Event and Action Plan in **Table 3.3** should be carried out.

Table 3.3 Event and Action Plan for Construction Noise Monitoring

EVENT	ACTION			
	ET	**IEC**	**ER**	**CONTRACTOR**
Action level being exceeded	1. Notify IEC, ER and Contractor; 2. Identify source and carry out investigation; 3. Discuss with the Contractor and formulate remedial measures; and 4. Increase monitoring frequency to check mitigation effectiveness if the exceedance is relevant to the Project-related construction activities.	1. Review the analysed results submitted by the ET; 2. Review the proposed remedial measures by the Contractor and advise the ER accordingly; and 3. Ensure remedial measures properly implemented.	1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. Require Contractor to propose remedial measures for the analysed noise problem; and 4. Ensure remedial measures are properly implemented.	1. Identify source, and carry out investigation and report the investigation to the ET, IEC and ER; 2. Submit noise mitigation proposals to IEC and ER; and 3. Implement noise mitigation proposals.
Limit level being exceeded	1. Notify IEC, ER, EPD and Contractor; 2. Identify source and carry out investigation; 3. Repeat measurements to confirm findings; 4. Increase monitoring frequency if the exceedance is relevant to the Project-related construction activities; 5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented; 6. Inform IEC, ER and EPD the causes and actions taken for the exceedances;	1. Check monitoring results and discuss amongst ER, ET, and Contractor on the potential remedial actions; 2. Review Contractors remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly; and 3. Ensure remedial measures properly implemented.	1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. Require Contractor to propose remedial measures for the analysed noise problem; 4. Ensure remedial measures properly implemented; and 5. 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. Identify source and carry out investigation and report the investigation to the ET, IEC and ER; 2. Take immediate action to avoid further exceedance; 3. Submit proposals for remedial actions to ER, ET and IEC within 3 working days of notification; 4. Implement the agreed proposals; 5. Resubmit proposals if problem still not under control; and 6. Stop the relevant portion of works as determined by the ER until the exceedance is abated.

EVENT	ACTION			
	ET	IEC	ER	CONTRACTOR
	7. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results; and 8. If exceedance stops, cease additional monitoring.			

3.3 Operational Phase – Fixed Plant

3.3.1 The maximum allowable sound power levels of the identified fixed noise sources of the Project were predicted in the EIA Report. Nevertheless, Fixed Noise Sources Management Plan (FNMP) should be prepared before the issue of tender and before commencement of the installation of fixed plant, subject to the contract arrangement of the Project and agreement with EPD. The FNMP should contain quantitative fixed noise impact assessment based on the best available information, accounting all design measures including noise mitigation measures. The FNMP should be certified by Certified Noise Modelling Professional of Hong Kong Institute of Qualified Environmental Professionals (HKIQEP) or equivalent.

3.3.2 In additional, Fixed Noise Audit Report (FNAR) should be prepared to demonstrate the compliance of the fixed plant noise sources of the Project with the maximum allowable sound power levels determined in the EIA Report, or otherwise approved by the EPD in compliance with the requirements in EIAO-TM having due regard to the characteristics of tonality, impulsiveness and intermittency. The FNAR should be certified by the ETL and verified by the IEC as conforming to the information and recommendations contained in the EIA Report.

3.3.3 No specific monitoring for the fixed plant operation is deemed necessary.

3.4 Operational Phase – Airborne Rail Noise

Noise Parameter and Criteria

3.4.1 To ensure that the operational airborne rail noise levels comply with the noise standards stipulated in the NCO, the ET should carry out commissioning test at the proposed monitoring locations identified in this Manual. The noise commissioning test report should be certified by the ETL and verified by the IEC as conforming to the information and recommendations contained in the EIA Report.

3.4.2 The Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (IND-TM) stipulates the appropriate Acceptable Noise Levels (ANL) for airborne rail noise. The ANLs are dependent on Area Sensitivity Rating (ASR) of the noise sensitive receivers and are shown in **Table 3.4**.

Table 3.4 Acceptable Noise Levels for Airborne Rail Noise

Time Period	Noise Criteria ($L_{eq, 30min}$, dB(A))		
	ASR A	ASR B	ASR C
Daytime and Evening (0700 to 2300 hours)	60	65	70
Night-time (2300 to 0700 hours)	50	55	60

Monitoring Equipment and Methodology

3.4.3 The monitoring equipment and methodology for operational noise monitoring should be same as those recommended for construction noise monitoring.

3.4.4 The monitoring station should normally be at a point 1m from the exterior of the noise sensitive façade and be at a position 1.2m above ground. If there is a problem with access to the normal monitoring position, an alternative position should be chosen, and a correction to the measurement results should be made. For reference, a correction of +3dB(A) should be made to free-field measurements. The ET should agree with the IEC on the corrections adopted.

3.4.5 One set of 30-minute measurement at the designated monitoring station should be conducted during night-time (2300 – 0700 hours). Noise measurements of the A-weighted equivalent continuous sound pressure level (L_{eq}) should be made. $L_{eq\ (30\ minutes)}$ should be used as the monitoring parameter. Supplementary information for data auditing, statistical results, such as L_{max}, L_{10} and L_{90} should also be obtained for reference.

Noise Monitoring Stations

3.4.6 The designated locations for airborne rail noise commissioning test are listed in **Table 3.5** and are shown in **Figure No. C1603/C/NOL/ACM/M62/351**.

Table 3.5 Noise Monitoring Stations for Commissioning Test

Monitoring Station No.(1)	NSR ID in EIA Report	NSR Description	ASR(2)
ON1	N87	Village House near Wang Ping Shan South Road	B
ON2	N59	The Dhamma Garden	B

Notes:
(1) One set of 30-minute measurement at the designated monitoring station should be conducted during night-time (2300 – 0700 hours). Relevant noise criterion should be adopted for compliance checking accordingly.
(2) The corresponding ASR of the NSR is determined based on the best available information and is for indicative assessment only. The Noise Control Authority shall determine noise impact from concerned noise sources on the basis of prevailing legislation and practices being in force, and the ASR determined in this report should not bind the Authority when enforcing the NCO based on the contemporary conditions. The ASR would be reviewed as necessary based on the contemporary conditions/situations.

3.4.7 The status and location of noise monitoring station may change after approval of this Manual. In such case, and if changes to the monitoring locations are considered necessary, the ET should propose alternative monitoring stations and seek approval from the ER and agreement from the IEC on the proposal. If alternative monitoring stations are proposed, these stations should be chosen based on the following criteria:

- Monitoring at locations close to the major operation activities of the Project that are likely to arise noise impacts;
- Monitoring as close as possible to the NSRs as defined in the EIAO-TM; and
- Assurance of minimal disturbance to the occupants and working under a safe condition during monitoring.

3.5 Mitigation Measures

Construction Phase

3.5.1 The assessment findings indicate that construction activities, with the adoption of the recommended mitigation measures, would not cause airborne noise exceedances except at a planned school during examination period. The Contractor should be responsible for the design and implementation of the recommended mitigation measures. The Contractor should also liaise with the representative of the concerned school and/or the Examination Authority to ascertain the exact dates and times of all examination periods during the construction period and should avoid conducting noisy activities during the examination periods if the school is relied on opened windows for ventilation. The implementation schedule for the recommended mitigation measures is presented in **Appendix B**.

3.5.2 Construction Noise Management Plan(s) (CNMP) should be prepared based on the best available information before the issue of tender and the commencement of

construction works, subject to the contract arrangement of the Project and agreement with EPD. The plan should include a quantitative construction noise impact assessment with details on the construction method, plant inventory and recommended noise mitigation measures for the future contractors' further update on CNMP before commencement of construction works and implementation in order to minimise the construction noise impact and comply with the EIAO-TM. In addition, further review on the cumulative construction noise impact should be conducted as necessary in the later CNMP when the information of the concurrent project is available. The CNMP(s) should be certified by Certified Noise Modelling Professional of HKIQEP or equivalent.

3.5.3 In the event of exceedances or Project related complaints, the Contractor should review the effectiveness of these mitigation measures and propose, design and implement alternative or additional measures as appropriate. The Contractor should liaise with the ET and ER on alternative or additional remedial measures, if appropriate, and the proposal of the measures should be submitted to the ER and IEC for agreement. The Contractor should implement the agreed remedial measures properly.

Operational Phase

3.5.4 The mitigation measures as recommended in the EIA Report for the fixed plant associated with the Project is presented in **Appendix B**. These measures should be reviewed and refined by the ER and ETL if there are any major design changes during the detailed design phase such that the recommended measures are adequate for alleviating the potential operational noise impacts.

4 GROUND-BORNE NOISE

4.1 Introduction

4.1.1 This section presents the requirement, methodology, equipment, monitoring locations and criteria for the monitoring and audit of ground-borne noise impacts during the construction and operational phase of the Project.

4.2 Construction Phase

4.2.1 According to the ground-borne noise assessment findings, it was predicted that the unmitigated construction ground-borne noise levels will comply with the stipulated daytime noise criteria, except that a planned school site in proximity to TBM operation during examination period. The Contractor should closely liaise with the representative of the education institution to confirm the examination periods, so as to avoid TBM operation in the vicinity of the schools within such periods. Therefore, ground-borne noise monitoring is considered not necessary during construction phase.

4.3 Operational Phase

Methodology

4.3.1 The operational ground-borne noise level should be measured in terms of the A-weighted equivalent continuous sound pressure level (L_{eq}). $L_{eq\ 30min}$ should be used as the monitoring parameter.

4.3.2 Supplementary information for data auditing and statistical results such as L_{10} and L_{90} should also be obtained for reference. A sample data record sheet is shown in **Appendix D** for reference.

4.3.3 With reference to the IND-TM issued under the NCO, the criteria for noise transmitted primarily through the structural elements of a building or buildings should be 10dB(A) less than the relevant ANL.

Monitoring Equipment

4.3.4 According to the requirements of the TM issued under the NCO, sound level meters in compliance with the International Electrotechnical Commission Publications 651:1979 (Type 1) and 804:1985 (Type 1) specifications should be used for carrying out the noise monitoring. Immediately prior to and following each noise measurement the accuracy of the sound level meter should 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 different between the calibration levels obtained before and after the noise measurement is less than 1.0 dB(A).

4.3.5 The ET is responsible for the provision of the monitoring equipment. He should ensure that sufficient noise measuring equipment and associated instrumentation are available for carrying out the regular impact monitoring and ad hoc monitoring. All the equipment and associated instrumentation should be clearly labelled.

Commissioning Test

4.3.6 A commissioning test should be conducted by the ET prior to the operation of the Project to confirm the compliance of the operational ground-borne noise levels with the NCO noise criteria. The ground-borne noise monitoring locations should be

performed at the selected key GBNSRs listed in **Table 4.1** and are illustrated in **Figure Nos. C1603/C/NOL/ACM/M62/401 to 408** The commissioning test report should be submitted to IEC for verification.

Table 4.1 Operational Ground-borne Noise Monitoring Locations

Station ID	GBNSR ID in EIA Report	Monitoring Location (1)	Figure No. (with prefix of C1603/C/NOL/ACM/)
OGN1	KSR-PG06a	Planned G/IC site at Kam Tin South Housing Development	M62/402
OGN2	KSR-PG02	Kam Tai Road Residential Development	M62/403
OGN3	AUT-G02	No. 137, Mo Fan Heung	M62/404
OGN4	NTM-G07	Village House near Wang Ping Shan South Road	M62/405
OGN5	NTM-G02	China Bible Seminary	M62/405
OGN6	SAT-PG01h	Potential Housing Development in STLMC DN	M62/406
OGN7	KTU-G02	Village House in Chau Tau Tsuen	M62/407
OGN8	KTU-PG01a	Planned Housing Development in Kwu Tung North	M62/408

Note:
(1) The monitoring station should be at the lowest sensitive floor where accessible of each designated monitoring location.

4.3.7 The status and location of noise sensitive receivers may change after this Manual is issued. In such event, and if changes to the monitoring locations are considered necessary, the ET should propose alternative monitoring locations and seek approval from the ER and agreement from the IEC on the proposal. When alternative monitoring locations are proposed, the monitoring locations should be chosen based on the following criteria:

- Monitoring at sensitive receivers close to the major site activities that are likely to have noise impact;
- Monitoring close to the noise sensitive receivers as defined in the Technical Memorandum; and
- Assurance of minimal disturbance to the occupants during monitoring in the vicinity of sensitive receivers.

4.3.8 The monitoring station should be at the lowest sensitive floor where accessible of each designated monitoring location and normally be at a position 1.2m above ground inside the building structures. If there is a problem with access to the normal monitoring position, an alternative position should be chosen, and a correction to the measurement results should be made. The ET should agree with the IEC on the monitoring position and the corrections adopted.

4.3.9 A summary of the operational ground-borne noise criteria is given in **Table 4.2** below.

Table 4.2 Operational Ground-borne Noise Criteria

Type of NSR / Assessment Point (1)	Ground-borne Noise Criteria, ($L_{eq, 30min}$, dB(A))	
	Day and Evening(2) (0700-2300 hrs)	Night(2) (2300 to 0700 hrs)
Domestic premises, hotels and hostels	60 for ASR "C"/ 55 for ASR "B" / 50 for ASR "A"	50 for ASR "C" / 45 for ASR "B" / 40 for ASR "A"
Churches, Educational Institutions and Clinics		- (3)

Notes:
(1) Assessment point locates at an internal location of a building in which the NSR is located.
(2) Ground-borne noise is deemed not to be affected by IF, therefore, the effect of IF should not be considered to determine the appropriate noise criteria.
(3) No sensitive use/activity during this period.

4.4 Mitigation Measures

Construction Phase

4.4.1 The assessment findings indicated that the unmitigated construction ground-borne noise levels would comply with the stipulated daytime noise criteria, except at a planned school site during examination period. The Contractor should closely liaise with the representative of the education institution to confirm the examination periods, so as to avoid TBM operation in the vicinity of the schools within such periods. Ground-borne noise monitoring is considered not necessary during construction phase.

Operational Phase

4.4.2 The current design of the Project would adopt Type 1a (Alt 1) trackform, and the predicted operational ground-borne noise at all GBNSRs would comply with the noise criteria. Nevertheless, the ground-borne noise predictions would be updated based on the result of tunnel impact test to be conducted upon the completion of tunnel construction and the updated information of the GBNSRs (e.g. building layout, land use and lowest occupied floor). In order to ensure no adverse operational ground-borne noise impact, a commissioning test should be conducted by ET prior to the operational phase of the Project.

5 WATER QUALITY

5.1 Introduction

5.1.1 Potential water quality impacts arising from the construction and operational phases of the Project were identified and assessed in the EIA Report. With the implementation of the recommended mitigation measures, no adverse water quality impacts from the Project would be expected during the construction and operational phases of the Project. This section defines the audit requirements to confirm the recommended mitigation measures are effectively implemented during the construction phase, while no monitoring or audit is required during the operational phase.

5.2 Mitigation Measures

5.2.1 As a preventive measures, monitoring of groundwater level would be required during the construction stage and thus a groundwater monitoring programme should be developed in detailed design stage for implementation during the construction.

5.2.2 Mitigation measures recommended for mitigation of construction phase water quality impacts are provided in the **Appendix B** of this Manual. The Contractor should be responsible for the design and implementation of the mitigation measures.

5.3 Audit Requirement

5.3.1 Regular audit should be carried out during construction phase by the ER, ET and Contractor to ensure that the recommended good site practices and the recommended mitigation measures listed in **Appendix B** are properly implemented by the Contractor. Apart from site audit, relevant documents including licences and permits should be reviewed and audited for compliance with the legislation and contract requirements.

6 SEWEREAGE AND SEWAGE TREATMENT IMPLICATIONS

6.1 Introduction

6.1.1 Potential sewerage and sewage treatment implications arising from the construction and operational phases of the Project were identified and assessed in the EIA Report. It is anticipated that there would be no unacceptable adverse impact on the existing and planned sewerage systems during both construction and operational phases of the Project. Therefore, no specific EM&A requirement would be required.

6.2 Mitigation Measures

Construction Phase

6.2.1 As stated in Section 7 of the EIA Report, sewage generated by the construction workforce would be collected by chemical toilets provided at construction sites of the Project. Hence, no sewerage and sewage treatment implications were identified, and no specific EM&A requirement would be required during the construction phase of the Project.

Operational Phase

6.2.2 As identified in Section 7 of the EIA Report, the sewage loading generated by the stations, ancillary buildings and depot will be connected to existing and planned public sewerage systems or tankered away by competent contractors, subject to the programme and provision of planned sewerage systems. According to the assessment, the public sewerage systems will have sufficient capacities to handle the loading generated by the operational phase of the Project. Hence, it is anticipated that there would be no unacceptable adverse sewerage and sewage treatment implications arising from the operation of the Project. Therefore, no EM&A requirement would be required during the operational phase of the Project.

7 WASTE MANAGEMENT

7.1 Introduction

7.1.1 Construction and Demolition (C&D) materials, land-based sediment, general refuse from workforce and chemical waste would be generated during the construction phase. It is the Contractor's responsibility to ensure all the waste arisen from the Project are handled, stored and disposed of in accordance with good waste management practices, relevant legislation and waste management guidelines. Provided that these wastes are handled, transported and disposed of using approved methods and that the recommended good site practices and relevant legislation are strictly followed, adverse environmental impacts would not be expected.

7.1.2 As there would be limited quantities of waste to be generated from the operation of the Project, no adverse environmental impacts would be anticipated with the implementation of good waste management practices. Monitoring and audit programme for the operational phase of the Project would not be required.

7.2 Audit Requirement

7.2.1 Regular audits and site inspections should be carried out during construction phase by the ER, ET and Contractor to ensure that the recommended good site practices and the recommended mitigation measures in **Appendix B** are properly implemented by the Contractor. The audits should concern all aspects of on-site waste management practices including waste generation, storage, recycling, transport and disposal. Apart from site inspection, documents including licences, permits, disposal and recycling records should be reviewed and audited for compliance with the legislation and contract requirements.

7.2.2 The requirements of the environmental audit programme are set out in **Section 15** of this Manual. The audit programme will verify the implementation status and evaluate the effectiveness of the mitigation measures.

7.3 Mitigation Measures

7.3.1 The mitigation measures recommended in EIA Report should form the basis of the Waste Management Plan (WMP) to be developed by the Contractor during the construction stage.

7.3.2 It is recommended that the waste generated during the construction activities should be audited regularly by the ET to determine if wastes are being managed in accordance with approved procedures and the site WMP. The audit should look at all aspects of on-site waste management practices including waste generation, storage, recycling, transport and disposal. Apart from site inspection, documents including licences, permits, disposal and recycling records should be reviewed and audited for compliance with the legislation and contract requirements. In addition, the routine site inspections should check the implementation of the recommended good site practices and other waste management mitigation measures.

7.3.3 With the appropriate handling, storage and disposal of waste arising from the construction works as recommended in **Appendix B**, adverse environmental impacts would not be expected. During the site inspections, the ET should pay special attention to the issues relating to waste management and check whether the Contractor has implemented the recommended good site practices and mitigation measures.

8 LAND CONTAMINATION

8.1 Introduction

8.1.1 Land contamination assessment was conducted for the Project. Site appraisals, in the form of desktop review and site walkovers, had been carried out to identify the areas with potential land contamination concern within the Project area.

8.1.2 As the concerned facilities / areas are still in operation until land resumption, there could be change in site activities and land uses within the Project Site prior to land resumption which may cause further contamination issues. Further site appraisal of the whole Project Site (including identified accessible sites, partially accessible sites and inaccessible sites, associated site investigation (SI) works and any necessary remediation action are recommended to be carried out after land resumption but prior to commencement of construction works by mean of excavation at the concerned area(s). Except for land remediation works, no construction works by mean of excavation should be carried out at the respective identified contaminated areas (if any) prior to the endorsement of the closure assessment. The recommended further assessment and remediation works, including the submission of Supplementary Contaminated Assessment Plan(s) (CAP(s)), Contamination Assessment Report(s) (CAR(s)) and if necessary, Remediation Action Plan(s) (RAP(s)) and Remediation Report(s) (RR(s)) to EPD for approval, would follow relevant Guidance Manual, Guidance Note and Practice Guide.

8.1.3 With the implementation of the recommended follow-up works (**Section 8.1.2** refers), any soil / groundwater contamination would be identified and properly treated prior to construction works at the concerned areas. Besides, no land contamination is anticipated during the operation phase. Specific EM&A requirement is therefore not required.

8.2 Mitigation Measures

8.2.1 If land contamination is identified, precautionary measures are recommended in **Appendix B** to minimise environmental impacts arising from handling of potentially contaminated materials. The Contractor should be responsible for the implementation of these measures.

9 ECOLOGY (TERRESTRIAL AND AQUATIC)

9.1 Introduction

9.1.1 Potential ecological impacts arising from the construction and operational phases of the Project were assessed in the EIA Report. There would be no direct impact on Country Parks and other recognized sites of conservation importance. Mitigation measures are recommended to minimise the potential direct and indirect impacts to the nearby recognized sites of conservation importance, ecologically sensitive areas, natural habitats, as well as the associated wildlife. With the implementation of appropriate mitigation measures, no unacceptable adverse residual impacts would be anticipated. Nonetheless, EM&A is considered necessary during construction and operation of the Project and the requirements are described below.

9.2 Mitigation Measures

9.2.1 The mitigation measures recommended in the EIA Report to minimise potential ecological impacts are detailed in **Appendix B**.

9.3 Monitoring Requirements

Monitoring of the Condition of Kam Po Road Egretry and Ardeid Night Roost

9.3.1 A pre-construction survey should be conducted for areas within 100m from the boundaries of works site/area to confirm the location and status of the Kam Po Road Egretry and Ardeid Night Roost (ANR). Monthly monitoring of the existing Kam Po Road Egretry and ANR should be conducted when the construction works are conducted within 100m of the Egretry and ANR. Criteria to be monitored include the status, location and extent of the Egretry and ANR, the condition of the nesting and roosting substrates, the species, abundance of ardeids, number of nests, any breeding activities such as nest sitting and chick feeding, the returning time of the roosting ardeids, as well as their flight height and flight path. The monitoring should be conducted to cover the peak period of ardeid activities, i.e. the egretry survey should start around half an hour before sunrise and last for about two hours after sunrise during the ardeid breeding season (March to August); the night roost survey should start from approximately an hour before sunset and lasted until nightfall when observation of ardeid is no longer possible. The exact time of sunrise and sunset on the date of survey should be made reference to the website of the Hong Kong Observatory. Direct observation should be made from an appropriate vantage point which enables view of the Egretry and ANR. Any changes in site condition or disturbances detected or observed at the monitoring locations, including both construction and non-construction related activities, during each monitoring visit should also be recorded.

9.3.2 In the event that night-time construction works would be conducted within 100m of the night roost, weekly monitoring should be conducted during the period of night-time construction works.

9.3.3 Contingency arrangement due to the uncontrollable issues (i.e. traffic jam, delay of concrete supply, breakdown of plant / equipment, etc) may result in conducting concreting works beyond the sunset time. In the event of occurrence of contingency arrangement, a notice with valid justification documents and contingency arrangement details should be prepared and recorded in the EM&A reports. This notice should also record any change in the ardeid night roost (e.g. displacement or abandonment) observed during contingency arrangement and any mitigation measures implemented and/or to be implemented.

9.3.4 The ecological monitoring should be undertaken by experienced ecologist(s) with at least 7 years of relevant working experience. The usage of the Egretry and ANR

should be reviewed and analysed, and if any significant decline is identified, the cause of the decline, with reference to any changes in site condition or disturbances detected, should be reviewed to identify any unpredicted indirect ecological impacts arising from the proposed Project. Remedial measures should be developed and implemented by the Contractor as necessary. In the event that the active Egretry and ANR are found to have relocated to 100m away from the boundary of Project footprint naturally, restriction on working hours can be ceased, subject to further consultation and agreement with AFCD/EPD.

Monitoring of Transplantation of Flora Species of Conservation Importance

9.3.5 All flora species of conservation importance should be protected as far as practicable, though two floral species of conservation importance (including a cluster of *Persicaria orientalis* and a sapling of *Aquilaria sinensis*) were recorded within the Project footprint (i.e. Sha Po/Au Tau Area). In case of unavoidable loss of flora species of conservation importance, according to the Protection and Transplantation Proposal, a post-transplantation monitoring programme should be carried out to ensure the satisfactory establishment of the transplanted plants. Details of post-transplantation monitoring programme such as monitoring frequency and parameters, maintenance works would be recommended in the proposal.

Monitoring of Compensatory Wetland

9.3.6 Compensatory wetland would be provided to compensate for the affected wetland habitat. Monitoring should be conducted after establishment of compensatory wetland. Parameters of monitoring should focus on the abundance of target species and habitat conditions (e.g. water depth, water quality and condition of the wetland vegetation etc.). Management programmes (e.g. water control, structural maintenance, supplemental planting, pest control, repair of damage etc.) should be conducted as necessary according to the agreed Habitat Creation and Management Plan which should be submitted for EPD's approval at least three months before commencement of compensatory works.

Monitoring of Bat Shelter

9.3.7 An on-site purpose-built bat shelter would be provided due to the direct loss of a day-roost of Himalayan Leaf-nosed Bats in one of the structures in the deserted Pok Wai Public School within the site of Pok Wai Ancillary Building. Details for the provision of a bat shelter will be further studied and submitted at least three months before the construction of bat shelter, detailing the location, design, management, maintenance and monitoring requirement for agreement with AFCD.

Monitoring of Impact from Groundwater Infiltration

9.3.8 Groundwater levels will be monitored at the areas close to the aboveground works sites where would have deep excavation and active fishponds as well as the tunnel alignment at LTCP in pre-construction and construction stages as part of the comprehensive groundwater monitoring strategy (Section 6 of the EIA Report refers). A Monitoring and Emergency Response Plan should be prepared in relation to the potential impacts to ecological sensitive area(s) (e.g. Country Park). The Plan should include, but not be limited to, details of monitoring locations and programme, a mechanism to monitor the implication from the works to the groundwater system and fishponds including their water levels, action levels and emergency responses such as immediate action, remedial action and investigation.

9.4 Audit Requirements

9.4.1 Site audit should be undertaken on weekly basis to check the proper implementation and maintenance of the recommended mitigation measures during construction phase of the Project.

10 FISHERIES

10.1 Introduction

10.1.1 Potential fisheries impacts arising from the construction and operational phases of the Project were assessed in the EIA Report. Limited impact on fisheries resources were anticipated.

10.2 Mitigation Measures

10.2.1 The mitigation measures recommended in the EIA Report to minimise potential fisheries impacts are provided in **Appendix B**.

10.3 Monitoring and Auditing Requirements

10.3.1 Groundwater levels will be monitored at the areas close to the aboveground works sites where would have deep excavation and active fishponds in pre-construction and construction stages as part of the comprehensive groundwater monitoring strategy (Section 6 of the EIA Report refers). A Monitoring and Emergency Response Plan should be prepared in accordance with **Section 9.3.8** of the Manual. The locations of the potentially affected active fishponds are listed in **Table 10.1** below and are illustrated in **Figure Nos. C1603/C/NOL/ACM/M62/601** to **604**.

Table 10.1 Potentially Affected Active Fishponds

Area	Location ID(1) of Potentially Affected Active Fishponds
Sha Po/Au Tau Area	SA#21 to #36
Ngau Tam Mei/Pok Wai Area	NP#33 to #42
San Tin/Shek Wu Wai Area	SS#35 to #38

Note:
(1) Location ID can be referred to **Figure Nos. C1603/C/NOL/ACM/M62/601** to **604**.

11 LANDSCAPE AND VISUAL

11.1 Introduction

11.1.1 The EIA Report has recommended landscape and visual mitigation measures for the construction and operational phases of the Project. This section defines the audit requirements to confirm the recommended landscape and visual impact mitigation measures are effectively implemented.

11.2 Mitigation Measures

11.2.1 The landscape and visual mitigation measures should be incorporated in the detailed design. The mitigation measures during construction and operational phases as recommended in the EIA Report are presented in **Appendix B**. Where feasible, the construction phase mitigation measures should be implemented as early as possible in order to minimise the landscape and visual impacts in the construction stage while the mitigation measures for the operational phase should be adopted during the detailed design and be built as part of the construction works so that they are in place before commissioning of the Project.

11.2.2 Any potential conflicts among the proposed mitigation measures, the Project works, and operational requirements should also be identified and resolved as early as practicable. Any changes to the mitigation measures should be incorporated in the detailed design.

11.3 Audit Requirements

11.3.1 Regular site audit should be undertaken during the construction phase of the Project to check that the proposed landscape and visual mitigation measures are properly implemented and maintained as per their intended objectives.

12 CULTURAL HERITAGE

12.1 Introduction

12.1.1 Desktop research and field evaluation were conducted and the findings indicated the present of cultural heritage resources (CHRs) (including built heritage and Sites of Archaeological Interest (SAIs)) and other identified items in the vicinity of the NOL alignment. Assessment results indicated that both direct (i.e. demolition of other identified items) and indirect impacts (i.e. ground-borne vibration) were anticipated in the construction and operational phases of the Project.

12.2 Mitigation Measures

12.2.1 The recommended mitigation measures as presented in **Appendix B** and summarize below should be implemented to mitigate the impacts on CHRs.

Built Heritage

Cartographic and Photographic Record

12.2.2 Other identified items (i.e. Fung Kat Vegetable Marketing Co-operative Society Ltd. and Pok Wai Public School) with imminent direct impact due to demolition should be preserved by record. Cartographic and photographic record, and other documentation means (including 3D scanning), should be conducted prior to the commencement of any construction works at the respective locations and the record should be shared with AMO for record purposes and future use, such as research, exhibition and educational programmes.

Monitoring of Ground Borne Vibration, Tilting and Settlement

12.2.3 During construction phase, monitoring of ground-borne vibration, tilting and ground settlement under Building Ordinance is proposed to be employed for the other identified item (i.e. San Yau Vegetable Marketing Co-operative Society Ltd.) during the construction phase. The monitoring should be incorporated with a set of Alert, Alarm and Action (3As) system strictly following the requirements set out in Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers - Ground-borne Vibrations and Ground Settlements Arising from Pile Driving and Similar Operations (PNAP APP-137) on vibration-sensitive and dilapidated buildings. If the alert level is exceeded, the monitoring frequency should be increased. If the alarm level is exceeded, the design of the construction may have to be amended. If the action level is exceeded, all works should be stopped. Empirical guidelines on the 3As criteria provided in PNAP APP-137 during construction phase are quoted in **Table 12.1**. The actual 3As criteria shall be further confirmed via an assessment on the effects of ground-borne vibrations, settlements and tilting on San Yau Vegetable Marketing Co-operative Society Ltd.

Table 12.1 Guidelines on 3As Criteria Recommended in PNAP APP-137

Building Type	Guide values of maximum ppv (mm/sec)	
	Transient Vibration	Continuous Vibration
Vibration-sensitive/ dilapidated buildings	7.5	3.0

Instrument	Criterion	Alert	Alarm	Action
Ground settlement marker	Total settlement	12mm	18mm	25mm
Services settlement	Total settlement &	12mm	18mm	25mm

marker	Angular distortion	or 1:600	or 1:450	or 1:300
Building tilting marker	Angular distortion	1:1000	1:750	1:500

12.2.4 Prior agreement and consent should be sought from the owner(s), stakeholder(s) and relevant Government department(s) for the installation of monitoring points on the building before commencement of the works. Record of monitoring should be submitted regularly to the Buildings Department during the construction under Buildings Ordinance. Buildings Department should be alerted in case any irregularities are observed.

12.2.5 No other identified item is located within 100m from the drill-and-blast tunnel section between NTD and PWA. However, should the construction method of the remaining tunnel boring machine (TBM) tunnel sections resort to blasting, the abovementioned mitigation measures should be applied to all the other identified items located within 100m from the underground works sites and areas under the same 3As system with the same criteria (**Table 12.1** refers).

Temporary Change of Access

12.2.6 There would be a temporary change of access to San Yau Vegetable Marketing Co-operative Society Ltd. during the construction phase. To ensure the smooth and continuous operation of the Society, a safe access route should be maintained for the users of the Society.

Archaeology

12.2.7 Potential impacts on archaeological areas have been avoided as far as practical through minimisation of works area. Based on the desktop review, the archaeological field survey during the course of EIA study, additional survey information and archaeological impact assessment from other recent project and archaeological prediction modelling, two archaeologically sensitive areas (ASA), namely Long Ha ASA and Ngau Tam Mei ASA located in the at-grade Project area of north of AUT Station, and south of NTM Station and NTD, respectively. Survey-cum-excavation is recommended to be conducted at these areas after land resumption and prior to the commencement of site formation and construction works at these areas to fully yield archaeological information and preserve archaeological remains (if any) by detailed records. Further archaeological investigation should be conducted at NTM-TP3 after land resumption and prior to the commencement of site formation and construction works to yield adequate archaeological information.

12.2.8 To satisfy licence requirements and provide a more comprehensive analysis on the archaeological potential with the Licence Area of the *Licence to Excavate and Search for Antiquities* (No. 478), future archaeological survey is required in the south of SAT Station after land resumption and prior to the commencement of site formation and construction works.

12.2.9 Mai Po Lung (South) ASA is located in the at-grade Project works site and works area to the northwest of SAT Station. It is observed that this ASA has experienced some level of modern disturbance, yet it might have archaeological deposits based on past discoveries. Archaeological watching brief is thus recommended for this ASA during the construction phase.

12.2.10 Survey-cum-excavation, archaeological survey/investigation and archaeological watching brief should be conducted by an archaeologist who should have obtained a *Licence to Excavate and Search for Antiquities* from the Antiquities Authority prior

to the commencement of the fieldworks. The scope, methodology and programme of these archaeological fieldworks should be agreed with AMO through the submission of Archaeological Action Plan. Should archaeological deposits discovered in the archaeological fieldworks, mitigation measures should be proposed and agreed with AMO.

12.2.11 If antiquities or supposed antiquities under the Antiquities and Monuments Ordinance (Cap. 53) are discovered during construction phase, the project proponent is required to inform AMO immediately for discussion of appropriate mitigation measures to be agreed by AMO before implementation by the project proponent to the satisfaction of AMO.

13 HAZARD TO LIFE

13.1 Introduction

13.1.1 The EIA Study concluded that no unacceptable risk is anticipated during the construction phase and no risk would be expected during operational phase of the Project. Nevertheless, good practices and mitigation measures are recommended to reduce the potential risk level as low as reasonably practicable.

13.2 Mitigation Measures

13.2.1 The recommended mitigation measures as presented in **Appendix B** of this Manual should be implemented to meet the EIAO-TM requirements.

14 ENVIRONMENTAL AUDITING

14.1 Site Inspection

14.1.1 Site inspection is one of the most effective tools to enforce the environmental protection requirements at the works sites and works areas by providing a direct mean to trigger and enforce specified environmental protection and pollution control measures. Site inspection should be undertaken regularly during the construction phase to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented for the activities associated with the Project.

14.1.2 The ET should be responsible for formulating the environmental site inspection programme as well as the deficiency and remedial action reporting system, and for carrying out the site inspections. The proposal for rectification, if any, should be prepared and submitted to the ETL and IEC by the Contractor.

14.1.3 Regular site inspections should be carried out and led by the ER and attended by the Contractor and ET at least once per week during the construction phase, while the IEC should undertake regular site audit at least once per month to audit and verify the overall environmental performance of the works and to assess the effectiveness of the ET and Contractor in their duties. The areas of inspection should not be limited to the environmental conditions and the pollution control and mitigation measures within the works sites and works areas, it should also review the environmental conditions of locations that are beyond the boundary of the works sites and works areas but are likely to be affected directly or indirectly by the construction site activities of the Project. During the inspection, the following information should be referred to:

- The EIA Report and EM&A recommendations on environmental protection and pollution control mitigation measures;
- Ongoing results of the EM&A programme;
- Works progress and programme;
- Individual works methodology proposals (which should include the proposal on associated pollution control measures);
- Contract specifications on environmental protection and pollution prevention control;
- Relevant environmental protection and pollution control legislations; and
- Previous site inspection results undertaken by the ET and others.

14.1.4 The Contractor should keep the ER and ET updated with all relevant environmental related information on the construction contract necessary for him/her to carry out the site inspections. Site inspection results and associated recommendations for improvements to the environmental protection and pollution control efforts should be recorded and followed up by the Contractor in an agreed time-frame. The Contractor should follow the procedures and time-frame stipulated in the environmental site inspection, and the deficiency and remedial action reporting system to be formulated by the ET, to report on any remedial measures subsequent to the site inspections.

14.1.5 The ER, IEC, ET and the Contractor should also carry out ad hoc site inspections 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 Event and Action Plan for the EM&A programme.

14.2 Compliance with Legal and Contractual Requirements

14.2.1 There are statuary requirements on environmental protection and pollution control with which construction activities must comply.

14.2.2 To ensure that the works are in compliance with the statutory requirement, all method statements of works should be submitted by the Contractor to the ER for approval and to the ETL for vetting to ensure sufficient environmental protection and pollution control measures have been included. The implementation schedule of mitigation measures is summarised in **Appendix B**. Any proposed changes to the mitigation measures in **Appendix B** should be certified by the ETL and verified by the IEC as conforming to the relevant information and recommendations contained in the EIA Report.

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

14.2.4 The Contractor should provide the update of the relevant documents to the ET so that works checking could be carried out effectively. The document should at least include the updated Works Progress Reports, updated Works Programme, method statements, any application letters for licences / permits under the environmental protection legislations, and copies of all valid licences / permits. The site diary should also be available for the inspection by the relevant parties.

14.2.5 After reviewing the documentation, the ET should advise the Contractor of any non-compliance with legislative requirements on environmental protection and pollution control so that they can timely take follow-up actions as appropriate. If the follow-up actions may still result in violation of environmental protection and pollution control requirements, the ER and ET should provide further advice to the Contractor to take remedial action to resolve the problem.

14.2.6 Upon receipt of the advice, the Contractor should undertake immediate action to remedy the situation. The ER and ET should follow up to ensure that appropriate action has been taken in order to satisfy legal requirements.

14.3 Choice of Construction Method

14.3.1 At times during the construction phase, the Contractor may propose alternative construction method(s) that had not been assessed in the EIA Report. The Contractor is therefore required to submit a proposal which provides the details of methodology and construction equipment to the ER, ETL and IEC for approval before commencement of work. The Contractor's options for alternative construction method(s) may introduce adverse environmental impacts into the Project, and therefore the Contractor and ET should review and determine, in accordance with established environmental standards and guidelines, as well as EIA Study recommendations and requirements, the adequacy of the environmental protection and pollution control measures in the Contractor's proposal in order to ensure no unacceptable impacts would result. To achieve this end, the ET should provide a copy of the Proactive Environmental Protection Proforma as shown in **Appendix D** to the IEC for verification before commencement of work. The IEC should verify the review of the alternative construction method(s) and endorse the proposal(s) on the basis of no adverse environmental impacts.

14.3.2 In case the Contractor needs to update the mitigation measures and/or the project implementation schedule as a result of alternative construction method(s) or other condition (e.g. site constraint(s)), the ET should also review the latest

recommendation of mitigation measures and/or project implementation schedule by submission of a Proactive Environmental Protection Proforma as shown in **Appendix D**. The IEC should verify the Proforma and conduct audit to confirm proper implementation of the alternative measures.

14.4 Environmental Complaints

14.4.1 The following procedures should be undertaken upon receipt of any environmental complaint (**Appendix E** refers):

- The Contractor to log complaint and date of receipt onto the complaint database and inform the ER, ET and IEC immediately;
- The Contractor to investigate, with the ER and ET, the complaint to determine its validity, and assess whether the source of the problem is due to construction works of the Project with the support of additional monitoring frequency and stations, if necessary;
- The Contractor to identify remedial measures in consultation with the IEC, ET and ER if a complaint is valid and due to the construction works of the Project;
- The Contractor to implement the remedial measures as required by the ER and to agree with the ET and IEC any additional monitoring frequency and stations, where necessary, for checking the effectiveness of the remedial measures;
- The ER, ET and IEC to review the effectiveness of the Contractor's remedial measures and the updated situation;
- The ET/Contractor to undertake additional monitoring if necessary and audit to verify the situation, and oversee that circumstances leading to the complaint do not recur;
- If the complaint is referred by the EPD, the Contractor to prepare interim report on the status of the complaint investigation and follow-up action stipulated above, including the details of the remedial measures and additional monitoring identified or already taken, for submission to EPD within the time frame assigned by the EPD; and
- The ET to record the details of the complaint, results of the investigation, subsequent actions taken to address the complaint and updated situation including the effectiveness of the remedial measures, supported by regular and additional monitoring results in the monthly EM&A reports.

15 REPORTING

15.1 Introduction

15.1.1 Types of reports that the ET should prepare and submit include Monthly EM&A Reports and Final EM&A Review Report. In accordance with Annex 21 of the EIAO-TM, a copy of the monthly and final review EM&A reports should be made available to the Director of Environmental Protection.

15.1.2 Reports can be provided in an electronic medium upon agreeing the format with the ER and EPD. All the monitoring data should be submitted in electronic medium.

15.2 Monthly EM&A Reports

15.2.1 The results and findings of all EM&A works required in this Manual should be recorded in the monthly EM&A reports prepared by the ET and endorsed by the IEC. The first Monthly EM&A Report should be prepared and submitted to EPD within a month after the major construction works commences with the subsequently Monthly EM&A Reports due in 10 working days of the end of each reporting month. Copies of each monthly EM&A report should be submitted to each of the three parties: ER, IEC and EPD. Before submission of the first monthly EM&A Report, the ET should liaise with the parties on the exact number of copies and format of the monthly reports in both hard copy and electronic copies.

15.2.2 The ET should review the number and location of monitoring stations and parameters every six months, or on as needed basis, in order to cater for any changes in the surrounding environment and the nature of works in progress.

15.3 First Monthly EM&A Report

15.3.1 The first Monthly EM&A Report should include at least but not limited to the following:

(i) executive summary (1-2 pages):
- breaches of A/L levels;
- complaint log;
- notifications of any summons and successful prosecutions;
- reporting changes; and
- future key issues.

(ii) basic project information:
- project organization including key personnel contact names and telephone numbers;
- construction programme;
- management structure; and
- works undertaken during the reporting month.

(iii) environmental status:
- advice on the status of statutory environmental compliance, such as the status of compliance with the EP conditions under the EIAO, submission status under the EP and implementation status of mitigation measures;
- works undertaken during the reporting month with illustrations (e.g. location of works, etc); and

- drawings showing the Project area, any environmental sensitive receivers and the locations of the monitoring stations.

(iv) summary of EM&A requirements:

- all monitoring parameters;
- environmental quality performance limits (A/L levels);
- Event and Action Plans;
- environmental mitigation measures, as recommended in the EIA Report; and
- environmental requirements in contract documents.

(v) implementation status:

- advice on the implementation status of environmental protection and pollution control/mitigation measures as recommended in the EIA Report.

(vi) monitoring results (in both hard and soft copies) together with the following information:

- monitoring methodology;
- name of laboratory and types of equipment used and calibration details;
- monitoring parameters;
- monitoring locations;
- monitoring date, time, frequency and duration; and
- graphical plots of the monitoring parameters in the reporting month annotated against the following;

  a) major activities being carried out on site during the reporting period;
  b) weather conditions during the reporting period;
  c) any other factors which might affect the monitoring results; and
  d) QA/QC results and detection limits.

(vii) report on non-compliance, complaints, notifications of summons and status of prosecutions:

- record of all non-compliance (exceedances) of the environmental quality performance limits (A/L levels);
- record of all complaints received, including locations and nature of complaints investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;
- record of all notification of summons and successful prosecutions for breaches of current environmental protection / pollution control legislation, including locations and nature of the breaches, investigation, follow-up actions taken, results and summary;
- review of the reasons for and the implications of non-compliances, complaints, summons and prosecutions including review of pollution sources and working procedures; and
- description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance.

(viii) others:

- an account of the future key issues as reviewed from the works programme and method statements of works;
- advice on the solid and liquid waste management status;
- record of any project changes from that originally proposed as described in the EIA Report (e.g. construction methods, mitigation proposals, design changes, etc); and
- comments (e.g. the effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions.

15.4 Subsequent Monthly EM&A Reports

15.4.1 Subsequent monthly EM&A Reports during the construction phase should include the following information:

(i) executive summary (1-2 pages):

- breaches of A/L levels;
- complaint log;
- notifications of any summons and successful prosecutions;
- reporting changes; and
- future key issues.

(ii) basic project Information:

- project organization including key personnel contact names and telephone numbers;
- construction programme;
- management structure;
- works undertaken during the reporting month; and
- any updates as needed to the scope of works, and construction methodologies.

(iii) environmental status:

- advice on the status of statutory environmental compliance, the status of compliance with the EP conditions under the EIAO, submission status under the EP and implementation status of mitigation measures;
- works undertaken during the reporting month with illustrations (such as location of works, etc); and
- drawings showing the Project area, any environmental sensitive receivers and the locations of the monitoring stations.

(iv) implementation status:

- advice on the implementation status of environmental protection and pollution control/mitigation measures as recommended in the EIA Report.

(v) monitoring results (in both hard and soft copies) together with the following information:

- monitoring methodology;

- name of laboratory and types of equipment used and calibration details;
- monitoring parameters;
- monitoring locations (and depth);
- monitoring date, time, frequency and duration; and
- graphical plots of the monitoring parameters in the reporting month annotated against the following;
  a) major activities being carried out on site during the reporting period;
  b) weather conditions during the reporting period;
  c) any other factors which might affect the monitoring results; and
  d) QA/QC results and detection limits.

(vi) report on non-compliance, complaints, notifications of summons and status of prosecutions:

- record of all non-compliance (exceedances) of the environmental quality performance limits (A/L levels);
- record of all complaints received, including the locations and nature of complaints investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;
- record of all notification of summons and successful prosecutions for breaches of current environmental protection / pollution control legislation, including locations and nature of the breaches, investigation, follow-up actions taken, results and summary;
- review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures; and
- descriptions of the actions taken in the event of non-compliances and deficiency reporting and any follow-up procedures related to earlier non-compliance.

(vii) others:

- an account of the future key issues as reviewed from the works programme and method statements of works;
- advice on the solid and liquid waste management status;
- record of any project changes from that originally proposed as described in the EIA (e.g. construction methods, mitigation proposals, design changes, etc); and
- comments (e.g. the effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions.

(viii) appendix:

- A/L levels;
- graphical plots of trends of the monitoring parameters over the past four reporting periods for the representative monitoring stations annotated against the following:
  a) major Project activities being carried out on site during the reporting period;
  b) weather conditions during the reporting period; and

c) any other factors that might affect the monitoring results.

- monitoring schedule for the present and next reporting period;
- cumulative statistics on notifications of summons and successful prosecutions; and
- outstanding issues and deficiencies.

15.5 Final EM&A Report - Construction Phase

15.5.1 The EM&A program should be terminated upon completion of those construction activities that have the potential to result in a significant environmental impact.

15.5.2 Prior to the proposed termination, the proposed termination should be implemented after the proposal has been endorsed by the IEC, the ER and the Project Proponent followed by final approval from the Director of Environmental Protection.

15.5.3 The ETL should prepare and submit the Final EM&A Report which should contain at least the following information:

(i) executive summary (1 - 2 pages);

(ii) drawings showing the Project area, environmental sensitive receivers and locations of the monitoring stations;

(iii) basic project information including a synopsis of the project organisation, contacts of key management, and a synopsis of works undertaken during the course of the Project;

(iv) a brief summary of EM&A requirements including:

- environmental mitigation measures, as recommended in the EIA Report;
- environmental impact hypotheses tested;
- environmental quality performance limits (A/L levels);
- all monitoring parameters; and
- Event and Action Plans;

(v) a summary of the implementation status of environmental protection and pollution control / mitigation measures, as recommended in the EIA Report, summarised in the updated implementation schedule;

(vi) advice on the solid and liquid waste management status;

(vii) graphical plots and the statistical analysis of the trends of monitoring parameters over the course of the Project, including the post-project monitoring for all monitoring stations annotated against:

- the major activities being carried out on site during the reporting period;
- weather conditions during the reporting period; and
- any other factors which might affect the monitoring results;

(viii) a summary of non-compliance (exceedances) of the environmental quality performance limits (A/L levels);

(ix) a review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures as appropriate;

(x) a description of the actions taken in the event of non-compliance;

(xi) a summary record of all complaints received, liaison and consultation undertaken, actions and follow-up procedures taken;

(xii) a summary record of notifications of summons and successful prosecutions for breaches of the current environmental protection / pollution control legislation, locations and nature of the breaches, investigation follow-up actions taken and results;

(xiii) a review of the validity of EIA predictions and identification of shortcomings of the recommendations proposed in EIA Report; and

(xiv) comments (for example, a review of the effectiveness and efficiency of the mitigation measures and of the performance of the environmental management system, that is, of the overall EM&A programme); and

(xv) recommendations and conclusions (for example, a review of success of the overall EM&A programme to cost-effectively identify deterioration and to initiate prompt effective mitigation action when necessary).

15.6 Data Keeping

15.6.1 No site-based documents (such as monitoring field records, laboratory analysis records, site inspection forms, etc.) are required to be included in the EM&A reporting documents. However, any such document should be properly maintained by the ET and be ready for inspection upon request. All relevant information should be clearly and systematically recorded in the document. Monitoring data should also be recorded in magnetic media form, and the software copy must be available upon request. All documents and data should be kept for at least one year following the completion of the construction phase EM&A for each construction contract.

15.7 Interim Notifications of Environmental Quality Limit Exceedances

15.7.1 With reference to the Event and Action Plans, when the environmental quality performance limits are exceeded and if they are proven to be valid, the ET should immediately notify the IEC, ER and EPD, as appropriate. The notification should be followed up with advice to the IEC, ER and EPD on the results of the investigation, proposed actions and success of the actions taken, with any necessary follow-up proposals. A sample template for the interim notification is presented in **Appendix F**.