

Highways Department

Tuen Mun Bypass

Environmental Monitoring and Audit (EM&A) Manual

Final | September 2023

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 287168

Ove Arup & Partners Hong Kong Ltd

Level 5 Festival Walk

80 Tat Chee Avenue

Kowloon Tong

Kowloon

Hong Kong

arup.com

Contents

1.	Introduction	1
1.1	Project Background	1
1.2	Purpose of the Manual	2
2.	Project Description	4
2.1	General Description of the Project	4
2.2	Designated Project	4
2.3	Construction Programme	4
3.	Project Organisation	5
3.1	Project Organisation	5
4.	Air Quality Impact	8
4.1	Introduction	8
4.2	Mitigation Measures	8
4.3	Air Quality Monitoring Parameters	8
4.4	Monitoring Equipment	8
4.5	Monitoring Methodology	9
4.6	Monitoring Location during Construction Phase	11
4.7	Impact Monitoring	14
4.8	Action and Limit Levels	15
4.9	Event and Action Plan	15
5.	Noise Impact	18
5.1	Introduction	18
5.2	Mitigation Measures	18
5.3	Noise Monitoring Parameter	19
5.4	Monitoring Equipment for Construction and Operational Phases	19
5.5	Airborne Construction Noise Monitoring	20
5.6	Groundborne Construction Noise Monitoring	24
5.7	Operational Noise Monitoring	26
6.	Water Quality Impact	27
6.1	Introduction	27
6.2	Mitigation Measures	27
6.3	Water Monitoring Parameters	27
6.4	Monitoring Equipment	28
6.5	Laboratory Measurement / Analysis	30
6.6	Monitoring Locations	30
6.7	Baseline Monitoring	30
6.8	Impact Monitoring	31
6.9	Action and Limit Levels	32
6.10	Event and Action Plan	32
7.	Waste Management Implications	1
7.1	Mitigation Measures	1

7.2	Environmental Monitoring and Site Audit Requirements	2
8.	Land Contamination	3
8.1	Introduction	3
8.2	Mitigation Measures	3
8.3	Environmental Monitoring and Site Audit Requirements	3
9.	Hazard to Life	4
9.1	Introduction	4
9.2	Mitigation Measures	4
9.3	Environmental Monitoring and Site Audit Requirements	4
10.	Landfill Gas Hazard	6
10.1	Introduction	6
10.2	Mitigation Measures	6
10.3	Environmental Monitoring and Site Audit	6
11.	Ecological Impact (Terrestrial)	9
11.1	Introduction	9
11.2	Mitigation Measures	9
11.3	Environmental Monitoring and Site Audit Requirements	9
12.	Landscape and Visual Impacts	12
12.1	Introduction	12
12.2	Mitigation Measures	12
12.3	Environmental Monitoring and Audit Requirement	13
13.	Cultural Heritage	14
13.1	Introduction	14
13.2	Mitigation Measures	14
13.3	Environmental Monitoring and Site Audit Requirements	15
14.	Site Environmental Audit	16
14.1	Site Inspection	16
14.2	Environmental Compliance	17
14.3	Choice of Construction Method	17
14.4	Environment Complaints	18
15.	Reporting	19
15.1	General	19
15.2	Baseline Monitoring Report	19
15.3	Monthly Monitoring Reports	20
15.4	Final EM&A Review Report	24
15.5	Data Keeping	25
15.6	Interim Notifications of Environmental Quality Limit Exceedances	25

Tables

Table 4.1	Recommended performance metrics and target values for on-site verification of PM monitoring equipment	10
Table 4.2	Proposed Construction Dust Monitoring Locations and Monitoring Periods	12
Table 4.3	Action Level and Limit Level for Air Quality (Dust)	15
Table 4.4	Event and Action Plan for Air Quality	16
Table 5.1	Proposed Airborne Construction Noise Monitoring Locations	20
Table 5.2	Action and Limit Levels for Airborne Construction Noise for Daytime	22
Table 5.3	Event and Action Plan for Airborne Construction Noise	23
Table 5.4	Proposed Groundborne Construction Noise Monitoring Locations	24
Table 5.5	Proposed Drill-and-blast / TBM Operating Time	25
Table 5.6	ANLs for Fixed Noise Sources	26
Table 6.1	Laboratory Analysis	30
Table 6.2	Locations of Proposed Water Quality Monitoring Stations	30
Table 6.3	Proposed Water Quality Monitoring Programme for Baseline Monitoring	31
Table 6.4	Proposed Water Quality Monitoring Programme for Impact Monitoring	32
Table 6.5	Action and Limit Levels for Water Quality	32
Table 6.6	Event and Action Plan for water quality	33
Table 10.1	Actions in the Event of Gas Being Detected	42
Table 12.1	Mitigation Measures for the Construction and Operational Phases	47

Figures

<u>Figure 2.1</u>	Location and Key Elements of the Project
<u>Figure 4.1</u>	Locations of Construction Dust Monitoring Stations
<u>Figure 5.1</u>	Locations of Construction Noise Monitoring Stations
<u>Figure 6.1</u>	Location of Water Quality Monitoring Station

Appendices

<u>Appendix 3.1</u>	Project Organisation for Environmental Works
<u>Appendix 4.1</u>	Environmental Mitigation Implementation Schedule
<u>Appendix 4.2</u>	Sample Data Sheet for RSP Monitoring
<u>Appendix 5.1</u>	Sample Data Sheet for Noise Monitoring
<u>Appendix 14.1</u>	Proactive Environmental Protection Proforma
<u>Appendix 15.1</u>	Sample Template for Interim Notification

1. Introduction

1.1 Project Background

- 1.1.1.1 The Government proposed the implementation of Tuen Mun Western Bypass (TMWB) and commenced the investigation and preliminary design for TMWB in 2008. Under the original transport infrastructures planning, the TMWB together with Tuen Mun-Chek Lap Kok Tunnel (TM-CLKT), which was commissioned in December 2020, were aimed to provide a direct north-south route linking Kong Sham Western Highway (KSWH), Northwest New Territories (NWNT), Tuen Mun River Trade Terminal, Hong Kong International Airport and the Hong Kong-Zhuhai-Macao Bridge Hong Kong Port.
- 1.1.1.2 To take forward TMWB, the Government consulted Tuen Mun District Council (TMDC) and Yuen Long District Council (YLDC) in July 2016 and September 2016 respectively. The District Council (DC) supported the implementation of TMWB in principle, but some members of TMDC expressed their concern that the connection at Tsing Tin Road might induce adverse air and noise impacts on the area near Kin Sang Estate, Tai Hing Estate and Tuen Mun Hospital. They also were worried about unacceptable congestion at Tuen Mun Road (TMR) (Fu Tei Section) arising from the additional traffic to/from TMWB.
- 1.1.1.3 The Highways Department (HyD) then commenced a further investigation and preliminary design study for TMWB in October 2017. Taking into account the comments from TMDC, HyD deleted the connection at Tsing Tin Road for TMWB. Nonetheless, without this connection, the usage of TMWB, and volume/capacity ratio would drop significantly, making the proposed scheme of TMWB no longer effective in alleviating traffic congestion at TMR (Fu Tei and Town Centre Sections), Wong Chu Road and Lung Fu Road.
- 1.1.1.4 In the 2019 Policy Address, the Government announced that it would re-plan the coastal development of Tuen Mun West. As such, there is a genuine need to review the planning of the future strategic routes and connecting roads within Tuen Mun with a view to meeting the traffic demand of the potential developments in Tuen Mun West.
- 1.1.1.5 The Government subsequently proposed Tuen Mun Bypass (TMB), hereafter called “the Project”, as an alternative highway scheme, to replace the originally proposed TMWB. TMB will not only provide a direct north-south route linking TM-CLKT and Yuen Long Highway (near Lam Tei Quarry), but also further improve the traffic conditions of some local roads in Tuen Mun, including TMR (Fu Tei and Town Centre Sections), Wong Chu Road and Lung Fu Road, with some spare capacity to accommodate the traffic demand from the future developments in Tuen Mun West.
- 1.1.1.6 Some Legislative Council (LegCo) members and the TMDC members have all along expressed concern about the traffic congestion at TMR (Fu Tei and Town Centre Sections), Wong Chu Road and Lung Fu Road, particularly subsequent to the commissioning of TM-CLKT. Therefore, timely implementation of the Project is required.
- 1.1.1.7 HyD and Transport Department (TD) had introduced the proposal of replacing the TMWB by TMB at the meeting with the Traffic and Transport Committee (T&TC) of TMDC in February 2021 and April 2021. Both T&TC of TMDC supported implementation of the Project in lieu of the previously proposed TMWB.

1.2 Purpose of the Manual

1.2.1.1 The purposes of this Environmental Monitoring and Audit (EM&A) Manual (the Manual) are to:

- Guide the set up of an EM&A programme to ensure compliance with the environmental impact assessment (EIA) recommendations;
- Specify the requirements for monitoring equipment;
- Propose environmental monitoring points, monitoring frequency, etc.;
- Propose Action and Limit Levels; and
- Propose Event and Action Plans.

1.2.1.2 This Manual outlines the monitoring and audit programme for the construction and operation of the Project and provides systematic procedures for monitoring, auditing and minimizing environmental impacts.

1.2.1.3 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 the EIA Process (EIAO-TM).

1.2.1.4 This Manual contains the following information:

- Responsibilities of the Contractor, the Project Manager or Project Manager's Representative (PMR), Environmental Team (ET), and the Independent Environmental Checker (IEC) under the context of EM&A;
- 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 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 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.

1.2.1.5 For the purpose of this Manual, the Project Manager's Representative (PMR) shall refer to the Project Manager as defined in the Construction Contract, in cases where the Project Manager's powers have been delegated to the PMR, in accordance with the Construction Contract. The ET leader, who shall be responsible for and in charge of the ET, shall refer to the person delegated the role of executing the environmental monitoring and audit requirements.

2. Project Description

2.1 General Description of the Project

2.1.1.1 Section 2 of the EIA Report has described the approaches adopted to avoid and minimize various environmental impacts throughout the design process. The design has therefore been taken forward as the basis for this EIA to demonstrate that all statutory requirements under the EIA Study Brief (No.: ESB-348/2021) and the EIAO are complied with. A brief summary of the key elements of the Project is given below:

- A road tunnel of about 7.5 km long by drill-and-blast and tunnel boring machine (TBM) method;
- Tunnel portals and interchange with associated aboveground road structure and link roads;
- Ventilation buildings and associated tunnel operation area including satellite control building, administration building, maintenance compound, recovery/ supporting area);
- Re-provision of facilities affected by the proposed works; and
- Proposed and temporary works area, temporary magazine site and barging point facilities.

2.1.1.2 The location of the Project is shown in **Figure 2.1**.

2.2 Designated Project

2.2.1.1 The Project would consist various Designated Projects (DPs) as listed under Part I, Schedule 2 of the EIAO.

- Item A1 - A carriageway for motor vehicles that is an expressway, trunk road, primary distributor road or district distributor road.;
- Item A7 - A road tunnel or railway tunnel more than 800 m in length between portals;
- Item K.10 - A depot for the storage of, or manufacturing plant for the manufacture of, explosives (as defined by section 2 of the Dangerous Goods Ordinance (Cap. 295)); and
- Item Q.1 - All projects involving earthworks partly or wholly in an existing country park.

2.3 Construction Programme

2.3.1.1 According to the latest information, construction of the Project is scheduled to commence in Q2 of Year 2025. The construction works would take about 8 years and are targeted to complete in or before 2033. This would however be subject to change during the on-going design process.

3. Project Organisation

3.1 Project Organisation

3.1.1.1 The ET should be an independent party from the IEC and the Contractor. The ET shall be established before the commencement of construction of the Project. The ET leader should possess at least 7 years of experience in EM&A and/ or environmental management.

3.1.1.2 An IEC shall be employed before commencement of construction of the Project. The IEC shall be an independent party from the Contractor and the ET and possess at least 7 years' experience in EM&A and/or environmental management.

3.1.1.3 The proposed project organisation and lines of communications with respect to environmental protection works are shown in **Appendix 3.1**.

3.1.1.4 The responsibilities of respective parties are:

Project Manager or Project Manager's Representative (PMR) or Project Proponent

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

The Contractor

- Implement the EIA recommendations and requirements;
- Provide assistance to ET in carrying out monitoring and auditing;
- Submit proposals on mitigation measures in case of exceedances of Action and Limit Levels in accordance with the Event and Action Plans;
- Implement measures to reduce impact where Action and Limit Levels are exceeded; and
- Adhere to the agreed procedures for carrying out compliant investigation.

Environmental Team (ET)

- Set up all the required environmental monitoring stations;
- Monitor various environmental parameters as required in the Manual;
- Analyse the environmental monitoring and audit data, review the success of EM&A programme, confirm the adequacy of mitigation measures implemented and the validity of the EIA predictions, and to identify any adverse environmental impacts arising;
- Carry out site inspection to investigate and audit the Contractors' site practice, equipment and work methodologies with respect to pollution control and

environmental mitigation measures, and take proactive actions to pre-empt problems;

- Prepare reports on the environmental monitoring data and site environmental conditions;
- Report on the environmental monitoring and audit results to the IEC, Contractor, the PMR and Environmental Protection Department (EPD) or its delegated representative;
- Recommend suitable mitigation measures to the Contractor in the case of exceedance of Action and Limit Levels in accordance with the Event and Action Plans;
- Undertake regular on-site audits / inspections and report to the Contractor and the PMR of any potential non-compliance;
- Follow up and close out non-compliance actions;
- Advise the Contractor on environmental improvement, awareness, enhancement matters, etc. on site;
- Adhere to the procedures for carrying out environmental complaint investigation;
- Liaise with Independent Environmental Checker (IEC) on all the performance matters, and timely submission of all the EM&A performa for IEC's approval;
- 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; and
- Timely submit the EM&A report to the Director of Environmental Protection.

Independent Environmental Checker (IEC)

- Review the EM&A works performed by the ET (at not less than monthly intervals);
- Audit the monitoring activities and results (at not less than monthly intervals);
- Validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations, monitoring procedures and location of sensitive receivers;
- Report the audit results to the PMR and EPD;
- Review and verify the EM&A reports (monthly and quarterly summary reports) submitted by the ET;
- Review the proposal on mitigation measures submitted by the Contractor in accordance with the Event and Action Plans;
- Check the mitigation measures submitted by the Contractor in accordance with the Event and Action Plans;
- Check the mitigation measures that have been recommended in the EIA and this Manual, and ensure they are properly implemented in a timely manner, when necessary;
- Report the findings of site inspections and other environmental performance reviews to PMR and EPD;
- Carry out random sample check and audit on monitoring data and sampling procedures, etc.;

- Conduct random site inspection;
- 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; and
- Verify the investigation results of the environmental complaint cases and the effectiveness of corrective measures.

3.1.1.5 Sufficient and suitably qualified professional and technical staff shall be employed by the respective parties to ensure full compliance with their duties and responsibilities, as required under the EM&A programme for the duration of the Project.

4. Air Quality Impact

4.1 Introduction

4.1.1.1 The EIA has considered the potential air quality impacts during construction and operational phases of the Project. With the implementation of recommended good site practices and mitigation measures, adverse construction dust impact is not anticipated. Continuous construction dust monitoring and regular site environmental audit at least once per week are also recommended to check the implementation of good site practices and mitigation measures, and to ensure no adverse dust impact on the nearby air sensitive receivers. The EIA has also concluded that there will be no adverse air quality impacts during operational phase and hence environmental monitoring and site inspections during operational phase are not required.

4.2 Mitigation Measures

4.2.1.1 In order to reduce the construction dust emission from the Project, regular watering and other good site practices should be implemented. In addition, mitigation measures to control the exhaust emissions from construction plant and equipment are also required. All the recommended good practices are summarised in the Environmental Mitigation Implementation Schedule (EMIS) in **Appendix 4.1**.

4.3 Air Quality Monitoring Parameters

4.3.1.1 Monitoring and audit of the Respirable Suspended Particulate (RSP) and Fine Suspended Particulate (FSP) levels shall be carried out by the ET to ensure that any deteriorating air quality could be readily detected and timely actions could be taken to rectify the situation.

4.3.1.2 1-hour and 24-hour average RSP, and 24-hour average FSP levels shall be measured continuously to indicate the impacts of construction dust on air quality. The hourly RSP and FSP levels shall be measured by Particulate Matter (PM) sensors.

4.3.1.3 All relevant data including temperature, pressure, weather conditions, wind direction and speed, reading from the monitoring equipment, and any other local atmospheric factors affecting or affected by site conditions, etc., shall be recorded down in detail. A sample data sheet is shown in **Appendix 4.2**.

4.4 Monitoring Equipment

4.4.1.1 PM sensor complying with the following specifications shall be used for carrying out the 1-hour and 24-hour average RSP, and 24-hour average FSP monitoring:

- Capable of real-time monitoring for RSP and FSP
- Averaging period: 1 hour and 24 hour
- Concentration range: 0 – 300 $\mu\text{g}/\text{m}^3$
- Resolution: at least 1 $\mu\text{g}/\text{m}^3$
- Accuracy: $\pm 10\%$ to standard particles
- Equipped with a shelter to protect the sensor

- Capable of operating continuously for a 7 days period

4.5 Monitoring Methodology

4.5.1 Measuring Procedure

4.5.1.1 The ET is responsible for the provision, installation, operation, maintenance, dismantle of the monitoring equipment. They shall ensure that sufficient number of PM sensors are available for carrying out the monitoring and ad hoc monitoring.

4.5.1.2 General measurement procedures involved in the impact 1-hour and 24-hour average RSP, and 24-hour average FSP monitoring are summarised below. The exact measurement procedures will be subject to different brands of the PM sensor as described in the respective user manual.

- Mount the PM sensor on a tripod or other solid structure at 1.5mAG;
- Ensure the PM sensor is properly connected to secured supply of electricity / batteries;
- Power up the PM sensor and connect the PM sensor to data management software via wired or wireless means;
- Check if the measurement data could be proper transferred to the data management software;
- Check if the measurement data could be properly stored; and
- Start the dust measurement with the site conditions and dust sources at the nearby area being properly recorded in a record sheet.

4.5.1.3 Wind data monitoring equipment shall also be provided and set up for several measurement locations (e.g. Lam Tei, Sham Shing and Pillar Point, etc.) for logging wind speed and wind direction near the dust monitoring locations. The equipment installation location shall be proposed by the ET and agreed with the IEC. For installation and operation of wind data monitoring equipment, the following points shall be observed:

- The wind sensors should be installed at an elevated level 10 meters above ground so that they are clear of obstructions or turbulence caused by buildings;
- The wind data should be captured by a data logger, the data recorded in the data logger shall be downloaded periodically for analysis at least once a month;
- 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.

4.5.1.4 On-site checking of the PM sensor shall be conducted by ET and agreed by IEC on the following approach :

- Prepare a transfer standard for PM monitoring, which has been calibrated against a PM reference monitor (i.e. the Federal Reference Methods (FRM) or Federal Equivalent Method (FEM) PM monitor);
- The inlets of the transfer standard and the monitoring equipment shall be collocated at the same height with a horizontal separation distance of less than 1 m;

- Warm-up the transfer standard on-site if necessary;
- Collocated monitoring shall be conducted in a continuous period to collect at least 20 valid 10-minute average measurements. The valid data rate shall be at least 80% during the collocation period; and
- The performance metrics and target values are shown in **Table 4.1**. If the performance of the monitoring equipment fails to meet the target values, the monitoring equipment needs to be re-calibrated or replaced.

Table 4.1 Recommended performance metrics and target values for on-site verification of PM monitoring equipment

Performance Metric		Target Value
<u>Tier 1</u>		
Bias	Slope	1.00±0.25
Linearity	Coefficient of Determination (R ²)	>0.70
<u>Tier 2</u>		
If Tier 1 criteria are not met due to narrow range of PM concentration (>30 µg/m ³ and >25 µg/m ³ as recommended span range for RSP and FSP, respectively) during the collocation period, Tier 2 will apply.		
Error	Root Mean Squared Error (RMSE)	<8 µg/m ³ for RSP <5 µg/m ³ for FSP

4.5.2 Calibration of PM Sensor

Transfer Standard (TS)

- 4.5.2.1 A TS is another PM monitor that is at least as capable as the sensor to be calibrated. Another sensor that has just been calibrated may serve the purpose provided its performance is known to be stable during the subsequent collocation period to be used as TS. Right before each on-site calibration, a TS can be used on-site, the TS itself needs to be calibrated e.g. collocating with an PM reference monitor, such as the FRM or FEM PM monitor at the accredited laboratories or research institutes, that has been calibrated against traceable standard. The TS/reference monitor collocation should last at least seven days.

On-site Calibration

- 4.5.2.2 The TS should be placed near (less than 1 m if practicable) the sensor to be calibrated so that both devices would be monitoring a similar environment. The TS is then turned on to warm-up for 30 to 60 minutes. The collocation period starts after the warm-up and TS is then left running with the sensor to be calibrated for at least three hours. The measurements from the sensor to be calibrated and the TS during the collocation period will be statistically analyzed.

Quality Control Criteria

- 4.5.2.3 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

- 4.5.2.4 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 (more than $30 \mu\text{g}/\text{m}^3$ and more than $25 \mu\text{g}/\text{m}^3$ as recommended span range for RSP and FSP, respectively) during the collocation period, Tier 2 will apply.

Tier 2: Root mean squared error

- 4.5.2.5 The root mean squared error of the sensor minute average measurements should be less than $8 \mu\text{g}/\text{m}^3$ for RSP and less than $5 \mu\text{g}/\text{m}^3$ for FSP.

Frequency

- 4.5.2.6 Each deployed sensor should be calibrated every month. If a sensor repeatedly failed in 2 or 3 consecutive calibrations, the sensor should be checked and maintained to improve its performance, or replaced.

- 4.5.2.7 It should be noted that this Quality Control Protocol may be subject to change.

4.6 Monitoring Location during Construction Phase

- 4.6.1.1 **Figure 4.1** shows the locations of the proposed construction dust monitoring stations. The status and location of ASRs may change after issuing this Manual. If such cases exist, the ET shall propose alternative monitoring locations and seek approval from PMR and agreement from the IEC and EPD. The locations of construction dust monitoring stations shall be reviewed and revised during detailed design on the basis of the latest information of the Project.

Table 4.2 Proposed Construction Dust Monitoring Locations and Monitoring Periods

Monitoring Station ID	ASR ID	Location	Construction Activity	Approximate Horizontal Distance from the nearest Construction Activities (m)	Monitoring Period ^[1]
Existing ASRs					
<i>Lam Tei Area</i>					
DM1	A013	Tsoi Yuen Tsuen House 159	<ul style="list-style-type: none"> • Construction of at-grade roads • Construction of tunnel portal, ventilation building and satellite control building • Slope works • Stockpiling area • Construction of underground explosive magazine 	20	Throughout the construction period of corresponding activity
DM2	A017	Tsoi Yuen Tsuen Village House		40	
DM3	A052	The Sherwood Podium		50	
DM4	A071	Fuk Hang Tsuen House 458		<10	
DM5	A073	Fuk Hang Tsuen Village House		<10	
DM6	A091	Tung Fuk Road Village House		50	
DM7	A099	Fuk Hang Tsuen Village House		<10	
DM8	A102	Chui Fuk Road Village House		<10	
DM9	A104	Fu Tei Ha Tsuen Village House		30	
DM31	A110	Fu Tei Ha Tsuen Village House		100	
<i>Sam Shing Area</i>					
DM10	A306	Harvest Garden Block 3	<ul style="list-style-type: none"> • Construction of tunnel portal, and ventilation building • Slope works • Stockpiling area 	50	Throughout the construction period of corresponding activity
DM11	A311	Kam Fai Garden Block 4		20	
DM12	A313	Caritas Li Ka Shing Care and Attention Home		30	
<i>Pillar Point Area</i>					
DM13	A402	TMCLK Main Control Building Windows	<ul style="list-style-type: none"> • Construction of slip roads • Construction of tunnel portal, ventilation building and administration building • Construction of slurry treatment plant • Construction of barging points and delivery point • Slope works • Stockpiling area 	30	Throughout the construction period of corresponding activity
DM14	A403	Butterfly Beach Laundry		40	
DM15	A417	Sawmill at 81-85 Ho Yeung Street		40	
DM16	A423	Pillar Point Fire Station		40	
DM17	A426	Chu Kong Warehouse Block 1 Window		<10	
DM18	A427	TMCLK Kiosk N2 FAI		<10	
DM32	N/A ^[2]	Butterfly Beach Park		140	

Monitoring Station ID	ASR ID	Location	Construction Activity	Approximate Horizontal Distance from the nearest Construction Activities (m)	Monitoring Period ^[1]
DM19	A431	EMSD Tuen Mun Vehicle Service Station	<ul style="list-style-type: none"> Construction of temporary explosive magazine 	Within Boundary	
DM20	A432	Administration Building of Pillar Point Sewage Treatment Works		30	
DM21	C405	Chu Kong Shipping Company Limited		60	
DM22	C406	Chu Kong Shipping Company Limited		60	
DM23	C408	Tuen Mun Fireboat Station		110	
<i>Siu Lam Area</i>					
DM24	C502	Siu Lam Village House	<ul style="list-style-type: none"> Construction of temporary explosive magazine 	420	Throughout the construction period of corresponding activity
DM25	C507	1001 Grandview Terrace		210	
DM26	C514	So Kwun Wat San Tsuen Village House		340	
Planned / Committed ASRs					
<i>Lam Tei Area</i>					
DM27	P005b	Proposed Public Housing at Lam Tei North	<ul style="list-style-type: none"> Construction of at-grade roads Construction of tunnel portal, ventilation building and satellite control building Slope works Stockpiling area Construction of underground explosive magazine 	30	Upon the intake of the population and throughout the construction period of corresponding activity
DM28	P006	Proposed Temporary Place of Recreation, Sports or Culture (Indoor Recreation Centre)		40	
DM29	P015	Proposed Development of Elderly Home by Pok Oi Hospital		20	
DM30	P021	Proposed Comprehensive Development in D.D. 130 and Adjoining Government Land		20	

Notes:

[1] The monitoring period is subject to the construction programme of the relevant contracts in the construction phase.

[2] N/A: Not applicable. The Butterfly Beach Park is not selected as representative ASR and no ASR ID has been assigned.

- 4.6.1.2 When alternative monitoring locations are proposed, the proposed locations should, as far as practicable:
- Monitor at site boundary or at ASRs close to the major site activities which are likely to have air quality impacts;
 - Monitor as close as possible to the ASRs as defined in the EIAO-TM;
 - Assure the minimal disturbance to the occupants and working under a safe condition during monitoring; and
 - Take into account the prevailing meteorological conditions.
- 4.6.1.3 The ET shall agree with IEC on the position of the PM sensor. When positioning the sensor, the following points shall be noted:
- A horizontal platform with appropriate support to secure the sensors against gusty wind should be provided;
 - No two sensors should be placed less than 2m apart;
 - The distance between the sampler and an obstacle, such as buildings, should be at least twice the height that the obstacle protrudes above the sensors;
 - A minimum of 2m of separation from walls, parapets and penthouses is required for rooftop sensors;
 - A minimum of 2m separation from any supporting structure, measured horizontally is required;
 - No furnace or incinerator flue is nearby;
 - Airflow around the sampler is unrestricted;
 - The sampler is more than 20m from the dripline;
 - Any wire fence and gate, to protect the sensors, should not cause any obstruction during monitoring;
 - Permission must be obtained to set up the sensors and to obtain access to the monitoring stations; and
 - A secured supply of electricity / batteries is needed to operate the sensors.
- 4.6.1.4 The ET may, depending on site conditions and monitoring results, decide whether additional monitoring locations shall be included or any monitoring locations could be removed / relocated during any stage of the construction phase, upon the agreement from the IEC and EPD.

4.7 Impact Monitoring

- 4.7.1.1 The ET shall carry out impact monitoring during major construction activities for the Project as specified in **Table 4.2**. Continuous RSP and FSP monitoring should be undertaken throughout the construction stage.
- 4.7.1.2 The monthly schedule of the impact monitoring programme should be drawn up by the ET one month prior to the commencement of the scheduled construction period. Before

commencing impact monitoring, the ET shall inform the IEC of the impact monitoring programme such that the IEC can conduct on-site audit.

4.8 Action and Limit Levels

4.8.1.1 The ET shall compare the impact monitoring results with air quality criteria set up for 1-hour and 24-hour average RSP, and 24-hour average FSP. **Table 4.3** shows the air quality criteria, namely Action and Limit Levels to be used. The Action and Limit Levels may be subject to the change based on the prevailing AQOs implemented at the time of the dust monitoring works.

Table 4.3 Action Level and Limit Level for Air Quality (Dust)

Action Level	Limit Level
1-hour RSP level = 150 $\mu\text{g}/\text{m}^3$	24-hour RSP level (rolling average) = 100 $\mu\text{g}/\text{m}^3$
	24-hour FSP level (rolling average) = 50 $\mu\text{g}/\text{m}^3$

4.9 Event and Action Plan

4.9.1.1 Should non-compliance of the air quality criteria occur, actions in accordance with the Event and Action Plan in **Table 4.4** shall be carried out.

Table 4.4 Event and Action Plan for Air Quality

Event	Action			
	ET	IEC	PMR	Contractor
Action level exceedance for one sample	<ol style="list-style-type: none"> 1. Notify IEC and PMR; 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. 	<ol style="list-style-type: none"> 1. Check monitoring data submitted by ET; 2. Check Contractor's working method; 3. Discuss with ET, PMR and Contractor on possible remedial measures; 4. Advise PMR and ET on the effectiveness of the proposed remedial measures; and 5. Supervise implementation of remedial measures. 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of exceedance in writing; 2. Notify Contractor; 3. In consultation with IEC and ET, agree with the Contractor on the remedial measures to be implemented; and 4. Ensure remedial measures are properly implemented. 	<ol style="list-style-type: none"> 1. Identify sources of exceedance and discuss with PMR, ET and IEC on possible remedial measures; 2. Implement remedial measures; and 3. Amend working methods if appropriate.
Action level exceedance for two or more consecutive samples	<ol style="list-style-type: none"> 1. Notify IEC and PMR; 2. Check the monitoring data and the performance of the monitoring equipment (refer to Section 4.5.1.4); 3. If exceedance is confirmed, identify source(s), investigate the causes of exceedance and propose remedial measures; 4. Discuss with IEC and Contractor on possible remedial measures required; 5. Assess effectiveness of Contractor's remedial measures and keep IEC and PMR informed of the results until exceedance stops; and 6. Notify EPD if the exceedance is confirmed to be related to the Project. 	<ol style="list-style-type: none"> 1. Check monitoring data submitted by ET; 2. Check Contractor's working method and verify the performance of the monitoring equipment to be checked by ET (refer to Section 4.5.1.4); 3. Discuss with ET and Contractor on possible remedial measures; 4. Advise PMR and ET on the effectiveness of the proposed remedial measures; and 5. Supervise implementation of remedial measures. 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of exceedance in writing; 2. Notify Contractor; 3. In consultation with IEC and ET, agree with the Contractor on the proposal for remedial measures to be implemented; and 4. Ensure the proposal for remedial measures are properly implemented. 	<ol style="list-style-type: none"> 1. Identify the sources and discuss with PMR, ET and IEC on possible remedial measures; 2. Submit a proposal for remedial measures to PMR, IEC and ET within 2 working days of notification of exceedance for agreement; 3. Implement the agreed proposal; and 4. Amend proposal if appropriate.
Limit level exceedance for one 24-hr rolling average RSP concentration	<ol style="list-style-type: none"> 1. Notify IEC, PMR, Contractor and EPD; 2. Check the monitoring data and verify the performance of the monitoring equipment (refer to Section 4.5.1.4); 	<ol style="list-style-type: none"> 1. Check monitoring data submitted by ET; 2. Check Contractor's working method and verify the performance of the 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of exceedance in writing; 2. Notify Contractor; 	<ol style="list-style-type: none"> 1. Identify the sources and discuss with PMR, ET and IEC on possible remedial measures;

Event	Action			
	ET	IEC	PMR	Contractor
record or/and one 24-hr rolling average FSP concentration record	<ul style="list-style-type: none"> 3. If exceedance is confirmed, identify source(s), investigate the causes of exceedance and propose remedial measures; 4. Discuss with IEC, PMR and Contractor on possible remedial measures required; 5. Assess effectiveness of Contractor's remedial measures and keep IEC and PMR informed of the results until exceedance stops; and 6. Notify EPD if the exceedance is confirmed to be related to the Project. 	<ul style="list-style-type: none"> monitoring equipment to be checked by ET (refer to Section 4.5.1.4); 3. Discuss with PMR, ET and Contractor on the possible remedial measures; 4. Advise PMR and ET on the effectiveness of the proposed remedial measures; 5. Review Contractor's remedial measures whenever necessary to assure their effectiveness and advise PMR and ET accordingly; and 6. Supervise the implementation of remedial measures. 	<ul style="list-style-type: none"> 3. In consultation with the IEC and ET, agree with the Contractor on the proposal for remedial measures to be implemented; 4. Ensure the proposal for remedial measures are properly implemented; and 5. If exceedance continues, identify what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated. 	<ul style="list-style-type: none"> 2. Take immediate action to avoid further exceedance; 3. Submit a proposal for remedial measures to PMR, IEC and ET within 2 working days of notification of exceedance for agreement; 4. Implement the agreed proposal; 5. Review and resubmit proposals if the problem is still not under control; and 6. Stop the relevant portion of works as determined by PMR until the exceedance is abated.

Notes:

ET – Environmental Team

IEC – Independent Environmental Checker

PMR – Project Manager's Representative

5. Noise Impact

5.1 Introduction

5.1.1.1 The EIA Report has considered the potential noise impacts associated with the construction and operation of the Project. Construction noise arising from the construction activities, would be the major potential noise impacts during the construction phase. With the implementation of mitigation measures, adverse construction noise is not anticipated. Nevertheless, a Construction Noise Management Plan (CNMP) is required and will be submitted to the Director of Environmental Protection (DEP). Adverse fixed noise impact from ventilation buildings, administration building, satellite control building and maintenance compound is not anticipated with the proper implementation of noise control mitigation measures. Nevertheless, a Fixed Noise Source Management Plan (FNMP) is required and will be submitted to the DEP.

5.2 Mitigation Measures

5.2.1 Construction Phase

5.2.1.1 Adverse construction noise impact is not anticipated with the implementation of mitigation measures such as good site practices, use of quality powered mechanical equipment (QPME) and quieter construction methods, use of temporary noise barriers and noise enclosures to screen noise from relatively static PMEs, etc. All the recommended mitigation measures and good site practices are summarised in the EMIS given in **Appendix 4.1**.

5.2.1.2 The Contractor shall be required to prepare a CNMP with reference to Section 8 and Annex 21 of the EIAO-TM as well as Section 4.3.5 of the EIA Report and this EM&A Manual. CNMP containing a quantitative construction noise impact assessment, the adopted quieter construction method(s) and equipment, noise mitigation measures and the construction noise impact monitoring and audit programme will be submitted to the EPD, with reference to the updated and identified plant inventories once available and in any case before tendering and commencement of the project construction, and if there is any change to the construction noise mitigation measures recommended in the CNMP, an updated CNMP shall be submitted one month before the implementation of such change. It shall also include an implementation schedule clearly listing out the mitigation measures, the implementation party, location and timing of implementation.

5.2.2 Operation Phase

Road Traffic Noise

5.2.2.1 Based on the assessment result, mitigation measures would not be required. Therefore, EM&A for road traffic noise during operational phase is not required.

Fixed Noise Source

- 5.2.2.2 For the proposed fixed noise sources, adverse noise impact from the administration building, satellite control building and ventilation buildings is not anticipated with the properly selection of the equipment and installation of acoustic attenuators such as quieter plant, silencer, barriers, enclosures, etc. All of the noise mitigation measures during operational phase are summarised in the EMIS given in **Appendix 4.1**.
- 5.2.2.3 The Contractor shall be required to prepare a FNMP with reference to Section 8 and Annex 21 of the EIAO-TM as well as Section 4.5.5 of the EIA Report and this EM&A Manual. The FNMP containing the quantitative fixed noise source impact assessment, noise mitigation measures and the fixed noise source impact monitoring and audit programme will be submitted to the EPD, with reference to the updated and identified inventories and utilization schedule once available and in any case before tendering and commencement of implementation of the Project. If there is any change to the specifications of the planned fixed noise sources, layout design, operation modes, mitigation measures, or any other factors that would have implications on the fixed noise sources impact as concluded in the FNMP, an updated FNMP shall be submitted to the EPD no later than one month before the implementation of any such change. It shall also include an implementation schedule clearly listing out the mitigation measures, the implementation party, location and timing of implementation.

5.3 Noise Monitoring Parameter

5.3.1 Construction Phase

- 5.3.1.1 Construction noise level shall be measured in terms of the A-weighted equivalent continuous sound pressure level (L_{eq}). $L_{eq(30min)}$ shall be used as the monitoring parameter for the time period between 0700 and 1900 hours on normal weekdays. If construction works are extended to include works during the hours of 1900 - 0700, and/or percussive piling is be carried out, applicable permits under NCO shall be obtained by the Contractor. The monitoring requirements and conditions stipulated in the permits have to be followed. A sample data sheet is shown in **Appendix 5.1**. Supplementary information for data auditing and statistical results such as L_{10} and L_{90} should also be obtained for reference.

5.3.2 Operational Phase

Fixed Noise Sources

- 5.3.2.1 For the fixed noise sources from administration building, satellite control building, ventilation buildings and maintenance compound shall be conducted for comparison with Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (IND-TM) for selecting appropriate Area Sensitive Ratings (ASRs).

5.4 Monitoring Equipment for Construction and Operational Phases

- 5.4.1.1 As referred to 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 shall be used for carrying out the noise monitoring. Immediately prior to and following each noise measurement, the

accuracy of the sound level meter shall be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements may be accepted as valid only if the calibration level from before and after the noise measurement agrees to within 1.0 dB.

5.4.1.2 Noise measurements should be made in accordance with standard acoustical principles and practices in relation to weather conditions. The wind speed shall be checked with a portable wind speed meter capable of measuring the wind speed in m/s.

5.4.1.3 The ET is responsible for the provision, installation, operation, maintenance and dismantling of the monitoring equipment. He shall ensure that sufficient noise measurement equipment and associated instrumentation are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. All the equipment and associated instrumentation shall be clearly labelled.

5.5 Airborne Construction Noise Monitoring

5.5.1 Monitoring Locations and Methodology

Construction Noise

5.5.1.1 The locations of airborne construction noise monitoring stations are summarised in **Table 5.1** and shown in **Figure 5.1**. The locations of construction noise monitoring stations shall be reviewed and revised during detailed design on the basis of the latest information of the Project.

Table 5.1 Proposed Airborne Construction Noise Monitoring Locations

Monitoring Station ID	NAP ID	Location	Key Construction Activity	Monitoring Period ^[1]
Existing NSRs				
<i>Lam Tei Area</i>				
NM1	VH-13	Village Houses near Fuk Hang Tsuen Road	<ul style="list-style-type: none"> Construction of at-grade roads Construction of tunnel portal, ventilation building and satellite control building Slope works Construction of underground explosive magazine 	Throughout the construction period of corresponding activities
NM2	FTT-01	Area at/near Fu Tei Ha Tsuen		
NM3	LFH-01	Area at/near Lo Fu Hang		
<i>Tuen Mun West Area</i>				
NM4	CLKS-01	Caritas Li Ka Shing Care and Attention Home	<ul style="list-style-type: none"> Construction of tunnel ventilation building and underground temporary adit Slope works Temporary re-provisioning of 	Throughout the construction period of corresponding activities
NM5	KAM-01	Kam Fai Garden		
NM12	HAN-01	Hanford Garden		

Monitoring Station ID	NAP ID	Location	Key Construction Activity	Monitoring Period ^[1]
			basketball court and toilet	
NM13	GOG-01	Goodview Garden	<ul style="list-style-type: none"> Temporary re-provision of carpark 	
<i>Siu Lam Area</i>				
NM9	GRT-03	Grandview Terrace	<ul style="list-style-type: none"> Construction of temporary explosive magazine 	Throughout the construction period of corresponding activities

Note:

[1] The monitoring period is subject to the construction programme of the relevant contracts in the construction phase.

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

- At locations close to the major site activities which are likely to have noise impacts;
- Close to the most affected existing noise sensitive receivers; and
- For monitoring locations located in the vicinity of the sensitive receivers, care should be taken to cause minimal disturbance to the occupants during monitoring.

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

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

5.5.1.5 The status and locations of the NSRs may change after issuing this Manual. In such case, the ET shall propose updated monitoring locations and seek approval from the PMR and agreement from the IEC and EPD on the proposal.

5.5.2 Baseline Monitoring

5.5.2.1 The ET shall carry out baseline airborne noise monitoring in all airborne noise monitoring stations prior to the commencement of the construction works. There shall not be any construction activities in the vicinity of the stations during the baseline monitoring. Continuous baseline noise monitoring for the A-weighted levels Leq, L10 and L90 shall be carried out daily for a period of at least two weeks in a sample period of 30 minutes between 0700 and 1900, and 5 minutes between 1900 and 0700 as well as all time at general holidays including Sundays. A schedule on the baseline monitoring shall be submitted to the PMR and IEC for approval before the monitoring starts.

5.5.2.2 There should not be any construction activities in the vicinity of the monitoring stations during the baseline monitoring. Any non-Project related construction activities in the

vicinity of the monitoring stations during the baseline monitoring should be noted and the source and location of such activities should be recorded.

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

5.5.3 Impact Monitoring

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

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

5.5.3.3 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 shall inform the IEC of the impact monitoring programme such that the IEC can conduct on-site audit.

5.5.4 Action and Limit Levels

5.5.4.1 The ET shall compare the airborne construction noise monitoring results with noise criteria. **Table 5.2** show the noise criteria, namely Action and Limit Levels to be used.

Table 5.2 Action and Limit Levels for Airborne Construction Noise for Daytime

Time Period	Land Use	Action Level	Limit Level
0700 - 1900 hours on normal weekdays	<ul style="list-style-type: none"> • All domestic premises; • Temporary housing accommodation; • Hostels; • Convalescent homes; and • Homes for the aged 	When one documented complaint is received	75
	<ul style="list-style-type: none"> • Places of public worship; • Courts of law; and • Hospitals and medical clinics 		70
	<ul style="list-style-type: none"> • Educational institutions (including kindergartens and nurseries) 		70 65 (During Examination)

5.5.5 Event and Action Plan

5.5.5.1 Should non-compliance of the noise criteria occur, actions in accordance with the Event and Action Plan in **Table 5.3** shall be carried out.

Table 5.3 Event and Action Plan for Airborne Construction Noise

Event	Action			
	ET	IEC	PMR	Contractor
Action Level Exceedance	<ol style="list-style-type: none"> 1. Notify IEC, PMR 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. 	<ol style="list-style-type: none"> 1. Review the analysed results submitted by the ET; 2. Review the proposed remedial measures by the Contractor and advise the PMR accordingly; and 3. Supervise the implementation of remedial measures. 	<ol style="list-style-type: none"> 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 	<ol style="list-style-type: none"> 1. Identify source, and carry out investigation and report the investigation to the ET, IEC and PMR; 2. Submit noise mitigation proposals to IEC and PMR; and 3. Implement noise mitigation proposals.
Limit Level Exceedance	<ol style="list-style-type: none"> 1. Inform IEC, PMR, EPD and Contractor; 2. Repeat measurements to confirm findings; 3. Increase monitoring frequency; 4. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented; 5. Inform IEC, PMR and EPD the causes and actions taken for the exceedances; 6. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and PMR informed of the results; and 7. If exceedance stops, cease additional monitoring. 	<ol style="list-style-type: none"> 1. Check monitoring results and discuss amongst PMR, ET, and Contractor on the potential remedial actions; 2. Ensure remedial measures properly implemented; and 3. Review Contractors remedial actions whenever necessary to assure their effectiveness and advise the PMR accordingly. 	<ol style="list-style-type: none"> 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. 	<ol style="list-style-type: none"> 1. Identify source and carry out investigation and report the investigation to the ET, IEC and PMR; 2. Take immediate action to avoid further exceedance; 3. Submit proposals for remedial actions to PMR, 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 PMR until the exceedance is abated.

Notes:

ET – Environmental Team

IEC – Independent Environmental Checker

PMR – Project Manager's Representative

Highways Department

Tuen Mun Bypass

Environmental Impact Assessment Report

5.6 Groundborne Construction Noise Monitoring

5.6.1 Monitoring Locations and Methodology

5.6.1.1 The locations of groundborne construction noise monitoring stations are summarised in **Table 5.4** and shown in **Figure 5.1**. The locations of construction noise monitoring stations shall be reviewed and revised during detailed design on the basis of the latest information of the Project.

Table 5.4 Proposed Groundborne Construction Noise Monitoring Locations

Monitoring Station ID	NAP ID	Location	Key Construction Activity	Monitoring Period ^[1]
Existing NSRs				
Tuen Mun West Area				
NM4	CLKS-01	Caritas Li Ka Shing Care and Attention Home	<ul style="list-style-type: none"> Construction of tunnel Construction of ventilation building and underground temporary adit Slope works 	Throughout the construction period of corresponding activities
NM5a	KAM-02	Kam Fai Garden		
NM6	cTMW-01	Tuen Mun Wu Hong Clinic	<ul style="list-style-type: none"> Construction of tunnel by TBM 	Throughout the construction period of corresponding activities
NM7	eLCW-01	Buddhist Leung Chik Wai College		
NM8 ^[2]	SSC-01	Siu Shan Court		
NM10	Te-201	Castle Peak Sam Chau Ma Temple		
NM11	SSE-01	Sam Shing Estate		

Notes:

- [1] The monitoring period is subject to the construction programme of the relevant contracts in the construction phase.
 [2] Subject to the development of P01 (Social welfare / Education facilities for Public Housing Development at Wu Shan Road), the monitoring location shall be adjusted to PTMW-01.

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

- At locations close to the major site activities which are likely to have noise impacts;
- Close to the most affected existing noise sensitive receivers; and
- For monitoring locations located in the vicinity of the sensitive receivers, care should be taken to cause minimal disturbance to the occupants during monitoring.

5.6.1.3 The groundborne construction noise monitoring station shall be at the lowest sensitive floor 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 station, an alternative position shall be chosen, and a correction to the measurement results should be made.

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

5.6.1.5 The status and locations of the NSRs may change after issuing this Manual. In such case, the ET shall propose updated monitoring locations and seek approval from the PMR and agreement from the IEC and EPD on the proposal.

5.6.2 Baseline Monitoring

5.6.2.1 The ET shall carry out baseline groundborne noise monitoring inside the buildings/structures in all groundborne noise monitoring station prior to the commencement of the construction works. There shall not be any construction activities in the vicinity of the stations during the baseline monitoring. Continuous baseline noise monitoring for the A-weighted levels Leq, L10 and L90 shall be carried out daily for a period of at least two weeks in a sample period of 30 minutes between 0700 and 1900, and 5 minutes between 1900 and 0700 as well as all time at general holidays including Sundays. A schedule on the baseline monitoring shall be submitted to the PMR and IEC for approval before the monitoring starts.

5.6.2.2 There should not be any construction activities in the vicinity of the monitoring stations during the baseline monitoring. Any non-Project related construction activities in the vicinity of the monitoring stations during the baseline monitoring should be noted and the source and location of such activities should be recorded.

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

5.6.3 Impact Monitoring

5.6.3.1 Continuous monitoring for the groundborne noise impact due to the drill-and-blast/TBM operation may be required. A specific construction groundborne noise monitoring plan should be proposed by the ET and submitted to the IEC, PMR and EPD for approval via the CNMP beforehand.

5.6.3.2 **Table 5.5** shows the proposed drill-and-blast/TBM operating hours in relation to the measured groundborne noise levels recorded at monitoring location of different uses.

Table 5.5 Proposed Drill-and-blast / TBM Operating Time

Case	Monitoring Period	Monitoring Results	Acceptable Operating Time
Domestic Premises			
1	0700 – 1900 hours	60 dB(A) < MNL ^[1] < 65 dB(A)	Daytime (Except general holidays and Sundays) (0700 – 1900 hrs) only
2	1900 – 2300 hours	MNL < 50/55/60 ^[2] dB(A)	Day and evening time of general holidays (including Sundays) (0700 to 2300 hours) and all weekdays during the

Case	Monitoring Period	Monitoring Results	Acceptable Operating Time
			evening (1900 to 2300 hours) ^[3]
3	2300 – 0700 hours	MNL < 35/40/45 ^[2] dB(A)	– ^[3]
Schools, Temples or other sensitive receivers			
4	0700 – 1900 hours	55 dB(A) < MNL < 60 dB(A) (during examination: 50 dB(A) < MNL < 55 dB(A))	Daytime during normal weekdays only ^[3]
5	1900 – 2300 hours	MNL < 50/55/60 ^[2] dB(A)	Day and evening time of general holidays (including Sundays) (0700 to 2300 hours) and all weekdays during the evening (1900 to 2300 hours) ^[3]
6	2300 – 0700 hours	MNL < 35/40/45 ^[2] dB(A)	– ^[3]

Notes:

- [1] MNL means Measured Noise Level. If MNL is higher than the Limit level, the ET should inform the affected NSRs the proposed working hour and period of TBM operation.
- [2] Noise criteria for Area Sensitive Rating “A”, “B” and “C” respectively.
- [3] The operating time of drill-and-blast / TBM will be subject to the granting of Construction Noise Permit and usages of the sensitive receivers.

5.7 Operational Noise Monitoring

5.7.1 Fixed Noise Sources Audit

5.7.1.1 The Contractor should also carry out a noise audit for all fixed noise sources before the operation of the Project, in order to ensure compliance with the noise standards stipulated in the EIAO-TM and NCO. The ANLs for different Area Sensitivity Ratings during different periods are summarised in the **Table 5.6**.

Table 5.6 ANLs for Fixed Noise Sources

Time Period	ANL, dB(A)		
	Area Sensitivity Rating A	Area Sensitivity Rating B	Area Sensitivity Rating C
Day (0700 to 1900 hours)	60	65	70
Evening (1900 to 2300 hours)	60	65	70
Night (2300 to 0700 hours)	50	55	60

6. Water Quality Impact

6.1 Introduction

6.1.1.1 The EIA Report has assessed the potential water quality impacts associated with the construction and operation of the Project. According to the EIA Report, adverse environmental impact is not anticipated during the construction and operational phases with proper implementation of the recommended mitigation measures and good site practices.

6.2 Mitigation Measures

6.2.1 Construction Phase

6.2.1.1 During the construction phase, recommended mitigation measures such as good site practices to control construction site runoff, provision of perimeter drains, on-site treatment of land-based works prior to discharge, etc., should be implemented. All the recommended mitigation measures are summarised in the EMIS in [Appendix 4.1](#).

6.2.2 Operational Phase

6.2.2.1 With proper connection to the public stormwater drainage and sewerage systems and mitigation measure in place such as stormwater surface runoff discharged to the nearby government drainage system with provision of silt trap, standard oil interceptors and the practices outlined in ProPECC PN 5/93, adverse impact is not anticipated during the operational phase. Therefore, no water quality monitoring and site audit are required.

6.3 Water Monitoring Parameters

6.3.1.1 The monitoring shall normally be established by measuring the dissolved oxygen (DO), dissolved oxygen saturation (DO%), temperature, turbidity, salinity, pH and suspended solids (SS) in water bodies at all designated locations as specified in [Section 6.6](#).

6.3.1.2 The measurements shall be taken at all designated monitoring stations 3 days per week during construction phase. The interval between two sampling surveys shall not be less than 36 hours.

6.3.1.3 Replicate in-situ measurements and samples collected from each independent sampling event shall be collected to ensure a robust statistically interpretable database. DO, DO%, pH, salinity, temperature and turbidity should be measured in-situ whereas other parameters should be determined by an accredited laboratory.

6.3.1.4 Other relevant data shall also be recorded, including monitoring location / position, time, water depth, tidal stages, weather conditions and any special phenomena or work underway at the construction site.

6.4 Monitoring Equipment

6.4.1 Dissolved Oxygen, Dissolved Oxygen Saturation and Temperature Measuring Equipment

6.4.1.1 The DO measuring instruments should be portable and weatherproof. The equipment should also complete with cable and sensor, and DC power source. It should be capable of measuring:

- A DO level in the range of 0 – 20 mg/L and 0 – 200% saturation; and
- A temperature of 0 – 45 degree Celsius.

6.4.1.2 The equipment should have a membrane electrode with automatic temperature compensation complete with a cable.

6.4.1.3 Should salinity compensation not be built-in to the DO equipment, in-situ salinity should be measured to calibrate the DO measuring instruments prior to each measurement.

6.4.2 Turbidity Measuring Equipment

6.4.2.1 The turbidity measuring instruments should be a portable and weatherproof with DC power source. It should have a photoelectric sensor capable of measuring turbidity level between 0 – 1000 NTU (e.g. Hach model 2100P or an approved similar instrument).

6.4.3 Salinity Measuring Equipment

6.4.3.1 A portable salinometer capable of measuring salinity in the range of 0 – 40 parts per thousand (ppt) should be provided for measuring salinity of the water at each monitoring location.

6.4.4 pH Measuring Equipment

6.4.4.1 A portable pH meter capable of measuring a pH range between 0.0 and 14.0 shall be provided under the specified conditions (e.g. Orion Model 250A or an approved similar instrument).

6.4.5 Positioning Equipment

6.4.5.1 A hand-held or boat-fixed type digital Differential Global Positioning System (DGPS) with way point bearing indication and Radio Technical Commission for maritime (RTCM) Type 16 error message “screen pop-up” facilities (for real-time auto-display of error messages and DGPS corrections from the Hong Kong Hydrographic Office), or other equipment instrument of similar accuracy, should be provided and used during marine water monitoring to ensure the monitoring vessel is at the correct location before taking measurements.

6.4.6 Water Depth Detector

- 6.4.6.1 A portable, battery-operated echo sounder should be used for water depths determination at each designated monitoring station. The detector can either be hand held or affixed to the bottom of the work boat, if the same vessel is to be used throughout the monitoring programme.

6.4.7 Water Sampling Equipment

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

6.4.8 Sample Containers and Storage

- 6.4.8.1 Water samples for SS should be stored in high density polythene bottles with no preservative added, packed in ice (cooled to 4°C without being frozen) and shipment to the testing laboratory. The samples shall be delivered to the laboratory within 24 hours of collection and be analysed as soon as possible after collection.

6.4.9 Calibration of In-Situ Instruments

- 6.4.9.1 The pH meter, DO meter and turbidimeter shall be checked and calibrated before use. DO meter and turbidimeter shall be certified by a laboratory accredited under HOKLAS or any other international accreditation scheme, and subsequently re-calibrated at quarterly basis throughout all stages of the water quality monitoring. Responses of sensors and electrodes should be checked with certified standard solutions before each use. Wet bulb calibration for a DO meter shall be carried out before measurement at each monitoring station.

6.4.10 Back-up Equipment and Vessels

- 6.4.10.1 Sufficient stocks of spare parts shall be maintained for replacements when necessary. Backup monitoring equipment shall also be made available so that monitoring can proceed uninterrupted even when some equipment is under maintenance, calibration, malfunction, etc.
- 6.4.10.2 The water quality monitoring will involve 2 monitoring stations as specified in **Section 6.6** and measurements should be conducted within the prescribed tidal conditions in order to ensure the measurement / samples are representative. A multi-probe monitoring equipment set integrated with water sampler(s) is highly recommended to improve the monitoring efficiency. Depending on the actual operation, more than one field survey vessels might be required simultaneously to ensure the monitoring are conducted within the acceptable monitoring period. The ET shall also consider the use of unattended automatic sampling / monitoring devices at fixed stations where monitoring are required throughout the construction period. The use of such unattended automatic devices, however, shall be subject to the approval of the PMR, IEC and EPD.

6.5 Laboratory Measurement / Analysis

- 6.5.1.1 At least 3 replicate samples from each independent sampling event are required for the SS measurement which shall be carried in a HOKLAS or international accredited laboratory. Sufficient water samples shall be collected at the monitoring stations for carrying out the laboratory measurement and analysis. The laboratory determination work shall start within 24 hours after collection of the water samples. The analysis for suspended solids is presented in **Table 6.1**.

Table 6.1 Laboratory Analysis

Parameters	Analytical Method	Reporting Limit
Suspended Solid (SS)	APHA 22ed 2540 D & E	0.5mg/L

6.6 Monitoring Locations

- 6.6.1.1 Water quality monitoring will be carried out at 4 locations (WM1, WM2, C1 and C2) of the inland water nearby the Project Site.
- 6.6.1.2 The proposed water quality monitoring locations are shown in **Figure 6.1** and listed in **Table 6.2**. The locations of water quality monitoring shall be reviewed and revised during detailed design on the basis of the latest information of the Project. The ET shall seek approval from IEC and EPD for any alternative monitoring locations.

Table 6.2 Locations of Proposed Water Quality Monitoring Stations

Monitoring Station ID	Description	Easting	Northing
WM1	Tuen Mun River	816734	830598
C1	Control Station of WM1	817065	830325
WM2	Channel near Lung Mun Road at Pillar Point	812478	825355
C2	Control Station of WM1	812451	825716

6.7 Baseline Monitoring

- 6.7.1.1 Baseline conditions for water quality shall be established and agreed with EPD prior to commencement of construction works. The purpose of the baseline monitoring is to establish ambient conditions prior to the commencement of the construction works and to demonstrate the suitability of the proposed impact and control monitoring stations.
- 6.7.1.2 The baseline monitoring shall be conducted for at least 4 weeks prior to the commencement of construction works. The proposed water quality monitoring schedule shall be submitted to EPD by the ET at least 2 weeks before the first day of the monitoring month. The interval between two sets of monitoring shall not be less than 36 hours. EPD shall also be notified immediately for any changes in schedule.
- 6.7.1.3 In general, where the difference in value between the first and second in-situ measurement of DO or turbidity parameters is more than 25% of the value of the first reading, the reading shall be discarded and further readings should be taken.

- 6.7.1.4 There should be no construction work in the vicinity of the stations during the baseline monitoring. The baseline data will be used to establish the Action and Limit Levels. The determination of Action and Limit Levels will be discussed in **Section 6.9**.
- 6.7.1.5 **Table 6.3** below summarizes the proposed monitoring frequency and water quality parameters for baseline monitoring.

Table 6.3 Proposed Water Quality Monitoring Programme for Baseline Monitoring

Item	Baseline Monitoring
Monitoring Period	At least 4 weeks prior to the commencement of construction work
Monitoring Frequency	3 Days in a Week
Monitoring Locations	WM1, WM2, C1 and C2
Monitoring Parameters	Dissolved oxygen (DO), dissolved oxygen saturation (DO%), temperature, turbidity, salinity, pH and suspended solids (SS).
Intervals between 2 Sets of Monitoring	Not less than 36 hours

6.8 Impact Monitoring

- 6.8.1.1 The impact monitoring shall be conducted during construction period. The purpose of impact monitoring is to ensure the implementation of the recommended mitigation measures, provide effective control of any malpractices, and provide continuous improvements to the environmental conditions. The proposed water quality monitoring schedule shall be submitted to EPD by the ET at least 2 weeks before the first day of the monitoring month. The interval between two sets of monitoring shall not be less than 36 hours. EPD shall also be notified immediately for any changes in schedule.
- 6.8.1.2 In general, where the difference in value between the first and second in-situ measurement of DO or turbidity parameters is more than 25% of the value of the first reading, the reading shall be discarded and further readings should be taken.
- 6.8.1.3 In case of project-related exceedances of Action and/or Limit Levels, the impact monitoring frequency shall be increased according to the requirement of Event and Action Plan. The details of Event Action Plan will be discussed in **Section 6.10**.
- 6.8.1.4 **Table 6.4** below summarises the proposed monitoring frequency and water quality parameters for and impact monitoring.

Table 6.4 Proposed Water Quality Monitoring Programme for Impact Monitoring

Item	Impact Monitoring
Monitoring Period	During entire construction period
Monitoring Frequency	3 Days in a Week
Monitoring Locations	WM1, WM2, C1 and C2
Monitoring Parameters	Dissolved oxygen (DO), dissolved oxygen saturation (DO%), temperature, turbidity, salinity, pH and suspended solids (SS)
Intervals between 2 Sets of Monitoring	Not less than 36 hours

6.9 Action and Limit Levels

6.9.1.1 The Action and Limit Levels for water quality are defined in **Table 6.5**.

Table 6.5 Action and Limit Levels for Water Quality

Parameters	Action Level	Limit Level
DO in mg/L	5 percentile of baseline data. ^[1]	4 mg/L or 1 percentile of baseline data. ^[1]
SS in mg/L	95 percentile of baseline data or 120% of upstream control station. ^[2]	99 percentile of baseline data or 130% of upstream control station. ^[2]
Turbidity in NTU	95 percentile of baseline data or 120% of upstream control station. ^[2]	99 percentile of baseline data or 130% of upstream control station. ^[2]

Notes:

[1] For DO, non-compliance occurs when monitoring results is lower than the limits.

[2] For SS and turbidity, non-compliance occurs when monitoring results is larger than the limits.

6.10 Event and Action Plan

6.10.1.1 Should non-compliance of the criteria occur, action in accordance with the Action Plan in the below **Table 6.6** shall be carried out.

Table 6.6 Event and Action Plan for water quality

Event	Action			
	ET	IEC	PMR	Contractor
Action level exceedance for one sampling day	<ol style="list-style-type: none"> 1. Inform IEC, Contractor and PMR; 2. Check monitoring data, all plant, equipment and Contractor's working methods; and 3. Discuss remedial measures with IEC and Contractor and PMR. 	<ol style="list-style-type: none"> 1. Discuss with ET, PMR and Contractor on the implemented mitigation measures; 2. Review proposals on remedial measures submitted by Contractor and advise the PMR accordingly; and 3. Review and advise the ET and PMR on the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss with IEC, ET and Contractor on the implemented mitigation measures; 2. Make agreement on the remedial measures to be implemented; and 3. Supervise the implementation of agreed remedial measures. 	<ol style="list-style-type: none"> 1. Identify source(s) of impact; 2. Inform the PMR and confirm notification of the non-compliance in writing; 3. Rectify unacceptable practice; 4. Check all plant and equipment; 5. Consider changes of working methods; 6. Discuss with PMR, ET and IEC and propose remedial measures to IEC and PMR; and 7. Implement the agreed mitigation measures.
Action level exceedance for more than one consecutive sampling days	<ol style="list-style-type: none"> 1. Repeat in-situ measurement on next day of exceedance to confirm findings; 2. Inform IEC, contractor and PMR; 3. Check monitoring data, all plant, equipment and Contractor's working methods; 4. Discuss remedial measures with IEC, contractor and PMR; and 5. Ensure remedial measures are implemented. 	<ol style="list-style-type: none"> 1. Discuss with ET, Contractor and PMR on the implemented mitigation measures; 2. Review the proposed remedial measures submitted by Contractor and advise the PMR accordingly; and 3. Review and advise the ET and PMR on the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss with ET, IEC and Contractor on the proposed mitigation measures; 2. Make agreement on the remedial measures to be implemented ; and 3. Discuss with ET, IEC and Contractor on the effectiveness of the implemented remedial measures. 	<ol style="list-style-type: none"> 1. Identify source(s) of impact; 2. Inform the PMR and confirm notification of the non-compliance in writing; 3. Rectify unacceptable practice; 4. Check all plant and equipment and consider changes of working methods; 5. Discuss with ET, IEC and PMR and submit proposal of remedial measures to PMR and IEC within 3 working days of notification; and 6. Implement the agreed mitigation measures.

Event	Action			
	ET	IEC	PMR	Contractor
Limit level exceedance for one sampling day	<ol style="list-style-type: none"> 1. Repeat measurement on next day of exceedance to confirm findings; 2. Inform IEC, contractor and PMR; 3. Rectify unacceptable practice; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Consider changes of working methods; 6. Discuss mitigation measures with IEC, PMR and Contractor; and 7. Ensure the agreed remedial measures are implemented 	<ol style="list-style-type: none"> 1. Discuss with ET, Contractor and PMR on the implemented mitigation measures; 2. Review the proposed remedial measures submitted by Contractor and advise the PMR accordingly; and 3. Review and advise the ET and PMR on the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss with ET, IEC and Contractor on the implemented remedial measures; 2. Request Contractor to critically review the working methods; 3. Make agreement on the remedial measures to be implemented; and 4. Discuss with ET, IEC and Contractor on the effectiveness of the implemented remedial measures. 	<ol style="list-style-type: none"> 1. Identify source(s) of impact; 2. Inform the PMR and confirm notification of the non-compliance in writing; 3. Rectify unacceptable practice; 4. Check all plant and equipment and consider changes of working methods; 5. Discuss with ET, IEC and PMR and submit proposal of additional mitigation measures to PMR and IEC within 3 working days of notification; and 6. Implement the agreed remedial measures.
Limit level exceedance for more than one consecutive sampling days	<ol style="list-style-type: none"> 1. Inform IEC, contractor and PMR; 2. Check monitoring data, all plant, equipment and Contractor's working methods; 3. Discuss mitigation measures with IEC, PMR and Contractor; 4. Ensure mitigation measures are implemented; and 	<ol style="list-style-type: none"> 1. Discuss with ET, Contractor and PMR on the implemented mitigation measures; 2. Review the proposed remedial measures submitted by Contractor and advise the PMR accordingly; and 3. Review and advise the ET and PMR on the effectiveness of the 	<ol style="list-style-type: none"> 1. Discuss with ET, IEC and Contractor on the implemented remedial measures; 2. Request Contractor to critically review the working methods; 3. Make agreement on the remedial measures to be implemented; 4. Discuss with ET and IEC on the effectiveness of the 	<ol style="list-style-type: none"> 1. Identify source(s) of impact; 2. Inform the PMR and confirm notification of the non-compliance in writing; 3. Rectify unacceptable practice; 4. Check all plant and equipment and consider changes of working methods; 5. Discuss with ET, IEC and PMR and submit proposal of additional mitigation measures

Event	Action			
	ET	IEC	PMR	Contractor
	5. Increase the monitoring frequency to daily until no exceedance of Limit Level for two consecutive days.	implemented mitigation measures.	implemented mitigation measures; and 5. Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the dredging activities until no exceedance of Limit level.	to PMR and IEC within 3 working days of notification; 6. Implement the agreed remedial measures; and 7. As directed by the PMR, to slow down or stop all or part of the dredging activities until no exceedance of Limit level.

Notes:

ET – Environmental Team

IEC – Independent Environmental Checker

PMR – Project Manager’s Representative

Each step of actions required shall be implemented within 1 working days unless otherwise specified or agreed with EPD.

7. Waste Management Implications

7.1 Mitigation Measures

7.1.1 Construction Phase

7.1.1.1 All the proposed mitigation measures during construction phase are stipulated in the EIA Report and summarised in [Appendix 4.1](#).

7.1.1.2 Wastes will be handled in accordance with the relevant legislation and guidelines and with the implementation of the proposed mitigation measures, no adverse environmental impacts from waste management are anticipated. EM&A is required for waste management during the construction phase only and the effective management of waste arising during the construction phase will be monitored through the site audit programme. The aims of the waste audit are:

- To ensure the waste arising from the works are handled, stored, collected, transferred and disposed of in an environmental acceptable manner; and
- To encourage the reuse and recycling of material.

7.1.1.3 A trip-ticket system should be operated to monitor all movements of both inert and non-inert C&D materials for delivered to Public Fill Reception Facilities (PFRFs), disposal at landfill and chemical wastes which will be collected by licensed chemical waste collectors to licensed facilities for final treatment and disposal. All dump trucks and vessels engaged on site for delivery of inert C&D materials from the site to PFRFs and for disposal of non-inert C&D materials from the site to the landfill should be equipped with GPS or equivalent system for tracking and monitoring of their travel routings and parking locations to prohibit illegal dumping and landfilling of C&D materials. Record and analysis of data collected by the mentioned GPS or equivalent system should be kept. Recommendations have been made in the EIA Report to ensure proper treatment and proper disposal of these wastes and summarised in [Appendix 4.1](#).

7.1.2 Operational Phase

7.1.2.1 For the general refuse from the employees within mainly the administration building and partly from the tunnel ventilation buildings, it should be separated from chemical waste by providing separated bins for storage to maximize the recyclable volume as far as practicable. A reputable waste collector should be employed to remove general refuse regularly to minimize odour, pest and litter impacts. Other than general refuse, opportunities for the reusing and recycling of chemical wastes should be explored where possible. As chemical waste is expected to be generated, a trip-ticket system should be operated in accordance with the Waste Disposal (Chemical Waste) (General) Regulation to monitor all movements of chemical wastes which will be collected by a licensed collector to a licensed facility for final treatment and disposal. With proper management, adverse waste management implications are not anticipated.

7.2 Environmental Monitoring and Site Audit Requirements

7.2.1 Construction Phase

7.2.1.1 The Contractor shall be required to pay attention to the environmental standards and guidelines, carry out appropriate waste management and obtain the relevant licenses/permits for waste disposal. The ET shall ensure that the Contractor has obtained from the appropriate authorities the necessary waste disposal permits or licenses including:

- Chemical Waste Disposal License under the Waste Disposal Ordinance (Cap 354);
- Dumping License under the Land (Miscellaneous Provisions) Ordinance (Cap 28); and
- Water Pollution Control Ordinance License under the Water Pollution Control Ordinance (Cap 358).

7.2.1.2 The Contractor shall refer to EPD's Guidance Notes for license applications when applying for the license/ permit and the ET shall refer to these Guidance Notes for auditing purposes.

7.2.1.3 Regular audits and site inspections (i.e. on a weekly basis) should be carried out during the construction phase by the ET to ensure that the recommended good site practices and other mitigation measures recommended in the EIA Report and in **Appendix 4.1** 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, a Waste Management Plan (WMP) as part of the Environmental Management Plan (EMP) shall be prepared by the Contractor and submitted to the PMR for approval. Documents including licenses, permits, disposal and recycling records should be reviewed and audited for compliance with the legislation and contract requirements. Monitoring of the implementation of the trip ticket system for disposal of C&D materials in accordance with DEVB TC(W) No. 6/2010 is also recommended.

7.2.1.4 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.

7.2.2 Operational Phase

7.2.2.1 As it is anticipated that there would not be any insurmountable impacts during the operational phase, monitoring and audit requirements are not required.

8. Land Contamination

8.1 Introduction

- 8.1.1.1 Based on the results of the site surveys presented in the approved Contamination Assessment Plan (CAP), potential contaminated areas have been identified within the Project Area. However, all of these areas are in operation and infeasible to conduct site investigation (SI) and sampling works at this EIA stage. There may be changes in site activities and land uses within the Project Site prior to the construction works that could result in further contamination issues. Whilst further site re-appraisal is required for the whole Project Areas, associated site investigation (SI) works and any necessary remediation works are required to be conducted when site assessment becomes available. The recommended further works, including a supplementary CAP, Contamination Assessment Report (CAR) and, where contamination has been identified, a Remediation Action Plan (RAP) and Remediation Report (RR) shall be prepared and submitted to the EPD for approval prior to the commencement of any construction/ development works.
- 8.1.1.2 With the implementation of the recommended follow-up works for the Project, any soil / groundwater contamination would be identified and properly treated prior to construction works at the concerned areas.

8.2 Mitigation Measures

- 8.2.1.1 Remediation work, if required, would be carried out after site operations have ceased and prior to the construction works at the potential contaminated area. Mitigation measures for the remediation works, if required, as recommended in the EIA Report to minimise environmental impacts arising from handling potentially contaminated materials. The recommended mitigation measures are detailed in [Appendix 4.1](#).

8.3 Environmental Monitoring and Site Audit Requirements

- 8.3.1.1 As any contaminated soil/ groundwater would be identified and properly treated prior to the commencement of any construction/ development works, land contamination during the operational phase is not expected. Therefore, environmental monitoring and site audit is not required during both construction or operational phases.

9. Hazard to Life

9.1 Introduction

9.1.1.1 The EIA Report concluded that with the implementation of proposed mitigation measures, no insurmountable potential risk arising from storage, transport and use of explosives is anticipated. Blasting activities regarding transport and use of explosives should be supervised and audited by the competent site staff to ensure strict compliance with the blasting permit conditions. The operation of the Project does not involve any use of explosives, potential risk during operational phase is not envisaged.

9.2 Mitigation Measures

9.2.1 Construction Phase

9.2.1.1 Recommendations have been made for implementation to meet the EIAO-TM requirements, such as reduction of amount of combustibles in the truck cabin, implementation as listed out in [Appendix 4.1](#). Other good site practices and design measures as listed out in [Appendix 4.1](#) are also proposed to further minimize the potential risk.

9.2.1.2 Subject to the liaison of the three concurrent projects Route 11, TMB and Lam Tei Underground Quarrying (LTUQ), a Hazard Management Plan would be formulated with a view to aligning the understanding of the risk of the three projects so that all the working populations at Lam Tei Quarry area, which includes the workforce induced under the construction and operational stage of three projects, could be considered as on-site populations in the quantitative risk assessment for all the three projects. The measures stipulated in the Hazard Management Plan may include, but not limited to, the adjustment of the blasting schedules of the three projects to minimize the potential cumulative impact, provision of common trainings and drills to the workforce of all the three projects, etc. The Hazard Management Plan, which would be agreed among the three projects, would be submitted to EPD for agreement prior to the tender invitation of construction phases of Route 11, TMB and LTUQ, whichever is earlier.

9.2.2 Operational Phase

9.2.2.1 No specific mitigation measures are required as no potential risk during operational phase is envisaged.

9.3 Environmental Monitoring and Site Audit Requirements

9.3.1 Construction Phase

9.3.1.1 Blasting activities regarding transport and use of explosives should be supervised and audited by the competent site staff to ensure strict compliance with the blasting permit conditions. Therefore, additional environmental monitoring and site audit is not required.

9.3.2 Operational Phase

- 9.3.2.1 No specific mitigation measures are required as no potential risk during operational phase is envisaged. Hence, environmental monitoring and site audit are not required.

10. Landfill Gas Hazard

10.1 Introduction

10.1.1.1 The EIA Report has documented the landfill gas (LFG) hazards associated with the Project. According to the EIA Report, with the provision of mitigation measures adverse impacts on the targets within the Project are not anticipated.

10.2 Mitigation Measures

10.2.1 Construction Phase

10.2.1.1 All the proposed precautionary and protection measures during construction phase are stipulated in the EIA Report and summarised in **Appendix 4.1**. These measures include appointment of Safety Officer, site safety measures, landfill gas monitoring and emergency management.

10.2.2 Design and Operational Phase

10.2.2.1 During the design and operational phases, the following precautionary and protection measures will be provided and implemented whether practicable:

- Passive control measures (e.g. gas-resistant membrane, dense well-compacted concrete, steel shuttering, natural ventilation system and synthetic composite geotextiles);
- Active control measures (e.g. mechanical ventilation system);
- Gas barriers and gas vents;
- Regular landfill gas monitoring; and
- Entry safety procedures for confined spaces.

10.2.2.2 All the proposed mitigation measures during design and operational phases are stipulated in the EIA Report and summarised in **Appendix 4.1**.

10.3 Environmental Monitoring and Site Audit

10.3.1 Construction Phase

10.3.1.1 Monitoring will be undertaken when construction works are carried out in confined space within the Consultation Zone. The monitoring requirements and procedures specified in Paragraphs 8.23 to 8.28 of EPD's *Guidance Note* are highlighted below:

- Periodically during ground-works construction, the works area should be monitored for methane, carbon dioxide and oxygen using appropriately calibrated portable gas detection equipment. The equipment should be intrinsically safe and calibrated according to the manufacturer's instructions.

- The monitoring frequency and areas to be monitored should be set down prior to commencement of works either by the Safety Officer or by an appropriate qualified person.
- Routine monitoring should be carried out in all excavations, manholes and chambers and any other confined spaces that may have been created by, for example, the temporary storage of building materials on the site surface.
- All measurements in excavations should be made with the monitoring tube located not more than 10mm from the exposed ground surface.
- A standard form, detailing the location, time of monitoring and equipment used together with the gas concentrations measured, should be used when undertaking manual monitoring to ensure that all relevant data are recorded.
- Monitoring of excavations should be undertaken as follows:

For excavations deeper than 1m, measurements should be made:

- at the ground surface before excavation commences;
- immediately before any staff enters the excavation;
- at the beginning of each working day for the entire period the excavation remains open; and
- periodically through the working day whilst the construction team is in the excavation.

For excavations between 300mm and 1m deep, measurements should be made:

- directly after the excavation has been completed; and
- periodically whilst the excavation remains open.

For excavations less than 300mm deep, monitoring may be omitted, at the discretion of the Safety Officer or other appropriately qualified person.

- If methane (flammable gas) or carbon dioxide concentrations are in excess of the trigger levels or that of oxygen is below the levels specified in the Emergency Management in the following section, then evacuation will be initiated.

Actions in the Event of Gas Being Detected

10.3.1.2 Depending on the results of the measurements, actions required will vary and should be set down by the Safety Officer or another appropriately qualified person. As a minimum these should encompass those actions specified in **Table 10.1**.

Table 10.1 Actions in the Event of Gas Being Detected

Parameter	Measurement	Action
O ₂	< 19% v/v	Increase underground ventilation to restore O ₂ to >19% v/v
	< 18% v/v	Stop works Evacuate all personnel

Parameter	Measurement	Action
		Increase ventilation further to restore O ₂ to >19% v/v
CH ₄	> 10% LEL	Prohibit hot works Increase ventilation to restore CH ₄ to <10% LEL
	>20% LEL	Stop works Evacuate all personnel Increase ventilation further to restore CH ₄ to <10% LEL
CO ₂	>0.5% v/v	Increase ventilation to restore CO ₂ to <0.5% v/v
	> 1.5% v/v	Stop works Evacuate all personnel Increase ventilation further to restore CO ₂ to <0.5% v/v

10.3.2 Design and Operational Phases

10.3.2.1 During the detailed design stage, the detailed design consultant should provide a more detailed assessment and finalize the design of the gas protective measures or ventilation to underground confined utility pits, manholes and ground floor rooms. The detailed design (drawings and specification) of landfill gas protection measures as well as the requirement for maintenance and monitoring should be prepared by a competent professional person and submitted to EPD for vetting.

10.3.2.2 During operation, regular monitoring of landfill gas should be conducted at buildings and enclosures within the Consultation Zone to verify the effectiveness and to ensure the continued performance of the implemented protection measures. Should abnormality be observed, it should be reported to EPD and the PPVL operator.

11. Ecological Impact (Terrestrial)

11.1 Introduction

11.1.1.1 The EIA Report has evaluated the ecological impacts associated with the construction and operation of the Project and ecological mitigation measures have been recommended to avoid, minimise and compensate the impact arising from the Project.

11.1.1.2 The mitigation measures aiming to avoid, minimise and mitigate the ecological impacts arising from the Project were identified in Section 10 of the EIA Report and are described in the following sections. The proposed ecological mitigation measures and good site practices should be checked as one of the elements under the environmental audit programme of the Project.

11.2 Mitigation Measures

11.2.1.1 The proposed mitigation measures and good site practices for ecological impacts are summarised in the EMIS in [Appendix 4.1](#).

11.3 Environmental Monitoring and Site Audit Requirements

11.3.1 Transplantation of Flora Species of Conservation Importance

11.3.1.1 Two flora species of conservation importance, including one individual of *Diospyros vaccinioides* was recorded and a small patch of *Gnetum luofuense* in mixed woodland near Pillar Point and near Wah Fat Playground, respectively, within the Project Area (aboveground) during the ecological baseline survey. Detailed vegetation survey should be conducted by suitably qualified botanist/ecologist for the Project Area (aboveground) within mixed woodland and shrubland/grassland at Pillar Point and near Wah Fat Playground prior to the commencement of construction activities at the mentioned locations to confirm the presence of flora species of conservation interest. The curriculum vitae of the qualified botanist/ecologist should be submitted to the AFCD for approval and comments prior to the survey. If on-site preservation is not feasible, transplantation and/or mitigation measures would be recommended as far as possible to minimize the unavoidable direct loss of these species. Transplantation proposal for the affected individuals would be prepared if necessary. Potential recipient sites for the affected flora species were identified within close vicinity of its original location and indicated in Figure 10.7 of EIA Report. A monitoring program should be prepared in the transplantation proposal by a suitably qualified botanist/ecologist prior to the transplantation works and monitor the health conditions of the transplanted individuals upon the completion of transplantation works at the recipient site.

11.3.2 Translocation of Freshwater Crab Species of Conservation Importance

11.3.2.1 Freshwater crab species of conservation importance, *Somanniathelphusa zanklon*, was recorded in the affected watercourse section S2, within the Project Area (aboveground) during the ecological baseline survey. While *Somanniathelphusa zanklon*, *Cryptopotamon anacoluthon*, and *Nanhaipotamon hongkongense* were recorded at the lower watercourse section where S2 and S2A is connected. An update ecological survey shall be conducted by a qualified ecologist as part of the ET with focus to the presence of the freshwater crabs

prior to the commencement of stream diversion works near Wah Fat Playground. An update ecological survey plan should be prepared by the qualified ecologist, whose curriculum vitae should be submitted together with the survey plan to AFCD for review and comments prior to the commencement of any survey to be conducted. Should freshwater crab species of conservation importance be found within the affected watercourse sections, a Freshwater Crab Translocation Plan should be prepared. Freshwater crab translocation should be conducted to move the individuals from the project area to suitable recipient site(s). The Freshwater Crab Translocation Plan should be prepared by the qualified ecologist as a part of the ET, certified by the IEC and submitted to AFCD within four months upon completion of the update aquatic survey to agree the detailed translocation procedures including the identified receptor site(s) and post-translocation monitoring programme. Approval from the Authority (e.g. AFCD) should be sought prior to conducting the translocation work. The freshwater crab translocation work should be conducted prior to the commencement of the stream diversion works near Wah Fat Playground, following the approved Freshwater Crab Translocation Plan. Upon the completion of the translocation work, post-translocation survey should be conducted at the recipient site to monitor the effectiveness of translocation.

11.3.3 Monitoring of Compensatory Woodland

11.3.3.1 Monitoring of the compensatory woodland should be performed on a regular basis after the first planting, to monitor the survival and establishment of trees and wildlife use. Survey in each compensatory woodland location will commence after the first planting. Randomly selected individuals of each planted species will be tagged and their survival rate will be computed. Supplementary planting will be recommended if deemed necessary. Wildlife use of the planted vegetation will also be monitored. Details of the monitoring will be included in the Woodland Compensation Plan to be submitted in the detailed design stage and agreed with relevant authorities.

11.3.4 Monitoring on Mitigation Measures on Groundwater Infiltration

11.3.4.1 The drill-and-blast/drill-and-break tunnel section in Tai Lam Country Park would be in granite and with sufficient depth below ground, together with the good practices and mitigation measures as described in Log Ref. W2 of **Appendix 4.1**, adverse impacts from groundwater infiltration is not anticipated. As an additional precautionary measure, surface water level monitoring at natural watercourses within Tai Lam Country Park, Lam Tei Irrigation Reservoir, and in the vicinity of the tunnelling works would be conducted during the construction and operation stages. Monthly monitoring should be conducted at the selected watercourses to monitor parameters (including water depth and water velocity) to record and evaluate if any abnormal significant decrease of the water level is arising from the Project. In case abnormalities is detected, the monitoring arrangement and remedial measures (if required) should be reported to EPD (who is the EIAO authority), AFCD and other relevant authorities. Details of the monitoring, including the monitoring locations, shall be agreed with AFCD during the detailed design stage prior to commencement of any construction activities.

11.3.5 General Site Inspection and Audit Requirement

- 11.3.5.1 The implementation of the proposed ecological mitigation measures and good site practices, which are summarised in the EMIS in **Appendix 4.1**, will be inspected and subjected to monthly site audit for all works under the Project, including Project Area near Tai lam Country Park, as part of the ecological monitoring programme during the construction period.

12. Landscape and Visual Impacts

12.1 Introduction

12.1.1.1 The EIA has recommended that EM&A for landscape and visual resources is undertaken during the design, construction and operational phases of the Project. The design, implementation and maintenance of landscape mitigation measures should be checked to ensure that any potential conflicts between the proposed landscape measures and any other works of the Project would be resolved at early as practical without affecting the implementation of the mitigation measures.

12.2 Mitigation Measures

12.2.1.1 The landscape and visual impact assessment of the EIA Report proposes a number of mitigation measures to ameliorate the landscape and visual impacts of the Project. These measures are listed in **Table 12.1** below and the implementation is summarised in the EMIS in **Appendix 4.1**.

Table 12.1 Mitigation Measures for the Construction and Operational Phases

Mitigation Measure Code	Summary Description	Mitigate Landscape Impacts	Mitigate Visual Impacts
Construction Phase			
CM01	Tree Protection and Preservation	Y	Y
CM02	Tree Transplantation	Y	Y
CM03	Works Area and Temporary Works Areas	Y	Y
CM04	Advance Implementation of Mitigation Planting	Y	Y
CM05	Decorative Screen Hoarding	-	Y
CM06	Control of night-time lighting	-	Y
Operational Phase			
OM01	Integrated Design Approach	Y	Y
OM02	Roadside Planting	Y	Y
OM03	Compensatory Planting Proposals	Y	Y
OM04	Post-Planting Monitoring	Y	Y
OM05	Treatment of Retaining Wall and Slopes	Y	Y
OM06	Design of Tunnel Portals	-	Y
OM07	Reinstatement of disturbed Landscape Space	Y	Y

12.2.1.2 Mitigation measures to be implemented during construction should be adopted from the start of construction and be in place throughout the entire construction period. Mitigation measures to be implemented during operation should be integrated into the detailed design and built as part of the construction works so that they are in place on commissioning of the Project as far as practical.

12.3 Environmental Monitoring and Audit Requirement

12.3.1.1 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. Site inspections should be undertaken monthly by the tree specialist or a qualified arborist or endorsed by a registered landscape architect engaged by ET during the construction period.

13. Cultural Heritage

13.1 Introduction

13.1.1.1 The EIA Report has assessed the potential cultural heritage impacts associated with the construction and operation of the Project and mitigation measures have been recommended to avoid, minimise and monitor the potential vibration impact to historic buildings. The EIA Report also concluded that the works area of the Project is considered to have no archaeological potential and therefore no adverse archaeological impact due to the Project is anticipated.

13.2 Mitigation Measures

13.2.1 Construction Phase

13.2.1.1 For archaeology, no adverse archaeological impact due to the proposed works is identified. As a precautionary measure, the project proponent and the contractor are required to inform Antiquities and Monuments Office (AMO) immediately when any antiquities or supposed antiquities under the Antiquities and Monuments Ordinance (Cap. 53) are discovered during the course of works. Based on the above, no mitigation measure is required.

13.2.1.2 For built heritage, potential vibration impact and cumulative built heritage impact rising from concurrent project *Traffic Improvement Scheme in Tuen Mun – Widening and Addition of Slip roads at Lung Fu Road/ Tuen Mun Road/ Wong Chu Road/ Hoi Wing Road* may be a concern for the Shing Miu (Grade 2 historic building) (GB-02), special attention should be paid to avoid adverse physical impact arising from the construction works to the heritage site. Design proposal, method of works and choice of machinery should be targeted to minimize adverse impacts to the heritage site. Any vibration and building movement induced from the construction works should be strictly monitored to ensure no disturbance and physical damages made to the heritage site during the course of works. Vibration and building settlement monitoring proposal for the GB-02, including checkpoint locations, installation details, response actions for each of the Alert/ Alarm/ Action (3As) levels and frequency of monitoring should be submitted for AMO's consideration. As no adverse impact on the Hung Lau (Grade 1 historic building) (GB-01) is identified, no mitigation measure for GB-01 is required.

13.2.1.3 Subject to detailed design of vibration generation activities at works areas near built heritage items BH-02 and BH-03, should potential vibration impact be unavoidable, vibration monitoring is recommended. Furthermore, for BH-03, appropriate protective and mitigation measures should be recommended during detailed design stage of the Project when the structural condition and assessment of BH-03 and the historical buildings/ structures/ features have been verified. The protective and mitigation measures should be agreed by AMO, and to be implemented to the satisfaction of AMO to safeguard against any potential adverse impact.

13.2.1.4 Excavation works in close vicinity to the heritage site should not jeopardize stability of the historic structures. It should not undermine or cause damage to foundation of the historic structures. Foundation information of the historic structures shall be verified on site if needed, sufficient lateral support should be provided and de-watering (if required)

should be carried out with great cautions to control ground movement and change of ground water regime at the heritage site.

13.2.1.5 Installation of monitoring checkpoints shall be carried out in great care and adequate protection shall be provided so as to avoid unnecessary disturbance / damage to the historic fabrics. Photo records of monitoring checkpoints shall be submitted upon installation for AMO's records. Monitoring records should be submitted to AMO on regular basis and please alert AMO should the monitoring reach Alert/ Alarm/ Action levels.

13.2.1.6 Pre and post condition survey should be carried out to record conditions of the heritage site and survey reports should be submitted for AMO's record.

13.2.2 Operational Phase

13.2.2.1 No adverse impacts identified in operational phase. No mitigation measure is required.

13.3 Environmental Monitoring and Site Audit Requirements

13.3.1.1 Regular site inspections and audits should be carried out by the ET at least once per week during the construction phase to ensure that the recommended mitigation measures related to cultural heritage are properly implemented.

14. Site Environmental Audit

14.1 Site Inspection

- 14.1.1.1 Site inspection provides a direct means to initiate and enforce specified environmental protection and pollution control measures. These shall be undertaken routinely to inspect construction activities in order to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented. Site inspection is one of the most effective tools to enforce the environmental protection requirements at the works area.
- 14.1.1.2 The ET shall be responsible for formulating the environmental site inspection programme as well as the deficiency and action reporting system, and for carrying out the site inspections. The proposal for rectification, if any, should be prepared and submitted to the ET Leader and IEC by the Contractor.
- 14.1.1.3 Regular site inspections shall be carried out and led by the PMR and attended by the Contractor and ET at least once per week during the construction phase. The IEC shall undertake regular site audit at least once per month to assess the performance of the Contractor(s). The areas of inspection shall not be limited to the environmental situation, pollution control and mitigation measures within the site. It should also review the environmental conditions of locations outside the works area which is likely to be affected, directly or indirectly, by the construction site activities of the Project. The ET shall make reference to the following information in conducting the inspection. During the inspection, the following information should be referred to:
- (i) EIA Report and the Manual recommendations on environmental protection and pollution control mitigation measures;
 - (ii) Ongoing results of the EM&A programme;
 - (iii) Works progress and programme;
 - (iv) Individual works methodology proposals (which shall include the proposal on associated pollution control measures);
 - (v) Contract specifications on environmental protection;
 - (vi) Relevant environmental protection and pollution control legislations; and
 - (vii) Previous site inspection results undertaken by the ET and others.
- 14.1.1.4 The Contractor shall keep the PMR and ET Leader updated with all the relevant environmental related information on the construction contract necessary for him 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 shall follow the procedures and time-frame as stipulated in the environmental site inspection, and the deficiency and action reporting system formulated by the ET, to report on any remedial measures subsequent to the site inspections.

14.1.1.5 The PMR, 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 a valid environmental complaint, or as part of the investigation work, as specified in the Event and Action Plans for the EM&A programme.

14.2 Environmental Compliance

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

14.2.1.2 In order to ensure the works comply with statutory requirements, all method statements of works should be submitted by the Contractor to the PMR for approval and to the ET Leader to ensure sufficient environmental protection and pollution control measures have been included. EMIS is summarised in **Appendix 4.1**. Any proposed changes to the mitigation measures shall be certified by the ET Leader and verified by the IEC as conforming to the relevant information and recommendations contained in the EIA Report.

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

14.2.1.4 The Contractor should provide the update of the relevant documents to the ET Leader so that checking can be carried out. The document shall at least include the updated works progress reports, updated works programme, method statements, any application letters for different licenses / permits under the environmental protection laws, and copies of all valid licenses / permits. The site diary and environmental records shall also be available for inspection by the relevant parties.

14.2.1.5 After reviewing the document, the ET shall advise the IEC and 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 still result in potential violation of environmental protection and pollution control requirements, the PMR and ET should provide further advice to the Contractor to take remedial action to resolve the problem.

14.2.1.6 Upon receipt of the advice, the Contractor shall undertake immediate actions to correct the situation. The PMR and ET shall follow up to ensure that appropriate action has been taken in order to satisfy legal requirements.

14.3 Choice of Construction Method

14.3.1.1 At times during the construction phase, the Contractor may submit method statements for various aspects of construction. This state of affairs would only apply to those construction methods that the EIA has not imposed conditions while for construction methods that have been assessed in the EIA, the Contractor is bound to follow the requirements and recommendations in the EIA study. The Contractor's options for alternative construction methods may introduce adverse environmental impacts into the Project. It is the responsibility of the Contractor and ET, in accordance with established standards, guidelines and EIA study recommendations and requirements, to review and determine 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 shall provide a copy of the Proactive Environmental Protection Proforma as shown in **Appendix 14.1** to the IEC for approval before commencement of work. The IEC should audit the review of the construction method and endorse the proposal on the basis of no adverse environmental impacts.

14.4 Environment Complaints

14.4.1.1 The following procedures should be undertaken upon receipt of any environmental complaint:

- The Contractor to log complaint and date of receipt onto the complaint database and inform the PMR, ET and IEC immediately;
- The Contractor to investigate, with the PMR 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 PMR 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 PMR 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 PMR, ET and IEC to review the effectiveness of the Contractor's remedial measures and the updated situation;
- The ET/Contractor to undertake monitoring and audit to verify the situation if necessary, 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 actions stipulated above, including the details of the remedial measures and 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 General

- 15.1.1.1 Reports can be provided in an electronic medium upon agreeing the format with the PMR and EPD. This would enable a transition from a paper / historic and reactive approach to an electronic / real time proactive approach. All the monitoring data shall also be submitted on diskettes or other approved medium. The formats for monitoring data to be submitted shall be separately agreed.
- 15.1.1.2 Types of reports that the ET shall prepare and submit include monthly EM&A report and final EM&A review report. In accordance with Annex 21 of the EIAO-TM, a copy of the monthly reports and final EM&A review reports shall be made available to the Director of Environmental Protection.

15.2 Baseline Monitoring Report

- 15.2.1.1 The baseline monitoring report shall include at least the following:
- (i) Up to half a page executive summary;
 - (ii) Brief project background information;
 - (iii) Drawings showing locations of the baseline monitoring stations;
 - (iv) Monitoring results (in both hard and diskette copies) together with the following information:
 - Monitoring methodology;
 - Name of laboratory and types of equipment used and calibration details;
 - Parameters monitored;
 - Monitoring locations;
 - Monitoring date, time, frequency and duration; and
 - QA / QC results and detection limits.
 - (v) Details of influencing factors, including:
 - Major activities, if any, being carried out on the site during the period;
 - Weather conditions during the period; and
 - Other factors which might affect monitoring results.
 - (vi) Determination of the Action and Limit levels for each monitoring parameter and statistical analysis of the baseline data;
 - (vii) Revisions for inclusion in the Manual; and
 - (viii) Comments, recommendations and conclusions.

- 15.2.1.2 The ET should prepare and submit a baseline monitoring report at least two weeks before commencement of construction of the Project. Copies of the baseline monitoring report should be submitted to the IEC, the PMR and EPD. The ET should liaise with the relevant parties on the exact number of copies required.

15.3 Monthly Monitoring Reports

- 15.3.1.1 The results and findings of all EM&A work required in the Manual shall be recorded in the monthly EM&A reports prepared by the ET and endorsed by the IEC. The EM&A report shall be prepared and submitted to EPD within 10 working days of the end of each reporting month, with the first report within the month after major construction works commences. Copies of each monthly EM&A report shall be submitted to the following parties: the IEC, the PMR and EPD. Before submission of the first EM&A report, the ET shall liaise with the parties on the required number of copies and format of the monthly reports in both hard copy and electronic medium.
- 15.3.1.2 The ET shall 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.

15.3.2 First Monthly EM&A Report

- 15.3.2.1 The first monthly EM&A report shall include at least the following:
- (i) Executive summary (1-2 pages):
 - Breaches of Action and Limit levels;
 - Compliant log;
 - Notifications of any summons and successful prosecutions;
 - Reporting changes; and
 - Future key issues.
 - (ii) Basic project information:
 - Project organisation including key personnel contact names and telephone numbers;
 - Programme;
 - Management structure; and
 - The work undertaken during the month.
 - (iii) Environmental status:
 - Advice on the status of statutory environmental compliance such as the status of compliance with the environmental permit (EP) conditions under the EIAO, submission status under the EP and implementation status of mitigation measures;
 - Works undertaken during the month with illustrations (such as location of works, daily excavation rate, etc.); and

- Drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring stations (with co-ordinates of the monitoring locations).
- (iv) A brief summary of EM&A requirements including:
- All monitoring parameters;
 - Environmental quality performance limits (Action and Limit 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 diskette 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;
 - Weather conditions during the period;
 - Any other factors which might affect the monitoring results; and
 - QA / QC results and detection limits.
- (vii) Report on non-compliance, complaints, and notifications of summons and successful prosecutions:
- Record of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
 - Record of all complaints received for each media, 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 work method statements;
- Advice on the solid and liquid waste management status;
- Record of any project changes from the originally proposed as described in the EIA Report (e.g. construction methods, mitigation proposals, design changes, etc.); and
- Comments (for example, effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions.

15.3.3 Subsequent Monthly EM&A Reports

15.3.3.1 Subsequent monthly EM&A reports shall include at least the following:

- (i) Executive summary (1-2 pages):
 - Breaches of Action and Limit levels;
 - Compliant log;
 - Notifications of any summons and successful prosecutions;
 - Reporting changes; and
 - Future key issues.
- (ii) Basic project information:
 - Project organisation including key personnel contact names and telephone numbers;
 - Programme;
 - Management structure; and
 - The work undertaken during the 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 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 month with illustrations (such as location of works, daily excavation rate, etc.); and
 - Drawings showing the Project area, any environmental sensitive receivers and the locations of the monitoring stations (with co-ordinates of the monitoring locations).
- (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 diskette 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;
 - Weather conditions during the period;
 - Any other factors which might affect the monitoring results; and
 - QA / QC results and detection limits.
- (vi) Report on non-compliance, complaints, and notifications of summons and successful prosecutions:
- Record of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
 - Record of all complaints received for each media, 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.
- (vii) Others:
- An account of the future key issues as reviewed from the works programme and work method statements;
 - Advice on the solid and liquid waste management status;
 - Record of any project changes from the originally proposed as described in the EIA (e.g. construction methods, mitigation proposals, design changes, etc.); and
 - Comments (for example, effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions.
- (viii) Appendices:
- Action and Limit levels;
 - Graphical plots of trends of the monitoring parameters at key stations over the past four reporting periods for representative monitoring stations annotated against the following:

- Major activities being carried out on site during the period;
- Weather conditions during the period; and
- Any other factors that might affect the monitoring results;
- Monitoring schedule for the present and next reporting period;
- Cumulative statistics on complaints, notifications of summons and successful prosecutions; and
- Outstanding issues and deficiencies.

15.4 Final EM&A Review Report

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

15.4.1.2 The proposed termination should only be implemented after the proposal has been endorsed by the IEC, the PMR and the Project Proponent followed by approval from the Director of Environmental Protection.

15.4.1.3 The final EM&A report should contain at least the following information:

- (i) Executive summary (1-2 pages):
- (ii) Drawings showing the Project area, any environmental sensitive receivers and locations of monitoring stations;
- (iii) Basic project information including a synopsis of the project organisation, contacts of key management, and a synopsis of work undertaken during the course of the Project or past twelve months;
- (iv) A brief summary of EM&A requirements including:
 - Environmental mitigation measure, as recommended in the EIA Report;
 - Environmental impact hypotheses tested;
 - Environmental quality performance limits (Action and Limit 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 project EIA Report, and summarised in the updated implementation schedule;
- (vi) Monitoring results (in both hard and diskette copies) together with the following information:
 - monitoring methodology;
 - equipment used and calibration details;
 - parameters monitored;
 - monitoring locations (and depth); and
 - monitoring date, time, frequency, and duration.

- (vii) Graphical plots and the statistical analysis of the trends of monitoring parameters over the course of the Project, including:
 - The major activities being carried out on site during the period;
 - Weather conditions during the period; and
 - Any other factors which might affect the monitoring results.
- (viii) A summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit 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 for each media, liaison and consultation undertaken, actions and follow-up actions taken and results;
- (xii) A review of the validity of EIA predictions and identification of shortcomings in EIA recommendations;
- (xiii) A summary record of notification of summons, successful prosecutions for breaches of environmental protection/pollution control legislation, and actions taken to rectify such breaches;
- (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 mitigatory action when necessary).

15.5 Data Keeping

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

15.6 Interim Notifications of Environmental Quality Limit Exceedances

- 15.6.1.1 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 and EPD, as appropriate. The notification should be followed up with advice to the IEC 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 15.1**.