Highways Department
Works Division

Agreement No. CE 76/2017 (HY)
Upgrading of Remaining Sections of Kam Tin and Lam Kam Road

Environmental Monitoring and Audit Manual

(EIA Study Brief No. ESB-310/2018)

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1.0 INTRODUCTION

1.1 Project Background

In 2007, Transport Department (TD) and Highways Department (HyD) proposed to upgrade the remaining sections of Kam Tin Road and Lam Kam Road to 7.3m ("Original Scheme"), which did not cover the upgrading of the road section of Kam Tin Road between Tung Wui Road and Fan Kam Road to 10.3m wide.

An Environmental Impact Assessment (EIA) study brief(No. ESB-170/2007) was issued in October 2007 by the Director of Environmental Protection under the Environmental Impact Assessment Ordinance (EIAO).

Assessment on environmental impacts for "Original Scheme" had been carried out. The EIA Report was approved by Environmental Protection Department (EPD) on 26 June 2009. HyD then applied for Environmental Permit (EP) on 10 April 2012 and the EP (EP No. EP-439/2012) was granted by EPD on 7 May 2012. No upgrading works has been carried out after the issuance of EP in 2012.

According to the traffic survey under the Traffic Impact Assessment (TIA) conducted by Civil Engineering and Development Department (CEDD) in November 2015 under Agreement No. CE 34/2014 (CE) "Site Formation and Infrastructure Works for the Initial Sites at Kam Tin South, Yuen Long – Investigation, Design and Construction", the volume to capacity (v/c) ratio of the road section of Kam Tin Road between Tung Wui Road and Fan Kam Road has exceeded 1.2. Taking into account the TIA findings by CEDD, TD considers if "Original Scheme" is to be implemented (i.e. upgrading the concerned road section of Kam Tin Road to standard 7.3m wide carriageway), the v/c ratio would still be very close to 1.2 having regard to full population intake of the Kam Tin South Development in 2031. Therefore, TD determined that there was a need to upgrade the road section of Kam Tin Road between Tung Wui Road and Fan Kam Road to 10.3m wide ("New Scheme") to bring down the v/c ratio below 1.0 to cater for the planned development.

The proposed upgrading works do not include any expressway, trunk road, primary distributor road or district distributor road, road or railway tunnel more than 800m in length between portals, and road or railway bridge more than 100m in length between abutments. As such, the Project does not constitute designated project under Schedule 2 Part 1 Categories A1, A7 and A8 of the Environmental Impact Assessment Ordinance (EIAO) Cap. 499. However, the proposed upgrading works encroach upon existing conservation areas. Hence, the upgrading of remaining sections of Kam Tin Road and Lam Kam Road (which is hereafter referred to as the "Project"), is classified as Designated Project (DP) under Schedule 2 Part 1 Category Q.1 of the EIAO and it requires an environmental permit before works commencement.

The Project location is shown in ***Figure 1.1*** and Conservation area near Project Boundary is shown in ***Figure 1.2***

The Project construction works are anticipated to commence in 2021 for completion in 2025. However, the actual programme is subject to review depending on the progress of the Project. Tentative construction programme is given in ***Appendix A***.

Project profile of the Project (Register No. PP-571/2018) was submitted on 11 October 2018 for application for an EIA Study Brief. Subsequently, a Study Brief (Register No. ESB-310/2018) was issued by EPD on 22 November 2018.

1.2 Project Description

The remaining unimproved sections of Kam Tin Road and Lam Kam Road are Kam Tin Road section between Tung Wui Road and Lam Kam Road; and Lam Kam Road section between Kam Tin Road and Kadoorie Farm. These remaining sections are single two-lane carriageway with substandard width. Road safety problems are compounded by overtaken vehicular traffic, sharp bends, hidden accesses, sub-standard gradients, inadequate lateral clearance, frequent usage of heavy vehicles, insufficient pedestrian crossing facilities and insufficient bus laybys.

The Project is to upgrade the remaining sections of Kam Tin Road and Lam Kam Road to a standard single two-lane carriageway, with the associated improvement of pedestrian facilities and public transport laybys.

The total length of the remaining sections of Kam Tin Road and Lam Kam Road to be upgraded under this Project is approximately 5.3 km. The scope of the Project includes the following:

(a) Upgrading of the remaining unimproved sections of Kam Tin Road (between Fan Kam Road and Lam Kam Road) and Lam Kam Road from a substandard single two-lane carriageway to a standard carriageway of at least 7.3m wide;
(b) Upgrading of the road section of Kam Tin Road (between Tung Wui Road and Fan Kam Road) to a 10.3m wide carriageway;
(c) Provision of 2m wide footpaths on both sides (if site conditions do not allow, 2m wide footpath on one side will be acceptable) and associated improvement of pedestrian facilities, public transport laybys and right-turning lanes at major junctions at Kam Tin Road & Kam Tai Road and Kam Tin Road & Wang Toi Shan Shan Tsuen Road; and
(d) Associated slope and drainage works, traffic aids and street lighting modification, landscaping works, etc. under the Project.

The Project comprises the following works:

(a) Site Clearance & Utility Diversion;
(b) Road Upgrading Works (Backfill and reinstatement works);
(c) Street Furniture & Soft Landscape Works;
(d) Excavation and Lateral Support (ELS) Works (Sheet piling and excavation works);
(e) Foundation and Substructure Works (Rebar fixing and concreting works);
(f) Geotechnical Works (Soil nail works); and
(g) Construction of Superstructure Works (Noise mitigation works), if necessary

1.3 Purpose of the EM&A Manual

The purpose of this Environmental Monitoring and Audit (EM&A) Manual is to guide the set-up of an EM&A programme to check on compliance with the study recommendations of the Project, to assess the effectiveness of the recommended mitigation measures, to specify the environmental monitoring requirements including monitoring points, frequency and establishment of Event and Action Plan and to identify any further need for additional mitigation measures or remedial actions.

This EM&A Manual aims to provide systematic procedures for monitoring, auditing and minimizing environmental impacts associated with the activities of the Project. It outlines the monitoring and audit programme for the Project.

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

This Manual contains the following information:

(a) Responsibilities of the Contractor, the Engineer or Engineer's Representative (ER), the Environmental Team (ET), and the Independent Environmental Checker (IEC) with respect to the environmental monitoring and audit requirements during the course of the Project;
(b) Project organization for the EM&A works;
(c) Requirements with respect to the construction programme schedule and the necessary environmental monitoring and audit programme to track the varying environmental impact;
(d) Details of the methodologies to be adopted, including all field laboratories and analytical procedures, and details on quality assurance and quality control programme;
(e) The rationale on which the environmental monitoring data will be evaluated and interpreted;
(f) Definition of Action and Limit levels;
(g) Establishment of Event and Action Plans;
(h) Requirements for reviewing pollution sources and working procedures required in the event of non-compliance with the environmental criteria and complaints;
(i) Requirements for presentation of environmental monitoring and audit data and appropriate reporting procedures; and
(j) Requirements for reviewing the EIA predictions and the effectiveness of the mitigation measures / environmental management systems and the EM&A programme.

This EM&A Manual is a dynamic document that should be reviewed regularly and updated as necessary during the construction and operation phases of the Project.

1.4 Project Organization

The roles and responsibilities of the various parties involved in the EM&A process and the organizational structure of the organizations responsible for implementing the EM&A programme are outlined below. The proposed project organization and lines of communication with respect to environmental protection works are shown in ***Figure 1.3***.

Environmental Team (ET)

The ET should be led and managed by the ET leader. The ET and ET leader shall be independent party from the Contractor and the IEC and has relevant professional qualifications or have sufficient relevant EM&A experience subject to approval of the ER and EPD. The ET Leader shall have at least 7 years of experience in conducting EM&A and/or environmental management. His / Her qualification shall be vetted by the ER. The ET should monitor the mitigation measures implemented by the Contractor on regular basis to ensure the compliance with the intended aims of the measures. The duties and responsibilities of the ET are:

- Set up all the required environmental monitoring stations;
- Monitor various environmental parameters as required in the EM&A Manual;
- Analyze the EM&A data and review the success of EM&A programme to cost-effectively 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 and investigate and audit the Contractors' site practice, equipment and work methodologies with respect to pollution control and environmental mitigation, and take proactive actions to pre-empt problems;
- Liaison with IEC on all environmental performance matters, and timely submission of all relevant EM&A proforma for IEC's approval;
- Prepare reports on the environmental monitoring data and site environmental conditions;
- Report on the EM&A results to the IEC, Contractor, the ER and 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 Plan;
- Give advice to the Contractor on environmental improvement, awareness, enhancement matters, etc. on site;
- Undertake regular and ad-hoc on-site audits / inspections and report to the Contractor and the ER of any potential non-compliance;
- Follow up and close out non-compliance actions, and
- Adhere to the procedures for carrying out environmental complaint investigation.

Engineer or Engineer's Representative (ER)

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

- Supervise the Contractor's activities and ensure that the requirements in the EM&A Manual are fully complied with;
- Inform and instruct the Contractor when action is required to reduce environmental impacts in accordance with the Event and Action Plan;
- Participate in joint site inspections and audits undertaken by the ET; and
- Investigate complaints according to the agreed procedures and instruct the Contractor to follow up.

The Contractor

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

- Implement the EIA recommendations and requirements;
- Notify the ET construction activities that may have environmental concern;
- Submit proposals on mitigation measures in case of exceedances of Action and Limit levels, in accordance with the Event and Action Plan;
- Implement measures to reduce environmental impacts where Action and Limit levels are exceeded until the events are resolved; and
- Investigate complaints according to the agreed procedures.

Independent Environmental Checker (IEC)

The IEC shall be employed by the Project Proponent prior to the commencement of the construction phases of the Project, and shall be an independent party from the Contractor and the ET. The IEC shall report directly to the EPD on matters relating to the EM&A programme and environmental impacts from the Project. The IEC should advise the ER on environmental issues related to the Project. The IEC should possess at least 7 years of experience in EM&A

and/or environmental management. The duties and responsibilities of the IEC are:

- Review and audit in an independent, objective and professional manner in all aspects of the EM&A programme;
- Validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations, monitoring procedures and locations of sensitive receivers;
- Audit the EIA recommendations and requirements against the status of implementation of environmental protection measures on site;
- Review the effectiveness of environmental mitigation measures and project environmental performance;
- On as-needed basis, verify and certify the environmental acceptability of the Environmental Permit (EP) holder's construction methodology, relevant design plans and submissions under the EP;
- Carry out random sample check and audit on monitoring data and sampling procedures, etc.;
- Conduct monthly and random site inspection;
- Verify the investigation results of environmental complaint cases and the effectiveness of corrective measures;
- Verify EM&A report that has been certified by the ET leader; and
- Provide feedback on the audit results to the ET or the EP holder according to the Event and Action Plan in the EM&A Manual.

1.5 Structure of the EM&A Manual

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

- Section 2 – Sets out EM&A requirement for air quality;
- Section 3 – Sets out EM&A requirement for noise;
- Section 4 – Details auditing requirement for water quality;
- Section 5 – Sets out EM&A requirement for waste management;
- Section 6 – Details auditing requirement for ecology;
- Section 7 – Details auditing requirement for land contamination;
- Section 8 – Details auditing requirement for landscape and visual;
- Section 9 – Describes scope and frequency of environmental site audits and sets out the general requirements of the EM&A programme; and
- Section 10 – Details the EM&A reporting requirements.

2.0 AIR QUALITY

2.1 Introduction

Based on the air quality impact assessment in the EIA, it has been anticipated that no adverse impacts would arise from the construction and operation of the Project. With proper implementation of dust control measures required under the Air Pollution Control (Construction Dust) Regulation and good site practices as recommended in the EIA report, it would be unlikely that the Project would result in adverse air quality impacts. The ET shall check the Contractor's implementation of air quality control measures to minimize the construction dust emissions during the regular site environmental audits.

2.2 EM&A Requirements during Construction Phase

Environmental monitoring and audit for potential dust impacts should be conducted during the construction phase of the Project for checking compliance with the legislative requirements.

Regular environmental audits in accordance with Section 9 of this Manual shall be undertaken during the construction works to ensure the proper implementation of the mitigation measures for potential construction dust emissions.

The site inspection shall be conducted in weekly basis. The ET is responsible for formulating an environmental site inspection, deficiency and remedial action reporting system, and for carrying out site inspections under the EM&A programme.

2.3 Monitoring Parameters for Air Quality

Monitoring and audit of the Total Suspended Particulate (TSP) levels shall be carried out by the ET to ensure that any deteriorating air quality could be readily detected and timely action taken to rectify the situation.

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

All relevant data including temperature, pressure, weather conditions, elapsed-time meter reading for the start and stop of the sampler, identification and weight of the filter paper, and 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 B***.

2.4 Monitoring Equipment for Air Quality

High volume samplers (HVSs) complying with the following specifications shall be used for carrying out the 1-hour TSP monitoring:

- 0.6 – 1.7 m^3 per minute adjustable flow range;
- Equipped with a timing / control device with +/- 5 minutes accuracy for 24 hours operations;
- Installed with elapsed-time meter with +/- 2 minutes accuracy for 24 hours operation;

- Capable of providing a minimum exposed area of 406 cm^2;
- Flow control accuracy: +/- 2.5% deviation over 24-hour sampling period;
- Equipped with a shelter to protect the filer and sampler;
- Incorporated with an electronic mass flow rate controller or other equivalent devices;
- Equipped with a flow recorder for continuous monitoring;
- Provided with a peaked roof inlet;
- Incorporated with a manometer;
- Able to hold and seal the filter paper to the sampler housing at horizontal position;
- Easily changeable filter; and
- Capable of operating continuously for a 24-hour period.

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

Initial calibration of dust monitoring equipment shall be conducted upon installation and thereafter every six months. The transfer standard shall be traceable to the internationally recognized primary standard and be calibrated annually. The calibration data should be properly documented for future reference by IEC. All the data should be converted into standard temperature and pressure condition.

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

If the ET proposes to use a direct reading dust meter to measure 1-hour TSP levels, they shall submit sufficient information to the IEC to prove that the instrument is capable of achieving a comparable results to the HVS. The instrument should also be calibrated regularly, and the 1-hour sampling shall be determined periodically by the HVS to check the validity and accuracy of the results measured by direct reading method.

Wind data monitoring equipment shall also be provided and set up 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 10m 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.

If the ET propose alternative dust monitoring equipment / methodology (e.g. direct reading methods) after the approval of this Manual, agreement from the IEC should be sought. The instrument should also be calibrated regularly following the requirements specified by the equipment manufacturers.

2.5 Laboratory Measurement / Analysis

A clean laboratory with constant temperature and humidity control, and equipped with necessary measuring and conditioning instruments to handle the dust samples collected, shall be available for sample analysis, and equipment calibration and maintenance. The laboratory should be Hong Kong Laboratory Accreditation Scheme (HOKLAS) accredited or other internationally accredited laboratory.

If a site laboratory is set up or a non-HOKLAS accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment shall be verified by IEC. Measurement performed by the laboratory shall be demonstrated to the satisfaction of the ER, IEC and EPD.

IEC shall conduct regularly audit to the measurement performed by the laboratory to ensure the accuracy of measurement results. The ET Leader shall provide the ER with one copy of the Title 40 of Code of Federal Regulations, Chapter 1 (Part 50), Appendix B for his / her reference.

Filter paper of size 8" x 10" shall be labelled before sampling. It shall be a clean filter paper with no pinholes, and shall be conditioned in a humidity-controlled chamber for over 24 hours and be pre-weighed before use for the sampling.

After sampling, the filter paper loaded with dust shall be kept in a clean and tightly sealed plastic bag. The filter paper shall then be returned to the laboratory for reconditioning in the humidity-controlled chamber followed by accurate weighing by an electronic balance with readout down to 0.1 mg. The balance shall be regularly calibrated against a traceable standard.

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

2.6 Monitoring Locations for Air Quality

Six designated air quality monitoring stations are selected for air quality monitoring during construction phase. ***Table 2.1*** describes the proposed air quality monitoring locations, which are also depicted in ***Figure 2.1***.

Table 2.1 Proposed Air Quality Monitoring Location

Monitoring Station ID	ASR ID	Description
AM1	A01	Village house, Pang Ka Tsuen
AM2	A04	Village House near Season Villas
AM3	A11	Village house, 50F Wang Toi Shan Yau Uk Tsuen
AM4	A18	Village house, 7A Sheung Tsuen
AM5	A23	Village house, 4 Sheung Tsuen
AM6	A32	Village house, 70 Lam Kam Road

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

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

- at the site boundary or such locations close to the major dust emission source;
- close to the air sensitive receivers as defined in the EIAO-TM;

- proper position/sitting and orientation of the monitoring equipment; and
- take into account the prevailing meteorological conditions.

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

- a horizontal platform with appropriate support to secure the samplers against gusty wind shall be provided;
- two samplers shall be placed less than 2 metres apart;
- the distance between the sampler and an obstacle, such as buildings, must be at least twice the height that the obstacle protrudes above the sampler;
- a minimum of 2 metres of separation from walls, parapets and penthouses is required for rooftop samplers;
- a minimum of 2 metres of 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 20 metres from the dripline;
- any wire fence and gate, to protect the sampler, shall not cause any obstruction during monitoring;
- permission must be obtained to set up the samplers and to obtain access to the monitoring stations; and
- a secured supply of electricity is needed to operate the samplers.

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.

2.7 Baseline Monitoring

Baseline monitoring shall be carried out at all of the designated monitoring locations as specified in ***Table 2.1*** for at least two weeks prior to the commissioning of major construction works to obtain ambient 1-hour TSP samples. Ambient 1-hour sampling should also be done at least 3 times per day at each monitoring station.

During the baseline monitoring, there should not be any major construction or dust generation activities in the vicinity of the monitoring stations. Before commencing baseline monitoring, the ET shall inform the IEC of the baseline monitoring programme such that IEC can conduct on-site audit to ensure accuracy of the baseline monitoring results.

In case the baseline monitoring cannot be carried out at the designated monitoring location, the ET shall carry out the monitoring at alternative location that can effectively represent the baseline conditions at the impact monitoring location. The alternative baseline monitoring location shall be agreed with the IEC prior to commencement of baseline monitoring.

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.

General meteorological conditions (wind speed, direction and precipitation) and notes regarding any significant adjacent dust producing sources should also be recorded throughout the baseline monitoring period. If the ET Leader considers that significant changes in the ambient conditions

have arisen, a repeat of the baseline monitoring may be carried out to update the baseline levels and air quality criteria, after consultation and agreement with the ER, IEC and EPD.

2.8 Impact Monitoring

The ET shall carry out impact monitoring during major construction activities for the Project as specified in ***Table 2.1***. For 1-hour TSP monitoring, the sampling frequency of at least 3 times in every 6 days should be undertaken when the highest dust impact occurs.

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.

2.9 Event and Action Plan for Air Quality

The Action and Limit levels for air quality are defined in ***Table 2.2***. Should non-compliance of the criteria occur, action in accordance with the Event and Action Plan in ***Appendix C*** shall be carried out.

Table 2.2 Action and Limit Levels for Air Quality

Parameter	Action	Limit
1-hour TSP Level in μg/m³	For Baseline Level ≤ 384μg/m³, Action Level = (Baseline Level * 1.3 + Limit Level)/2; For Baseline Level > 384μg/m³, Action Level = Limit Level	500μg/m³

2.10 Mitigation Measures

To ensure compliance with the Air Pollution Control (Construction Dust) Regulation, good site practices should be implemented and incorporated in the contract clauses to minimize construction dust impact. A number of proposed dust suppression measures listed below and Implementation Schedule given in ***Appendix D*** of this EM&A Manual are to be implemented.

- Limitation of each active construction work front to occupy about 50m x 10m work area at any one time, and with a separation distance of more than 600m between two concurrent work areas;
- Works area for site clearance shall be sprayed with water before, during and after the construction so as to maintain the entire surface wet;
- All dusty materials shall be sprayed with water immediately prior to any loading, unloading or handling so as to maintain the dusty materials wet;
- Hoarding of not less than 2.4 m above ground shall be provided, as far as practicable, along the Project Boundary which is next to the public areas;
- Restricting heights not higher than 1.5m above ground from which materials are to be dropped, as far as practicable to minimize the fugitive dust arising from unloading/ loading;
- Any stockpile of dusty materials shall be covered entirely by impervious sheeting; and/ or placed in an area sheltered on the top and 4 sides;
- Immediately before leaving a construction site, all vehicles shall be washed to remove any dusty materials from its body and wheels; and

- Where a vehicle leaving a construction site is carrying a load of dusty materials, the load shall be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle.

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

2.11 EM&A Requirements during Operation Phase

No specific monitoring and audit during the operation phase of the Project is required.

3.0 NOISE

3.1 Introduction

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

Construction noise impact and road traffic noise impact from the Project are predicted at the identified noise sensitive receivers (NSRs). Noise mitigation measures would be required to reduce noise levels in order to meet the stipulated standards. A noise monitoring programme should be undertaken to confirm such mitigation measures would be implemented properly.

According to the EIA, road traffic noise levels should be monitored at representative NSRs, which are in the vicinity of the recommended direct mitigation measures, during the first year after road opening. The purpose of the monitoring is to ascertain that the recommended mitigation measures are effective in reducing the noise levels.

3.2 Construction Noise Monitoring

Construction noise mitigation measures would be required to reduce noise levels to the stipulated standard. A noise monitoring and audit programme should be undertaken to confirm such mitigation measures would be implemented properly.

3.3 Noise Monitoring Parameters for Construction Noise

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

As supplementary information for data auditing statistical results such as L_{10} and L_{90} shall also be obtained for reference. A sample data record sheet is shown in ***Appendix B***. The ET Leader may modify the data record sheet for this EM&A programme but the format of which should be agreed by the IEC.

3.4 Monitoring Equipment for Construction Noise

As referred to in 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 1.0dB. Annual calibration of all sound level meters and acoustic calibrators shall be conducted by a laboratory in Hong Kong or the manufacturer in compliance with national standards as recommended by the manufacturer of the sound level meter and acoustic calibrator.

Noise measurements should not be made in the presence of fog, rain, wind with a steady speed

exceeding 5m/s or wind with gusts exceeding 10m/s. The wind speed shall be checked with a portable wind speed meter capable of measuring the wind speed in m/s.

The ET is responsible for the availability of monitoring equipment. He shall ensure sufficient noise measuring equipment and associated instrumentations are available for carrying out noise monitoring works. All the equipment and associated instrumentations shall be clearly labelled, stored and maintained according to the manufacturer's instructions. The ET shall also liaise with the concerned parties for gaining access to the monitoring stations for the installation of the monitoring equipment and carrying out monitoring.

3.5 Monitoring Location for Construction Noise

Six designated noise monitoring stations are selected for construction noise monitoring. ***Table 3.1*** describes the construction noise monitoring locations, which are also depicted in ***Figure 3.1***.

Table 3.1 Proposed Construction Noise Monitoring Location

Monitoring Station ID	NSR ID	Description	Uses
CN1	N06	Village house, 18E Shek Kong San Tsuen	Residential
CN2	N11	Village House near Season Villas	Residential
CN3	N28	Village house, 46 – 47 Wang Toi Shan Lo Uk Tsuen	Residential
CN4	N39	Village house, 7A Sheung Tsuen	Residential
CN5	N44	Village house, 4 Sheung Tsuen	Residential
CN6	N55	Village house, 70 Lam Kam Road	Residential

The selection of monitoring locations should be identified 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 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.

The monitoring station shall normally be at a point 1m from the exterior of the building facade of the sensitive receivers and be at a position 1.2m above the ground.

The status and locations of noise sensitive receivers may change after this Manual is issued. If such cases exist, the ET shall propose updated monitoring locations according to the active construction sites and seek approval from ER and agreement from the IEC and EPD.

If there is a problem with access to the normal monitoring position, an alternative position may be chosen according to the criteria as mentioned above, and a correction to the measurement results shall be made. For reference, a correction of +3dB(A) shall be made to the free field measurements. The ET shall agree with the IEC on the monitoring position and the corrections adopted. Once the position for the monitoring station is chosen, the baseline monitoring and the impact monitoring shall be carried out at the same position.

3.6 Baseline Monitoring

The ET shall carry out baseline monitoring prior to the commencement of the construction

works. 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. A schedule on the baseline monitoring for construction noise prior to the commencement of the construction works shall be submitted to the IEC for approval before the monitoring starts.

Before commencing the baseline monitoring, the ET shall inform the IEC of the baseline monitoring programme such that the IEC can conduct on-site audit to ensure accuracy of the baseline monitoring results.

There shall not be any construction activities in the vicinity during the baseline monitoring. In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET shall liaise with IEC to agree on an appropriate set of data to be used as a baseline reference and submit to the EPD for approval.

3.7 Impact Monitoring for Construction Noise

Construction noise monitoring should be carried out at the designated monitoring station when there are Project-related construction activities being undertaken within a radius of 300m from the monitoring stations. The monitoring frequency should depend on the scale of the construction activities. An initial guide on the monitoring is to obtain one set of 30-minute measurement at each station between 0700 and 1900 hours on normal weekdays at a frequency of once a week when construction activities are underway.

During normal construction working hour (0700-1900 Monday to Saturday), monitoring of $L_{eq, (30min)}$ noise levels (as six consecutive $L_{eq, (5min)}$ readings) shall be carried out at the agreed monitoring locations once every week in accordance with the methodology in the EIAO-TM.

If construction works are extended to include works during the hours of 1900 - 0700, additional weekly impact monitoring shall be carried out during evening and night-time works. Applicable permits under NCO shall be obtained by the Contractor.

In case of non-compliance with the construction noise criteria, more frequent monitoring as specified in the Event and Action Plan given in ***Appendix C*** 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.

A schedule on the impact monitoring shall be submitted to the ER and IEC for approval before commencement of monitoring.

3.8 Event and Action Plan for Construction Noise

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

Table 3.2 Action and Limit Levels for Construction Noise

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

3.9 Operation Noise Monitoring

In order to evaluate the effectiveness of the proposed noise barriers and to verify the road traffic noise predictions made in the EIA, operation noise monitoring upon commissioning of the noise barriers is recommended. Road traffic noise monitoring should be carried out during the first year of the operation phase at representative NSRs located in the vicinity of the recommended direct mitigation measures.

3.10 Monitoring Parameters for Operation Road Traffic Noise

The ET should carry out monitoring of road traffic noise after the works under Contract are completed and commence the operation of the Project. The road traffic noise level shall be measured in terms of the A-weighted equivalent continuous sound pressure level. $L_{10(1hour)}$ shall be used as the monitoring parameter for the time period of peak traffic flow during weekday from 0700 – 0900 hours and 1700–1900 hours. During the road traffic noise measurement, traffic volume, percentage of heavy vehicles defined in the "Calculation of Road Traffic Noise" (CRTN) by Department of Transport of UK and traffic speed of all concerned road sections shall be recorded. This information should be obtained separately for each traffic flow direction. Supplementary information for data auditing and statistical results such as L_{eq} and L_{90} should also be obtained for reference.

Noise measurements shall not be made in fog, rain, wind with a steady speed exceeding 5m/s or wind with gusts exceeding 10m/s. The wind speed shall be checked with a portable wind speed meter capable of measuring the wind speed in m/s.

3.11 Monitoring Equipment for Operation Road Traffic Noise

The requirement of monitoring equipment for road traffic noise could be referred to ***Section 3.4***.

3.12 Monitoring Location for Operation Road Traffic Noise

Monitoring shall be carried out at the affected receivers facing the road sections with various types of noise barriers upon commissioning of the Project. Those most affected noise sensitive receivers identified in the EIA report have been identified as the noise monitoring locations in this EM&A Manual. The operation noise monitoring locations during operation phase are listed in ***Table 3.3*** and shown in ***Figure 3.2***.

Table 3.3 Proposed Operation Noise Monitoring Location

Monitoring Station ID	NSR ID	Description(1)	Proposed Noise Barrier Nearby
ON1	N03	Village house, Evergreen Garden	4m and 5m vertical
ON2	N30	Village house, 30 Wang Toi Shan Lo Uk Tsuen	5m vertical
ON3	N44	Village house, 4 Sheung Tsuen	5m vertical
ON4	N54	Village house	3m vertical

Remarks:
(1) The ET shall agree with the IEC and EPD on the exact monitoring locations before the commencement of the monitoring.

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 +3dB(A) shall be made to the free field measurements. The ET shall agree with the IEC on the monitoring position and the corrections adopted.

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

- At locations facing the road sections with various type of noise barriers upon commissioning of the Project;
- Close to the 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.

3.13 Impact Monitoring for Operation Road Traffic Noise

Noise monitoring shall be carried out at all the designated monitoring stations as shown in ***Table 3.3*** upon commissioning of the noise barriers. For each monitoring point, one set of $L_{10(1hour)}$ for each of AM and PM peak hour periods on normal weekdays in the first year should be measured, so that there will not be a situation in which the flow is too low to enable a fair comparison. Two sets of measurement shall be obtained within the first year of operation.

During the measurement, traffic volume, percentage of heavy vehicles and speeds of vehicles should also be recorded such that the data can be used for normalization for the measured road traffic noise levels. Measured noise level upon normalization using the counted traffic data at the time of measurement should be compared with the predicted road traffic noise levels in the EIA. The correction factor for normalization is calculated according to CRTN:

$$\text{Correction Factor} = 10\text{Log}\left(\frac{Q'}{Q}\right) + 33\text{Log}\left(\frac{V' + 40 + 500/V'}{V + 40 + 500/V}\right) + 10\text{Log}\left(\frac{1 + 5p'/V'}{1 + 5p/V}\right)$$

Q' is the traffic flow under baseline / normalized condition,
V' is the traffic speed under baseline / normalized condition,
p' is the percentage heavy vehicle under baseline / normalized condition,
Q is measured traffic flow during the road traffic noise-monitoring event,
V is measured traffic speed during the road traffic noise-monitoring event,
p is measured percentage heavy vehicle during the road traffic noise monitoring event.

3.14 Operation Noise Monitoring Plan

The ET should prepare and deposit to EPD, at least 6 months before the operation of the proposed roads under the Project, a monitoring plan for the purpose of evaluating the effectiveness of the installed noise barriers by comparing the noise impact predictions with the actual road traffic noise levels upon erection of the installed noise barriers.

The operation noise monitoring plan should contain monitoring locations, monitoring schedules, methodology of baseline and operation noise monitoring including noise measurement procedures, traffic volume, percentage of heavy vehicles and speed checks, and methodology of comparison with the predicted levels.
The ET should carry out the monitoring in accordance with the deposited monitoring plan

unless with prior justifications and agreement from the IEC, ER and EPD.

3.15 Operation Noise Monitoring Report

Monitoring details and results including the comparison between the measured noise levels and the predicted levels, and comment on the discrepancies between the predicted and measured noise levels should be recorded in a report to the deposited to the IEC, HyD and EPD within one month of the completion of the operation noise monitoring. The report should be certified by the ET Leader and verified by the IEC before deposit with EPD.

For road traffic noise, the measured/monitored noise levels shall be compared with the predicted results and the predicted traffic flow conditions (calculated noise levels based on concurrent traffic census obtained). In case discrepancies are observed, explanation shall be given to justify the discrepancies.

3.16 Construction Noise Mitigation Measures

The EIA has recommended construction noise control and mitigation measures during construction phase. The Contractor shall be responsible for the design and implementation of these measures as listed below and Implementation Schedule given in ***Appendix D*** of this EM&A Manual:

- Good site practices to limit noise emissions at the source;
- Use of quality powered mechanical equipment (QPME);
- Use of temporary noise barrier, enclosure and/or noise insulation fabric to screen noise from relatively static PMEs; and
- Alternative quiet construction method

The above mitigation measures would need to be implemented in the work fronts as good practices where appropriate. In the event of non-compliance(s) or complaint(s), the Contractor shall liaise with the ET Leader on some other mitigation measures, propose them to ER and IEC for approval and carry out the mitigation measures after approval.

Implementation of Good Site Practices

Good site practices can reduce the noise impacts on affected NSRs, although the effectiveness of these practices can vary depending on actual site conditions, and hence it is difficult to quantify effectiveness. The recommended practices are as follows:

- PMEs should be kept to a minimum and the parallel use of them should be avoided;
- Intermittent use of PME which can be shut down between work periods or throttled down to a minimum;
- Mobile PME should be sited as far from NSRs as possible;
- PME known to emit noise strongly in one direction should be orientated to direct away from the nearby NSRs; and
- Only well-maintained plant should be operated on-site and PME should be serviced regularly during the construction programme

Adoption of Quality Powered Mechanical Equipment

For the use of quiet plant associated with the construction works, reference has been made to

the PME listed in the QPME system and other commonly used PME listed in the EPD website, which contains the SWLs for specific quiet PME. The SWLs for quiet PME adopted for the assessment are detailed in Appendix 4.3 of the EIA Report. The type of quiet PME adopted in this assessment is for reference only. The Contractors may adopt alternative quiet PME with the same or lower SWL as long as it can be demonstrated that they would not result in construction noise impacts worse than those predicted in this assessment.

Use of Movable Noise Barrier / Enclosure / Noise Insulation Fabric

To alleviate the construction noise impact on the affected NSRs, construction noise barrier, enclosure and/or noise insulation fabric would be erected to provide screening from the construction plant. It is anticipated that suitably designed barriers could achieve at least 5dB(A) reduction for movable plant and 10dB(A) for stationary plant. A typical design which has been used locally is a wooden framed barrier with a small-cantilevered upper portion of superficial density no less than 10kg/m^2 on a skid footing with 50mm thick internal sound absorptive lining. No sound leaks should be allowed through the barriers due to holes, slits, cracks, openings or gaps.

The use of full enclosure has been considered in this assessment to shelter relatively static plant such as generator. These enclosures can provide about 15dB(A) noise reduction. Acoustic enclosures, which completely cover the noisy part of PME, can also provide significant noise reduction. 15 dB(A) of noise reduction is assumed as enclosing the hand-held breaker in an acoustic enclosure with suitable ventilation.

Noise insulation fabric should also be adopted for certain PME such as drill rig, vibrating hammer and rock drill etc. It should be lapped such that there are no openings or gaps on the joints. A noise reduction of 10 dB(A) can be achieved for the PME lapped with noise insulation fabric.

Alternative Quiet Construction Method

Traditional sheet piling works at hard ground would result in significant noise impacts to the nearby NSRs. Alternative quiet constriction method such as silent piling by press-in method has been considered in this assessment. A sheet pile is clipped and pressed under the ground. Noise can be minimized by press-in sheet piles with drilling simultaneously for piling works at harder ground. The noise impact can also be further reduced as the piling works can be completed within the shorter duration by using this method.

Hand-held breaker is proposed as alternative construction equipment for pneumatic excavator mounted breaker for ELS works in all work fronts under mitigated scenario. As such, QPME reference, EPD-06880, with SWL of 108 dB(A) is recommended in the assessment. The practicability is confirmed by the Project Engineer.

Stationary concrete pump is proposed as alternative construction equipment for mobile plant of lorry mounted concrete pump for geotechnical works in all work fronts under mitigated scenario. Therefore, noise barrier, with noise reduction of 10 dB(A), could be adopted to alleviate the noise emitted from stationary concrete pump. The practicability is confirmed by the Project Engineer. In addition to the implementation of above recommended measures, it is also recommended that in-situ concrete mixing method using concrete mixer (electric) should be adopted for works at work front Zone 23A (as shown in *Figure 2.5* of the EIA Report) which construction noise level to the nearest NSR (i.e. N11) exceeds the construction noise criteria. Concrete mixer (electric) has a lower SWL than the concrete lorry mixer and the construction noise level of using this PME in the work front could be further reduced. No construction noise

level exceedance at N11 is anticipated after adoption of concrete mixer (electric) in Zone 23A.

The Contractor shall prepare a construction noise mitigation plan detailing the temporary and permanent mitigation measures for construction noise impact arising from the Project before the commencement of construction works. All the noise mitigation measures as set out in the construction noise mitigation plan shall be implemented and properly maintained during the construction phase of the Project to minimize the noise impact to nearby NSRs.

3.17 Operation Noise Mitigation Measures

Direct noise mitigation measures are proposed including installation of vertical noise barriers along some sections of Kam Tin Road and Lam Kam Road and application of low noise road surfacing (LNRS) on some road sections to alleviate adverse road traffic noise impact on the affected NSRs. The mitigation measures are listed in below ***Table 3.4*** and ***Table 3.5*** and are shown in ***Figure 3.3***.

Direct Noise Mitigation Measures

Low Noise Road Surfacing

LNRS with total length of approximate 2.1km would be applied on several road sections of Kam Tin Road. LNRS could be adopted for several road sections of Kam Tin Road under the Project. Locations of proposed LNRS are shown in ***Figure 3.3*** and listed ***Table 3.4*** below.

Table 3.4 Extents and Locations of Proposed Low Noise Road Surfacing

LNRS Chainage	Approximate Length, m	Figure Reference
CHA 0+65.00 to CHA 3+00.00 (both lane)	235	*Figure 3.3a*
CHA 4+40.00 to CHA 6+35.00 (both lane)	195	*Figure 3.3a*
CHA 6+35.00 to CHA 7+20.00 (westbound single lane)	85	*Figure 3.3a*
CHA 10+80.00 to CHA 12+00.00 (both lane)	120	*Figure 3.3b*
CHA 15+50.00 to CHA 16+10.00 (westbound single lane)	60	*Figure 3.3b*
CHA 16+10.00 to CHA 18+80.00 (both lane)	270	*Figure 3.3b*
CHA 19+05.00 to CHA 20+15.00 (both lane)	110	*Figure 3.3b*
CHA 20+15.00 to CHA 21+45.00 (westbound single lane)	130	*Figure 3.3b*
CHA 22+05.00 to CHA	155	*Figure 3.3c*

23+60.00 (both lane)		
CHB 24+80.00 to CHB 26+70.00 (both lane)	190	*Figure 3.3c*
CHA 30+55.00 to CHA 32+20.00 (both lane)	165	*Figure 3.3c*
CHA 33+55.00 to CHA 34+25.00 (both lane)	70	*Figure 3.3c*
CHB 35+20.00 to CHB 36+50.00 (both lane)	130	*Figure 3.3d*
CHB 36+50.00 to CHB 37+50.00 (southbound single lane)	100	*Figure 3.3d*
CHA 37+50.00 to CHA 38+00.00 (both lane)	50	*Figure 3.3d*

Vertical Noise Barrier

A total length of approximately 837m is recommended after consideration of constraints of implementing noise barriers with reference to the criteria under the "Guidelines on Design of Noise Barriers" jointly published by the Environmental Protection Department and the Highways Department. The proposed general arrangement for the noise barriers shall be examined in the design stage to review the suitability of preliminary design in view of changing site conditions.

Locations of proposed noise barriers are shown in ***Figure 3.3*** and listed ***Table 3.5*** below.

Table 3.5 Extents and Locations of Proposed Noise Barriers

Location	Noise Barrier ID	Barrier Type	Height, m	Approximate Length, m	Figure Reference
Kam Tin Road	NB1	Vertical (reflective)	4m	60m	near N03 (shown in ***Figure 3.3a***)
	NB2	Vertical (reflective)	5m	35m	near N03 (shown in ***Figure 3.3a***)
	NB12	Vertical (reflective)	5m	25m	near N09 (shown in ***Figure 3.3a***)
	NB17	Vertical (reflective)	5m	30m	near N12 (shown in ***Figure 3.3b***)
	NB18	Vertical (reflective)	5m	45m	near N12 (shown in ***Figure 3.3b***)
	NB19	Vertical (reflective)	5m	140m	near N13 (shown in ***Figure 3.3b***)
	NB37	Vertical (reflective)	5m	25m	near N21 (shown in ***Figure 3.3b***)
	NB39	Vertical (reflective)	5m	32m	near N21 (shown in ***Figure 3.3b***)
	NB52	Vertical	5m	40m	near P08

Location	Noise Barrier ID	Barrier Type	Height, m	Approximate Length, m	Figure Reference
		(absorptive)			(shown in ***Figure 3.3c***)
	NB54	Vertical (absorptive)	5m	38m	near N28 (shown in ***Figure 3.3c***)
	NB55	Vertical (absorptive)	5m	52m	near N29 and N31 (shown in ***Figure 3.3c***)
	NB56	Vertical (absorptive)	5m	35m	near N30 (shown in ***Figure 3.3c***)
	NB72	Vertical (absorptive)	5m	30m	near P12 (shown in ***Figure 3.3c***)
	NB92	Vertical (reflective)	5m	132m	near P14 (shown in ***Figure 3.3d***)
	NB94	Vertical (reflective)	5m	25m	near N46 (shown in ***Figure 3.3d***)
Lam Kam Road	NB114	Vertical (absorptive)	3m	40m	near N55 (shown in ***Figure 3.3e***)
	NB116	Vertical (absorptive)	3m	53m	near N54 (shown in ***Figure 3.3e***)

Alternative Mitigation Measures for Planned NSRs

After the exhaustion of the above at-source mitigation measures, the predicted overall noise levels of the planned NSRs still exceed the noise criteria. At-receiver mitigation measures, such as alternative building orientation, building setback, special building design, boundary wall noise barriers and provision of architectural fins/acoustic windows/balconies, are proposed to alleviate the road traffic noise impacts on the planned NSRs.

Alternative noise mitigation measures, for example, by means of alternative building orientation, setback and layout design of individual developments, could be explored at the detailed design stage of future developments. The orientation and disposition of the buildings could be adjusted not facing Kam Tin Road and Lam Kam Road directly and could be located away from the roads to minimize the road traffic noise impact as far as practicable. Boundary wall of the residential developments, if any, could be designed as noise barrier to screen the propagation of road traffic noise source. Provision of architectural fins/acoustic windows/balconies for any planned public and private housings are subject to further study by the future public and private developers respectively. Future developers can further explore alternative options which can achieve corresponding road traffic noise reduction during the detailed design stage.

Future landowners of the planned NSRs should also consider alternative land use arrangement and alternative site in future development planning, such as, using the site for development which does not rely on openable window for ventilation. During design of the master layout plan, the use of any noise tolerant buildings as screening structures to alleviate the potential road traffic noise impact in future development should be explored.

As per the Outline Zoning Plan, all land uses of the planned NSRs are Residential (Group D) and Village Type Development. The maximum building height for residential buildings (Group D) and village houses is about 2 to 3 storeys (6 to 8.23m). Therefore, the opportunity of building using extended podium is considered not practicable. Decking over the roads, i.e. Kam Tin Road, would substantially deteriorate the existing landscape and visual environment and quality. As such, decking over Kam Tin Road as noise mitigation measure is not a preferable option.

However, noise impact assessment at the planned residential sites is proposed to be conducted by future developers at the detailed design stage to study whether the future development layout would avoid exposing to excessive road traffic noise levels so as to minimise the scale and extent of the proposed noise mitigation measures such as special building design and architectural fins/acoustic windows/balconies. The requirement of noise impact assessment should be included in the land lease condition or planning briefs of the residential sites.

Indirect Noise Mitigation Measures

After implementing the proposed LNRS and noise barriers, the predicted overall noise levels of some of the NSRs still exceed the noise criteria. Based on the criteria as stated in Section 4.6.4 of the EIA Report, the eligibility test for indirect noise mitigation measure is conducted. Details of the eligibility test are given in *Appendix 4.14* of the EIA Report. As no representative existing NSRs would fall within all the three testing criteria, it is considered that no indirect mitigation measures would be required.

4.0 WATER QUALITY

4.1 Introduction

The water quality impact assessment in the EIA report recommended that regular site inspections are required, in order to ensure all mitigation measures proposed during the construction phase are implemented properly.

4.2 Site Inspection

The site inspection shall be conducted in weekly basis. The ET is responsible for formulating an environmental site inspection, deficiency and remedial action reporting system, and for carrying out site inspections under the EM&A programme. The construction site drainage of an active work front should be checked during the regular site inspection. A schematic diagram illustrating the general drainage design for a work front is given in ***Figure 4.1***.

4.3 Mitigation Measures

Construction Phase

Construction site runoff and drainage should be prevented or minimized in accordance with the guidelines stipulated in the "EPD's Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN 1/94)". In order to check that the water quality mitigation measures have been implemented by the Contractor as good site practices, the ET shall include the following items as part of their site inspections and audit:

Dust Suppression

Water used in dust suppression should as far as practicable be re-circulated after sedimentation. When there is a need for final disposal, the wastewater should be leaded to silt removal facilities before being discharged to the storm drain.

Wheel Washing Water

All vehicles and plant should be cleaned before they leave a construction site to minimize the deposition of earth, mud, debris on roads. A wheel washing facility should be provided at every site exit if practicable and wheel-wash overflow shall be directed to silt removal facilities before being discharged to the storm drain. The Project Boundary between the wheel washing facility and the public road should be placed with sand bunds to prevent wheel-wash overflow from entering public road drains.

Wastewater from Concrete Casting

Wastewater generated from the washing down of mixing trucks and drum mixers and similar equipment should whenever practicable be recycled. The discharge of wastewater should be kept to a minimum. To prevent pollution from wastewater overflow, the pump sump of any water recycling system should be provided with an on-line standby pump of adequate capacity and with automatic alternating devices. Under normal circumstances, surplus wastewater may be discharged into foul sewers after treatment in silt removal.

Rubbish and Litter

Good site practices should be adopted to remove rubbish and litter from construction sites so as to prevent the rubbish and litter from spreading from the works area. It is recommended to clean the construction sites on a regular basis. Adequate refuse collection points shall be provided on-site.

Construction Site Runoff

The site practices outlined in ProPECC PN 1/94 "Construction Site Drainage" should be followed as far as practicable to minimise surface runoff and the chance of erosion. It is expected that the following measures recommended will effectively control runoff from the works sites and avoid water pollution downstream and shall be implemented during construction phase.

Surface runoff from construction sites should be discharged into storm drains via sand/silt removal facilities such as sedimentation basin/tank. Earth bunds or waterfilled barriers with geotextile sheet should be provided on site boundaries to intercept surface runoff from outside the site so that it will not wash across the site and to prevent surface runoff flowing out of the site. Bunds or sandbags should also be used within the site to direct surface runoff into the silt removal facilities. Stagnant surface runoff should be pumped to the silt removal facilities before discharged into storm drains.

Manholes (including newly constructed ones) should always be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris from getting into the drainage system without having previously passed through sedimentation tank, and to prevent storm runoff from getting into foul sewers. Discharge of surface runoff into foul sewers must always be prevented in order not to unduly overload the foul sewerage system.

Silt removal facilities and manholes should be maintained and the deposited silt and grit should be removed regularly, at the onset of and after each rainstorm to prevent local flooding.

Surface excavation should be carefully programmed to avoid wet-season operation. If it is unavoidable, any exposed top soils should be covered with a tarpaulin or other means. For the purpose of preventing soil erosion, temporary exposed slope surfaces should be covered e.g. by tarpaulin, as excavation proceeds. Earthworks final surfaces should be well compacted and the subsequent permanent work or surface protection should be carried out immediately after the final surfaces are formed to prevent erosion caused by rainstorms.

Open stockpiles (e.g. aggregates, sand and fill material) should also be covered with a tarpaulin to avoid erosion during rainstorms. The washing of material from the stockpiles directly into the storm drains should be prevented by passing the runoff through sedimentation tank. Arrangements should always be in place in such a way that adequate surface protection measures can be safely carried out well before the arrival of a rainstorm.

Spillage of Chemicals

Chemical waste, as defined under the Waste Disposal (Chemical Waste) (General) Regulation, includes any substance being scrap material, or unwanted substances specified under Schedule 1 of the Regulation. Substances likely to be generated by construction activities arise from the maintenance of construction plant and equipment of the Project. These include, but not limited to the following:

- Lubricating oil and waste fuel (diesel) from construction plant with improper maintenance; and
- Spent solvents from equipment cleaning activities.

Due to the scale of an active work front of the Project, it is anticipated that no maintenance shop for construction plant and equipment would be operated on-site and storage fuel on-site is minimal. Drainage traps such as grease traps and petrol interceptors will be installed at each of the drainage outlets to filter out chemical pollutants from surface runoff.

Mitigation such as providing drip tray/proper storage of chemical containers will be strictly implemented during the construction works. In case of any leakage on bare ground, oil and grease decontamination kit will be available on-site for clean-up of oil leakage. Any fuels should be stored in bunded areas such that spillage can be easily collected. The Contractor shall prepare an oil / chemical clean-up plan in the Waste Management Plan before the commencement of construction works. It should ensure that leakages or spillages are contained and cleaned up immediately. Once spillage is identified on-site, the clean-up procedures should be carried out as below:

- Contact the Site Agent and/or Foreman immediately and report the spillage;
- Identify the source of spillage and determine nature of the material;
- Stop leakage immediately where possible;
- Identify all current and potential affected areas according to the flow of spillage and stop the spillage from flowing to other works areas;
- Contain the surface runoff of spillage by using bunds made from available materials;
- After the surface runoff of spillage is contained, remove the materials (including contaminated soil where necessary) using pumps and/or absorbent materials; and
- Dispose of the materials, including the contaminated soil, as chemical waste

Waste oil should be collected and stored for recycling or disposal, in accordance with the Waste Disposal Ordinance (Cap. 354). Contractor must register as a chemical waste producer if chemical wastes would be produced from the construction activities. The Waste Disposal Ordinance (Cap. 354) and its subsidiary regulations in particular the Waste Disposal (Chemical Waste) (General) Regulation, should be observed and complied with for disposal of chemical wastes. The Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes published under the Waste Disposal Ordinance (Cap. 354) details the requirements to deal with chemical wastes. General requirements are given as follows:

- Suitable containers should be used to hold the chemical wastes to avoid leakage or spillage during storage, handling and transport;
- Chemical waste containers should be suitably labelled, to notify and warn the personnel who are handling the wastes, to avoid accidents; and
- Storage area should be selected at a safe location on site and adequate space should be allocated to the storage area

Sewage Effluent from Construction Workforce

Portable chemical toilets would be provided for handling the sewage effluent generated by the workforce. The number of the chemical toilets required for the construction sites would be subject to later detailed design, the capacity of the chemical toilets, and Contractor's site practices. A licensed Contractor would be employed to provide appropriate and adequate portable toilets and be responsible for appropriate disposal and maintenance.

Domestic sewage generated by the construction workforce should be appropriately managed to avoid potential adverse impacts of uncontrolled sewage discharge into nearby water courses. Portable chemical toilets shall be appropriately located on-site in proximity to all major works areas where they shall remain and be maintained in good working order for the convenience of the workforce during the construction phase.

The provision of temporary toilet facilities within the Water Gathering Ground, if any, is subject to approval of the Director of Water Supplies. As a minimum requirement, temporary toilet facilities must be located more than 30m from any watercourse.

Notices would be posted at conspicuous locations to remind the workers not to discharge any sewage or wastewater into the nearby environment during the construction phase of the Project. Regular environmental audit on the construction site would be conducted in order to provide an effective control of any malpractices and achieve continual improvement of environmental performance on site.

Construction Works in Close Proximity of Nearby Water Bodies

The practices outlined in ETWB TC (Works) No. 5/2005 "Protection of natural streams/rivers from adverse impacts arising from construction works" should also be adopted where applicable to minimize the water quality impacts upon any natural streams or surface water systems. Relevant mitigation measures from the ETWB TC (Works) No. 5/2005 are listed below:

- Construction works close to the inland waters should be carried out in dry season as far as practicable where the flow in the surface channel or stream is low.
- The use of less or smaller construction plants may be specified in areas close to the water courses to reduce the disturbance to the surface water.
- Temporary storage of materials (e.g. equipment, chemicals and fuel) and temporary stockpile of construction materials should be located well away from any water courses during carrying out of the construction works.
- Stockpiling of construction materials and dusty materials should be covered and located away from any water courses.
- Construction debris and spoil should be covered up and/or disposed of as soon as possible to avoid being washed into the nearby water receivers.
- Proper shoring may need to be erected in order to prevent soil or mud from slipping into the watercourses.
- Fencing should be erected on the sides facing the nearest stream course to trap all wind-blown litters such as paper, plastic bags, bottles and boxes within the site from entering the nearby water bodies.
- The proposed works site inside or in the proximity of natural rivers and streams should be temporarily isolated, such as by placing of cofferdam with silt curtain with lead edge at bottom and properly supported props, to prevent adverse impacts on the stream water qualities. Other protective measures should also be taken to ensure that no pollution or siltation occurs to the water gathering grounds of the work site.
- The natural bottom and existing flow in the river should be preserved as much as possible to avoid disturbance to the river habitats. If temporary access track on riverbed is unavoidable, this should be kept to the minimum width and length. Temporary river crossings should be supported on stilts above the riverbed.

The Contractor shall also comply with the "Condition of Working within Water Gathering Ground" during Project construction. Any effluent discharged from the proposed development at

points within gathering grounds should comply fully at all times with standards for effluents stipulated in Table 2 and paragraph 8.4 of the "Technical Memorandum on Effluent Standards" issued under section 21 of the WPCO.

Operation Phase

Road gullies should be provided to direct and collect all surface runoff to the drainage system. The capacity should be properly designed to cater for all surface water.

Road gullies with standard design should be incorporated during the detailed design to remove particles present in stormwater runoff. Screening facility such as standard gully grating, with spacing which is capable of screening off large substances such as fallen leaves and rubbish should be provided at the inlet of drainage system.

Road drains should be properly maintained and cleaned regularly to ensure good service condition. Good management measures such as regular cleaning of road gullies and sweeping of road surface should be carried out prior to occurrence rainstorm.

4.4 Compliance Audits

Any effluent discharges from the site would be required to comply with the terms and conditions of a discharge license to be applied as necessary under the Water Pollution Control Ordinance (WPCO).

Monitoring of the effluent from the works area is required during the construction phase of the Project. The monitoring should be carried out in accordance with the valid discharge licenses issued by EPD throughout the entire construction period. The monitoring frequency and parameters specified in the discharge license under WPCO should be fully complied with during the monitoring.

5.0 WASTE MANAGEMENT

5.1 Introduction

The quantity and timing for the generation of waste during the construction phase have been estimated in the EIA Report.

Through proper on-site handling and storage (covered containers), reuse (of inert construction wastes) and off-site disposal (via approved waste collectors to approved waste facilities and/or disposal grounds) the generation, handling and disposal of these wastes will not give rise to any adverse environmental impacts during the construction phase. However, given the potential for environmental impacts to arise from improper waste management (e.g. visual impact, nuisance, etc.), it is recommended that waste control and mitigation measures be implemented as part of general good site practices.

5.2 Mitigation Measures

A Waste Management Plan (WMP), as part of the Environmental Management Plan (EMP) should be prepared in accordance with ETWB TC(W) No. 19/2005 and submitted to the ER to oversee the construction works in accordance with the specification and contractual requirement for approval. The recommended mitigation measures should form the basis of the WMP. The monitoring and auditing requirement stated in ETWB TC(W) No. 19/2005 should be followed with regard to the management of C&D materials.

With the appropriate handling, storage and disposal of waste arising from the construction works as summarized in ***Appendix D***, potential adverse environmental impacts would be minimized. During the site inspections, the ET should pay special attention to the issues relating to waste management and check whether the Contractor has implemented the recommended good site practices and mitigation measures.

5.3 Audit Requirement

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

The requirements of the environmental audit programme are set out in Section 9 of this Manual. The audit programme will verify the implementation status and evaluate the effectiveness of the mitigation measures.

6.0 ECOLOGY

6.1 Introduction

The EIA Report has reviewed the ecological impact due to the Project. Due to the scale of the Project and the existing environment in the vicinity of the Project, the overall ecological impacts during construction phase are considered minor without mitigation measures while the overall ecological impacts during operation phase are considered insignificant. Hence, no ecological monitoring is required. However, regular site inspection by an experienced ecologist is recommended to ensure adequate mitigation measures / best practice guidelines are implemented throughout construction of the Project, in particular the Conservation Area, secondary woodland and near the watercourses.

6.2 Mitigation Measures

To further minimize the ecological impact arising from the Project, the following mitigation measures will be carried out.

A detailed vegetation survey will be conducted within the proposed works areas as well as the Conservation Area before construction to identify any plant species of conservation importance before construction activities to be carried out. Protection measures shall be implemented to protect any plant species of conservation importance identified.

Good site practice should be implemented to avoid unnecessary disturbance to nearby habitats and associated wildlife. The following mitigation measures should be implemented:

- Confining the works within the Project Boundary;
- Controlling access of site staff to avoid damage to the vegetation in surrounding areas
- Placement of equipment or stockpile in the existing disturbed / urbanized area within the Project Boundary of the Project to minimize disturbance to vegetated areas

Construction site runoff shall be controlled. For details, please refer to Section 4.3.

A balance between lighting for safety, and avoiding excessive lighting can be achieved through the use of directional lighting to avoid light spill into sensitive areas (i.e. Conservation Area and secondary woodland).

To reduce collision from birds, the design of noise barrier will avoid / minimise the use of transparent / reflective materials or adopt bird-friendly design on the surfaces.

The following measures should be implemented to further minimize impacts from disturbance such as noise, air quality and water quality issues.

- The use of quiet plant and EPD's Quality Powered Mechanical Equipment (QPME);
- The use of movable noise barrier;
- The use of temporary noise screening structures or purpose-built temporary noise barriers;
- Install site hoarding as temporary noise barrier where construction works are undertaken;
- Mitigation measures stipulated in the ProPECC PN 1/94 "Construction Site Drainage" should be complied to minimize water quality impact.

7.0 LAND CONTAMINATION

7.1 Introduction

A total of 44 potentially contaminated sites were identified in the EIA Study, of which over 90% of the potentially contaminated sites are currently used as vehicle repairing/dismantling workshops and open storage area, having a potential of land contamination and recommended for further investigation prior to the works at these locations. Prior to the commencement of site clearance at these locations, a sampling and analysis programme shall be prepared and implemented.

7.2 Land Contamination Assessment

Site re-appraisal is required for the identified potentially contaminated sites as well as other areas within the Project Boundary to address any change in land use that may give rise to potential land contamination issues as soon as the sites become accessible and a supplementary Contamination Assessment Plan (CAP) should be submitted and endorsed by EPD before site investigation. A Contamination Assessment Report (CAR) which includes the site investigation sampling and testing results will be prepared for EPD's agreement upon completion of the site investigation. If contamination is identified, Remediation Action Plan (RAP) shall be also prepared and submitted to EPD for agreement prior to the commencement of the remediation works. Upon completion of the remediation, a Remediation Report (RR) shall be submitted to EPD for agreement. No construction works of site should be carried out prior to the agreement of the RR.

7.3 Mitigation Measures

As general measures, when handling identified contaminated materials, the following control measures should be implemented by the Contractor and the implementation status of the following measures should be monitored through the site audit programme by the ET:

- Exposure to any contaminated materials can be minimised by the wearing of appropriate clothing and personal protective equipment;
- Adequate training and instructions of the potential hazards associated with the contaminated materials shall be provided to site staff and workers;
- Measures shall be implemented to prevent non-workers from approaching the identified potential contamination areas in order to avoid exposure to contaminants;
- Where appropriate, the use of bulk handling equipment should be maximised to reduce the potential contacts between excavated contaminated materials and associated workers;
- All temporary stockpiles of the materials shall be completely covered with waterproof material to avoid leaching of contaminants, especially during rainy season; and
- Surface water shall be diverted around any contaminated areas or stockpiles to minimise potential runoff into excavations.

8.0 LANDSCAPE AND VISUAL

8.1 Introduction

The EIA has recommended landscape and visual mitigation measures to be undertaken during both the construction and operation 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 as early as practical without affecting the implementation of the mitigation measures.

8.2 Mitigation Measures

The Landscape and Visual Assessment of the EIA recommended a series of mitigation measures for both the construction and operation phases to ameliorate the landscape and visual impacts of the Project. These measures include the following as shown in ***Table 8.1*** and ***Table 8.2***, which are also summarized in the environmental mitigation implementation schedules provided in Chapter 9 of the EIA Report:

Table 8.1 Proposed Construction Phase Mitigation Measures of Landscape and Visual Impacts

Mitigation Code	Mitigation Measures	Funding Agency	Implementation Agency
CP1	**Preservation of Existing Vegetation** – The proposed Project should avoid disturbance to existing trees as far as practicable. A total of 1250 trees within the Project Boundary will not be affected by the work and will be retained in-situ and the tree protection measures as detailed in the Section 26 of the General Specifications for Civil Engineering Works (2006 Edition) should be written into the contract documents as such to ensure they would be properly preserved; and reference on tree care should also be made to the relevant sections of the www.greening.gov.hk maintained by the Development Bureau. Trees not in conflict with the Project will be protected by fencing as appropriate to prevent canopy and root zone damage from excavation works, vehicles and material storage	HyD	HyD
CP2	**Works Area and Temporary Works Areas** – The landscape of these works areas should be restored to its original status or new amenity area following the completion of the construction phase. Construction site controls shall be enforced, where possible, to ensure that the landscape and visual impacts arising from the construction phase activities are minimized including the storage of materials, the location and appearance of site accommodation and the careful design of site lighting to prevent light spillage. Screen hoarding will be erected around the temporary works area.	HyD	HyD

Mitigation Code	Mitigation Measures	Funding Agency	Implementation Agency
CP3	**Programme for Compensatory Planting –** Replanting of disturbed vegetation should be undertaken at the earliest possible stage during the construction phase of the Project to maximize its effect during the operation phase.	HyD	HyD
CP4	**Tree Transplantation –** Trees have been recommended for transplanting for their moderate transplanting success, and it is recommended to relocated the tree to a permanent receptor site within the Project Boundary directly after the completion of a 2 stages root preparation period (with a minimum of 60 days interval) as far as practicable, and the work should follow the Highways Guidelines HQ/GN/13 - Interim Guidelines for Tree Transplanting Works under Highways Department's Vegetation, as well as the latest guidelines issued from the Greening, Landscape and Tree Management Section of the Development Bureau. Details regarding the transplantation will be submitted in the tree survey report to relevant government departments for approval in accordance with ETWB TC(W) No. 29/2004, DEVB TC(W) No.7/2015 and "Guidelines on Tree Transplanting", GLTMS of DEVB.	HyD	HyD

Table 8.2 Proposed Operation Phase Mitigation Measures of Landscape and Visual Impacts

Mit. Code	Mitigation Measures	Funding Agency	Implementation Agency	Maintenance/ Management Agency
OP1	**Integrated design approach** – The alignment and structures associated with the widened road should integrated, as far as technically feasible, with existing roadside structures and the landscape context to reduce the potential cumulative impact of the proposed works. The location and orientation of the associated structures should where possible avoid landscape and visually sensitive areas such woodland, shrubland and agricultural fields. The architectural design should seek to reduce the apparent visual mass of the engineering structures through the use of textured finishes and colour blocking. Earth tones are preferred as these match the existing landscape and visual context.	HyD	HyD	HyD

Mit. Code	Mitigation Measures	Funding Agency	Implementation Agency	Maintenance/ Management Agency
OP2	**Roadside Planting –** These planting areas will utilize largely native tree and shrub species either with high canopy and thin foliage to allow visual access in the views from the adjacent landscape to the distant roadside or rural landscape or dense foliage at selected locations to provide shaded environment for pedestrians and the creation. Native tree planting on the existing and proposed cut slopes will improve the ecological connectivity between existing woodland habitats with the advantage of creating a more coherent landscape framework.	HyD	HyD	LCSD
OP3	**Compensatory Planting Proposals –** In accordance with DEVB TC(W) No. 7/2015, the compensatory planting proposal should has the basic primary objective of planting compensatory trees in a ratio not less than 1:1 in terms of quantity as far as practicable. The soil specification will follow the Clause 3.0 of the Section 3 Landscape Softworks and Establishment Works of the General Specification for Civil Engineering Works (2006 ed.) and a layer of mulching not less than 50mm shall be applied to the planting areas. The size of the trees to be planted would be 100mm in girdle width (DBH) and planted with a spacing not less than 5m interval to promote healthy establishment and development of a decent growth form. With the implementation of the proposed compensatory planting plan, there will be no net loss of trees in terms of quantity as far as practicable.	HyD	HyD	LCSD
OP4	**Treatment of Retaining Wall and Slopes –** The design and implementation of the aesthetic appearance of the retaining wall and slopes will be undertaken in accordance with GEO Publication No. 1/2011 - Technical Guidelines on Landscape Treatment for Slopes (2011), WBTC No. 29/93 on control of Visual Impact of Slopes and WBTC No. 17/2002 on Improvement to the Appearance of	HyD	HyD	HyD

Mit. Code	Mitigation Measures	Funding Agency	Implementation Agency	Maintenance/ Management Agency
	Slopes. The engineered structures will be aesthetically enhanced through the use of soft landscape works including tree and shrub planting to give these man-made features a more natural appearance and blending them into the local rural landscape. Light standard sized tree planting will be used on the face of soil cut slopes with a gradient of less than 30 degrees, at the crest and toe of the slope, and within berm planters. These smaller, younger plants will adapt to their new growing conditions more quickly than larger sized stock and establish a naturalistic effect more rapidly. Slopes with a gradient of greater than 30 degrees will be hydroseeded using a mixture of native trees and shrubs. Vertical greening measures shall also be considered on engineering structures. This includes the use of climbing and trailing plants both planted at the crest and toe of the features, and within pockets within the slopes. It is proposed that native species be used to enhance the ecological value of the road corridor and minimize potential maintenance requirements. These measures will be applied to the retaining walls and newly regraded slopes features.			
OP5	**Provision of Visually Pleasing Aesthetic Treatment on Noise Barriers –** Translucent plexiglass with aesthetic pattern will be fully considered for design of noise barrier to enhance visual interest.	HyD	HyD	HyD

The measures proposed in the EIA to mitigate the landscape and visual impacts arising from the Project should be incorporated within the detailed landscape design drawings and contract documents including the protection of existing trees where possible, the transplanting of existing trees and the planting of new trees and shrubs.

9.0 ENVIRONMENTAL AUDITING

9.1 Site Inspection

Site inspection provides a direct means to trigger and enforce the specified environmental protection and pollution control measures are in compliance with the contract specifications. They shall be undertaken regularly and routinely by ET to inspect the site activities in order to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented by the Contractor in accordance with the EM&A recommendations. With well-defined pollution control and mitigation specifications and a well-established site inspection, deficiency and remedial action reporting system, the site inspection is one of the most effective tools to enforce the environmental protection requirements on the site.

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

Regular site inspections shall be carried out at least once per week during the construction period of the proposed road. The areas of inspection shall include but not be limited to compliance with environmental legislation, pollution control and mitigation measures within the site. It should also review the environmental situation outside the Project Boundary that is likely to be affected, directly or indirectly, by the site activities. The ET Leader shall make reference to the following information in conducting the inspection:

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

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

The ER, ET and the Contractor should also carry out ad hoc site inspections if significant environmental problems are identified. Inspections may also be required subsequent to receipt of an environmental complaint, or as part of the investigation work, as specified in the Event and Action Plan for the EM&A programme.

9.2 Compliance with Legal and Contractual Requirements

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

To ensure that the workers are in compliance with the contractual requirements, all method statements of works should be submitted by the Contractor to the ER for approval and to the ET Leader for vetting to determine if sufficient environmental protection and pollution control measures have been included. The implementation schedule of mitigation measures is summarized in ***Appendix D***.

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

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

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

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

9.3 Environmental Complaints

Complaints received on environmental issues shall be referred to the ET Leader for carrying out complaint investigation procedures. Upon receipt of complaints the ET shall undertake the tasks outlined in points 1-9 below:

1. Log complaint and date of receipt onto the complaint database and inform the IEC immediately;
2. Investigate the complaint to determine its validity, and to assess whether the source of the problem is due to works activities;
3. If a complaint is valid and due to works, identify mitigation measures in consultations with the IEC;
4. If mitigation measures are required, advise the Contractor accordingly;
5. Review the Contractor's implementation of the identified mitigation measures, and the current situation;
6. If the complaint is transferred from EPD, submit interim report to EPD on status of the complaint investigation and follow-up action within the time frame assigned by EPD;
7. Undertake additional monitoring and audit to verify the complaint if necessary, and ensure that any valid reason for complaint does not recur through proposed amendments to work methods, procedures, machines and/or equipment, etc;

8. Report the investigation results and the subsequent actions to the source of complaint. (If the source of complaint is identified through EPD, the results should be reported within the time frame assigned by EPD); and
9. Log a record on the complaint, investigation, the subsequent actions and the results in the monthly EM&A reports.

The ET shall immediately notify the Contractor, ER, Project Proponent and EPD of any complaints received and keep him well informed of the actions being taken to settle these complaints.

During the complaint investigation work, the Contractor and ER shall co-operate with the ET Leader in providing all the necessary information and assistance for completion of the investigation. If mitigation measures are identified to be required in the investigation in consultation with the IEC, the Contractor shall promptly carry out the measures. The ER shall ensure that the Contractor has implemented the mitigation measures.

9.4 Documentation

All documentation is required to be filed in a traceable and systematically manner and ready for inspection upon request. All EM&A results and findings shall be documented in the EM&A report prepared by the ET and endorsed by IEC prior to circulation to the Contractor, ER and EPD.

10.0 REPORTING

10.1 Introduction

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

Reports can be provided in an electronic medium upon agreeing the format with the ER and EPD. All the monitoring data (baseline and impact) should be submitted in electronic medium and made available through a dedicated internet website.

10.2 Baseline Monitoring Report

The ET should prepare and submit a Baseline Environmental Monitoring Report within 10 working days after completion of the baseline monitoring works. It should be first verified by the IEC before formal submission to EPD. Copies of the Baseline Environmental Monitoring Report should be submitted to the IEC, ER and EPD. The ET should liaise with the relevant parties on the exact number of copies required.

The Baseline Monitoring Report should include at least the following information:

- Up to half a page of executive summary;
- Brief description of project background information;
- Drawings showing locations of the baseline monitoring stations;
- Monitoring results (in both hard and diskette copies) together with the following information:
  - Monitoring methodology
  - Name of the laboratory and types of equipment used and calibration details
  - Parameters monitored
  - Monitoring locations (and depth)
  - Monitoring date, time, frequency and duration
  - QA/QC results and detection limits
- Details of influencing factors, including:
  - Major activities, if any, being carried out in the works area during the period
  - Weather conditions during the period
  - Other factors which might affect the monitoring results
- Determination of the Action and Limit Levels (AL levels) for each monitoring parameter and statistical analysis of the baseline data;
- Revisions for inclusion in the EM&A Manual; and
- Comments and conclusions

10.3 Monthly EM&A Reports

The results and findings of all EM&A works required in this Manual should be recorded in the monthly EM&A reports prepared by the ET and endorsed by the IEC. The first Monthly EM&A Report should be prepared and submitted to EPD within a month after the major construction works commences with the subsequently Monthly EM&A Reports due in 10 working day of the

end of each reporting month. Copies of each monthly EM&A report should be submitted to each of the three parties: ER, IEC and EPD. Before submission of the first monthly EM&A Report, the ET should liaise with the parties on the exact number of copies and format of the monthly reports in both hard copy and electronic copies.

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

First Monthly EM&A Report

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

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

- Breaches of Action and Limit levels;
- Complaint log;
- Notifications of any summons and successful prosecutions;
- Reporting changes; and
- Future key issues.

(ii) Basic project information:

- Project organization including key personnel contact names and telephone numbers;
- Construction programme;
- Management structure; and
- Works undertaken during the reporting month.

(iii) Environmental status:

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

(iv) Summary of EM&A requirements:

- 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;
- Graphical plots of the monitoring parameters in the reporting month annotated against the following;
  - Major activities being carried out on site during reporting period;
  - Weather conditions during the reporting period;
  - Any other factors which might affect the monitoring results; and
  - QA/QC results and detection limits.

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

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

(viii) Others:

- An account of the future key issues as reviewed from the works programme and method statements of works;
- Advice on the solid and liquid waste management status;
- A forecast of the works programme, impact predictions and monitoring schedule for the next three months;
- Compare the EM&A data in the reporting month with the EIA predictions and annotate with explanation for any discrepancies; and
- Comments (e.g. the effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions.

<u>Subsequent Monthly EM&A Reports</u>

Subsequent monthly EM&A Reports during the construction phase and specified operation phase monitoring period should include the information:

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

- Breaches of Action and Limit levels;

- Complaint log;
- Notifications of any summons and successful prosecutions;
- Reporting changes; and
- Future key issues

(ii) Basic project information:

- Project organization including key personnel contact names and telephone numbers;
- Construction programme;
- Management structure; and
- Works undertaken during the reporting month.

(iii) Environmental status:

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

(iv) Implementation status:

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

(v) Monitoring results (in both hard and diskette copies) together with the following information:

- Monitoring methodology;
- Name of the laboratory and types of equipment used and calibration details;
- Monitoring parameters;
- Monitoring locations (and depth);
- Monitoring date, time, frequency and duration;
- Graphical plots of the monitoring parameters in the reporting month annotated against the following;
  - Major activities being carried out on site during the reporting period;
  - Weather conditions during the reporting period;
  - Any other factors which might affect the monitoring results; and
  - QA/QC results and detection limits.

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

- Record of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
- Record of all complaints received (written or verbal), including the locations and nature of complaints investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;
- Record of all notification of summons and successful prosecutions for the breaches of current environmental protection / pollution control legislation, including locations and

nature of the breaches, investigation, follow-up actions taken, results and summary;
- Review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures; and
- Descriptions of the actions taken in the event of non-compliances and deficiency reporting and any follow-up procedures related to earlier non-compliance.

(vii) Others:

- An account of the future key issues as reviewed from the works programme and method statements of works;
- Advice on the solid and liquid waste management status;
- A forecast of the works programme, impact predictions and monitoring schedule for the next three months;
- Compare the EM&A data in the reporting month with the EIA predictions and annotate with explanation for any discrepancies; and
- Comments (e.g. the effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions.

(viii) Appendix:

- Action and Limit levels;
- Graphical plots of trends of the monitoring parameters over the past four reporting periods for the representative monitoring stations annotated against the following:
  - Major Project activities being carried out on site during the reporting period;
  - Weather conditions during the reporting 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;
- Outstanding issues and deficiencies.

10.4 Annual EM&A Review Reports

The ET Leader should prepare and submit the Annual EM&A Review Report which should contain at least the following information:

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

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

(iii) Basic project information including a synopsis of the project organization, contacts of key management, and a synopsis of work undertaken during the past 12 months;

(iv) A brief summary of EM&A requirements including;
- Environmental mitigation measures, as recommended in the EIA Report;
- Environmental impact hypotheses tested;
- Environmental quality performance limits (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 EIA Report, summarized in the updated implementation schedule;

(vi) Graphical plots and the statistical analysis of the trends of monitoring parameters over the past 12 months, including the post-project monitoring for all monitoring stations annotated against:
- The major activities being carried out on site during the reporting period;
- Weather conditions during the reporting period; and
- Any other factors which might affect the monitoring results;

(vii) A summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);

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

(ix) A description of the actions taken in the event of non-compliance;

(x) A summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;

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

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

(xiii) 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

(xiv) A review of success of the overall EM&A programme to cost-effectively identify deterioration and to initiate prompt effective mitigation action when necessary.

10.5 Final EM&A Review Report – Construction Phase

The EM&A programme should be terminated upon completion of the construction works and specified operation phase monitoring period so that the potential to cause significant environmental impacts is ceased and the post-project monitoring is concluded.

Prior to the proposed termination, tit would be required to consult related local community and should be endorsed by the IEC, ER and the Project Proponent prior to final approval from the Director of Environmental Protection.

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

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

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

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

(iv) A brief summary of EM&A requirements including;
- Environmental mitigation measures, as recommended in the EIA Report;
- Environmental impact hypotheses tested;
- Environmental quality performance limits (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 EIA Report, summarized in the updated implementation schedule;

(vi) Graphical plots and the statistical analysis of the trends of monitoring parameters over the course of the Project, including the post-project monitoring for all monitoring stations annotated against:
- The major activities being carried out on site during the reporting period;
- Weather conditions during the reporting period; and
- Any other factors which might affect the monitoring results;

(vii) A summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);

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

(ix) A description of the actions taken in the event of non-compliance;

(x) A summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;

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

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

(xiii) 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

(xiv) A review of success of the overall EM&A programme to cost-effectively identify deterioration and to initiate prompt effective mitigation action when necessary.

10.6 Data Keeping

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

10.7 Interim Notification of Environmental Quality Limit Exceedances

With reference to the Event and Action Plan, 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 interim notification is presented in ***Appendix E***.