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1. INTRODUCTION

Project Description

- 1.1 The Sha Tin and Tai Po Drainage Master Plan (DMP) Study, completed in October 1999, indicated that certain stormwater drains and natural rivers/streamcourses in the Sha Tin and Tai Po areas did not have the required hydraulic capacity to meet the flow requirements. To minimize the risks of flooding and to cope with future developments as identified in the DMP Study, construction of river channels, upgrading of existing stormwater drains, construction of flood pumping stations in the low-lying areas and other minor drainage facilities were recommended.
- 1.2 Upon completion of the DMP Study, Drainage Services Department (DSD) of Hong Kong SAR Government commissioned Maunsell Consultants Asia Ltd. (MCAL) to undertake Agreement No. CE50/2001 (DS) Drainage Improvement in Sha Tin and Tai Po – Design and Construction (hereinafter referred to as “the Assignment”), for implementing the drainage improvement works at various locations as recommended by the DMP study to alleviate the potential flooding problems in Sha Tin and Tai Po districts.
- 1.3 This manual presents the environmental monitoring and auditing requirements associated with the proposed drainage improvement works in Shuen Wan (the Project), which comprises the following five works items:
 - Construction of a 1000m long 3m x 2.5m twin-cell box culvert along Tung Tsz Road
 - Replacement of existing gates by automatic mechanical gates at the mouth of Wai Ha River
 - Construction of a 280m long 1200dia. drainage pipe near Wai Ha Village
 - Construction of a 260m long 2100dia. flood relief drain along Ting Kok Road
 - Construction of a floodwater pumping station at Shuen Wan
- 1.4 An Environmental Impact Assessment (EIA) study has been conducted to provide information on the nature and extent of potential environmental impacts pertinent to the construction and operation of the Project. The findings are presented in a separate EIA Report.
- 1.5 **Figure 1.1** shows the location of the Project.

Purpose of this Manual

- 1.6 As part of the EIA study, the purpose of this Environmental Monitoring and Audit (EM&A) Manual is to provide guidelines for the setting up of an EM&A programme to check on compliance with the environmental protection conditions, EIA Report recommendations, assess the effectiveness of the recommended mitigation measures, and identify any need for additional mitigation measures or remedial action. This Manual also outlines the monitoring and audit programme for the construction and operation phases of the works proposed under the Project.
- 1.7 The EM&A Manual has been prepared in accordance with the requirements stipulated in Annex 21 of the Technical Memorandum on the EIA Process (EIAO TM).
- 1.8 This Manual contains the following information:
 - Responsibilities of the Contractor, the Engineer or Engineer’s Representative (ER), Environmental Team (ET) and Independent Environmental Checker (IEC) with respect to the EM&A requirements during the implementation of the Project.
 - Information on the project organization and programming of construction activities.

- Project construction schedule and necessary environmental monitoring and audit programme to track environmental impacts.
- Requirements for the review of pollution sources and working procedures in the event of non-compliance of the project's environmental performance criteria.
- Environmental monitoring protocols and their technical requirements.
- Environmental auditing procedures.
- Requirements for the documentation of environmental monitoring and audit data, and appropriate reporting procedures.
- Complaint resolution procedures.

1.9 For the purpose of this Manual, the ET leader, who should be responsible for and in charge of the ET, should refer to the person or party delegated the role of executing the respective EM&A requirements.

Project Implementation

1.10 The preliminary project programme for this Project is presented in **Table 1.1**.

Table 1.1 Preliminary Project Programme

Task Description	Tentative/Actual Completion Date
Selection of the Scheme	May 2005
Detailed Design of Works	February 2007
Commencement of Works Contract	December 2007
Completion of the Contract	June 2010

Environmental Monitoring and Audit Requirements

1.11 The construction and operational phase environmental impacts of the Project were assessed, and are presented in the EIA report on Drainage Improvement in Sha Tin and Tai Po – Design and Construction. The EIA report has identified the recommended environmental mitigation measures to minimize the potential adverse environmental impacts identified. An implementation schedule of the recommended mitigation measures is also prepared as part of the EIA study and is provided in **Appendix A** of this Manual.

Project Organisation

1.12 The proposed project organisation and lines of communication with respect to environmental protection works are shown in **Figure 1.2**.

1.13 The general duties/responsibilities of various parties comprise the following:

Engineer or Engineer's Representative (ER)

1.14 The term ER, refers to the organisation responsible for overseeing the construction works or operation of the Project undertaken by various Contractors, and for ensuring that the construction works are undertaken by the Contractors in accordance with the specification and requirements in the Contract. The ER should:

- Monitor the Contractors' compliance with contract specifications, including Environmental Permit (EP) conditions, and the implementation and operation of the environmental mitigation measures.
- Follow the requirements in the agreed Event / Action Plan in the event of any exceedance.

- Provide assistance to the ET as necessary in the implementation of the EM&A programme.
- Engage IEC services to audit EM&A works carried out by the ET.
- Require the Contractor to follow the agreed protocols or those in the contract specifications in the event of exceedance or complaints.

The Contractor

- 1.15 The term “Contractor” should be taken to mean all construction contractors and sub-contractors, working on site at any one time. Besides reporting to the ER, the Contractor should:
- Work within the scope of the relevant requirements in the contract and EP.
 - Participate in site inspections undertaken by the ET and undertake any corrective actions as necessary.
 - Provide information / advice to the ET regarding works activities which may contribute to the generation of adverse environmental conditions.
 - Implement measures to reduce impact where Action and Limit levels are exceeded.
 - Submit proposals on mitigation measures in case of exceedances of Action and Limit levels in accordance with the Event / Action Plans.
 - Follow the procedures for carrying out complaint investigation.

Independent Environmental Checker (IEC)

- 1.16 The IEC should advise the ER on environmental issues related to the Project, and should be empowered to audit the environmental performance of construction.
- 1.17 The IEC should have at least 7 years’ local experience in EM&A and ecology, and one year of which should be relevant to recent ecological survey / monitoring work in the Shuen Wan area. The IEC should also have relevant professional qualifications, which should include being an Accredited Monitoring Professional of the Hong Kong Institute of Environmental Impact Assessment (HKIEIA), and have relevant project management experience. The appointment of the IEC is subject to the approval of the ER. The IEC should be employed prior to the commencement of the construction of the Project.
- 1.18 The main duty of the IEC is to carry out environmental audit of the project; this should include, inter alia, the following:
- Review and audit 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.
 - Carry out random sample check and audit on monitoring data and sampling procedures.
 - Conduct random site inspection.
 - 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 a need basis, verify and certify the environmental acceptability of the Contractor’s construction methodology (both temporary and permanent works), relevant design plans and

submissions under the EP. Where necessary, the IEC should seek the least impact alternative in consultation with ET leader and the Contractor.

- Verify the investigation results of complaint cases and the effectiveness of corrective measures.
- Verify EM&A report that has been certified by the ET leader.
- Feedback audit results to ET according to Event and Action Plan in the manual.
- Conduct a specific monitoring programme of the compensatory ecological habitats. Details of the monitoring requirements are set out in **Section 6.16** of this Manual.

Environmental Team (ET)

- 1.19 The ET leader and the ET should be employed to conduct the EM&A programme and check the Contractor's compliance with the Project's environmental performance requirements during construction. The ET should be led and managed by the ET leader.
- 1.20 The ET leader should be an independent party from the Contractor and should possess at least 7 years' local experience of EM&A and have relevant professional qualifications, which should include being an Accredited Monitoring Professional of the Hong Kong Institute of Environmental Impact Assessment (HKIEIA). The ET leader should have at least 3 years of experience in ecological monitoring given ecological impact would be the key environmental issue of this Project. The appointment of the ET is subject to the approval of the ER and the Director of Environmental Protection.
- 1.21 Suitably qualified staff should be included in the ET, and resources for the implementation of the EM&A programme should be allocated in time under the Contract, to enable fulfilment of the requirements as specified in the EM&A Manual during construction and operation of the Project.
- 1.22 Duties of the ET are:
- Conduct sampling, analysis and statistical evaluation of monitoring parameters with reference to the EIA study recommendations and requirements.
 - Conduct environmental site surveillance.
 - Audit of compliance with environmental protection, and pollution prevention and control regulations.
 - Monitor the implementation of environmental mitigation measures.
 - Monitor compliance with the environmental protection clauses/specifications in the Contract.
 - Review construction programme and comment as necessary.
 - Review construction methodology and comment as necessary.
 - Conduct complaint investigation, evaluation and identification of corrective measures.
 - Liaise with IEC on all environmental performance matters, and timely submit all relevant EM&A proforma for IEC's approval.
 - Provide advice to the Contractor on environmental improvement, awareness, enhancement matters, etc. on site.
 - Submit EM&A report timely to the Project Proponent and the Director of Environmental Protection.

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

2. CONSTRUCTION NOISE

Introduction

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

Methodology and Criteria

- 2.2 The construction noise level should be measured in terms of the A-weighted equivalent continuous sound pressure level (L_{eq}). L_{eq} (30 minutes) should be used as the monitoring parameter for the time period between 0700 and 1900 hours on normal weekdays. For all other time periods, L_{eq} (5 minutes) should be employed for comparison with the Noise Control Ordinance (NCO) criteria.
- 2.3 Supplementary information for data auditing, statistical results such as L_{10} and L_{90} should also be obtained for reference. A sample data record sheet is shown in **Appendix B** for reference.
- 2.4 Whilst the Noise Control Ordinance (NCO) does not provide for the statutory control of construction activities occurring on weekdays during normal working hours (i.e. Monday to Saturday inclusive 0700-1900 hours), a daytime standard of $L_{Aeq}(30 \text{ minute})$ 75dB stipulated in *Annex 5 of the Technical Memorandum on Environmental Impact Assessment Process* is used as the appropriate criterion for all residential dwellings; while a daytime standard of $L_{Aeq}(30 \text{ minute})$ 70dB was adopted for all educational institutions during normal school days and L_{Aeq} (30 minute) 65dB during examination periods.
- 2.5 The NCO provides statutory controls on general construction works during restricted hours (i.e. 1900-0700 hours Monday to Saturday and at any time on Sundays and public holidays). The ANLs for evenings and holidays and for night-time are dependent on the Area Sensitivity Rating at the NSR. The relevant ANLs are provided in Table 2.1.

Table 2.1 Acceptable Noise Levels (ANLs)

Time Period	Area Sensitivity Rating		
	A	B	C
All days during the evening (1900-2300 hours) and general holidays (including Sundays) during the day and evening (0700-2300 hours) All days during the night-time (2300-0700)	60	65	70
	45	50	55

Monitoring Equipment

- 2.6 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 should be used for carrying out the noise monitoring. Immediately prior to and following each noise measurement the accuracy of the sound level meter should be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements may be accepted as valid only if the calibration level from before and after the noise measurement agree to within 1.0 dB.
- 2.7 Noise measurements should not be made in the presence of fog, rain, wind with a steady speed exceeding 5ms^{-1} or wind with gusts exceeding 10ms^{-1} . The wind speed should be checked with a portable wind speed meter capable of measuring the wind speed in m/s.

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

Monitoring Locations

2.9 Based on the EIA study, four worst affected locations are designated for construction noise monitoring as listed in Table 2.2 and illustrated in **Figure 2.1**. The status and location of noise sensitive receivers may change after issuing this manual. If such cases exist, the ET Leader should propose updated monitoring locations and seek approval from ER and agreement from the IEC and EPD on the proposal.

Table 2.2 Noise Monitoring Stations during Construction Phase

Noise Monitoring Station	Noise Monitoring Location
M1	14, Shuen Wan Chim Uk
M2	150, San Tau Kok
M3	31, Wai Ha
M4	Block 15, Treasure Spot Garden

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

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

2.11 The monitoring station should normally be at a point 1 m from the exterior of the noise sensitive facade and be at a position 1.2 m above ground. If there is a problem with access to the normal monitoring position, an alternative position should be chosen, and a correction to the measurements should be made. For reference, a correction of +3 dB(A) should be made to the free field measurements. The ET should agree with the IEC and EPD on the monitoring position and the corrections adopted. Once the positions for the monitoring stations are chosen, the baseline monitoring and the impact monitoring should be carried out at the same positions.

Baseline Monitoring

2.12 The ET should carry out baseline noise monitoring prior to the commencement of the construction works. The baseline monitoring should be measured for a continuous period of at least 14 consecutive days at a minimum logging interval of 30 minutes (as six consecutive $L_{Aeq, 5min}$ readings) for daytime and 15 minutes (as three consecutive $L_{Aeq, 5min}$ readings) for evening time and night time. The L_{eq} , L_{10} and L_{90} should be recorded at the specified interval. A schedule on the baseline monitoring should be submitted to the IEC and EPD for approval before the monitoring starts.

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

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

Impact Monitoring

- 2.15 Noise monitoring should be carried out at all the designated monitoring stations. The monitoring frequency should depend on the scale of the construction activities. The following is an initial guide on the regular monitoring frequency for each station on a weekly basis when noise generating activities are underway:
- one set of measurements between 0700 and 1900 hours on normal weekdays.
- 2.16 In case of non-compliance with the construction noise criteria, more frequent monitoring, as specified in the Action Plan in **Table 2.4**, should be carried out. This additional monitoring should be continued until the recorded noise levels are rectified or proved to be irrelevant to the construction activities.

Event and Action Plan

- 2.17 The Action and Limit levels for construction noise are defined in **Table 2.3**. Should non-compliance of the criteria occur, action in accordance with the Action Plan in **Table 2.4** should be carried out.

Table 2.3 Action and Limit Levels for Construction Noise

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

*Acceptable Noise Levels for Area Sensitivity Rating of A/B/C.

Table 2.4 Event / Action Plan for Construction Noise

EVENT	ACTION			
	ET Leader	IEC	ER	CONTRACTOR
Action Level	<ol style="list-style-type: none"> 1. Notify IEC and Contractor. 2. Carry out investigation. 3. Report the results of investigation to the IEC, ER and Contractor. 4. Discuss with the Contractor and formulate remedial measures. 5. Increase monitoring frequency to check mitigation effectiveness. 	<ol style="list-style-type: none"> 1. Review the analysed results submitted by the ET. 2. Review the proposed remedial measures by the Contractor and advise the ER accordingly. 3. Supervise the implementation of remedial measures. 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing. 2. Notify Contractor. 3. Require Contractor to propose remedial measures for the analysed noise problem; 4. Check remedial measures are properly implemented. 	<ol style="list-style-type: none"> 1. Submit noise mitigation proposals to IEC. 2. Implement noise mitigation proposals.
Limit Level	<ol style="list-style-type: none"> 1. Notify IEC, ER, EPD and Contractor. 2. Identify source. 3. Repeat measurements to confirm findings. 4. Increase monitoring frequency. 5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented. 6. Inform IEC, ER and EPD the causes and actions taken for the exceedances. 7. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results. 8. If exceedance stops, cease additional monitoring. 	<ol style="list-style-type: none"> 1. Discuss amongst ER, ET, and Contractor on the potential remedial actions. 2. Review Contractors remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly. 3. Supervise the implementation of remedial measures. 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing. 2. Notify Contractor. 3. Require Contractor to propose remedial measures for the analysed noise problem. 4. Check remedial measures properly implemented. 5. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated. 	<ol style="list-style-type: none"> 1. Take immediate action to avoid further exceedance. 2. Submit proposals for remedial actions to IEC within 3 working days of notification. 3. Implement the agreed proposals. 4. Resubmit proposals if problem still not under control. 5. Stop the relevant portion of works as determined by the ER until the exceedance is abated.

Mitigation Measures

Good Site Practice

- 2.18 The following good site practices were recommended in the EIA study:
- Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction program;
 - Silencers or mufflers on construction equipment should be utilized and should be properly maintained during the construction program;
 - Mobile plant, if any, should be sited as far from NSRs as possible;
 - Machines and plant (such as trucks) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
 - Plant known to emit noise strongly in one direction should, wherever possible, be orientated so that the noise is directed away from the nearby NSRs; and
 - Material stockpiles and other structures should be effectively utilised, wherever practicable, in screening noise from on-site construction activities.

Adoption of Quieter PME

- 2.19 The EIA study recommended the use of quieter plants for the construction tasks proposed for the Project. The quieter plants recommended are listed in the table below.

Table 2.5 Quieter PME Recommended for Adoption during Construction Phase

PME	Reference	SWL
Excavator / Loader	BS C3/97	105
Dump Truck	BS C9/39	103
Concrete Lorry Mixer	BS C6/23	100
Vibratory Poker	BS C6/32	100
Breaker, Excavator Mounted (Hydraulic)	BS C8/12	106
Vibratory Roller	Noise data of Quality PME from EPD Website	101

Use of Temporary Noise Barrier

- 2.20 Temporary noise barriers of about 3.5m high have been recommended in the EIA study for screening of noise from the PMEs used for the construction of box culvert and site clearance. This can achieve a 5 dB(A) reduction for movable plants and 10dB(A) for stationary plant, depending on the line of sight that could be blocked by the barriers when viewed from the NSR.
- 2.21 **Figure 2.2** shows the typical section of the proposed temporary noise barriers. The barriers should be made of material of surface mass in excess of 7kg/m² to achieve the predicted screening effect.

Use of Quieter Alternative Construction Method

- 2.22 Quieter alternative construction method (hereinafter referred to as “the Low Impact Method”) has been proposed in the EIA study. This method involves using PMEs with lower impact and generally smaller in size, making it possible to be enclosed by noise enclosure which can further reduce the noise emission levels. **Table 2.6** presents the proposed PME for the Low Impact Method.

Table 2.6 Plant Inventory for the Low Impact Method

Construction Sub-task	PME	Reference	SWL
Pipe laying at Wai Ha			
Excavation	Hand-held breaker	CNP024	108
	Air compressor	CNP002	102
	Mini backhoe	CNP082	94
Pipe Laying	Mini backhoe	CNP082	94
	Vibratory poker	BSC6/32	100
Backfilling	Vibratory poker	BSC6/32	100
	Vibratory roller	EPD Website: Quality PME	101

Noise Enclosures and Temporary Noise Barriers

- 2.23 Noise enclosure has been proposed in the EIA study to alleviate the construction noise impact. It can be used for enclosing the PMEs (except mini backhoe) as listed in **Table 2.6**. For mini backhoe, the roof panels of the noise enclosure should be removed when it is in use and the side panels would form a temporary noise barrier (as illustrated in **Figure 2.2**) along the periphery of the works area. The conceptual design of the noise enclosure is shown in **Figures 2.3**.
- 2.24 The noise enclosure should be made of materials with a surface mass of not less than 10kg/m² to achieve the maximum screening effect. Openings should be provided at the side of the noise enclosure facing towards the natural hillside and away from the NSRs for ventilation. The noise enclosure should be designed to achieve at least 15dB(A) noise reduction for PME.
- 2.25 The implementation schedule for the recommended mitigation measures is presented in **Appendix A**.

3. AIR QUALITY

Introduction

- 3.1 This section presents the requirements, methodology, equipment, monitoring locations, criteria and protocols for the audit of air quality impacts during the construction phase of the Project.
- 3.2 According to the EIA study, significant dust emission arising from the construction activities would not be expected. With the implementation of mitigation measures as stipulated in the *Air Pollution Control (Construction Dust) Regulation*, it would be unlikely that the Project would result in adverse air quality impact on the representative ASRs.
- 3.3 Therefore, no air quality monitoring would be required during construction of the drainage improvement works. It is recommended that auditing works during construction phase be carried out to check that the Contractor has implemented the recommended mitigation measures to minimize the construction dust impact.

Site Inspection

- 3.4 Weekly site audits should be carried out to inspect the construction activities and works areas in order to confirm the recommended dust control mitigation measures are implemented and are working effectively. The Contractor should be responsible for the implementation of the *Air Pollution Control (Construction Dust) Regulation* and good site practices

Air Quality Mitigation Measures

- 3.5 Mitigation measures have been proposed in the EIA study, including the implementation of the *Air Pollution Control (Construction Dust) Regulation* and good site practices. The practical measures are summarized as below:
- Use of regular watering to reduce dust emissions from exposed site surfaces and unpaved road, with complete coverage, particularly during dry weather;
 - Use of frequent watering for particularly dusty static construction areas and areas close to ASRs;
 - Tarpaulin covering of all dusty vehicle loads transported to, from and between site location;
 - Establishment and use of vehicle wheel and body washing facilities at the exit points of the site;
 - Routing of vehicles and positioning of construction plant should be at the maximum possible distance from ASRs;
 - Stockpiled excavated materials should be covered with tarpaulin, and should be removed off-site within 24 hours to avoid any odour nuisance arising.
- 3.6 Upon receipt of an environmental complaint, or as part of the environmental audit, the Contractor should liaise with the ET on some other mitigation measures, propose to ER for approval, and implement the mitigation measures.

4. WATER QUALITY

Introduction

- 4.1 The water quality assessment in the EIA study identified that no adverse impact would occur during the construction and operation of the Project provided the recommended mitigation measures were properly implemented. It is recommended that regular site inspections (at least weekly) be undertaken to audit the construction activities and works areas in order to check the recommended mitigation measures are properly implemented.

Site Inspection

- 4.2 Site inspection should be conducted at least weekly to inspect the construction activities and works areas in order to check the recommended mitigation measures are properly implemented

Water Quality Mitigation Measures

- 4.3 Mitigation measures recommended for the construction and operation phases of the Project are summarized below. The implementation schedule of the recommended water quality mitigation measures is presented in **Appendix A**.

Construction Phase

Construction Run-off and Drainage

- 4.4 Mitigation measures should be implemented to control construction site runoff and drainage from the works areas, and to prevent runoff and drainage water with high levels of suspended solids from entering the Wai Ha River, fishponds and the receiving water body of Tolo Harbour.
- 4.5 The site practices outlined in ProPECC PN 1/94 "Construction Site Drainage" should be followed as far as practicable during the drainage improvement works in order to minimise surface runoff and to control erosion, and also to retain and reduce any suspended solids prior to discharge. These practices include the following items and should be implemented as an erosion control plan during the construction phase:
- Before commencing any site formation work, all sewer and drainage connections should be sealed to prevent debris, soil, sand etc. from entering public sewers/drains.
 - Temporary ditches should be provided to facilitate run-off discharge into appropriate watercourses, via a silt retention pond. No site run-off should enter the fishponds at Shuen Wan.
 - Sand/silt removal facilities such as sand traps, silt traps and sediment basins should be provided to remove sand/silt particles from runoff to meet the requirements of the Technical Memorandum standard under the Water Pollution Control Ordinance. The design of silt removal facilities should be based on the guidelines provided in ProPECC PN 1/94. All drainage facilities and erosion and sediment control structures should be inspected monthly and maintained to attain proper and efficient operation at all times and particularly during rainstorms.
 - Water pumped out from excavated pits should be discharged into silt removal facilities.
 - During rainstorms, exposed slope/soil surfaces should be covered by a tarpaulin or other means, as far as practicable. Other measures that need to be implemented before, during, and after rainstorms are summarized in ProPECC PN 1/94.
 - Exposed soil areas should be minimized to reduce potential for increased siltation and contamination of runoff.

- Earthwork final surfaces should be well compacted and subsequent permanent work or surface protection should be immediately performed to reduce the potential of soil erosion.
- Open stockpiles of construction materials or construction wastes on-site of more than 50 m³ should be covered with tarpaulin or similar fabric during rainstorms.

4.6 With standard water pollution control measures set out in ProPECC PN1/94 in place, it is anticipated that the construction phase discharges would comply with the WPCO requirements.

4.7 In addition, precautionary measures for controlling potential water quality impact due to the proposed works close to the Conservation Area should be required in order to safeguard the known sites of high ecological value during the construction phase, particularly during the rainy season as there is a risk that intense rainfall events may result in discharge of turbid drainage water. The contractor should implement the following mitigation measures:

- For the construction of the box culvert next to the existing channel of the Wai Ha River, sand bags should be deployed around the boundary of the works trench to prevent muddy water ingress into the adjacent CA or Wai Ha River. As an effective measure, sand bags should be used to surround the excavated trench. Generally, the sand bags will be placed up to a height of 300mm to provide adequate allowance for the built-up water level during rainstorm event. With sand bags in place, surface runoff will be intercepted and flow to Wai Ha River or collected by the existing drainage system as usual.
- Sheet-piles, which would be installed around the works trench near the Conservation Area, would be extended above ground level for about 2m to serve as hoardings to isolate the works site.
- Tarpulin sheets would be used to cover the excavation areas during heavy rainstorms. This would prevent the ingress of rainwater into the trench minimising the risk of muddy water getting into Wai Ha River and the adjacent Conservation Area.
- Any concrete washing water would be contained inside the works site surrounded by the extended sheet piles. A pump sump at the bottom of the trench would be provided to pump any excess water during concrete washing.
- Stockpiling the excavated materials adjacent to the Conservation Area would not be allowed. The excavated materials would be either removed off site immediately after excavation, or stockpile at location(s) away from the Conservation Area. The stockpile locations should be approved by the site engineer.

General Construction Activities

4.8 Debris and refuse generated on-site should be collected, handled and disposed of properly to avoid entering the Wai Ha River and fish ponds at Shuen Wan. Stockpiles of cement and other construction materials should be kept covered when not being used.

4.9 Oils and fuels should only be used and stored in designated areas which have pollution prevention facilities. To prevent spillage of fuels and solvents to nearby water bodies, all fuel tanks and storage areas should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank. The bund should be drained of rainwater after a rain event.

Sewage from Construction Workforce

4.10 Temporary sanitary facilities, such as portable chemical toilets, should be employed on-site. A licensed contractor would be responsible for appropriate disposal and maintenance of these facilities.

River Channel Excavation Works

- 4.11 The excavation works within the upstream end of the existing river channel of the Wai Ha River for the construction of the proposed box culvert should be carried out in dry condition. Containment measures such as bunds and barriers should be used within the affected length of the river channel and the excavation works restricted to within an enclosed dry section of the channel. The excavation works should be restricted to the period from October to April.

5. WASTE MANAGEMENT IMPLICATIONS

Introduction

- 5.1 Waste management should be the contractor's responsibility to confirm that all wastes produced during the construction phase for the drainage improvement works are handled, stored and disposed of in accordance with good waste management practices and EPD's regulations and requirements. The recommended mitigation measures should form the basis of the Waste Management Plan to be developed by the Contractor.
- 5.2 Waste materials generated during construction activities, such as construction and demolition (C&D) material, chemical wastes and general refuse, are recommended to be audited at regular intervals (at least quarterly) to check that proper storage, transportation and disposal practices are being implemented. The Contractor should be responsible for the implementation of any mitigation measures to minimise waste or redress problems arising from the waste materials.

Waste Control and Mitigation Measures

- 5.3 Mitigation measures for waste management are summarised below. With the appropriate handling, storage and removal of waste arisings during the construction works as defined below, the potential to cause adverse environmental impacts would be minimised. The implementation schedule of the recommended mitigation measures is presented in **Appendix A**. 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 other mitigation measures.

Good Site Practices

- 5.4 Appropriate waste handling, transportation and disposal methods for all waste arisings generated during the construction works should be implemented such that construction wastes do not enter the river channels and coastal waters of Inner Tolo Harbour, and to minimize potential impacts where works areas are located close to ecological sensitive receivers.
- 5.5 It is not anticipated that adverse waste management related impacts would arise, provided that good site practices are strictly followed. Recommendations for good site practices during the construction activities include:
- Nomination of approved personnel, such as a site manager, to be responsible for good site practices and making arrangements for collection of all wastes generated at the site and effective disposal to an appropriate facility.
 - Training of site personnel in proper waste management and chemical waste handling procedures.
 - Provision of sufficient waste disposal points and regular collection for disposal.
 - Appropriate measures to minimise windblown litter and dust during transportation of waste by either covering trucks or by transporting wastes in enclosed containers.
 - Separation of chemical wastes for special handling and appropriate treatment at the Chemical Waste Treatment Facility.
 - Regular cleaning and maintenance programme for drainage systems, sumps and oil interceptors.
 - A recording system for the amount of waste generated, recycled and disposal (including the disposal sites) should be proposed.

- A Waste Management Plan should be prepared and submitted to the Engineer for approval. One may make reference to ETWB TCW No. 19/2005 for details.

5.6 In order to monitor the disposal of C&D material at landfills and public filling areas, as appropriate, and to control fly tipping, a trip-ticket system should be included as one of the contractual requirements. One may make reference to ETWB TCW No. 31/2004 for details. The use of a trip-ticket system should be required to avoid any illegal or unplanned dumping of waste generated by the Project, particularly at works areas close to ecological sensitive receivers.

Waste Reduction Measures

5.7 Good management and control can prevent the generation of significant amounts of waste. Waste reduction is best achieved at the planning and design stage, as well as by ensuring the implementation of good site practices. Recommendations to achieve waste reduction include:

- Segregation and storage of different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal.
- To encourage collection of aluminium cans by individual collectors, separate labelled bins should be provided to segregate this waste from other general refuse generated by the work force.
- Any unused chemicals or those with remaining functional capacity should be recycled.
- Maximising the use of reusable steel formwork to reduce the amount of C&D material.
- Prior to disposal of C&D waste, it is recommended that wood, steel and other metals should be separated for re-use and / or recycling to minimise the quantity of waste to be disposed of to landfill.
- Proper storage and site practices to minimise the potential for damage or contamination of construction materials.
- Plan and stock construction materials carefully to minimise amount of waste generated and avoid unnecessary generation of waste.

5.8 In addition to the above good site practices and waste reduction measures, specific mitigation measures are recommended below for the identified waste arisings to minimise environmental impacts during handling, transportation and disposal of these wastes.

Construction and Demolition Material

5.9 To minimize the environmental impacts during the collection and transportation of C&D material, the following mitigation measures are recommended:

- The excavated material with suitable characteristics/size should be reused on-site as fill material as far as practicable, such as for backfilling of the box culvert and drainage pipe works, to minimise off-site disposal of C&D material.
- Suitable areas should be designated within the works site boundaries for temporary stockpiling of C&D material.
- Within stockpile areas, the following measures should be taken to control potential environmental impacts or nuisance:
 - covering material during heavy rainfall;
 - locating stockpiles to minimise potential visual impacts; and

- minimizing land intake of stockpile areas as far as possible
- When disposing C&D material at a public filling area, the material should only consist of soil, rock, concrete, brick, cement plaster/mortar, inert building debris, aggregates and asphalt. The material should be free from marine mud, household refuse, plastic, metals, industrial and chemical waste, animal and vegetable matter, and other material considered to be unsuitable by the Filling Supervisor.

Chemical Wastes

5.10 If chemical wastes are produced at the construction site, the following mitigation measures should be implemented to minimize the environmental impacts associated with the handling, transportation and disposal of chemical waste:

- Contractor should be required to register with the EPD as a Chemical Waste Producer and to follow the guidelines stated in the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.
- Good quality containers compatible with the chemical wastes should be used, and incompatible chemicals should be stored separately.
- Appropriate labels should be securely attached on each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as explosives, flammable, oxidizing, irritant, toxic, harmful, corrosive, etc.
- The Contractor should use a licensed collector to transport and dispose of the chemical wastes generated at the Chemical Waste Treatment Centre at Tsing Yi, or other licensed facility, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

General Refuse

5.11 The recommended mitigation measures for the handling of general refuse are as below:

- General refuse should be stored in enclosed bins or compaction units separate from C&D material.
- A reputable waste collector should be employed by the contractor to remove general refuse from the site, separately from C&D material.
- An enclosed and covered area is preferred to reduce the occurrence of 'wind blown' light material.

6. ECOLOGICAL IMPACT

Introduction

- 6.1 The ecological impact assessment in the EIA Report identified that ecological impacts resulting from the proposed drainage improvement works are anticipated to be very minor in scale. Nevertheless, measures were identified in the EIA Report that would minimise any potential ecological impact. Ecological mitigation measures are detailed in the following sections.

Ecological Mitigation Measures

- 6.2 Following *EIAOTM Annex 16* guidelines, mitigation measures are proposed in this section to avoid, minimise and compensate for identified ecological impacts.

Avoidance/ Minimising

- 6.3 Wherever possible, proposed drainage improvement works have been designed to avoid or minimise direct impacts to areas of recognised conservation importance in the Assessment Area including Conservation Area (CA), Coastal Protection Area (CPA), and Site of Special Scientific Interest (SSSI).
- 6.4 The following measures should be implemented to minimise identified ecological impacts during the construction and operation phase.

Construction Phase

- 6.5 The proposed twin cell box-culvert constructed partially underneath Tung Tsz Road has been designed to reduce the footprint of the proposed works from 0.35ha to 0.3ha, thereby minimising direct impacts to marsh habitat and the CA.
- 6.6 During the construction of the proposed twin cell box-culvert, the following measures are recommended to be implemented:
- Sheet-pilings, which will be installed around the trench of excavation, should be extended above ground level for ~2m to act as hoarding to isolate the works site.
 - The trenching works for the construction of the proposed box culvert should be carried out in phases, with a trench length of not more than 120m in each phase. The trench should be backfilled and compacted with suitable materials upon completion of each phase of the construction works.
 - The construction of intercept point of twin cell box culvert at the upstream of Wai Ha River should be confined to only one side of the river bank.
 - Construction works of box culvert should be conducted in the existing artificially modified channel as far as practicable which lined with masonry wall in order to minimised impact to natural stream section.
 - To restore and enhance the ecological value of the stream, the affected river bank should be reinstated to its original condition or lined with rock-filled gabion.
 - Planting pits should be provided in the gabion bank to allow the re-establishment of riparian vegetation.

- The existing natural riverbed and substrates should be retained and the natural pool-riffle sequence should be re-created in the new channel bed.

6.7 Concerning the excavation works, the following measures should be implemented:

- All works conducted within or close to water bodies should be carried out from October to April, with construction by making use of land-based plant.
- Works within river/stream channels should be restricted to an enclosed dry section of the river, with containment measures such as bunds and barriers used within the river to minimize the impacts upon the downstream water body.
- Site runoff should be directed towards regularly cleaned and maintained silt traps and oil/grease separators to minimise the risk of sedimentation and pollution of river water. The silt and oil/grease separators should be appropriately designed for the local drainage and ground conditions.
- To minimize leakage and loss of sediments during excavation in narrow channels, tightly sealed closed grab excavators should be deployed where material to be handled is wet.

6.8 It has been identified in the EIA report that a plant species of conservation interest (Hong Kong Pavetta, *Pavetta hongkongensis*) would be potentially affected by the construction of the proposed box-culvert. In view of this, specific mitigation measures have been recommended for this species:

- The affected individuals should be transplanted to a suitable nearby habitat prior to the construction phase.
- A detailed vegetation survey of the affected species of conservation interest should be conducted by a suitably qualified botanist/ecologist to identify the affected individuals in order to provide details for transplantation scheme. A detailed transplantation methodology should be formulated before the commencement of transplantation.
- Transplantation should be supervised by a suitably qualified botanist/horticulturalist.

6.9 To minimise disturbance to habitats adjacent to the works areas, noise mitigation measures as listed below should be implemented:

- Quieter construction plant should be used during the construction phase.
- Temporary noise barriers should be used during the construction of the box-culvert along Tung Tsz Road, the floodwater pumping station, the mechanical gate, and drainage pipe to minimise potential construction phase disturbance to ardeids that may breed in Shuen Wan Egretty SSSI, and avifauna foraging in marsh habitat.
- Noise generating construction works near the Shuen Wan Egretty SSSI should be avoided as far as practicable during the breeding season (March to June) of the ardeids. Works near the SSSI (i.e. installation of mechanical gate) could be restricted to be executed outside the breeding season by provision of special conditions in the contract document.
- To further minimise construction noise impact to the marshland and prevent tipping, storage of construction material and encroachment of personnel into the marshland area, hoardings with minimum height of 2m should be set up along the south side of the proposed box culvert works area adjacent to the marsh, extending at least 20m at both ends, throughout the construction period.

6.10 Standard good site practice measures should be implemented throughout the construction phase. The measures should include:

- Placement of equipment or stockpile in designated works areas and access routes selected on existing disturbed land to minimise disturbance to natural or moderate-high ecological value habitats.
- Construction activities should be restricted to work areas that should be clearly demarcated. The work areas should be reinstated after completion of the works.
- Waste skips should be provided to collect general refuse and construction wastes. The wastes should be disposed of timely and properly off-site.
- General drainage arrangements should include sediment and oil traps to collect and control construction site run-off.
- Open burning on works sites is illegal, and should be strictly prohibited.

Operation Phase

6.11 Potential operational phase activities in newly box-culvert would be limited to regular maintenance such as de-silting. Impacts to aquatic communities in the nearby water channel resulting from these activities are expected to be minor. Nevertheless, the following measures are recommended to minimise potential impacts resulting from operational phase activities:

- To minimise sedimentation, de-silting should be limited to the dry season.
- Waste material produced during de-silting should be disposed of in a timely and appropriate manner.

Compensation

6.12 Compensatory planting as listed below would be required due to the unavoidable loss of trees and vegetations.

- Planting of trees should be provided within the project area to compensate for the unavoidable loss of approximately 0.08ha of secondary woodland habitat that would be affected by the drainage improvement works.
- Planting of trees and other vegetation within project area along the banks of Wai Ha River and Tung Tsz Road should also provide compensation for unavoidable tree-felling and loss of riparian vegetation resulting from the proposed works.
- The compensatory planting should make use of native plant species with flowers/fruits attractive to wildlife.

6.13 As there will be loss of a small area of marsh habitat (about 0.30ha) within the CA resulting from the construction of the box-culvert along Tung Tsz Road, a proposed area (about 0.8ha) for the compensation for the marsh as well as secondary woodland habitats loss (0.08ha) will be required. Details of the compensation include the followings:

- The compensation will make use of an existing low ecological value recreational fishpond on government land adjacent to the marsh.
- The above-mentioned pond should be enhanced by removing boardwalks around the existing pond, and restoring vegetation along the pond bunds. It should also be re-profiled to provide areas of shallow water (approximately 15-50cm deep), creating a suitable foraging habitat for wildlife.

- Screen planting of shrubs and trees along the south-eastern bund of the pond should be implemented to minimise disturbance to avifauna and other wildlife from the adjacent recreational fishpond.

Ecological Monitoring and Audit Requirements

- 6.14 The proper implementation of mitigation measures during construction and operation phase recommended in Section 6.3 to 6.13 should be monitored and audited.
- 6.15 Following transplantation, the health and condition of individuals of the plant species of conservation interest affected by the proposed works should be monitored by a qualified botanist/ecologist. Monitoring should cover 12-month period following transplantation, and be conducted once a week in the first 3 months and at least once per month in the remaining of monitoring period.
- 6.16 A specific monitoring programme of the compensatory habitats is recommended. The programme should provide data on the establishment of marsh communities, and allow an assessment of the relative success of mitigation measures to be made.
- 6.17 The ecological monitoring should be conducted by qualified local ecologist(s) of the Independent Environmental Checker (IEC) with at least 7 years relevant ecology and EM&A experience. The ecologist(s) should collect baseline data before the commencement of construction phase, with monitoring conducted during the construction and operation phases. Information collected should include the physical and biological parameters of the important habitats such as marsh, stream and the compensatory habitat. A simple Event and Action Plan for construction and operation phase is recommended in **Table 6.1**. Monitoring programme details should be agreed with the Agriculture, Fisheries and Conservation Department (AFCD). The IEC should submit reports on the findings of each monitoring trip, and a final report summarising the monitoring results over the entire monitoring period to AFCD and Environmental Protection Department (EPD).

Table 6.1 Event and Action Plan

Event	Action	
	Construction Phase	Operation Phase
Detection of exceedance of compliance to physical and biological parameters measured	1. Identify sources/reasons of exceedance. 2. Increase frequency of monitoring visits. 3. Review and identify any changes in construction activities. 4. Propose and implement remedial action. 5. Check the effectiveness of remedial action.	1. Identify sources/reasons of exceedance. 2. Increase frequency of monitoring visits. 3. Review and identify any changes in the operation of drainage works. 4. Propose and implement remedial action. 5. Check the effectiveness of remedial actions.

7. LANDSCAPE AND VISUAL

Introduction

- 7.1 Landscape and Visual Impact Assessment in the EIA Report has identified the key issues and the possible impacts due to the proposed work. It has also recommended mitigation measures for minimizing the impacts and for improving overall landscape and visual quality. The Contractor of the Project should be responsible for the implementation of mitigation measures.

Monitoring Requirement

- 7.2 A Registered Landscape Architect (RLA) as a member of the ET, with local construction site experience should be responsible for conducting the baseline review and monitoring the design, implementation and maintenance of landscape and visual mitigation measures during construction and operational phases in accordance with the EIA Report.

Construction Phase

Baseline Review

- 7.3 A baseline review should be undertaken at the commencement of the construction contracts. The purpose of the review is:
- to check the status of the landscape resources within, and immediately adjacent to, the construction sites and works areas.
 - to determine whether any change has occurred to the status of the landscape resources since the EIA.
 - to determine whether amendments in the design of the landscape and visual mitigation measures are required for those changes.
 - to recommend any necessary amendments to the design of the landscape and visual mitigation measures.

Landscape and Visual Monitoring

- 7.4 The design, implementation and maintenance of landscape and visual mitigation measures should be checked bi-weekly to check that they are fully realised. Any potential conflicts between the proposed landscape measures and any other project works or operational requirements should also be recorded for the Contractor to resolve in early stage, without compromising the intention of the mitigation measures.

Operational Phase

Landscape and Visual Monitoring

- 7.5 All landscape and visual mitigation measures should be monitored quarterly during the first year of the Operational Phase to check on the effectiveness of the mitigations.

Mitigation Measures

Construction Phase

7.6 A number of landscape and visual mitigation measures during the construction phase have been proposed in the EIA report, and are summarized as below:

- Use of hoardings as visual screens for the construction in the works areas.
- Use of temporary barriers, covers and drainage provision around the construction works as contaminant / sediment control to prevent the contaminants and sediments from entering the sensitive water-based habitats.
- Implementation of pollution control measures to minimise any adverse environmental impacts to the surrounding habitats.
- Liaison with the nursery operator as necessary to minimise any adverse impact to the daily operation and plant holding capacity of the nursery.
- Maintenance and protection of the existing trees, especially their crowns, trunks and roots, within work sites.
- Provision of construction light should be controlled at night to avoid excessive glare to the surrounding villages and to Plover Cove.

Operation Phase

7.7 Landscape and visual mitigation measures during the operation phase as listed below should be implemented to minimize the potential impacts:

- Viewing area formation by planting with shrubs, grasses and benches along the area.
- Architectural design of the pump house will help it fit into the existing suburban, natural to semi-natural surroundings.
- Landscape design of pump house by providing sufficient planting around its boundary fence,
- Enhancement planting along Tung Tsz Road with shrubs / trees of suitable species to help protect the stream and marshes.
- Construction of box culvert should be with at least 1.0m soil depth for enhancement planting.
- Transplanting of existing affected trees to adjacent locations should be carried out.
- Preparation for transplanting is needed to allow sufficient time for root pruning and rootball preparation prior to transplanting.
- Reinstatement of affected area should be carried out to check that the works areas are properly reinstated.

7.8 The implementation for the recommended landscape and visual impact mitigation measures is presented in **Appendix A**.

8. ENVIRONMENTAL AUDIT

Site Inspection

- 8.1 Site inspection provides a direct means to assess and check the project's environmental protection and pollution control measures are in compliance with relevant statutory requirements. Site inspection should be undertaken regularly and routinely by the ET to inspect construction activities in order to check that appropriate environmental protection and pollution control mitigation measures are implemented in accordance with EIA recommendations. With well defined pollution control and impact mitigation specifications and an established efficient and remedial action reporting system, site inspection is an effective tool to verify the acceptable environmental performance on the construction site.
- 8.2 The ET leader should be responsible for formulation of the environmental site inspection, deficiency and remedial action reporting system, and for carrying out site inspection works. He should in consultation with the IEC, prepare a procedure for the site inspection, deficiency and remedial action reporting requirements, and submit to the Contractor for agreement, and to the ER for approval, within 21 days of commencement of the construction contract.
- 8.3 Regular site inspections should be carried out at least once per week for all works areas. The inspections should cover the environmental situation, pollution control and mitigation measures within the works areas; they should also review the environmental situation outside the works areas which is likely to be affected, directly or indirectly, by the site activities. The ET leader should make reference to the following information in conducting the inspection:
- i. The EIA recommendations and requirements on environmental protection and pollution control mitigation measures.
 - ii. Works progress, programme, site/aerial photos and site plans.
 - iii. Individual works methodology proposals (which should include proposal on associated pollution control measures).
 - iv. Contract specifications on environmental protection and pollution prevent control.
 - v. Relevant environmental protection and pollution control laws, ProPECC Notes.
 - vi. Previous site inspection results.
- 8.4 The Contractor should update the ET leader with all relevant information of the construction contract necessary for him to carry out site inspections. Inspection results and associated recommendations for improvements in the Project's environmental performance should be submitted to the IEC and the Contractor within 24 hours for reference and for taking immediate remedial action. The Contractor should follow the procedures and time-frame as stipulated in the environmental site inspection, deficiency and remedial action reporting system (formulated by the ET leader), to report on any remedial measures subsequent to the site inspections.
- 8.5 The ET and/or IEC should also carry out ad hoc site inspections if major unacceptable or unforeseen environmental problems are identified. Inspections may also be required subsequent to receipt of an environmental complaint, or as part of the investigation work, as specified in the Action Plan for environmental monitoring and audit.

Compliance with Legal and Contractual Requirements

- 8.6 There are contractual environmental protection and pollution control requirements as well as environmental protection and pollution control laws in Hong Kong with which construction activities should comply.
- 8.7 The ET leader should also review the progress and programme of the works to check that relevant environmental laws have not been violated, and that any foreseeable potential for violating laws can be prevented.

- 8.8 The Contractor should regularly copy relevant documents to the ET leader so that the checking of the Project's environmental performance can be carried out effectively. Documents to be submitted by the Contractor should include at least the updated Works Progress Reports, Works Programme, application for any necessary licence / permits under relevant environmental protection laws, and all the valid licence / permits received to date. The site diary should also be available for the ET leader's inspection upon his request.
- 8.9 After reviewing the documents, the ET leader should advise the Contractor and inform the IEC of any non-compliance with the project contractual and legislative requirements on environmental protection and pollution control. The Contractor should take follow-up and appropriate remedial actions. If the ET leader's review concludes that the current status of licence / permit application and any planned environmental protection and pollution control works may not cope with the works programme, or potential violation of environmental protection and pollution control requirements may arise, he should advise the Contractor and ER accordingly. The review should be copied to IEC for any follow-up action.
- 8.10 Upon receipt of the advice, the Contractor should undertake immediate action to remedy the situation. The ER should follow up to check that appropriate action has been taken by the Contractor to satisfy Project's environmental protection and pollution control requirements

Environmental Complaints

- 8.11 Complaints should be referred to the ET leader for carrying out complaint investigation procedures. The ET leader should undertake the following procedures upon receipt of any complaint:
- (i) Log complaint and date of receipt onto the complaint database and inform the IEC immediately.
 - (ii) Investigate the complaint to determine its validity, and assess whether the source of the problem is due to works activities.
 - (iii) Identify mitigation measures in consultation with the IEC if a complaint is valid and due to works.
 - (iv) Advise the Contractor accordingly if mitigation measures are required.
 - (v) Review the Contractor's response to identified and required mitigation measures, and the current situation.
 - (vi) If the complaint is transferred from the EPD, submit interim report to the EPD on the status of the complaint investigation and follow-up action within the time frame assigned by the EPD.
 - (vii) Undertake additional monitoring and audit to verify the situation if necessary, and check that any valid reason for complaint does not recur through the proposed amendments to work methods, procedures, machines and/or equipment, etc.
 - (viii) Report investigation results and subsequent actions to complainant (if the source of complaint is EPD, the results should be reported within the timeframe assigned by the EPD).
 - (ix) Log a record of the complaint, investigation, the subsequent actions and the results in the monthly EM&A reports.
- 8.12 During the complaint investigation work, the Contractor and ER should cooperate with the ET leader in providing all necessary information and assistance for completion of the investigation. If mitigation measures (in consultation with the IEC) are required following the investigation, the Contractor should promptly carry out the measures. The ER should check that the measures have been carried out by the Contractor.

9. REPORTING

General

- 9.1 Reports can be provided in an electronic medium upon agreeing the format with EPD. This would enable a transition from a paper / historic and reactive approach to an electronic / real time proactive approach. All the monitoring data (baseline and impact) should also be submitted on diskettes. The format for noise monitoring data to be submitted on diskette is shown in **Appendix B**.
- 9.2 Types of reports that the ET leader should prepare and submit include baseline monitoring report, monthly EM&A report, quarterly EM&A summary report and final EM&A review report. In accordance with Annex 21 of the EIAO-TM, a copy of the monthly, quarterly summary and final review EM&A reports should be made available to the Director of Environmental Protection.

Baseline Monitoring Report

- 9.3 The ET leader should prepare and submit a Baseline Environmental Monitoring Report within 10 working days of completion of the baseline monitoring. Copies of the Baseline Environmental Monitoring Report should be submitted to the Contractor, the IEC, the ER and the EPD. The ET leader should liaise with the relevant parties on the exact number of copies they require. The report format and baseline monitoring data format should be agreed with the EPD prior to submission.
- 9.4 The baseline monitoring report should include at least the following:
- (i) Up to half a page executive summary.
 - (ii) Brief project background information.
 - (iii) Drawings showing locations of the baseline monitoring stations.
 - (iv) Monitoring results (in both hard and diskette copies) together with the following information:
 - Monitoring methodology.
 - Types of equipment used and calibration details.
 - Parameters monitored.
 - Monitoring locations.
 - Monitoring date, time, frequency and duration.
 - Quality assurance (QA) / quality control (QC) results and detection limits.
 - (v) Details of influencing factors, including:
 - Major activities, if any, being carried out on the site during the period.
 - Weather conditions during the period.
 - Other factors which might affect results.
 - (vi) Determination of the Action and Limit Levels for each monitoring parameter and statistical analysis of the baseline data, the analysis should conclude if there is any significant difference between control and impact stations for the parameters monitored.
 - (vii) Revisions for inclusion in the EM&A Manual.
 - (viii) Comments, recommendations and conclusions.

Monthly EM&A Reports

- 9.5 The results and findings of all EM&A work required in the Manual should be recorded in the monthly EM&A reports prepared by the ET leader. The EM&A report should be prepared and submitted within 10 working days of the end of each reporting month, with the first report due the month after construction commences. Each monthly EM&A report should be submitted to the following parties: the Contractor, the IEC, the ER and the EPD. Before submission of the first EM&A report, the ET leader should liaise with the parties on the required number of copies and format of the monthly reports in both hard copy and electronic medium.
- 9.6 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

- 9.7 The first monthly EM&A report should include at least 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.
 - Future key issues.
 - (ii) Basic project information:
 - Project organisation including key personnel contact names and telephone numbers.
 - Construction programme.
 - Management structure, and
 - Works undertaken during the month.
 - (iii) Environmental status:
 - Works undertaken during the month with illustrations (such as location of works).
 - Drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations (with co-ordinates of the monitoring locations).
 - (iv) A brief summary of EM&A requirements including:
 - All monitoring parameters.
 - Environmental quality performance limits (Action and Limit levels).
 - Event-Action Plans.
 - Environmental mitigation measures, as recommended in the project EIA study final report.
 - 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 project EIA.
- (vi) Monitoring results (in both hard and diskette copies) together with the following information:
 - Monitoring methodology.
 - Name of types of equipment used and calibration details.
 - Parameters monitored.
 - Monitoring locations.
 - Monitoring date, time, frequency, and duration.
 - Weather conditions during the period.
 - Any other factors which might affect the monitoring results.
 - QA/QC results and detection limits.
- (vii) Report on non-compliance, complaints, and notifications of summons and successful prosecutions:
 - Record of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels).
 - Record of all complaints received (written or verbal) for each media, including locations and nature of complaints investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary.
 - Record of all notification of summons and successful prosecutions for breaches of current environmental protection / pollution control legislation, including locations and nature of the breaches, investigation, follow-up actions taken, results and summary.
 - Review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures.
 - Description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance.
- (viii) Others
 - An account of the future key issues as reviewed from the works programme and work method statements.
 - Advice on the solid and liquid waste management status.
 - Comments (for examples, effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions.

Subsequent Monthly EM&A Reports

9.8 Subsequent monthly EM&A reports should include the following:

- (i) Executive summary (1 - 2 pages):
 - Breaches of Action and Limit levels.
 - Complaints log.
 - Notifications of any summons and successful prosecutions.
 - Reporting changes.
 - Future key issues.
- (ii) Environmental status:
 - Works undertaken during the month with illustrations (such as location of works etc.).
 - Drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations.
- (iii) Implementation status:
 - Advice on the implementation status of environmental protection and pollution control / mitigation measures, as recommended in the project EIA.
- (iv) Monitoring results (in both hard and diskette copies) together with the following information:
 - Monitoring methodology.
 - Name of types of equipment used and calibration details.
 - Parameters monitored.
 - Monitoring locations.
 - Monitoring date, time, frequency, and duration.
 - Weather conditions during the period.
 - Any other factors which might affect the monitoring results.
 - QA / QC results and detection limits.
- (v) Report on non-compliance, complaints, and notifications of summons and successful prosecutions:
 - Record of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels).
 - Record of all complaints received (written or verbal) for each media, including locations and nature of complaints investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary.
 - Record of all notification of summons and successful prosecutions for breaches of current environmental protection / pollution control legislation, including locations and nature of the breaches, investigation, follow-up actions taken, results and summary.

- Review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures.
 - Description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance.
- (vi) Others
- An account of the future key issues as reviewed from the works programme and work method statements.
 - Advice on the solid and liquid waste management status.
 - Comments (for examples, effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions.
- (vii) Appendix
- Action and Limit levels.
 - Graphical plots of trends of monitored parameters at key stations over the past four reporting periods for representative monitoring stations annotated against the following:
 - major activities being carried out on site during the period.
 - weather conditions during the period.
 - 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.

Quarterly EM&A Summary Reports

- 9.9 A quarterly EM&A summary report of around five pages should be produced and should contain at least the following information.
- (i) Up to half a page executive summary.
 - (ii) Basic project information including a synopsis of the project organisation, programme, contacts of key management, and a synopsis of works undertaken during the quarter.
 - (iii) A brief summary of EM&A requirements including:
 - Monitoring parameters.
 - Environmental quality performance limits (Action and Limit levels).
 - Environmental mitigation measures, as recommended in the project EIA Final Report.
 - (iv) Advice on the implementation status of environmental protection and pollution control / mitigation measures, as recommended in the project EIA Final Report, summarised in the updated implementation schedule.

- (v) Drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations.
- (vi) Graphical plots of any trends in monitored parameters over the past four months (the last month of the previous quarter and the present quarter) for representative monitoring stations annotated against:
 - Major activities being carried out on site during the period.
 - Weather conditions during the period.
 - Any other factors which might affect the monitoring results.
- (vii) Advice on the solid and liquid waste management status.
- (viii) A summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels).
- (ix) A brief review of the reasons for and the implications of any non-compliance, including a review of pollution sources and working procedures.
- (x) A summary description of actions taken in the event of non-compliance and any follow-up procedures related to any earlier non-compliance.
- (xi) A summarised record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken.
- (xii) Comments (for examples, a review of the effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions for the quarter.
- (xiii) Proponents' contacts and any hotline telephone number for the public to make enquiries.

Final EM&A Review Report

9.10 The final EM&A report should include, inter alia, the following information:

- (i) An executive summary.
- (ii) Drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations.
- (iii) Basic project information including a synopsis of the project organisation, contacts of key management, and a synopsis of work undertaken during the entire construction period.
- (iv) A brief summary of EM&A requirements including:
 - Monitoring parameters.
 - Environmental quality performance limits (Action and Limit levels).
 - Environmental mitigation measures, as recommended in the project EIA study final report.
 - Event-Action Plans.
- (v) A summary of the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the project EIA Report, summarised in the updated implementation schedule.

- (vi) Graphical plots of the trends of monitored parameters over the construction period for representative monitoring stations, including the post-project monitoring annotated against:
 - The major activities being carried out on site during the period.
 - Weather conditions during the period.
 - 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).
- (xi) A brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures as appropriate.
- (xii) A summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance.
- (xiii) A summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken.
- (xiv) 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 in EIA recommendations.
- (xiii) Comments (for examples, 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).
- (xiv) Recommendations and conclusions (for example, a review of success of the overall EM&A programme to cost-effectively identify deterioration and to initiate prompt effective mitigatory action when necessary).

Data Keeping

- 9.11 No site-based documents (such as monitoring field records, laboratory analysis records, site inspection forms, etc.) are required to be included in the monthly EM&A reports. However, any such document should be well kept by the ET leader 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. Data format should be agreed with EPD. All documents and data should be kept for at least one year following completion of the construction contract.

Interim Notifications of Environmental Quality Limit Exceedances

- 9.12 With reference to the Event and Action Plan, when the environmental quality performance limits are exceeded, the ET leader should immediately notify the IEC and EPD, as appropriate. The notification should be followed up with advice to IEC and EPD on the results of the investigation, proposed actions and success of the actions taken, with any necessary follow-up proposals. A sample template for the interim notifications is presented in Appendix C.