

Drainage Services Department
Consultants Management Division
42/F, Revenue Tower
5 Gloucester Road
Wanchai, Hong Kong

**Agreement No. CE 80/2001(DS)
Drainage Improvement in
Tsuen Wan and Kwai Chung –
Tsuen Wan Drainage Tunnel**

**Environmental Monitoring & Audit
Manual**

Document No. 204417/28/B

June 2005

Mott Connell Limited
40/F, Hopewell Centre
183 Queen's Road East
Wan Chai, Hong Kong

List of Contents	Page
Chapters	
1 INTRODUCTION	4
1.1 Purpose of the Manual	4
1.2 Review of the EM&A Manual	5
1.3 Background	5
1.4 Site Location	5
1.5 Sensitive Receivers	5
1.6 Environmental Monitoring and Audit Requirements	6
1.7 Project Organisation	6
1.8 Construction Programme	7
2 AIR QUALITY	8
2.1 Introduction	8
2.2 Air Quality Parameters	8
2.3 Monitoring Equipment	8
2.4 Monitoring Locations	8
2.5 Baseline Monitoring	9
2.6 Impact Monitoring	10
2.7 Event and Action Plan for Air Quality	10
3 NOISE	13
3.1 Introduction	13
3.2 Noise Parameters	13
3.3 Monitoring Equipment	13
3.4 Monitoring Locations	13
3.5 Baseline Monitoring	14
3.6 Impact Monitoring	14
3.7 Event and Action Plan for Noise	15
3.8 Construction Groundborne Noise	16
4 WATER QUALITY	18
4.1 Introduction	18

4.2	Water Quality Parameters	18
4.3	Sampling Procedures and Monitoring Equipment	18
4.3.1	Dissolved Oxygen and Temperature Measuring Equipment	18
4.3.2	Turbidity Measurement Instrument	19
4.3.3	Sample Containers and Storage for Suspended Solids Measurement	19
4.3.4	Calibration of In-Situ Instruments	19
4.3.5	Laboratory Measurement/Analysis	19
4.4	Monitoring Locations	19
4.5	Baseline Monitoring	20
4.6	Impact Monitoring	21
4.7	Event and Action Plan for Water Quality	22
5	ECOLOGY	25
5.1	Introduction	25
5.2	Ecological Mitigation Measures during the Construction Phase	25
5.3	Monitoring and Auditing of Mitigation Measures	25
6	FISHERIES	26
6.1	Introduction	26
7	CULTURAL HERITAGE	27
7.1	Introduction	27
7.2	Environmental Monitoring & Audit	27
8	WASTE MANAGEMENT	28
8.1	Introduction	28
8.2	Environmental Monitoring & Audit	28
9	SITE ENVIRONMENTAL AUDIT	29
9.1	Introduction	29
9.2	Compliance with Legal and Contractual Requirements	30
9.3	Environmental Complaints	30
10	REPORTING	32
10.1	General	32
10.2	Baseline Monitoring Report	32
10.3	EM&A Reports	33
10.4	Data Keeping	38
10.5	Interim Notifications of Environmental Quality Limit Exceedances	39

Tables

Table 2.1	Dust Monitoring Stations	9
Table 2.2	Action and Limit Levels for Air Quality	10
Table 2.3	Event/Action Plan for Air Quality	11
Table 3.1	Noise Monitoring Stations	14
Table 3.2	Action and Limit Levels for Construction Noise	15
Table 3.3	Event/Action Plan for Construction Noise	15
Table 4.1	Typical Action and Limit Levels for Water Quality	22
Table 4.2	Event/Action Plan for Water Quality	23

Figures

Figure 1.1	Location Plan
Figure 1.2a	Location of Representative Sensitive Receivers Around Intake I-1
Figure 1.2b	Location of Representative Sensitive Receivers Around Intake I-2
Figure 1.2c	Location of Representative Sensitive Receivers Around Intake I-3
Figure 1.2d	Location of Representative Sensitive Receivers Around Outfall O-1
Figure 1.3	Project Organisation and Lines of Communication
Figure 1.4	Outline Construction Programme
Figure 1.5	Proposed Monitoring Locations for Water Quality During Construction and Post Construction Ground Water

Annexes

Annex A	Implementation Schedule
Annex B	Environmental Monitoring Data Recording Sheets
Annex C	Complaint Log
Annex D	Interim Notification of Environmental Quality Limit Exceedances

1 INTRODUCTION

1.1 Purpose of the Manual

The purpose of this Environmental Monitoring and Audit (EM&A) Manual, hereafter referred to as the Manual, is to guide the setup of an EM&A programme to ensure compliance with the Environmental Impact Assessment (EIA) study recommendations, to assess the effectiveness of the recommended mitigation measures and to identify any further need for additional mitigation measures or remedial action. This Manual outlines the monitoring and audit programme proposed for the Drainage Improvement in Tsuen Wan and Kwai Chung - Tsuen Wan Drainage Tunnel.

This Manual contains the following:

- a) responsibilities of the Contractor, the Engineer or Engineer's Representative (ER) Independent Environmental Checker (IEC) and Environmental Team (ET) with respect to the environmental monitoring and audit requirements during the course of the project;
- b) information on project organisation and programming of construction activities for the project;
- c) the hypotheses of potential impacts, the basis for and description of the broad approach underlying the environmental monitoring and audit programme;
- d) requirements with respect to the construction schedule and the necessary environmental monitoring and audit programme to track the varying environmental impacts;
- e) the specific questions and testable hypotheses that the monitoring programme is designed to answer;
- f) details of the methodologies to be adopted, including all field, laboratory and analytical procedures, and details on quality assurance and quality control programme;
- g) the rationale on which the environmental monitoring data will be evaluated and interpreted and the details of the statistical procedures that will be used to interpret the data;
- h) definition of Action and Limit levels (AL Levels);
- i) establishment of Event and Action Plans;
- j) requirements for reviewing pollution sources and working procedures required in the event of non-compliance of the environmental criteria and complaints;
- k) requirements for presentation of environmental monitoring and audit data and appropriate reporting procedures; and
- l) requirements for review of EIA predictions and effectiveness of the environmental monitoring and audit programme.

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

1.2 Review of the EM&A Manual

It shall be noted that this EM&A Manual is subject to changes. The Manual shall be reviewed and updated later, where necessary, near the commencement of construction of the Project.

1.3 Background

The Drainage Services Department (DSD) proposes to construct a tunnel of an internal diameter of 6.5m and length 5.13km in order to alleviate the flooding risk in Tsuen Wan and Kwai Chung.

This project is a Designated Project under Schedule 2 Part I Category Q, of the Environmental Impact Assessment Ordinance (EIAO) as part of the proposed Tsuen Wan Drainage Tunnel passes underneath the existing Tai Mo Shan Country Park. An Environmental Impact Assessment (EIA) Study has therefore been undertaken to provide information on the nature and extent of environmental impacts arising from the construction and operation of the proposed designed project and related activities taking place concurrently. From the EIA the recommendations for monitoring contained herein, are made.

1.4 Site Location

The proposed tunnel section flows from the junction of Shing Mun Road and Wo Yi Hop Road and discharges to south of Yau Kom Tau underneath Castle Peak Road as shown in **Figure 1.1**.

1.5 Sensitive Receivers

Sensitive receivers have been identified in the EIA and are shown on **Figures 1.2a, 1.2b, 1.2c and 1.2d**. Representative Sensitive Receivers (SRs) used for air, noise and water are selected according to the criteria set out in the TMEIA and listed as follows:

- Sik Sik Yuen Ho Fung College and Kwai Shue House at Intake I-1 (ASR and NSR);
- Hong Hoi Chee Hong Temple, Yuen Yuen Care and Attention Home for the Aged and Western Monastery at Intake I-2 (ASR and NSR);
- Squatters and Route Twisk Villa at Intake I-3 (ASR and NSR);
- Beach Tower (Long Beach Gardens) and Greenview Terrace at Outfall O-1 (ASR and NSR);
- Rambler Channel (ASR and NSR);
- Ma Wan Tung Wan Beach and Sam Dip Tam (ASR and NSR);
- Bathing Beaches (WSR);
- Fish Culture Zone (WSR);
- Water Recreational Areas (WSR); and

- Water Gathering Grounds (WSR);

1.6 Environmental Monitoring and Audit Requirements

The EIA study identified the likely environmental impacts during construction and operational phases including dust, noise, water quality, waste management, fisheries, ecology and cultural heritage. These impacts can be minimised to acceptable levels with the implementation of environmental mitigation measures and environmental monitoring and audit requirements. An Implementation Schedule of the environmental mitigation measures recommended in the EIA Report is described in **Annex A**. In order to ensure the acceptability, monitoring and audit requirements have been identified and are described in details in the subsequent sections.

1.7 Project Organisation

The proposed project organisation is shown in **Figure 1.3**. The responsibilities of respective parties are:

The Contractor

- provide assistance to ET in carrying out monitoring;
- submit proposals on mitigation measures in case of exceedances of Action and Limit levels in accordance with the Event and Action Plans;
- implement measures to reduce impact where Action and Limit levels are exceeded, and
- adhere to the procedures for carrying out complaint investigation in accordance with *Section 9.3*.

The Engineer or Engineers Representative

- supervise the Contractors activities and ensure that the requirements in the EM&A Manual are fully complied with;
- inform the Contractor when action is required to reduce impacts in accordance with the Event and Action Plans;
- employ an IEC to audit the results of the EM&A works carried out by the ET; and
- adhere to the procedures for carrying out complaint investigation in accordance with *Section 9.3*.

The Environmental Team

- monitor the various environmental parameters as required in the EM&A Manual;
- analyse 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 inspections to investigate and audit the Contractor's site practice, equipment and work methodologies with respect to pollution control and environmental mitigation, and anticipate environmental issues for proactive action before problems arise;
- audit and prepare audit reports on the environmental monitoring data and the site environmental conditions;
- report on the EM&A results to the IEC, Contractor, the ER, and the EPD;

- recommend suitable mitigation measures to the Contractor in the case of exceedance of action and Limit levels in accordance with the Event and Action Plans; and
- adhere to the procedures for carrying out complaint investigation in accordance with *Section 9.3*.

The ET leader shall have relevant professional qualifications, or have sufficient relevant EM&A experience subject to approval of the ER and the Environmental Protection Department (EPD).

Independent Environmental Checker

- review the EM&A works performed by the ET;
- audit the monitoring activities and results;
- evaluate the EM&A reports submitted by the ET;
- review the proposals for mitigation measures submitted by the Contractor in accordance with the Event and Action Plans; and
- adhere to the procedures for carrying out complaint investigation in accordance with *Section 9.3*.

Sufficient and suitably qualified professional and technical staff shall be employed by the respective parties to ensure full compliance with their duties and responsibility, as required under the EM&A programme for the duration of the project. The ET shall not be in any way an associated body of the Contractor.

1.8 Construction Programme

A preliminary project programme is shown in **Figure 1.4**.

The major construction activities are tunnel construction, drill & blast, concreting works, excavation and piling.

Construction of the proposed tunnel, intake structures and outfall are planned to commence in mid 2007 for completion by late 2011.

2 AIR QUALITY

2.1 Introduction

The Contractor shall follow the Air Pollution Control (Construction Dust) Regulation to implement dust mitigation measures during construction to minimise the dust impact to the nearby air sensitive receivers and to ensure the effectiveness of the implementation of dust mitigation measures recommended in the EIA Report.

2.2 Air Quality Parameters

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 actions taken to rectify the situation.

Monitoring will examine 1-hour TSP levels where exceedances have been predicted. 1-hour TSP levels shall be measured by direct reading methods to indicate the impacts of construction dust on air quality.

All relevant data including temperature, pressure, weather conditions, reading for the start and stop of the sampler, and other special phenomena and work progress of the concerned site etc. shall be recorded down in details. A sample data sheet is shown in **Annex B**.

2.3 Monitoring Equipment

The ET Leader is responsible for provision of the monitoring equipment. He shall ensure that sufficient number of equipment with appropriate calibration kits are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. All the equipment shall be clearly labelled.

Calibration of dust monitoring equipment shall be conducted as specified by the manufacturer. The calibration data shall be properly documented for future reference. All the data shall be converted into standard temperature and pressure condition.

2.4 Monitoring Locations

The dust monitoring locations (Refer to **Figure 1.2a - 1.2b**) are summarised in **Table 2.1**. As approval is needed from the premises landlord for dust monitoring equipment installation, it is not certain that a suitable location will be approved. The status and locations of dust sensitive receivers may change after issuing this manual. If such cases exist, the ET Leader shall propose updated monitoring locations and seek agreement from ER, IEC and EPD.

Table 2.1 Dust Monitoring Stations

Description	Monitoring Station	Location
Sik Sik Yuen Ho Fung College	ASR 1	Intake 1
Hong Hoi Chee Hong Temple	ASR 3	Intake 2
Beach Tower (Long Beach Gardens)	ASR 8	Outfall 1
Greenview Terrace (Block 1)	ASR 9	Outfall 1

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

- a) at the site boundary or such locations close to the major dust emission source;
- b) close to the sensitive receptors; and
- c) take into account the prevailing meteorological conditions.

When positioning the samplers, the following points shall be noted:

- a) only one at each location;
- b) 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;
- c) a minimum of 2 metres of separation from walls, parapets and penthouses is required;
- d) a minimum of 2 metres separation from any supporting structure, measured horizontally is required;
- e) no furnace or incinerator flue or building vent is nearby;
- f) airflow around the sampler is unrestricted;
- g) the sampler is more than 20 metres from the dripline;
- h) any wire fence and gate, to protect the sampler, shall not cause any obstruction during monitoring;
- i) permission must be obtained to gain access to the monitoring stations; and
- j) if needed, a secured supply of electricity shall be obtained to operate the samplers.

2.5 Baseline Monitoring

The ET shall carry out 1-hour TSP baseline sampling 3 times per day at all of the designated monitoring locations for at least 14 consecutive days prior to the commissioning of the construction works.

During the baseline monitoring, there shall not be any construction or dust generation activities in the vicinity of the monitoring stations. A schedule on the baseline monitoring shall be submitted to the ER and IEC for approval before the monitoring starts.

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

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 and submit to ER for approval.

Ambient conditions may vary seasonally and shall be reviewed as required. If the ET considers that the ambient conditions have been changed and a repeat of the baseline monitoring is required to be carried out for obtaining the updated baseline levels, the monitoring shall be at times when the contractor's activities are not generating dust, at least in the proximity of the monitoring stations. Should a change in ambient conditions be determined, the baseline levels and, in turn, the air quality criteria, shall be revised. The revised baseline levels and air quality criteria shall be agreed with EPD and IEC.

2.6 Impact Monitoring

The ET is responsible for impact monitoring during the course of the works. For 1-hr TSP monitoring, the sampling frequency of at least three times in every six-days shall be undertaken when the highest dust impact occurs.

In case of non-compliance with the air quality criteria, more frequent monitoring exercise, as specified in the Action Plan in *Section 2.7*, shall be conducted within 24 hours after the result is obtained. This additional monitoring shall be continued until the excessive dust emission or the deterioration in air quality is rectified.

2.7 Event and Action Plan for Air Quality

The baseline monitoring results form the basis for determining the air quality criteria for the impact monitoring. The ET shall compare the impact monitoring results with air quality criteria set up for 1-hour TSP level. **Table 2.2** shows the air quality criteria, namely Action and Limit (AL) Levels to be used. Should non-compliance of the air quality criteria occurs, actions in accordance with the Action Plan in **Table 2.3** shall be carried out.

Table 2.2 Action and Limit Levels for Air Quality

Parameters	Action	Limit
1-hour TSP Level in $\mu\text{g}/\text{m}^3$	For baseline level $\leq 384 \mu\text{g}/\text{m}^3$, Action level = $(130\% \text{ of baseline level} + \text{Limit level})/2$ For baseline level $> 384 \mu\text{g}/\text{m}^3$, Action level = Limit Level	500

Table 2.3 Event/Action Plan for Air Quality

Event	Action			
	ET Leader	IEC	ER	Contractor
Action Level				
1. Exceedance for one sample	1. Identify source, investigate the causes of exceedance and propose remedial measures. 2. Inform IEC and ER. 3. Repeat measurement to confirm finding. 4. Increase monitoring frequency to daily.	1. Check monitoring data submitted by ET. 2. Check Contractor's working method.	1. Notify Contractor.	1. Rectify any unacceptable practice. 2. Amend working methods if appropriate.
2. Exceedance for two or more consecutive samples	1. Identify the source. 2. Inform IEC and ER. 3. Advise ER on the effectiveness of the proposed remedial measures 4. Repeat measurements to confirm findings. 5. Increase monitoring frequency to daily. 6. Discuss with IEC and the Contractor on remedial actions required. 7. If exceedance continues, arrange meeting with IEC and ER. 8. If exceedance stops, cease additional monitoring.	1. Check monitoring data submitted by ET. 2. Check the Contractor's working method. 3. Discuss with ET Leader and the Contractor on possible remedial measures. 4. Advise ER on the effectiveness of the proposed remedial measures. 5. Supervise implementation of remedial measures.	1. Confirm receipt of notification of exceedance in writing. 2. Notify the Contractor. 3. Ensure remedial measures properly implemented.	1. Submit proposals for remedial actions to IEC within 3 working days of notification. 2. Implement the agreed proposals. 3. Amend proposal if appropriate.
Limit Level				
1. Exceedance for one sample	1. Identify source, investigate the causes of exceedance and propose remedial measures. 2. Inform ER and EPD. 3. Repeat measurement to confirm finding. 4. Increase monitoring frequency to daily. 5. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results.	1. Check monitoring data submitted by ET. 2. Check the Contractor's working method. 3. Discuss with ET Leader and the Contractor on possible remedial measures. 4. Advise ER on the effectiveness of the proposed remedial measures. 5. Supervise implementation	1. Confirm receipt of notification of exceedance in writing. 2. Notify the Contractor. 3. Ensure remedial measures properly implemented.	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. Amend proposal if appropriate.

Event	Action			
	ET Leader	IEC	ER	Contractor
		of remedial measures.		
2. Exceedance for two or more consecutive samples	1. Notify IEC, ER, EPD and the Contractor. 2. Identify the source. 3. Repeat measurements to confirm findings. 4. Increase monitoring frequency to daily. 5. Carry out analysis of the Contractor's working procedures to determine possible mitigation to be implemented. 6. Arrange meeting IEC and ER to discuss the remedial actions to be taken. 7. Assess effectiveness of the Contractor's remedial actions and keep IEC, EPD and ER informed of the results. 8. If exceedance stops, cease additional monitoring.	1. Discuss amongst ER, ET Leader and the Contractor on the potential remedial actions. 2. Review the Contractor's remedial actions whenever necessary and advise ER accordingly. 3. Supervise the implementation of remedial measures.	1. Confirm receipt of notification of exceedance in writing. 2. Notify the Contractor. 3. In consultation with IEC, agree with the remedial measures to be implemented. 4. Ensure remedial measures are properly implemented. 5. If exceedance continues, consider what activity of the work is responsible and instruct the Contractor to stop that activity of work until the exceedance is abated.	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 activity of works as determined by ER until the exceedance is abated.

3 NOISE

3.1 Introduction

The monitoring programme shall be carried out by the ET to ensure that the noise level of construction works complies with the 75dB(A) criterion for domestic premises, with 70 dB(A) for schools and with a further reduction to 65dB(A) during examination periods.

3.2 Noise Parameters

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

A 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 **Annex B** for reference.

3.3 Monitoring Equipment

As refer to the Technical Memorandum (TM) issued under the Noise Control Ordinance (NCO), sound level metres 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. The calibration of the sound level meters and their respective calibrators shall be carried out in accordance with the manufacturer's requirements.

Noise measurements shall not be made in the presence of fog, rain, wind with a steady speed exceeding 5 ms⁻¹ or wind with gusts exceeding 10 ms⁻¹.

The ET Leader is responsible for the provision and maintenance of the monitoring equipment. He shall ensure that sufficient noise measuring equipment and associated instrumentation are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. All the equipment and associated instrumentation shall be clearly labelled. The location of equipment installation should be proposed by the ET Leader and agreed with the ER and EPD in consultation with the IEC.

3.4 Monitoring Locations

The noise monitoring locations (Refer to **Figure 1.2a - 1.2b**) are summarised in **Table 3.1**. The status and locations of noise sensitive receivers may change after issuing this manual. If such cases exist, the ET Leader shall propose updated monitoring locations and seek agreement from ER, IEC and EPD.

Table 3.1 Noise Monitoring Stations

Description	Monitoring Station	Location
Sik Sik Yuen Ho Fung College	NSR 1	Intake 1
Hong Hoi Chee Hong Temple	NSR 3	Intake 2
Squatters	NSR 6	Intake 3
Beach Tower (Long Beach Gardens)	NSR 8	Outfall 1
Greenview Terrace (Block 1)	NSR 9	Outfall 1

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

- at locations close to the major site activities which are likely to have noise impacts;
- close to the noise sensitive receivers (any domestic premises, temporary housing accommodation, educational institution, place of public worship, shall be considered as a noise sensitive receiver); and
- for monitoring locations located in the vicinity of the sensitive receivers, care shall 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 sensitive receivers building facade and be at a position 1.2m above the ground. If there is a problem with access to the normal monitoring position, an alternative position may be chosen, and a correction to the measurements shall be made. For reference, a correction of +3dB(A) shall be made to the free field measurements. The ET Leader shall agree with the IEC on the monitoring positions and the correction adopted. Once the positions for the monitoring stations are chosen, the baseline monitoring and the impact monitoring shall be carried out at the same positions.

3.5 Baseline Monitoring

The ET shall carry out baseline noise monitoring prior to the commencement of the construction works. There shall not be any construction activities in the vicinity of the stations during the baseline monitoring. Continuous baseline noise monitoring for the A-weighted levels L_{Aeq} , L_{A10} and L_{A90} shall be carried out daily for a period of at least two weeks in a sample period of 30 minutes between 0700 and 1900. A schedule on the baseline monitoring shall be submitted to the ER and IEC for approval before the monitoring starts.

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

3.6 Impact Monitoring

During normal construction working hour (0700-1900 Monday to Saturday), monitoring of $L_{Aeq, 30min}$ noise levels (or as six consecutive $L_{Aeq, 5min}$ readings) shall be carried out at the

agreed monitoring locations once every week in accordance with the methodology in the TM.

Other noise sources such as road traffic may make a significant contribution to the overall noise environment. Therefore, the results of noise monitoring activities will take into account such influencing factors, which may not be presented during the baseline monitoring period.

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

3.7 Event and Action Plan for Noise

The AL Levels for construction noise are defined in **Table 3.2**. Should non-compliance of the criteria occurs, action in accordance with the Action Plan in **Table 3.3**, 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)

Note:

* 70 dB(A) for schools and 65 dB(A) during school examination periods.

Table 3.3 Event/Action Plan for Construction Noise

Event	Action			
	ET Leader	IEC	ER	Contractor
Action Level	1. Notify IEC and the Contractor. 2. Carry out investigation. 3. Report the results of investigation to IEC and the Contractor. 4. Discuss with the Contractor and formulate remedial measures. 5. Increase monitoring frequency to check mitigation measures.	1. Review with analysed results submitted by ET. 2. Review the proposed remedial measures by the Contractor and advise ER accordingly. 3. Supervise the implement of remedial measures.	1. Confirm receipt of notification of exceedance in writing. 2. Notify the Contractor. 3. Require the Contractor to propose remedial measures for the analysed noise problem. 4. Ensure remedial measures are properly implemented.	1. Submit noise mitigation proposals to IEC. 2. Implement noise mitigation proposals.

Event	Action			
	ET Leader	IEC	ER	Contractor
Limit Level	1. Identify the source. 2. Notify IEC, ER, EPD and the Contractor. 3. Repeat measurement 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 & actions taken for the exceedances. 7. Assess effectiveness of the Contractor's remedial actions and keep IEC, EPD and ER informed of the results. 8. If exceedance stops, cease additional monitoring.	1. Discuss amongst ER, ET Leader and the Contractor on the potential remedial actions. 2. Review the Contractor's remedial actions whenever necessary to assure their effectiveness and advise ER accordingly. 3. Supervise the implementation of remedial measures.	1. Confirm receipt of notification of exceedance in writing. 2. Notify the Contractor. 3. Require the Contractor to propose remedial measures for the analysed noise problem. 4. Ensure remedial measures are properly implemented. 5. If exceedance continues, consider what activity of the work is responsible and instruct the Contractor to stop that activity of work until the exceedance is abated.	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 activity of works as determined by the ER until the exceedance is abated.

3.8 Construction Groundborne Noise

Prediction of construction groundborne noise indicates the criteria will be achieved at most NSRs except exceedances are predicted at Hong Hoi Chee Hong Temple (NSR3) and Squatters (ASR6). It is recommended to restrict the TBM operation in non-restricted period (i.e. 0700 - 1900) at these NSRs. In order to ensure proper control of groundborne noise is executed by the contractor, a monitoring requirement is recommended at the Hong Hoi Chee Hong Temple at Intake 2 and Squatters at Intake 3 for compliance checking. According to the monitoring schedule, TBM operation would be carried out for about 3 months in the vicinity of Hong Hoi Chee Hong Temple at intake 2 and Squatters at intake 3. If groundborne noise criterion is exceeded, the monitoring shall continue daily until acceptance has been restored against the criterion. Otherwise the monitoring can be discontinued.

The criterion include TM for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (TM-Places) under the NCO stipulates that noise transmitted primarily through the structural elements of building, or buildings, shall be 10 dB(A) less than the relevant ANLs. Daytime groundborne construction noise criterion of 60 dB(A) therefore applies with reference to TM-EIAO 70 dB(A) criterion for schools and taking account of the minus 10 dB(A) requirement under the NCO TM-Places. Following the same principle for groundborne noise criteria, groundborne construction noise levels inside domestic premises relying on open window for ventilation will be limited to 65

dB(A), with reference to the daytime airborne noise criterion of 75 dB(A) in accordance with TM-EIAO.

4 WATER QUALITY

4.1 Introduction

An assessment of potential impacts to water quality due to the construction and operation of Drainage Improvement in Tsuen Wan and Kwai Chung - Tsuen Wan Drainage Tunnel has been carried out. As there is no dredging or reclamation required for the project, the water quality impact would be insignificant with the protection measures recommended in Section 5.6 of the EIA report. However in view of the sensitive nature of the rivers/streams and bathing beaches in the Study Area, it is suggested that a programme of monitoring be established to confirm the mitigation measures are protecting these water bodies. The sites and working practices will be audited by the ET.

In the event of spillages an emergency response plan and including monitoring (during and following the event) would need to be effected. Similarly, a response plan for preventing surface water runoff during (or after) a rainstorm/ typhoon will be required to prevent uncontrolled runoff from the construction works sites at the intake structures and outfall. The effectiveness of such measures will be audited as described in Section 5.7 of the EIA report.

4.2 Water Quality Parameters

Monitoring for Dissolved Oxygen (DO), temperature, turbidity, pH, suspended solids (SS) and *E. coli* (during operation) shall be undertaken at designated monitoring locations. The purpose of which is to ensure that any deterioration in water quality can be readily detected and timely action can be taken to resolve any problems. It should be noted that DO, temperature, turbidity and pH should be measured in-situ whereas SS and *E. coli* are assayed in a laboratory.

In association with the water quality parameters, other relevant data shall also be measured, such as monitoring location/position, time, weather conditions, and any special phenomena and description of work underway at the construction site etc.

4.3 Sampling Procedures and Monitoring Equipment

(N.B. Water samples for all monitoring parameters shall be collected, stored, preserved and analysis according to Standard Methods, APHA 17 ed. and/or methods agreed by the Director of Environmental Protection. *In-situ* measurements at monitoring locations including DO, turbidity and water depth shall be collected by equipment with the characteristics and functions listed in the following sections).

The following equipment and facilities shall be provided by the ET and used for the monitoring of water quality impacts:

4.3.1 Dissolved Oxygen and Temperature Measuring Equipment

- (a) The instrument should be portable and weatherproof using a DC power source. The equipment should be capable of measuring:

- a DO level in the range of 0-20 mg/l and 0-200% saturation; and
 - a temperature of between 0-45 degree Celsius.
- (b) It should have a membrane electrode with automatic temperature compensation complete with a cable.

4.3.2 *Turbidity Measurement Instrument*

The instrument should be portable and weatherproof using a DC power source. It should have a photoelectric sensor capable of measuring turbidity between 0-1000 NTU, such as a Hach model 2100P or similar approved.

4.3.3 *Sample Containers and Storage for Suspended Solids Measurement*

Water samples for SS analysis should be stored in high density polythene bottles with no preservative added, packed in ice (cooled to 4°C without being frozen), delivered to the laboratory, and analysed as soon as possible after collection.

4.3.4 *Calibration of In-Situ Instruments*

All pH meters, DO meters and turbidimeters shall be checked and calibrated prior to use. DO meters and turbidimeters shall be calibrated by a laboratory accredited under HOKLAS or any other international accreditation scheme, and subsequently re-calibrated at 3 monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes shall be checked with certified standard solutions before each use. Wet bulb calibrations for all DO meters shall be carried out before measurement at each monitoring location. For the on site calibration of field equipment, BS 127:1993, "Guide to field and on-site test methods for the analysis of waters" should be observed.

4.3.5 *Laboratory Measurement/Analysis*

Analysis shall be carried out in a HOKLAS or other international accredited laboratory. If a site laboratory is set up or a non-HOKLAS or non-international accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment, analytical procedures, and quality control shall be approved by the DEP.

Each sample shall be analysed in accordance with the APHA Standard Methods for the Examination of Water and Wastewater, 18th edition, or an equivalent method approved by the DEP. If an in-house or non-standard method is proposed, details of the method verification may require to be submitted to the DEP. In any circumstance, the sample testing shall comply with a comprehensive quality assurance and quality control programme. The laboratory should be prepared to demonstrate the quality programmes to the DEP when requested.

4.4 **Monitoring Locations**

The water quality monitoring points during construction are proposed to include Kwai Chung Nullah at Intake I-1, Tai Ho Nullah at Intake I-2, Chung Hang Nullah at Intake I-3 (Refer to **Figure 1.5**). Also while the construction of the outfall does not require dredging or

reclamation, it is suggested to undertake monitoring for the period during which the rip rap (to prevent erosion) is placed. The final locations and number of the monitoring points shall be agreed with EPD at least 2 weeks before undertaking any works. The status and locations of water quality sensitive receivers may change after issuing this manual. If such cases exist, the ET leader shall propose updated monitoring locations and seek approval from the ICE and DEP.

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

- (a) at locations close to and preferably at the boundary of the mixing zone of the major site activities as indicated in the EIA final report, which are likely to have water quality impacts;
- (b) close to the sensitive receptors which are directly or likely to be affected;
- (c) for monitoring locations located in the vicinity of the sensitive receptors, care shall be taken to cause minimal disturbance during monitoring;
- (d) two or more control stations which shall be at locations representative of the project site in its undisturbed condition. Control stations shall be located, as far as is practicable, both upstream and down stream of the works area.

Control stations are necessary to compare the water quality from potentially impacted sites with the ambient water quality. Control stations shall be located within the same body of water as the impact monitoring stations but shall be outside the area of influence of the works and, as far as practicable, not affected by any other works.

Measurements shall be taken at 3 water depths, namely, 1m below water surface, mid-depth and 1m above sea bed, except where the water depth less than 6m, the mid-depth station may be omitted. Should the water depth be less than 3m, only the mid-depth station will be monitored. The ET Leader shall seek approval from the IEC and DEP on all the monitoring stations.

Replicates in-situ measurements and samples collected from each independent sampling event are required for all parameters to ensure a robust statistically interpretable dataset.

4.5 Baseline Monitoring

Baseline conditions for the water quality of the sensitive nature of the rivers/streams shall be established and agreed with DEP prior to the commencement of works. The purposes of the baseline monitoring are to establish ambient conditions prior to the commencement of the construction works and to demonstrate the suitability of the proposed impact, control and reference monitoring points.

The baseline conditions shall normally be established by measuring the water quality parameters specified in *Section 4.2*. The measurements shall be taken at all designated monitoring stations including control points, 3 days per week, for at least 4 weeks prior to the commencement of construction works.

There shall not be any construction activities over water in the vicinity of the points during the baseline monitoring.

In exceptional case when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall seek approval from the IEC and DEP on an appropriate set of data to be used as baseline reference.

Baseline monitoring schedule shall be faxed to EPD 1 week prior to the commencement of baseline monitoring. The interval between 2 sets of monitoring shall not be less than 36 hours.

4.6 Impact Monitoring

During the course of the construction works, monitoring shall be undertaken 3 days per week, with sampling at the designated monitoring points. The interval between 2 sets of monitoring shall not be less than 36 hours except where there are exceedances of Action and/or Limit levels, in which case the monitoring frequency will be increased. The frequency of monitoring shall be agreed with EPD at least 2 weeks before undertaking any works.

After the tunnel is in operation, post construction confirmatory monitoring (Refer to **Figure 1.5**) shall be conducted during the wet season (April to September) in the first year. As the average frequency of tunnel usage is estimated to be 28 days per annum, it is recommended to monitor the resulting water quality for 20% of the events, i.e. 6 monitoring shall be carried out at the outfall within 12 hours of tunnel being activated by the rainfall over 30mm/hr. This will focus on SS, turbidity, *E. coli* and DO monitoring. The confirmatory monitoring shall be reviewed by the ET at the end of the first operational year to determine if further monitoring is required and to be agreed with EPD.

In order to ensure the water levels in the stream courses and thus on the surrounding habitats will not be affected, the groundwater levels along the tunnel will be measured throughout the construction and maintenance period. A one-year programme of baseline monitoring commenced in March 2005. These data will be submitted to EPD prior to the commencement of construction works. During the construction, the groundwater levels will be monitored by piezometers and shall be checked twice a week. The measurement locations during construction will be determined in the ongoing Geotechnical Investigation Report. It is proposed to measure the groundwater levels once per month after construction and the monitoring program will be subject to review in the maintenance period (the first operational year). The proposed monitoring locations for post construction groundwater are illustrated on **Figure 1.5**. Monitoring data will be submitted to EPD for record purposes.

Proposed water quality monitoring schedule shall be faxed to EPD on or before the first day of the monitoring month, EPD shall be notified immediately of any change in schedule by fax.

4.7 Event and Action Plan for Water Quality

The water quality assessment criteria, namely Action and Limit levels are based on the results of baseline monitoring, standards for effluents discharged into Groups A and D, Inland Waters and WQO of the Western Buffer Water Control Zone (Refer to **Table 4.1**). The actions in accordance with the Action Plan in **Table 4.2** shall be carried out if the water quality assessment criteria are exceeded at any designated monitoring points.

Table 4.1 Typical Action and Limit Levels for Water Quality

Parameters	Action	Limit
<i>DO in mg/l (Surface, Middle & Bottom)</i>	<u>Surface & Middle</u> 5%-ile of baseline data for surface and middle layer. <u>Bottom</u> 5%-ile of baseline data for bottom layer.	<u>Surface & Middle</u> 4mg/l except 5mg/l for FCZ or 1%-ile of baseline data for surface and middle layer <u>Bottom</u> 2mg/l or 1%-ile of baseline data for bottom layer
<i>SS in mg/l (depth-averaged)</i>	95%-ile of baseline data or 120% of upstream control station's SS at the same tide of the same day	99%-ile of baseline or 130% of upstream control station's SS at the same tide of the same day and specific sensitive receiver water quality requirements (e.g. required suspended solids levels for concerned sea water intakes)
<i>Turbidity (Tby) in NTU (depth-averaged)</i>	95%-ile of baseline data or 120% of upstream control station's Tby at the same tide of the same day	99%-ile of baseline or 130% of upstream control station's Tby at the same tide of the same day

Notes:

- For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.
- For SS and Tby, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.
- All the figures given in the table are used for reference only and the EPD may amend the figures whenever it is considered as necessary.

Table 4.2 Event/Action Plan for Water Quality

Event	ET Leader	IC(E)	ER	Contractor
Action Level being exceeded by one sampling day	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm finding; 2. Identify source(s) of impact; 3. Inform IC(E) and Contractor; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IC(E) and Contractor; and 6. Repeat measurement on next day of exceedance. 	<ol style="list-style-type: none"> 1. Discuss with ET and Contractor on the mitigation measures; 2. Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; and 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss with IC(E) on the proposed mitigation measures; and 2. Make agreement on the mitigation measures to be implemented. 	<ol style="list-style-type: none"> 1. Inform the ER and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Consider changes of working methods; 5. Discuss with ET and IC(E) and propose mitigation measures to IC(E) and ER; and 6. Implement the agreed mitigation measures.
Action Level being exceeded by more than one consecutive sampling day	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm finding; 2. Identify source(s) of impact; 3. Inform IC(E) and Contractor; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IC(E) and Contractor; 6. Ensure mitigation measures are implemented; 7. Prepare to increase the monitoring frequency to daily; and 8. Repeat measurement on next day of exceedance. 	<ol style="list-style-type: none"> 1. Discuss with ET and Contractor on the mitigation measures; 2. Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; and 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss with IC(E) on the proposed mitigation measures; 2. Make agreement on the mitigation measures to be implemented; and 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Inform the Engineer and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Consider changes of working methods; 5. Discuss with ET and IC(E) and propose mitigation measures to IC(E) and ER within 3 working days; and 6. Implement the agreed mitigation measures.
Limit Level being exceeded by one sampling day	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm finding; 2. Identify source(s) of impact; 3. Inform IC(E), Contractor and EPD; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IC(E), ER and Contractor; 6. Ensure mitigation measures are implemented; and 7. Increase the monitoring frequency to daily until no exceedance of Limit level. 	<ol style="list-style-type: none"> 1. Discuss with ET and Contractor on the mitigation measures; 2. Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; and 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss with IC(E), ET and Contractor on the proposed mitigation measures; and 2. Request Contractor to critically review the working methods; 3. Make agreement on the mitigation measures to be implemented; and 4. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Inform the Engineer and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Consider changes of working methods; 5. Discuss with ET and IC(E) and ER and propose mitigation measures to IC(E) and ER within 3 working days; and 6. Implement the agreed mitigation measures.

Event	ET Leader	IC(E)	ER	Contractor
<i>Limit Level being exceeded by more than one consecutive sampling day</i>	<ol style="list-style-type: none"> 1. Repeat in-situ measurement to confirm finding; 2. Identify source(s) of impact; 3. Inform IC(E), Contractor and EPD; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IC(E), ER and Contractor; 6. Ensure mitigation measures are implemented; and 7. Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days. 	<ol style="list-style-type: none"> 1. Discuss with ET and Contractor on the mitigation measures; 2. Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; and 3. Assess the effectiveness of the implemented mitigation measures. 	<ol style="list-style-type: none"> 1. Discuss with IC(E), ET and Contractor on the proposed mitigation measures; and 2. Request Contractor to critically review the working methods; 3. Make agreement on the mitigation measures to be implemented; 4. Assess the effectiveness of the implemented mitigation measures; and 5. Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the marine work until no exceedance of Limit Level. 	<ol style="list-style-type: none"> 1. Inform the ER and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3. Check all plant and equipment; 4. Consider changes of working methods; 5. Discuss with ET and IC(E) and ER and propose mitigation measures to IC(E) and ER within 3 working days; 6. Implement the agreed mitigation measures; and 7. As directed by the Engineer, to slow down or to stop all or part of the marine work or construction activities.

5 ECOLOGY

5.1 Introduction

With the exception of low to moderate impact to the middle course of Sam Dip Tam Stream (location of Intake I-2) and Tso Kung Tam Stream (location of Intake I-3), the direct ecological impact due to the construction and operation of the drainage channel is expected to be low.

No adverse residual impact due to the construction and operation of the channels is expected after the implementation of the proposed mitigation measures including provision of 2.2 ha of compensatory planting (including 1 ha of tree planting), approximately 280 m² of natural stream bottom and reinstatement of the intertidal habitat.

5.2 Ecological Mitigation Measures during the Construction Phase

The ecological assessment indicates that during construction works the potential impacts to ecological assemblages are environmentally acceptable and no ecology specific mitigation measures are required. In accordance with the guidelines in the EIA-TM on ecology impact assessment the general policy for mitigating impacts to ecological resources, in order of priority, are:

- **Avoidance** : Potential impacts should be avoided to the maximum extent practicable by adopting suitable alternatives;
- **Minimisation** : Unavoidable impacts should be minimised by taking appropriate and practicable measures such as constraints on intensity of works operations or timing of works operations; and
- **Compensation** : The loss of important species and habitats may be provided for elsewhere as compensation. Enhancement and other conservation measures should always be considered whenever possible.

The detailed implementation of the ecological mitigation measures stated in *Section 7.7* of EIA report should be checked as part of the environmental monitoring and audit procedures during the construction period. No other ecology-specific measures are considered necessary.

5.3 Monitoring and Auditing of Mitigation Measures

EIA report indicates that no adverse residual impact due to the construction and operation of the tunnel and intake structures is expected after the implementation of the proposed mitigation measures. The design has been developed based on avoidance, minimisation and compensation to reduce the ecological impact. Although no ecological monitoring is required, mitigation measures should be audited to ensure effective implementation of such measures.

6 FISHERIES

6.1 Introduction

Reviews of existing information on commercial fisheries resources and fishing operations located within the Study Area have been undertaken. Information from a study on fishing operations in Hong Kong and the AFCD Port Surveys indicate that fisheries production values in the vicinity of the Study Area vary but are medium to low.

The construction and operation of the Project will not give rise to impacts to fisheries, as there is no predicted adverse impact to water quality or habitat loss.

The implementation of the water quality mitigation measure stated in the Section 5 (Water Quality) of EIA report should be checked as part of the environmental monitoring and audit procedures during the construction period. No other fisheries-specific measures are considered necessary.

7 CULTURAL HERITAGE

7.1 Introduction

A literature review supplemented by an archaeological investigation identified no sites of archaeological significance in the Study Area. No mitigation measure of archaeological resources is considered necessary.

One Grade III building (Po Kwong Yuen Monastery at Lo Wai) and 86 historical buildings and structures were identified within the Study Area during the built heritage survey. Most of the identified sites except a few sites at Lo Wai, Sam Dip Tam and Yau Kom Tau settlement areas are located over 70 m from the Preferred Option of the drainage tunnel alignment and the associated Intakes/Outfall construction activities.

Potential vibration impact on a number of historical buildings and structures at Lo Wai, Sam Dip Tam and Yau Kom Tau has been identified in *Section 8.5* of the EIA report and appropriate mitigation measures have been recommended including the adoption of construction methods that minimises generation of excessive vibration, a pre-construction survey to establish the existing condition of the potentially affected buildings and vibration monitoring as part of the EM&A programme.

7.2 Environmental Monitoring & Audit

Baseline and vibration impact monitoring should be undertaken in the proximity of the potentially impacted sites at Lo Wai, Sam Dip Tam and Yau Kom Tau to ensure the performance meets with the vibration criteria to be discussed and agreed with AMO. The ET Leader shall prepare a methodology of conducting structural monitoring for submission to Antiquities and Monuments Office (AMO) and Buildings Department (BD).

In addition, before the commencement of the construction work, the Contractor shall also consult AMO on any other mitigation measures that would be required administratively or under the Antiquities and Monuments Ordinance. The Contractor shall implement these requirements from AMO during the construction period.

8 WASTE MANAGEMENT

8.1 Introduction

The potential environmental impacts with the handling and disposal of waste arising from the construction the Tsuen Wan Drainage Tunnel have been assessed. Operational impacts on the proposed route are not expected to be a key concern and no detailed assessment will be required. Key issues include the need for effective waste management planning during the construction phase. The assessment has concluded that the potential environmental impacts associated with the handling, storage, treatment and disposal of waste arising for the construction of the Tsuen Wan Drainage Tunnel meet the requirements of the EIAO-TM.

8.2 Environmental Monitoring & Audit

It is recommended that auditing of each waste stream should be carried out periodically by the contractor to determine if wastes are being managed in accordance with approved procedures and the site waste management plan. The audits should look at all aspects of waste management including waste generation, storage, recycling, treatment, transport and disposal. An appropriate audit programme would be to undertake a first audit at the commencement of the construction works, and then to audit monthly thereafter.

9 SITE ENVIRONMENTAL AUDIT

9.1 Introduction

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

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

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

- a) the EIA recommendations on environmental protection and pollution control mitigation measures;
- b) works progress and programme;
- c) individual works methodology proposals (which shall include proposal on associated pollution control measures);
- d) the contract specifications on environmental protection;
- e) the relevant environmental protection and pollution control laws; and
- f) previous site inspection results.

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

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

9.2 Compliance with Legal and Contractual Requirements

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

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

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

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

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

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

9.3 Environmental Complaints

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

- a) log complaint and date of receipt onto the complaint database and inform the IEC immediately;
- b) investigate the complaint to determine its validity, and to assess whether the source of

the problem is due to works activities;

- c) if a complaint is valid and due to works, identify mitigation measures;
- d) if mitigation measures are required, advise the Contractor accordingly;
- e) review the Contractor's response on the identified mitigation measures, and the updated situation;
- f) if the complaint is transferred from EPD, submit interim report to EPD on status of the complaint investigation and follow-up action within the time frame assigned by EPD;
- g) undertake additional monitoring and audit to verify the situation if necessary, and review that any valid reason for complaint does not recur;
- h) report the investigation results and the subsequent actions to the source of complaint for responding to complainant (If the source of complaint is EPD, the results shall be reported within the time frame assigned by EPD); and
- i) record the complaint, investigation, the subsequent actions and the results in the monthly EM&A reports.

During the complaint investigation work, the Contractor and ER shall cooperate with the ET Leader in providing all the necessary information and assistance for completion of the investigation. If mitigation measures are identified in the investigation, the Contractor shall promptly carry out the mitigation. The ER shall ensure that the measures have been carried out by the Contractor. A copy of compliant log is shown in **Annex C**.

10 REPORTING

10.1 General

The reporting guidelines referred to in this section are based upon a paper based system, however, the same information can be provided by an electronic medium upon agreeing the format with the ER and EPD. All the monitoring data (baseline and impact) shall also be submitted in diskettes in a format shown in **Annex B**. It is proposed real-time reporting of monitoring data for the project through a dedicated internet website.

10.2 Baseline Monitoring Report

The ET Leader shall prepare and submit a Baseline Environmental Monitoring Report within 10 working days of completion of the baseline monitoring. Copies of the Baseline Environmental Monitoring Report shall be submitted to all parties; the Contractor, the IEC, the ER and the EPD. The format and content of the report, and the representation of the baseline monitoring data shall be in a format to the satisfaction of EPD and include, but not be limited to the following:

- a) up to half a page executive summary;
- b) brief project background information;
- c) drawings showing locations of the baseline monitoring stations;
- d) monitoring results (in both hard and diskette copies) together with the following information:
 - monitoring methodology;
 - name of 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;
- e) details on influencing factors, including
 - major activities, if any, being carried out on the site during the period;
 - weather conditions during the period;
 - other factors which might affect the results.
- f) determination of the AL Levels for each monitoring parameter and statistical analysis of the baseline data; the analysis shall conclude if there is any significant difference between control and impact stations for the parameters monitored, and the following information shall be recorded:
 - graphical plots of monitored parameters in the month annotated against;
 - the major activities being carried out on site during the period;

- g) revisions for inclusion in the EM&A Manual; and
- h) comments and conclusions.

10.3 EM&A Reports

The results and findings of all EM&A work required in the Manual shall be recorded in the monthly EM&A reports prepared by the ET Leader. The EM&A report shall be prepared, endorsed by IEC and submitted within 10 working days of the end of each reporting month, with the first report due in the month after construction commences. Before submission of the first EM&A report, the ET Leader shall liaise with the parties on the exact number of copies and format of the monthly reports in both hard copy and electronic medium requirement. The ET Leader shall review the number and location of monitoring stations and parameters to monitor every 6 months or on as needed basis in order to cater for the changes in surrounding environment and nature of works in progress.

First Monthly EM&A Report

The First Monthly EM&A Report shall include at least the following :

- a) 1-2 pages executive summary;
 - Breaches of AL levels;
 - Complaints Log;
 - Notifications of any summons and successful prosecutions;
 - Reporting Changes; and
 - Future key issues.
- b) Basic Project Information
 - Project organisations including key personnel contact names and telephone numbers;
 - Programme;
 - Management structure; and
 - Works undertaken during the month.
- c) Environmental Status
 - Work undertaken during the month with illustrations (such as location of works daily dredging/filling rates percentage fines in the fill material used); and
 - Drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations.
- d) Summary of EM&A requirements
 - All monitoring parameters;
 - AL Levels;
 - Event-Action Plans;
 - Environmental mitigation measures, as recommended in the project EIA Report; and
 - Environmental requirements in contract documents.

e) Implementation Status

Advice on the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the project EIA Report, summarised in the updated implementation schedule (in **Annex A**).

f) Monitoring Results

To provide monitoring results (in both hard and diskette copies) together with the following information:

- Monitoring methodology;
- Name of laboratory and types of equipment used and calibration details;
- Parameters monitored;
- Monitoring locations (and depth);
- Monitoring date, time, frequency, and duration;
- Weather conditions during the period;
- Any other factors which might affect the monitoring results; and
- QA/QC results and detection limits.

g) Report on Non-compliance, Complaints, Notifications of Summons and Successful Prosecutions

- Record of all non-compliance (exceedances) of the environmental quality performance limits (AL 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 notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislations, 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
- Description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance.

h) Others

- An account of the future key issues as reviewed from the works programme and work method statements; and
- Advice on the solid and liquid waste management status.

Subsequent Monthly EM&A Reports

The subsequent Monthly EM&A Reports shall include the following :

a) Executive Summary (1-2 pages)

- Breaches of AL levels;

- Complaint Log;
- Notifications of any summons and successful prosecutions;
- Future key issues.

b) Environmental Status

- Works undertaken during the month with illustrations including key personnel contact names and telephone number; and
- Drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations.

c) Implementation Status

Advice on the implementation status of environmental protection and pollution control/mitigation measures including measures for air, noise, water quality and ecological impacts etc, as recommended in the EIA Report, summarised in the updated implementation schedule (see **Annex A**).

d) Monitoring Results

To provide monitoring results (in both hard and diskette copies) together with the following information:

- Monitoring methodology;
- Name of laboratory and types of equipment used and calibration details;
- Parameters monitored;
- Monitoring locations (and depth);
- Monitoring date, time, frequency, and duration;
- Weather conditions during the period;
- Any other factors which might affect the monitoring results; and
- QA/QC results and detection limits.

e) Report on Non-compliance, Complaints, Notifications of Summons and Successful Prosecutions

- Record of all non-compliance (exceedances) of the environmental quality performance limits (AL 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 notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislations, 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
- A description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance.

f) Others

- An account of the future key issues as reviewed from the works programme and work method statements; and
- Advice on the solid and liquid waste management status.

g) Appendix

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

The Quarterly EM&A Summary Report which shall generally be around 5 pages (including about 3 of text and tables and 2 of figures) shall contain at least the following information:

- a) up to half a page executive summary;
- b) basic project information including a synopsis of the project organisation, programme, contacts of key management, and a synopsis of work undertaken during the quarter;
- c) a brief summary of EM&A requirements including:
 - monitoring parameters;
 - environmental quality performance limits (AL Levels); and
 - environmental mitigation measures, as recommended in the EIA Report;
- d) advice on the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the project EIA study report, summarised in the updated implementation schedule;
- e) drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
- f) graphical plots of the trends of monitored parameters over the past 4 months (the last month of the previous quarter and the present quarter) for representative monitoring stations annotated against;
 - the major activities being carried out on site during the period;
 - weather conditions during the period; and
 - any other factors which might affect the monitoring results;

- g) advice on the solid and liquid waste management status;
- h) a summary of non-compliance (exceedances) of the environmental quality performance limits (AL Levels);
- i) an quarterly assessment of constructional impacts on water quality at the project site including but not limited to comparison of the difference between the quarterly mean and 1.3 times of the ambientment which is defined as 30% increase of the baseline data or EPD data of the related parameters by using appropriate statistical procedures. Suggestion of appropriate mitigation measures if the quarterly assessment analytical results demonstrate that the quarterly mean is significantly higher than the liaison water quality times of the ambient mean ($p < 0.05$);
- j) a brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures;
- k) a summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;
- l) a summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;
- m) comments (e.g. effectiveness and efficiency of the mitigation measures), recommendations (e.g. any improvement in the EM&A programme) and conclusions for the quarter; and
- n) proponents' contacts and any hotline telephone number for the public to make enquiries.

Annual/Final EM&A Review Reports

The Annual/Final EM&A Report shall contain at least the following information:

- a) Executive Summary (1-2 pages);
- b) drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
- c) basic project information including a synopsis of the project organisation contacts of key management, and a synopsis of work undertaken during the course of the project or past twelve months;
- d) a brief summary of EM&A requirements including:
 - (i) environmental mitigation measures, as recommended in the project EIA Report;
 - (ii) environmental impact hypotheses tested;
 - (iii) AL Levels;
 - (iv) all monitoring parameters; and
 - (v) Event-Action Plans;

- e) a summary of the implementation status of environmental protection and pollution control/mitigation measures as recommended in the project EIA study report summarized in the updated implementation schedule;
- f) graphical plots and the statistical analysis of the trends of monitored parameters over the course of the project, including the post project monitoring (for the past twelve months for annual report) for all monitoring stations against:
 - the major activities being carried out on site during the period;
 - weather conditions during the period; and
 - any other factors which might affect the monitoring results;
- g) a summary of non-compliance (exceedances) of the environmental quality performance limits (AL Levels);
- h) a review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures as appropriate;
- i) a description of the actions taken in the event of non-compliance;
- j) a summary record of all complaints received (written or verbal) for each media liaison and consultation undertaken, action and follow-up procedures taken;
- k) 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;
- l) a review of the validity of EIA Report predictions and identification of shortcomings in EIA Report recommendations;
- m) a review of the effectiveness and efficiency of the mitigation measures; and
- n) a review of success of the EM&A programme to cost effectively identify deterioration and to initiate prompt effective mitigatory action when necessary.

10.4 Data Keeping

The site document such as the monitoring field records, laboratory analysis records, site inspection forms, etc. are not required to be included in the monthly EM&A reports for submission. However, the document shall be well kept by the ET Leader and be ready for inspection upon request. All relevant information shall be clearly and systematically recorded in the document. The monitoring data shall also be recorded in magnetic media form, and the software copy can be available upon request. The water quality data software format shall be agreed with EPD. All the documents and data shall be kept for at least one year after completion of the construction contract.

10.5 Interim Notifications of Environmental Quality Limit Exceedances

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

ANNEX A

IMPLEMENTATION SCHEDULE

ANNEX A IMPLEMENTATION SCHEDULE

Agreement No. CE 80/2001(DS) Drainage Improvement in Tsuen Wan and Kwai Chung – Tsuen Wan Drainage Tunnel

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure ?	Location of the measure	When to implement the measure ?	What requirements or standards for the measure to achieve ?
Air Quality					
3.6.1	<p>Specific</p> <p>As mentioned in Section 3.5, exceedances of 1-hour and 24-hour average TSP guideline levels have been predicted at most of the ASRs. Hence, mitigation measures are considered necessary in order to suppress the potential dust impact.</p> <p>The dust suppression measures set out in the <i>Air Pollution Control (Construction Dust) Regulation</i>, in fact, are more extensive. Therefore, it is expected that with watering the construction site every four times daily together with strict implementation of dust suppression measures as stipulated in the <i>Air Pollution Control (Construction Dust) Regulation</i>, the dust level is expected to be reduced by over 75%.</p> <p>General</p> <p>To further ensure compliance with the guideline and AQO limit at the ASRs at all time, it is recommended to implement the <i>Air Pollution Control (Construction Dust) Regulation</i> and include good site practice in the contract clauses to minimize cumulative dust impact. In addition, a comprehensive dust monitoring and audit programme is recommended to ensure proper implementation of the identified mitigation measures. Details of the monitoring and audit requirements are provided in a separate EM&A Manual.</p> <ul style="list-style-type: none"> • effective dust screens, sheeting or netting should be provided to enclose the scaffolding from the ground floor level of the building or if a canopy is provided at the first floor level, from the first floor level, up to the highest level of the scaffolding where a scaffolding is erected around the perimeter of a building under construction; • dump truck for material transport should be totally enclosed by impervious sheeting; • any excavated dusty materials or stockpile of dusty materials should be covered entirely by impervious sheeting or sprayed with water so as to maintain the entire surface wet, and recovered or backfilled or reinstated within 24 hours of the excavation or unloading; • stockpile of dusty materials should not extend beyond the pedestrian barriers, fencing or traffic cones; • dusty materials remaining after a stockpile is removed should be wetted with water and cleared from the surface of roads; 	DSD's Contractor	Construction Sites	Work During Construction	Air Pollution Control (Construction Dust) Regulation

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure ?	Location of the measure	When to implement the measure ?	What requirements or standards for the measure to achieve ?
3.6.1	<ul style="list-style-type: none"> the area where vehicle washing takes place and the section of the road between the washing facilities and the exit point should be paved with concrete, bituminous materials or hardcores; where a site boundary adjoins a road, street or other area accessible to the public, hoarding of not less than 2.4m high from ground level should be provided along the entire length except for a site entrance or exit; every main haul road should be scaled with concrete and kept clear of dusty materials or sprayed with water so as to maintain the entire road surface wet; the portion of road leading only to a construction site that is within 30m of a designated vehicle entrance or exit should be kept clear of dusty materials; stockpile of dusty materials should be either covered entirely by impervious sheeting, placed in an area sheltered on the top and the 3 sides; or sprayed with water so as to maintain the entire surface wet; all dusty materials should be sprayed with water prior to any loading, unloading or transfer operation so as to maintain the dusty material wet; vehicle speed should be limited to 10 kph except on completed access roads; every vehicle should be washed to remove any dusty materials from its body and wheels before leaving the construction sites; the load of dusty materials carried by vehicle leaving a construction site should be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle; and the working area of excavation should be sprayed with water immediately before, during and immediately after the operations so as to maintain the entire surface wet. 	DSD's Contractor	Construction Work Sites	During Construction	Air Pollution Control (Construction Dust) Regulation
Noise					
4.6.1	<p>During Construction</p> <p>Appropriate mitigation measures such as the use of quiet equipment and movable barriers will be developed to ensure that noise can be reduced to acceptable levels without causing programme delays.</p> <p><i>Good Site Practice</i></p> <p>Good site practice and noise management can significantly reduce the impact of construction site activities on nearby NSRs. The following package of measures should be followed during construction:</p> <ul style="list-style-type: none"> only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction works; machines and plant that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum; 	DSD's Contractor	Construction Work Sites	During Construction	PN 2/93 Noise from Construction Activities & EIAO

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure ?	Location of the measure	When to implement the measure ?	What requirements or standards for the measure to achieve ?
4.6.1	<ul style="list-style-type: none"> plant known to emit noise strongly in one direction should, where possible, be orientated to direct noise away from the NSRs; mobile plant should be sited as far away from NSRs as possible; and material stockpiles and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities. <p><i>For Drill and Blast Works</i></p> <ul style="list-style-type: none"> Charge mass per delay should be decreased by minimising the number of blastholes firing on each delay. Smaller blasthole patterns and longer delays should be used between dependent charges. Times of blasting should be established to suit the situation and firing blasts when neighbours are busy with their daily tasks (and at a regular time such as lunch time). <p><i>For TBM Tunnelling</i></p> <ul style="list-style-type: none"> For the tunnel excavation, it is anticipated that beyond the initial length (say within 30m), excavation will be carried out well within the tunnel and door should be provided to further minimize the noise nuisance to the nearby receivers. 	DSD's Contractor	Construction Work Sites	During Construction	PN 2/93 & EIAO
4.6.2	<p>During Operation</p> <p>Good site practice and noise management can significantly reduce the impact of maintenance activities on nearby NSRs. The following package of measures should be followed during construction:</p> <ul style="list-style-type: none"> only well-maintained plant should be operated on-site; machines and plant that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum; and plant known to emit noise strongly in one direction should, where possible, be orientated to direct noise away from the NSRs. 	DSD's Contractor	Project Area	During Operation	NCO & EIAO
Water Quality					
5.9.1	<p>During Construction</p> <p>Mitigation measures and a spill control and response plan have been prepared for works at the intakes and work sites.</p> <p><i>Precautions to be taken at any time of year when rainstorms are likely:</i></p> <ul style="list-style-type: none"> Temporarily exposed surfaces should be covered e.g. by tarpaulin. Temporary access roads should be protected by crushed stone or gravel. Trenches should be dug and backfilled in short sections. Measures should be taken to minimize the ingress of rainwater into trenches. <p><i>Actions to be taken when a rainstorm is imminent or forecast:</i></p> <ul style="list-style-type: none"> Silt removal facilities, should be checked to ensure that they can function properly. 	DSD's Contractor	Construction Work Sites	During Construction	Practice Note for Professional Persons with regard to site drainage (ProPECC PN 1/94) and WQO

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure ?	Location of the measure	When to implement the measure ?	What requirements or standards for the measure to achieve ?
5.9.1	<ul style="list-style-type: none"> Open stockpiles of construction materials on site should be covered with tarpaulin or similar fabric. All temporary covers to slopes and stockpiles should be secured. <p><i>Actions to be taken during or after rainstorms:</i></p> <ul style="list-style-type: none"> Silt removal facilities should be checked and maintained to ensure satisfactory working conditions. <p>Spill Control and Response Plan</p> <p>1. Prevention and Precaution Measures</p> <p>General Precautions</p> <ul style="list-style-type: none"> No discharge of silty water into watercourses. All materials to be used during construction and operation shall be identified and their hazard potential evaluated. Maintenance of vehicles and equipment involving activities with potential for leakage and spillage shall only be undertaken with the areas appropriately equipped to control these discharges. Any soil contaminated with chemicals/oils shall be removed from site and the void created shall be filled with suitable materials. Any construction plant which causes pollution to catchwaters or water gathering ground due to leakage of oil or fuel shall be removed off-site immediately. Suitable containers shall be used to hold the chemical wastes to avoid leakage or spillage during storage, handling and transport. Chemical waste containers shall be suitably labelled to notify and warn the personnel who are handling the wastes to avoid accidents. Storage areas shall be selected at safe locations on site and adequate space shall be allocated to the storage area. Prevent obstructions and tripping hazards. <p>Storage Precautions</p> <ul style="list-style-type: none"> All chemical storage containers shall be correctly labelled. Solid and impermeable enclosure walls or storage shelves shall be used. Only compatible chemical wastes shall be stored in the same storage area. The storage areas shall be inspected to detect any leakages or defective containers on a regular basis. The condition of the storage containers shall be checked regularly. Suitable notices warning of hazards, emergency response plans, telephone numbers etc shall be posted around the site, including storage areas. Large and heavy containers shall be stored at ground level. 	DSD's Contractor	Construction Sites Work	During Construction	WQO

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure ?	Location of the measure	When to implement the measure ?	What requirements or standards for the measure to achieve ?
5.9.1	<ul style="list-style-type: none"> Chemical waste containers shall be stored below eye level. Adequate space for handling of the containers shall be provided. Spill response kits shall be located adjacent/near to the storage areas. A log of chemical wastes shall be maintained. Incompatible chemicals shall be stored separately. <p>2. Responses/Action Plan</p> <p>All Workers shall be made aware of emergency telephone numbers and the location of all relevant pollution control equipment. Training be given in emergency response/action plans. The action include the following steps:</p> <ul style="list-style-type: none"> Only trained personnel who are equipped with protective clothing and equipment shall be allowed to enter the spillage area for clean up. Spills shall be transferred appropriate back into containers using suitable equipment. Absorbent materials shall be used to clean up the spills and shall be disposed of as chemical wastes. Where appropriate suitable solvents may be used to clean the contaminated area after removal of all contaminated materials. All necessary protective devices, safety equipment, containers and clean up materials for emergency use shall be maintained to a high standard. <p>3. Spill Clean Up and Disposal</p> <p>Effect the response plan.</p> <p>Control the leakage and absorb the spillage using suitably absorbent materials.</p> <p>Provide safety equipment and personal protective equipment for handling of chemical wastes would be similar to that for handling of chemicals.</p> <p><i>Safety equipment includes but is not limited to:</i></p> <ul style="list-style-type: none"> Fire extinguishers. Spades, brushes, dustpan, mop and bucket (or similar readily available on site). Absorbent material such as dry sand, tissues and toweling (all materials readily available on-site). Containers including plaster bags, drums, etc. Absorbing materials. Pumps. <p><i>Personal protective equipment includes as appropriate:</i></p> <ul style="list-style-type: none"> First-aid kits. Safety helmet and goggles. Gloves which can resist chemical reaction. 	DSD's Contractor	Construction Work Sites	During Construction	WQO

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure ?	Location of the measure	When to implement the measure ?	What requirements or standards for the measure to achieve ?				
	<ul style="list-style-type: none">Protective boot and clothing.								
5.9.1	<ul style="list-style-type: none">Respirators and gas masks.Face visor and masks.	DSD’s Contractor	Construction Work Sites	During Construction	WQO				
5.9.2	Emergency Responses to Spillages Emergency plans and clean up procedures will need to be provided by the Contractor recognising his specific working methods and construction programme, activities and sequences. Agreement must be sought prior to commencement of the construction work but the following principles should be considered. <i>The emergency plans should include the procedures for:</i> <ul style="list-style-type: none">spill prevention and precaution;response actions; andspill clean up and disposal. <i>Spill prevention and precaution embraces good site practice and covers:</i> <ul style="list-style-type: none">good housekeeping practices;chemical storage requirements; andchemical transfer and transport.								
5.9.3	During Operation Regular inspection of the tunnels is essential to monitor the structural integrity and proper functioning of the drainage tunnel, which allows repairing of structural deterioration when it begins to develop. It is recommended that routine inspection shall be carried out at least two times per year for the drainage tunnel at the beginning and end of wet season from April to September.								
Waste Management									
6.5.1	During Construction <i>Vegetation Removed from Site Clearance</i> Wastes generated from site clearance shall be sorted and excavated topsoil segregated from roots for re-use in landscaping works, thus eliminating the need for off-site disposal. <i>Construction and Demolition Materials</i> The Contractor should reuse any C&D material on-site. C&D waste should be segregated and stored in different containers to other wastes to encourage the re-use or recycling of materials and their proper disposal. The use of wooden hoardings shall not be allowed. An alternative material, which can be reused or recycled, for example, metal (aluminium, alloy, etc) shall be used.					DSD’s Contractor	Construction Work Sites	During Construction	Waste Disposal Ordinance (Cap.354); Waste Disposal (Chemical Wastes) (General) Regulation (Cap 354) and ETWBTC No. 15/2003, Waste Management on Construction Site

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure ?	Location of the measure	When to implement the measure ?	What requirements or standards for the measure to achieve ?
6.5.1	As referred to the section 6.4.1, the 317,936m ³ of inert surplus material generated by the project is suitable for public fill. The public fill reception facility at Tuen Mun Area 38 provides a suitable facility for the reuse of surplus inert C&D material generated from the project.	DSD's Contractor	Construction Work Sites	During Construction	WDO (Cap.354), ETWBTC No. 15/ 2003, ETWBTC No. 12/2002 and ETWBTC No. 31/2004
	Under the contract, the contractor will be required to minimise the generation of C&D material and reuse it on site through the following:				
	(a) to plan in the design and construction, methods to minimise the generation of C&D material;				
	(b) to submit a Waste Management Plan (WMP) in accordance with Environment Transport and Works Bureau Technical Circular (ETWBTC) No. 15/2003 or any superseding circular(s);				
	(c) to reuse recycled aggregates in accordance with ETWBTC No. 12/2002 or any superseding circular(s);				
	(d) to observe the requirements of the Trip-Ticket System, stipulated in ETWBTC No. 31/2004 or any superceding circular(s), for disposal of C&D material;				
	(e) to incorporate a Waste Management System into the WMP for effective management and control of C&D materials to avoid/reduce/minimise the generation of C&D material during construction.				
	The contractor will be required to properly sort into inert C&D materials, metals, timber and other non-inert C&D material in the workplace to prevent cross-contamination.				
	In addition, DSD will conduct site inspection to monitor the contractors' performance in the implementation of the WMP and other relevant specified requirements.	DSD	Construction Work Sites	During Construction	WDO (Cap.354) and ETWBTC No. 15/2003
	<i>Excavated Materials</i> Excavated materials should be segregated from other wastes to avoid contamination thereby ensuring acceptability at public filling areas and avoiding the need for disposal at landfill.	DSD's Contractor	Construction Work Sites	During Construction	WDO (Cap.354) and ETWBTC No. 15/2003
	<i>Municipal Waste</i> Temporary refuse collection facilities should be set-up by the contractor and wastes should be stored in appropriate containers prior to collection and disposal.				
	Domestic effluent generated by the workforce will be directed to foul sewer or chemical toilets if public facilities are not available.				
6.5.1	<i>Waste Management Plan</i> A Waste Management Plan (WMP) for the construction of the Project should be prepared as part of the contractors submission. It will provide recommendations for appropriate recycling or disposal route and should include method statement for stockpiling and transportation of the excavated material and other construction wastes should also be included in the WMP and approved before the commencement of construction. All mitigation measures arising from the approved WMP shall be fully implemented.	DSD's Contractor	Construction Work Sites	During Construction	WDO (Cap.354), ETWBTC No. 15/2003 and ETWBTC No. 33/2002

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure ?	Location of the measure	When to implement the measure ?	What requirements or standards for the measure to achieve ?
	For the purpose of enhancing the management of C&D material including rock, and to minimize its generation at source, a C&D Material Management Plan (C&DMMP) has been prepared for this project and would be processed in accordance with the Environment, Transport and Works Bureau Technical Circular (Works) No. 33/2002 - Management of Construction and Demolition Material Including Rock.				
Ecology					
7.7.1	Avoidance The surface structures are located mainly on existing disturbed areas (ie pollution and urbanisation) and have generally avoided the natural stream sections of higher species diversity and abundance of aquatic organisms. The major construction activities at streams are scheduled to avoid wet season of high water flow which may adversely affect the downstream natural habitats due to the construction runoff.	DSD's Contractor	Construction Sites	During Construction	EIAO
7.7.2	Minimisation The previous discussion in Section 7.6.4 has indicated that the impacts on ecological resources due to the construction and operation of the proposed Project are generally expected to be low. The following mitigation measures to minimise impacts and disturbance to the surrounding habitats, are recommended. <u>Measures for Construction Runoff</u> Install sheet piles/cofferdam/weir along the boundary of the works area within the stream habitats in particular Sam Dip Tam Stream and Tso Kung Tam Stream before the commencement of works to prevent construction runoff during construction. Provision of adequate designed sand/ silt removal facilities such as sand traps, silt traps and sediment basin in the areas which could potentially be affected may be required. <u>Good Construction Practice</u> Erect fences along the boundary of the works area before the commencement of works to prevent tipping, vehicle movements, and encroachment of personnel onto adjacent areas, particularly the stream habitats. Avoid any damage and disturbance, particularly those caused by filling and illegal dumping, to the remaining and surrounding natural stream habitats. Regularly check the work site boundaries to ensure that they are not breached and that no damage occurs to surrounding areas. Prohibit and prevent open fires within the site boundary during construction and provide temporary fire fighting equipment in the work areas. Treat any damage that may have occurred to individual major trees in the adjacent area with surgery.				
	Erect fences along the boundary of the works area before the commencement of works to prevent tipping, vehicle movements, and encroachment of personnel onto adjacent areas, particularly the stream habitats. Avoid any damage and disturbance, particularly those caused by filling and illegal dumping, to the remaining and surrounding natural stream habitats. Regularly check the work site boundaries to ensure that they are not breached and that no damage occurs to surrounding areas. Prohibit and prevent open fires within the site boundary during construction and provide temporary fire fighting equipment in the work areas. Treat any damage that may have occurred to individual major trees in the adjacent area with surgery.	DSD's Contractor	Construction Sites	During Construction	EIAO

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure ?	Location of the measure	When to implement the measure ?	What requirements or standards for the measure to achieve ?
	Reinstate temporary work sites/disturbed areas, particularly stream of natural bottom and bank, plantation, intertidal habitat, and the areas located within the proposed Ecological Park, immediately after completion of the construction works, ie through on-site tree/shrub planting and reprovion of natural or semi-natural bottom (also refer to Section 7.7.3), in order to facilitate the recolonisation of the wildlife recorded during the baseline surveys. Tree/shrub species used should make reference from those in the surrounding area.	DSD's Contractor	Construction Work Sites	During Construction	EIAO
7.7.3	Compensation				
	Provide natural stream bed (approximately 0.03 ha) for the new Dry Weather Flow Channel (created from village-orchard) by laying natural stones at Intake I-2 (Figure 7.7). The reinstated stream bed shall mimic the existing natural conditions with certain portion of big boulders creating the lentic and lotic zones for the aquatic fauna, and while it will be developed during detailed design may draw on concepts shown in Figure 2.18.				
	Provide natural stream bed (approximately 0.5 ha,) for the Approach Channel and Dry Weather Flow Channel by laying natural stones at Intake I-3 (Figure 7.8). The reinstated stream bed shall mimic the existing natural conditions (rocky bottom with very limited aquatic plants) with certain portion of big boulders creating the lentic and lotic zones for the aquatic fauna, and while it will be developed during detailed design may draw on concepts shown in Figure 2.18.				
	Provide natural bottom (ie retain the existing stream bed or reinstate the stream bed by providing boulders/ rocks, riprap or gabion) for the affected stream sections (Figure 7.8) in order to allow natural colonisation of aquatic fauna.				
	Provide at least 2.2 ha of compensatory planting on the permanent and temporary affected plantation areas, particularly the slopes along access road and adjacent to Intake I-3 and cascade at Outfall O-1, after construction to stabilise the slope to present soil erosion and consequent stream sedimentation. Among the 2.2 ha compensatory planting, at least 0.5 ha of compensatory tree planting on the new formed slope along the access road of the Intake I-3 and 0.5 ha of compensatory tree planting over the cascade (by constructing intermediate platform) at Outfall O-1 will be provided (location refer to Figures 7.4 – 7.6). Species used for planting should take reference from the species identified in Appendix F and be native to <u>Hong Kong</u> or <u>South China region</u> .				
	Provide armour rocks for the affected intertidal habitat in order to allow natural colonisation of intertidal organisms.				

EIA Ref.	Recommended Mitigation Measures	Who to implement the measure ?	Location of the measure	When to implement the measure ?	What requirements or standards for the measure to achieve ?
Cultural Heritage					
8.6	As no impacts on recorded archaeological sites or area with archaeological potential were identified within the Study Area, no mitigation measure for archaeological resources is considered necessary.				
	The construction methods to be employed should seek to avoid potential vibration impacts to Kuen Yuen Tung Monastery at Lo Wai, the Western Monastery, Yuen Yuen Home for the Aged, Hong Hoi Chee Hong Temple, Chiu Yum Tsing Yuen, Tse's Grave, Wan Lin Bridge and Sam Dip Tam Rock Carving in Sam Dip Tam and the Tin Hau Temple, Yam Kom Tau Village Rural Committee and the Yeung's Ancestral Hall in Yau Kom Tau as these sites fall within 50 m of the Preferred Option of the drainage tunnel alignment or associated Intakes/Outfall construction activities. Construction works that generates excessive vibration in close proximity to these sites should be restricted to protect the building from adverse vibration impacts and to ensure that the building structures will not be damaged as a result of these impacts.	DSD's Contractor	Construction Sites Work	During Construction	EIAO
	In order to ensure that no structural or superficial damage will be caused by the construction activities, a precautionary approach involving a pre-construction condition survey and establishment of appropriate vibration limits for the potentially impacted structures should be adopted. Protection measures for the potentially impacted structures, if considered necessary from the pre-construction condition survey, should be implemented prior to the commencement of construction works. Vibration monitoring during the construction phase should be undertaken as part of the EM&A programme.	Qualified archaeologist/ built heritage specialist	Construction Sites Work	Pre-construction	EIAO
Fisheries					
10.6	In accordance with the guidelines in the <i>EIAO-TM</i> on fisheries impact assessment the general policy for mitigating impacts to fisheries, in order of priority are avoidance, minimization and compensation. Impacts to fisheries resources and fishing operations have largely been avoided during the construction and operation of the drainage tunnel through the avoidance of dredging, reclamation and filling activities. Good construction practice and associated measures were recommended in Water Quality Assessment in Section 5 to control water quality impacts to within acceptable levels and are also expected to control impacts to fisheries resources. Hence, no fisheries-species mitigation measures are required during construction and operation of the drainage tunnel.	DSD's Contractor	Construction Sites Work	During Construction	EIAO

ANNEX B

**ENVIRONMENTAL MONITORING
DATA RECORDING SHEETS**

ANNEX B

Data Sheet for TSP Monitoring

Monitoring Location			
Details of Location			
Sampler Identification			
Date & Time of Sampling			
Elapsed-time	Start (min.)		
Meter Reading	Stop (min.)		
Total Sampling Time (min.)			
Weather Conditions			
Site Conditions			
Initial Flow Rate, Qsi	Pi	(mmHg)	
	Ti	(°C)	
	Hi	(in.)	
	Qsi	(Std. m ³)	
Final Flow Rate, Qsf	Pf	(mmHg)	
	Tf	(°C)	
	Hf	(in.)	
	Qsf	(Std. m ³)	
Average Flow Rate (Std. m ³)			
Total Volume (Std. m ³)			
Filter Identification No.			
Initial Wt. of Filter (g)			
Final Wt. of Filter (g)			
Measured TSP Level (ug/m ³)			

Name & Designation

Signature

Date

Field Operator :

Laboratory Staff:

Checked by:

ANNEX B

Noise Monitoring Field Record Sheet

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

Name & Designation

Signature

Date

Recorded by :

Checked by:

ANNEX B

Water Quality Monitoring Data Record Sheet

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

Name & Designation

Signature

Date

Recorded by :

Checked by:

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

ANNEX C

COMPLAINT LOG

ANNEX C

COMPLAINT LOG

Log Ref.	Date / Location	Complainant / Date of Contract	Details of Complaint	Investigation / Mitigation Action	File Closed

Signed by Environmental Team Leader : _____ Date : _____

ANNEX D

**INTERIM NOTIFICATION OF
ENVIRONMENTAL QUALITY LIMIT EXCEEDANCES**

ANNEX D

**Sample Template for Interim Notifications of
Environmental Quality Limits Exceedances**

Incident Report on Action Level or Limit Level Non-compliance

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

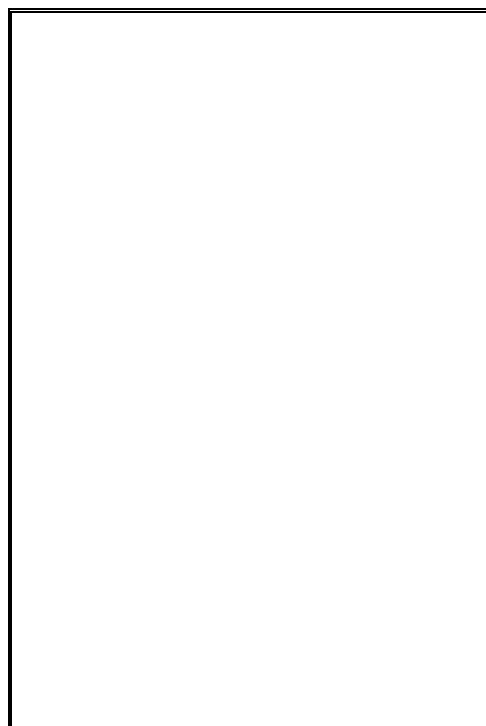
Location Plan

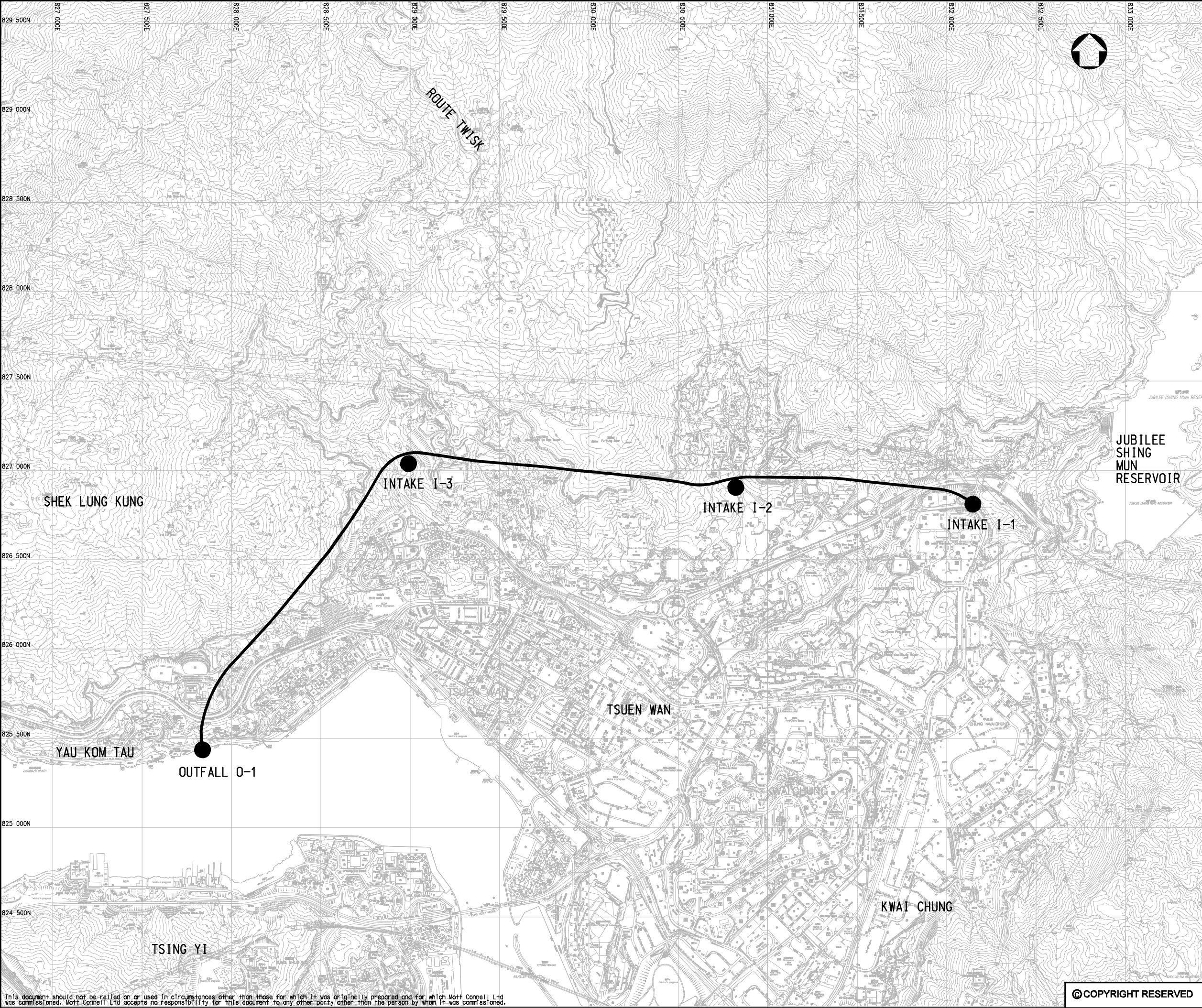
Prepared by:

Designation:

Signature:

Date:





This document should not be relied on or used in circumstances other than those for which it was originally prepared and for which Mott Connell Ltd was commissioned. Mott Connell Ltd accepts no responsibility for this document to any other party other than the person by whom it was commissioned.

© COPYRIGHT RESERVED

Key Plan:

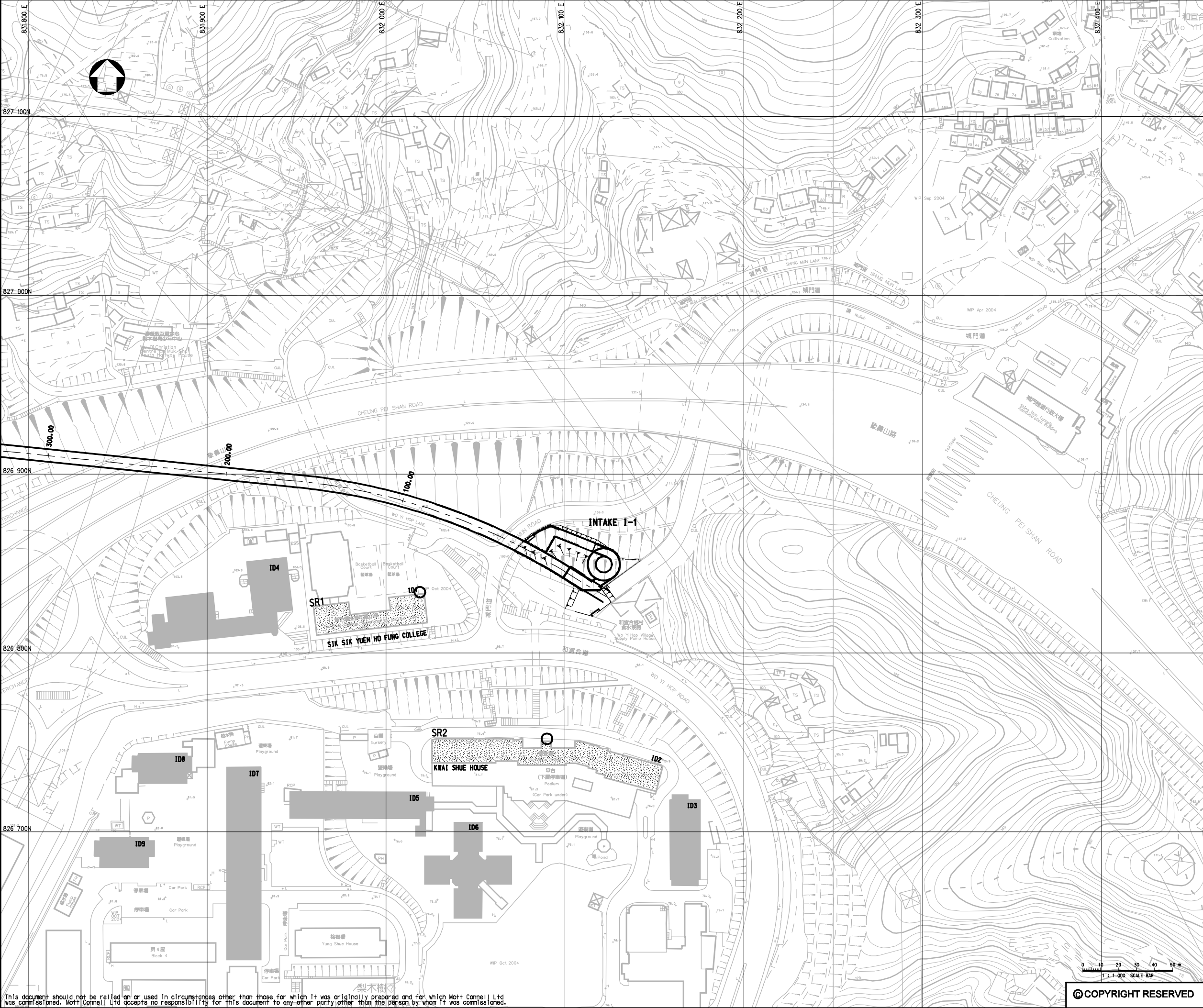
Notes:
1. CO-ORDINATES REFER TO HONG KONG METRIC GRID (1980).
2. ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM (P.D.).
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

Key to symbols
LEGENDS :

TUNNEL ALIGNMENT

INTAKE/OUTFALL STRUCTURES

B1	MAR 05	EL	FOR EM&A MANUAL		
Rev	Date	Drawn	Description	Ch'kd	App'd
Client					
<div></div> <div>The Government of the Hong Kong Special Administrative Region Drainage Services Department</div>					
Consulting Engineers Mott Connell Ltd. <div>in Association with MVA Hong Kong Ltd WL/Delft Hydraulics Ltd</div> <div>EDAW Earth Asia Ltd Chesterton Petty Ltd</div> <div>Environmental Resources Management</div>					
Project Drainage Improvement in Tsuen Wan and Kwai Chung - Tsuen Wan Drainage Tunnel - Investigation					
Title TUNNEL ALIGNMENT AND SURROUNDING AREA					
Designed	CF		Eng.Chk.	MT	
Drawn	HL	HL	Approved	TMC	
Dwg.Chk.	KN		Scale		
Project	204417				Status
CAD file	J:\204417\DRAWING\FIGURE EM&A MANUAL\FIGURE1.1.dgn				
Drawing No.	FIGURE 1.1				Rev 01



This document should not be relied on or used in circumstances other than those for which it was originally prepared and for which Mott Connell Ltd was commissioned. Mott Connell Ltd accepts no responsibility for this document to any other party other than the person by whom it was commissioned.

Key Plan:

Notes:

- CO-ORDINATES REFER TO HONG KONG METRIC GRID (1980).
- ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM (P.D.).
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

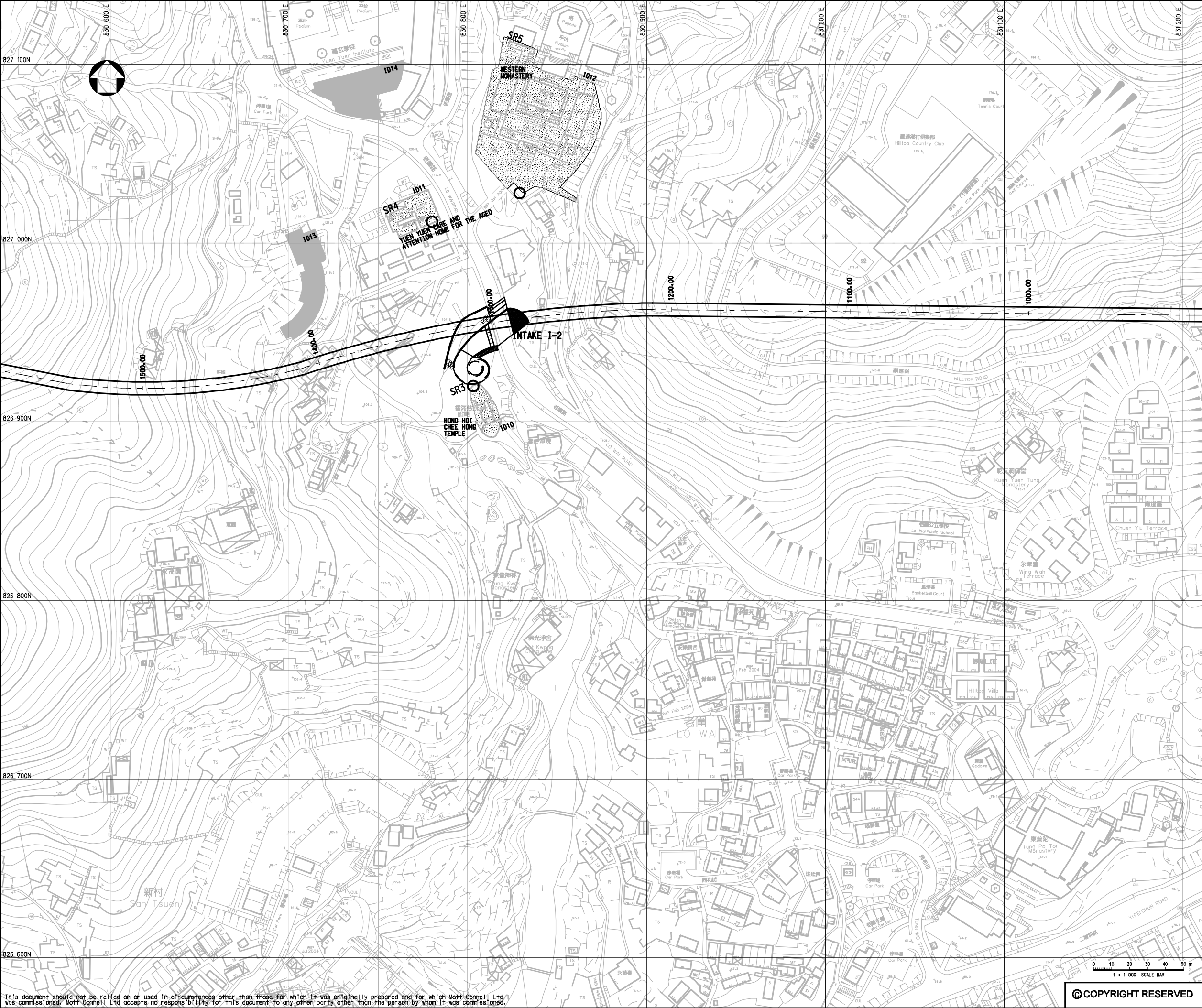
Key to symbols

LEGENDS :

- TUNNEL ALIGNMENT
- EXISTING LAND BOUNDARY
- REPRESENTATIVE SENSITIVE RECEIVER (USED FOR MODELLING PURPOSES) SR=ASR/NSR
- SELECTED SENSITIVE RECEIVERS
- SELECTED ASSESSMENT POINT

01	MAR 05	EL	FOR EM&A MANUAL		
Rev	Date	Drawn	Description	Ch'kd	App'd
Client					
Consulting Engineers Mott Connell Ltd. in Association with MVA Hong Kong Ltd WL/Delft Hydraulics Ltd EDAW Earth Asia Ltd Chesterton Petty Ltd Environmental Resources Management					
Project Drainage Improvement in Tsuen Wan and Kwai Chung - Tsuen Wan Drainage Tunnel - Investigation					
Title LOCATIONS OF REPRESENTATIVE SENSITIVE RECEIVERS AROUND INTAKE 1 - 1					
Designed	CF		Eng.Chk.	MT	
Drawn	HL		Approved	TMC	
Dwg.Chk.	KN		Scale	1:1000 @ A1	
Project 204417					
CAD file j:\204417\drawing\figure em&a manual\figure1.2a.dgn					
Drawing No. FIGURE 1.2a					
Status					
Rev 01					

© COPYRIGHT RESERVED



This document should not be relied on or used in circumstances other than those for which it was originally prepared and for which Mott Connell Ltd. was commissioned. Mott Connell Ltd. accepts no responsibility for this document to any other party other than the person by whom it was commissioned.

Key Plan:

Notes:

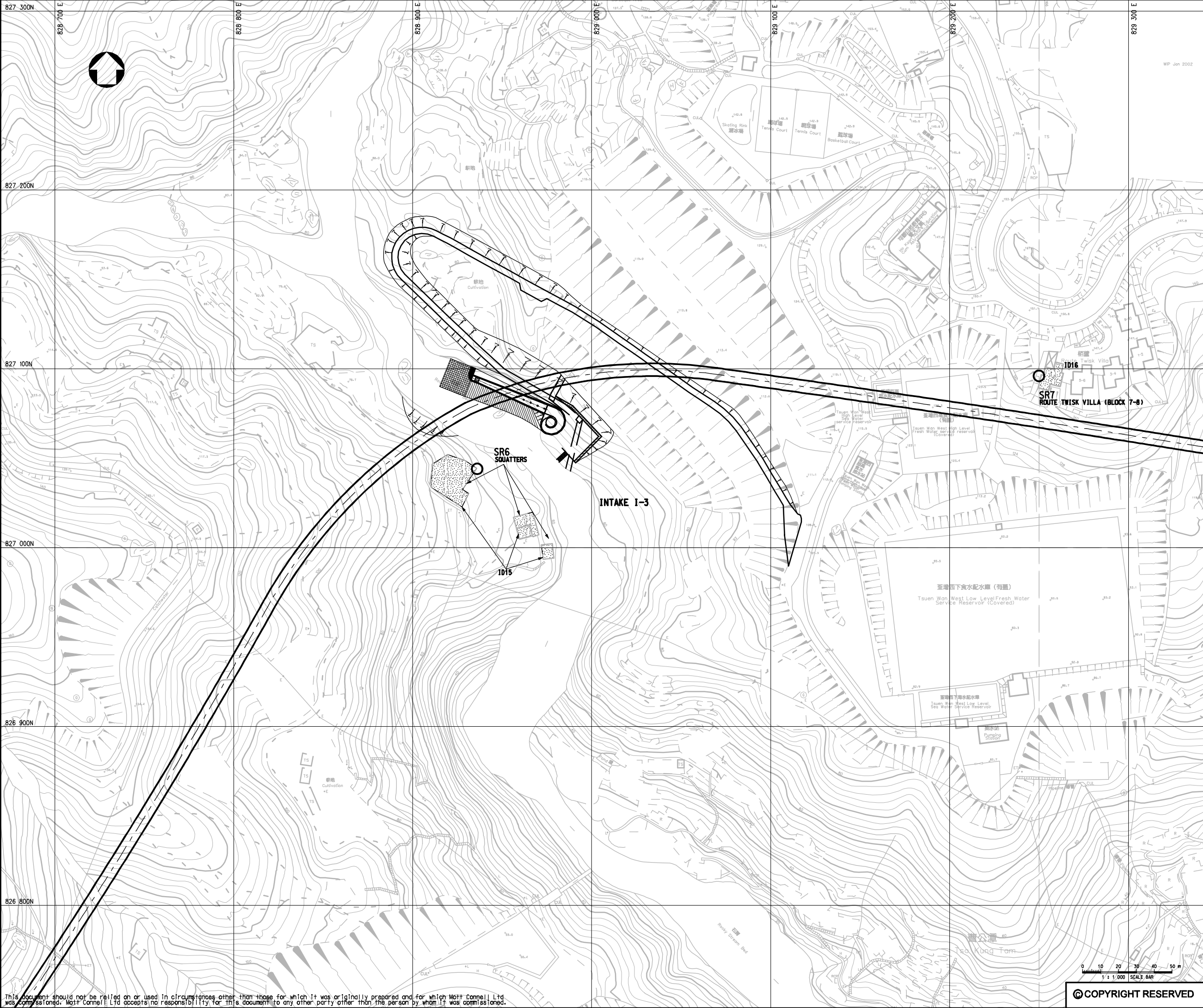
- CO-ORDINATES REFER TO HONG KONG METRIC GRID (1980).
- ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM (P.D.).
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

Key to symbols

LEGENDS :

- TUNNEL ALIGNMENT
- EXISTING LAND BOUNDARY
- REPRESENTATIVE SENSITIVE RECEIVER (USED FOR MODELLING PURPOSES) SA=ASR/NSR
- SELECTED SENSITIVE RECEIVERS
- SELECTED ASSESSMENT POINT

01	MAR 05	EL	FOR EM&A MANUAL		
Rev	Date	Drawn	Description	Ch'kd	App'd
Client					
Consulting Engineers Mott Connell Ltd. in Association with MVA Hong Kong Ltd WL/Delft Hydraulics Ltd EDAW Earth Asia Ltd Chesterton Petty Ltd Environmental Resources Management					
Project Drainage Improvement in Tsuen Wan and Kwai Chung - Tsuen Wan Drainage Tunnel - Investigation					
Title LOCATIONS OF REPRESENTATIVE SENSITIVE RECEIVERS AROUND INTAKE I - 2					
Designed	CF		Eng.Chk.	MT	
Drawn	HL	HL	Approved	TMC	
Dwg.Chk.	KN		Scale	1:1000 @ A1	
Project 204417					Status
CAD file j:\204417\drawing\figure em&a manual\figure1.2b.dgn					
Drawing No.					Rev
FIGURE 1.2b					01



Key Plan:

Notes:

- CO-ORDINATES REFER TO HONG KONG METRIC GRID (1980).
- ALL LEVELS ARE IN METRES ABOVE PRINCIPAL DATUM (P.D.).
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

Key to symbols

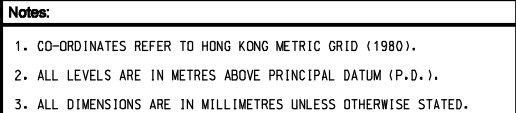
LEGENDS :

- TUNNEL ALIGNMENT
- EXISTING LAND BOUNDARY
- REPRESENTATIVE SENSITIVE RECEIVER (USED FOR MODELLING PURPOSES) SR=ASR/NSR
- SELECTED SENSITIVE RECEIVERS
- SELECTED ASSESSMENT POINT

01	MAR 05	EL	FOR EM&A MANUAL		
Rev	Date	Drawn	Description	Ch'kd	App'd
Client					
Consulting Engineers Mott Connell Ltd. in Association with MVA Hong Kong Ltd WL/Delft Hydraulics Ltd EDAW Earth Asia Ltd Chesterton Petty Ltd Environmental Resources Management					
Project Drainage Improvement in Tsuen Wan and Kwai Chung - Tsuen Wan Drainage Tunnel - Investigation					
Title LOCATIONS OF REPRESENTATIVE SENSITIVE RECEIVERS AROUND INTAKE 1 - 3					
Designed	CF		Eng.Chk.	MT	
Drawn	HL	HL	Approved	TMC	
Dwg.Chk.	KN		Scale	1:1000 @ A1	
Project 204417					Status
CAD file j:\204417\drawing\figure em&a manual\figure1.2c.dgn					
Drawing No.					Rev
FIGURE 1.2c					01

This document should not be relied on or used in circumstances other than those for which it was originally prepared and for which Mott Connell Ltd was commissioned. Mott Connell Ltd accepts no responsibility for this document to any other party other than the person by whom it was commissioned.

© COPYRIGHT RESERVED



01	MAR 05	EL	FOR EM&A MANUAL	<i>mt</i>	<i>[Signature]</i>
Rev	Date	Drawn	Description	Ch'k'd	App'd

Consulting Engineers

Mott Connell Ltd.

in Association with

MVA Hong Kong Ltd W/L/Delft Hydraulics Ltd	EDAW Earth Asia Ltd Chesterton Petty Ltd	Environmental Resources Management
---	---	---------------------------------------

Title
LOCATIONS OF REPRESENTATIVE SENSITIVE RECEIVERS AROUND OUTFALL O-1

Designed	CF	<i>CF</i>	Eng.Chk	MT	<i>MT</i>
Drawn	HL	HL	Approved	TMC	<i>MT</i>
Dwg.Chk.	KN	<i>KN</i>	Scale	1:1000 @ A1	
Project	204417				Status
CAD file	j:\204417\drawing\figure sm&e manual\figure 1.2d.dgn				
Drawing No.	FIGURE 1.2d				Rev 01

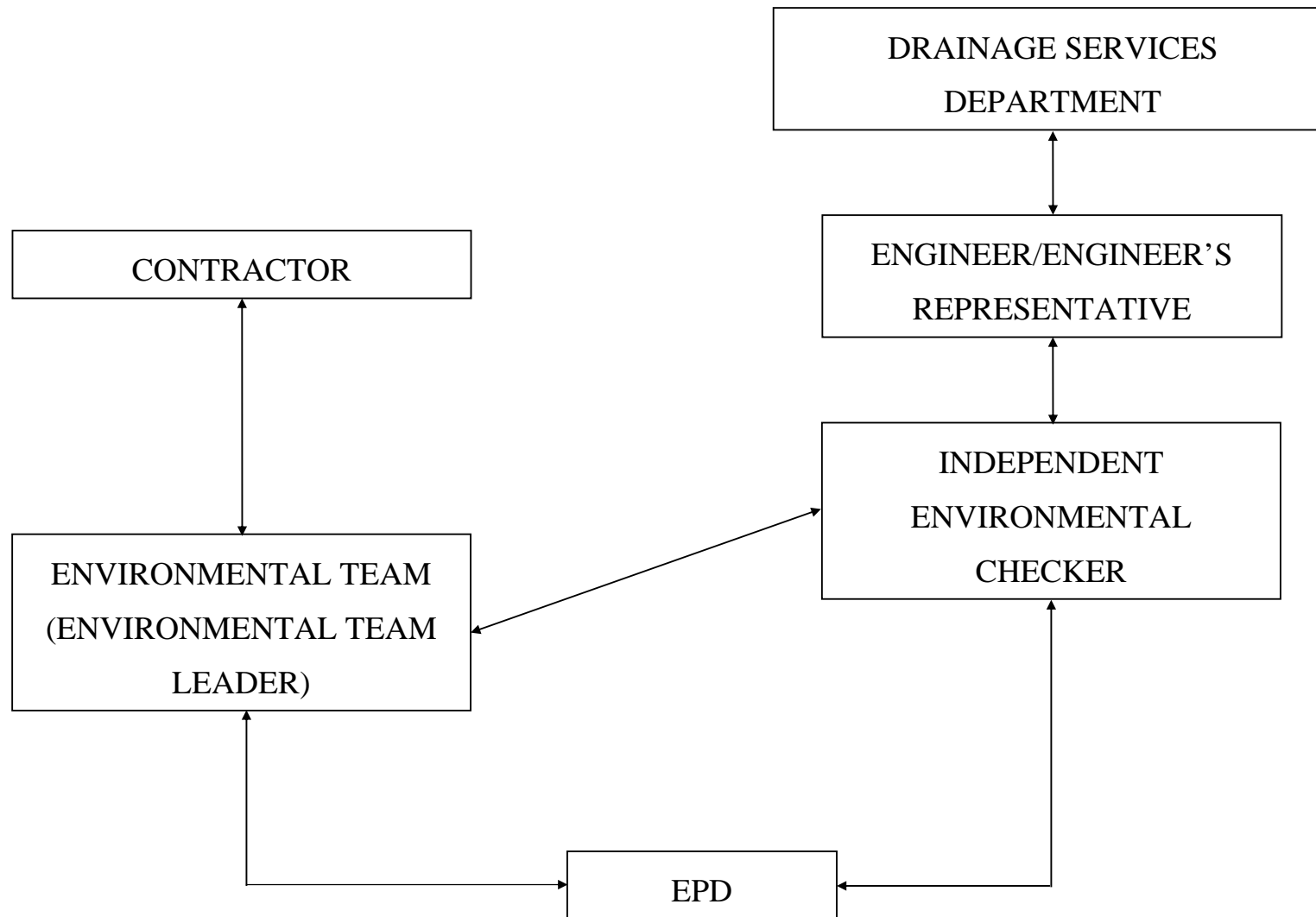
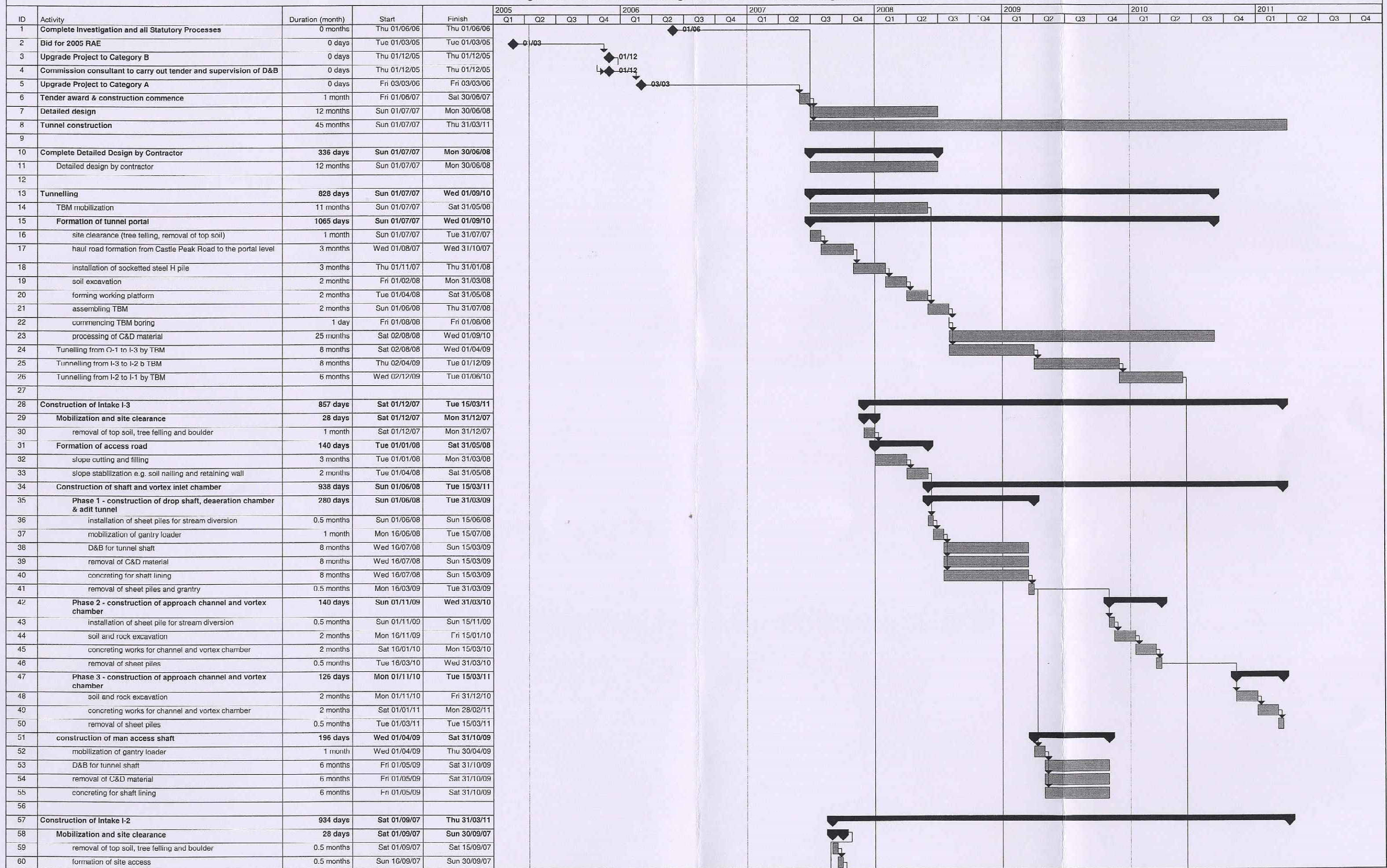


Figure 1.4 - Tsuen Wan Drainage Tunnel - Construction Programme



Project: TWDT_program(revised14-9-0)
Date: Tue 12/04/05

Task
Split

Progress
Milestone

Summary
Rolled Up Task

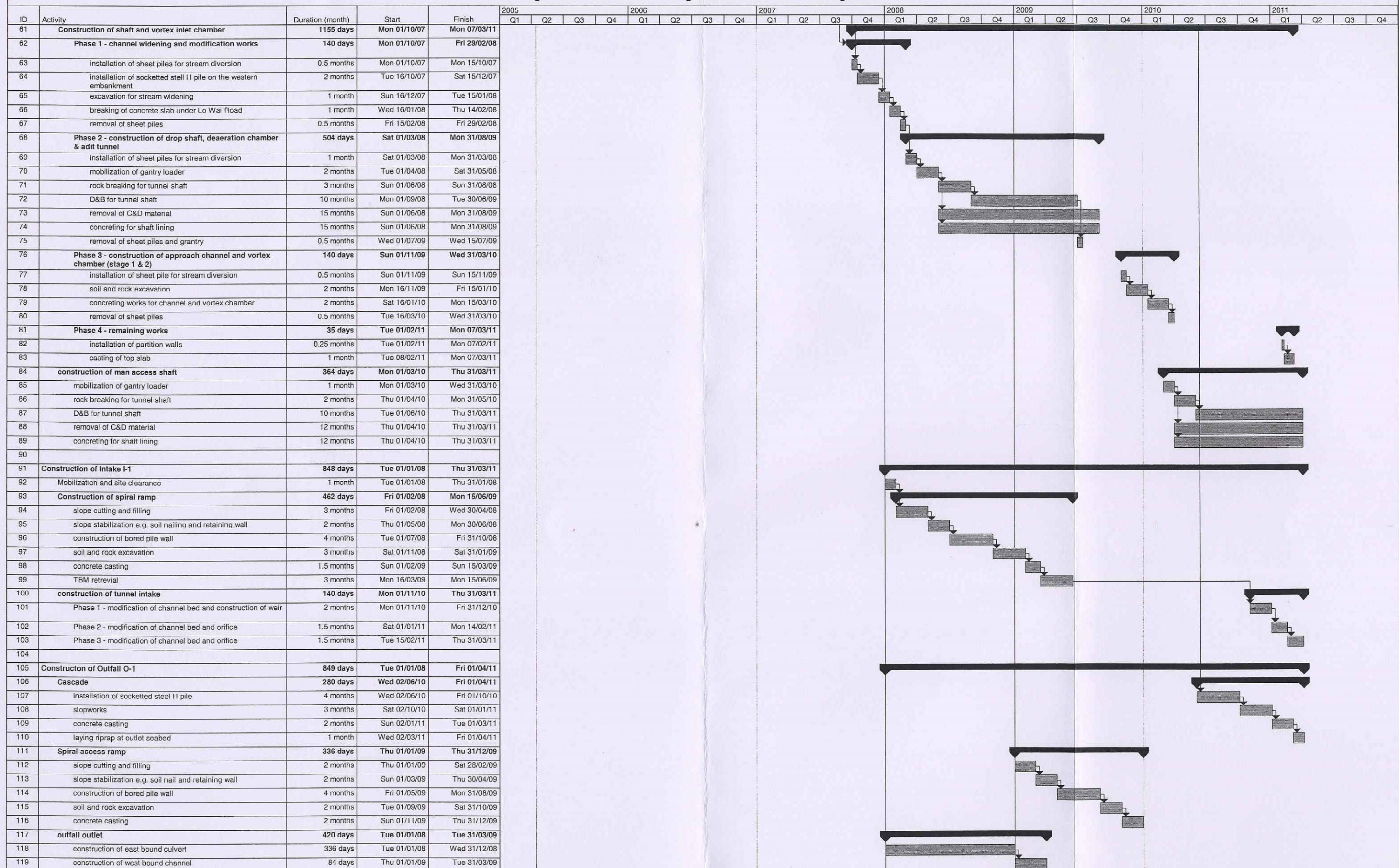
Rolled Up Split
Rolled Up Milestone

Rolled Up Progress
External Tasks

Project Summary
External Milestone

Deadline

Figure 1.4 - Tsuen Wan Drainage Tunnel - Construction Programme



Project: TWDI_program(revised14-9-0
Date: Tue 12/04/05

Task
Split

Progress
Milestone

Summary
Rolled Up Task

Rolled Up Split
Rolled Up Milestone

Summary
Rolled Up Task

Rolled Up Split
Rolled Up Milestone

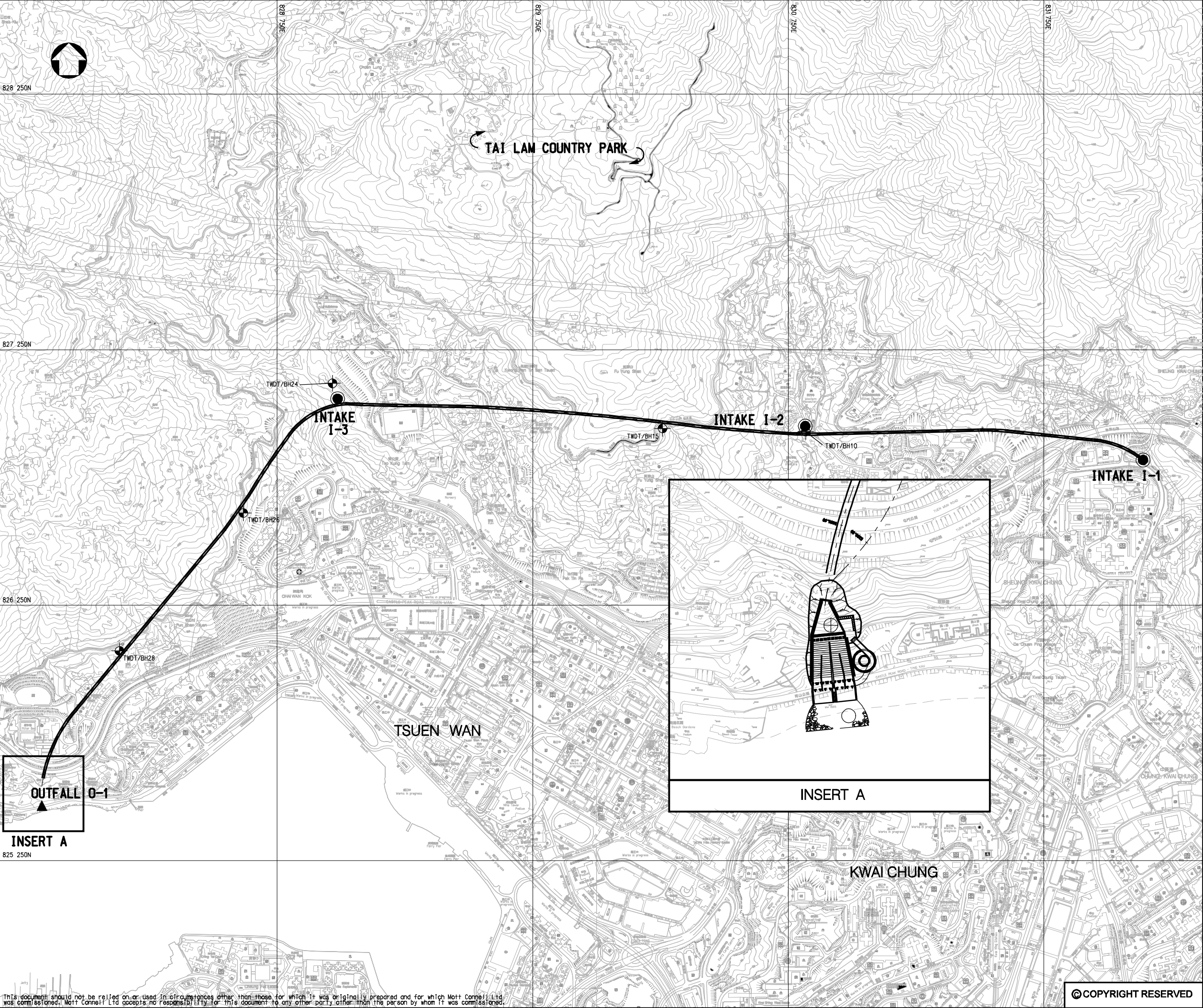
Summary
Rolled Up Task

Rolled Up Progress
External Tasks

Project Summary
External Milestone

Deadline

↓



Key Plan:

Notes:

Key to symbols

LEGENDS :

●

LOCATIONS OF INTAKE STRUCTURES

▲

LOCATIONS OF OUTFALL STRUCTURE

—

PREFERRED TUNNEL ALIGNMENT

⊕

PROPOSED LOCATIONS FOR POST-CONSTRUCTION GROUND WATER MONITORING

○

PROPOSED LOCATIONS FOR WATER MONITORING DURING CONSTRUCTION (FOR INDICATION ONLY)

⊕

PROPOSED LOCATION FOR WATER MONITORING DURING OPERATION (FOR INDICATION ONLY)

© COPYRIGHT RESERVED

This document should not be relied on or used in circumstances other than those for which it was originally prepared and for which Mott Connell Ltd. was commissioned. Mott Connell Ltd. accepts no responsibility for this document to any other party other than the person by whom it was commissioned.