Highways Department
Major Works Project Management Office

KTB/201/Issue 1

Agreement No. CE 7/94
PWP Item No. 6246TH

Kam Tin Bypass
Design and Construction Consultancy

Environmental Monitoring and Audit Manual

Joint Consultants

Binnie Consultants Limited
Wilbur Smith Associates Limited
Harris & Sutherland (Far East) Limited

in association with

Peter Tan & Associates

January 1996

BINNIE

Document Amendment Record

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Document Title : EM & A MANUAL ENVIRONMENTAL IMPACT ASSESSMENT	**Client :** HIGHWAYS DEPARTMENT	

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ALL	26/9/95	1	DRAFT EIA REPORT
ALL	15/12/95	2	FINAL EIA REPORT (DRAFT - LIMITED ISSUE) (EPD - 3, HyD - 1)
APPENDIX of KTB/200 TO KTB/201	25/1/96	1	EM& A MANUAL BECOMING SEPARATE DOCUMENT.
ALL	18/3/96	1	ISSUE WITH FINAL EIA & EXECUTIVE SUMMARY TO ALL RELEVANT PARTIES.

Prepared by : A.M.Proctor Signed : Date : 25/1/96

* The Registered Recipient is responsible for destroying or marking as 'superseded' all superseded documents.

ENVIRONMENTAL MONITORING AND AUDIT MANUAL

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	Name	Signature	Date
Prepared	A.M. PROCTOR		25/1/96
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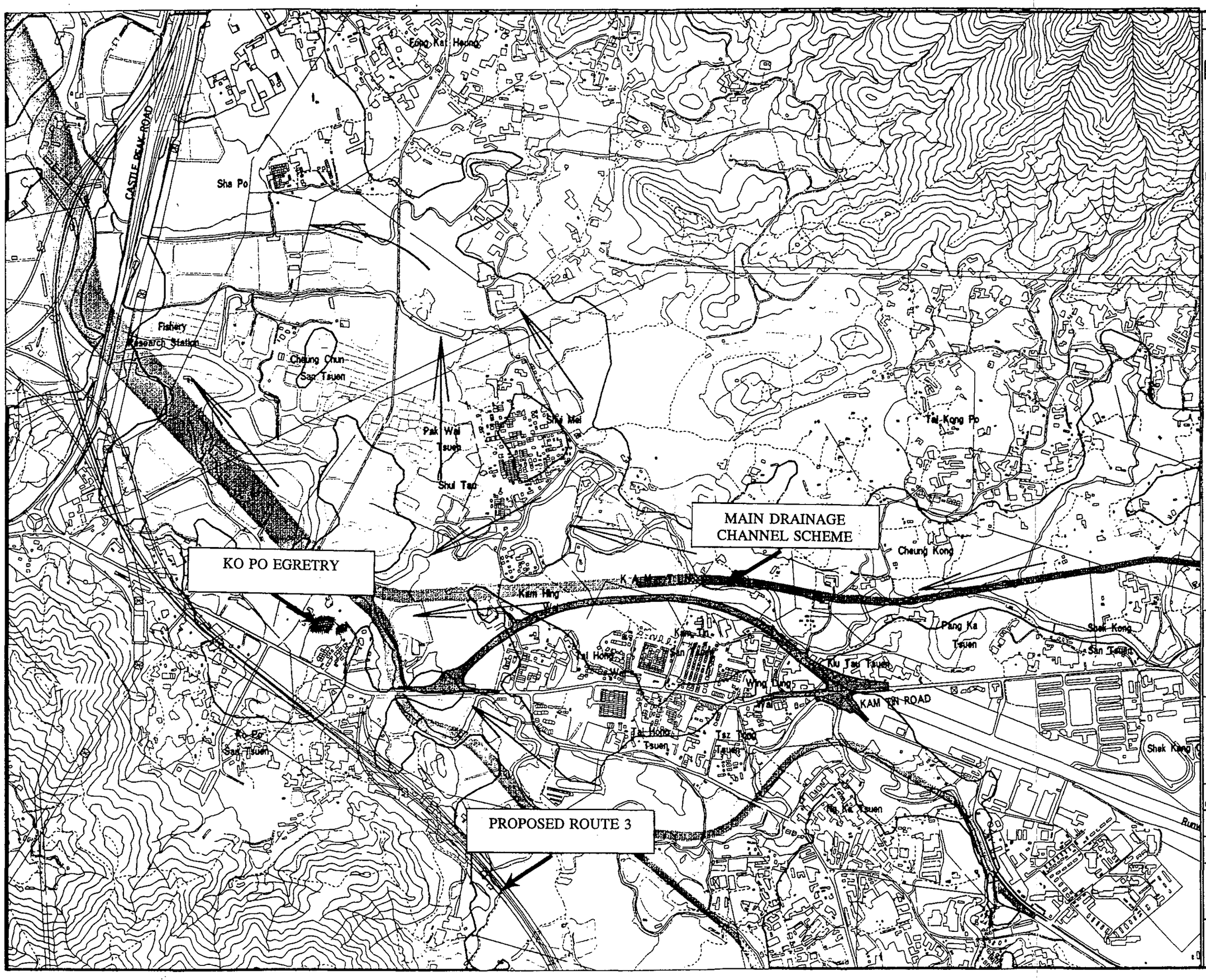
Figures



LEGEND :

- Flood Storage Area In 1992
- Proposed Kam Tin Bypass
- Floodway
- River Training By DSD

Project title

Agreement no. CE 7/94
Kam Tin By-pass

Drawing title

EIA - KAM TIN BYPASS & ADJACENT PROJECTS

Plan register no.

BCL1/home3/mapbase/BASIN1/ZF16/KTCOMP2

Figure No. 1.1

Scale N.T.S.

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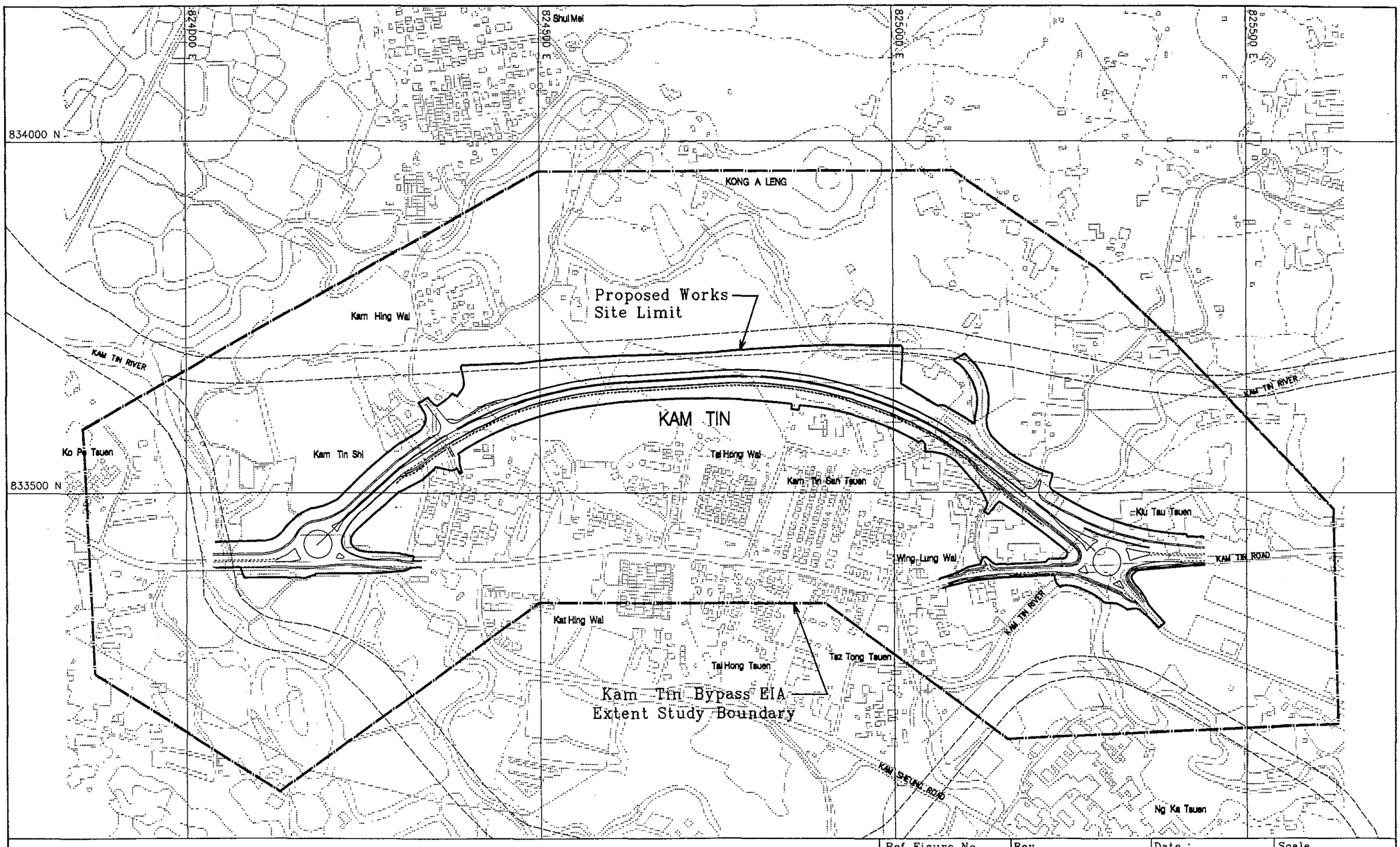
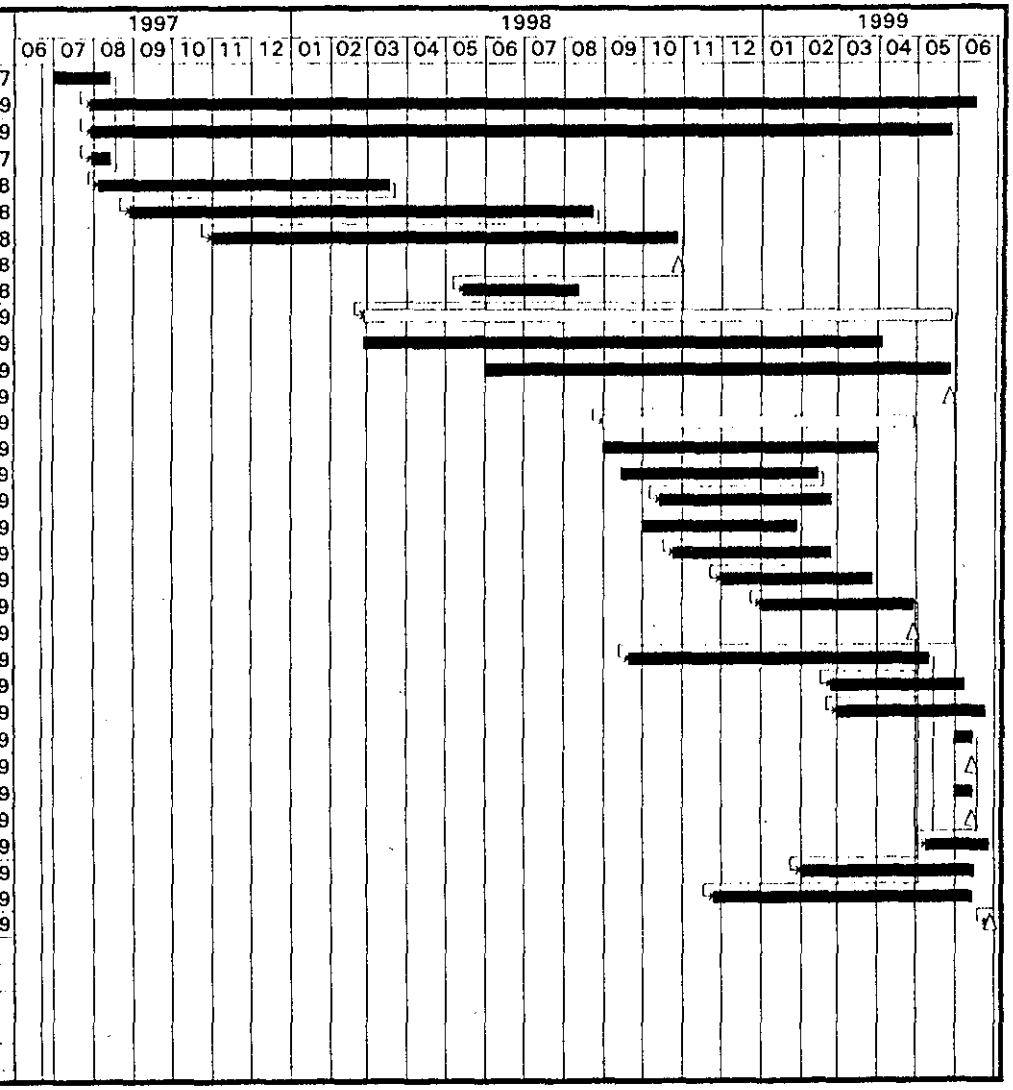


Agreement no. CE 7/94 Kam Tin By-pass	Ref. Figure No.	Rev.	Date : SEP. 95	Scale N.T.S.
Title : KAM TIN BY-PASS GENERAL LAYOUT	Joint Consultants : Binnie Consultants Limited Wilbur Smith Associates Limited Harris & Sutherland (Far East)			Figure No. 1.2

Figure 1.3 Proposed Kam Tin Bypass Construction Programme

Row #	Task Name	Start	End
1	Site Office, Plant Mobilization, Site Clearance	30/06/1997	14/08/1997
2	Traffic Diversion (continual task)	29/07/1997	15/06/1999
3	Existing Drainage Diversion (continual task)	30/07/1997	28/05/1999
4	Remove unsuitable material	30/07/1997	14/08/1997
5	Ground Treatment Work	05/08/1997	19/03/1998
6	Cross Road Drainage/Flood Mitigation Measure	29/08/1997	24/08/1998
7	Road Embankment	31/10/1997	28/10/1998
8	Embankment Completion	29/10/1998	29/10/1998
9	Subway	15/05/1998	13/08/1998
10	Slope Drainage	27/02/1998	28/05/1999
11	U - Channel	27/02/1998	05/04/1999
12	Trapezoidal Channel	01/06/1998	28/05/1999
13	Drainage Completion	28/05/1999	28/05/1999
14	Roadwork	01/09/1998	30/04/1999
15	Footpath Paving	01/09/1998	02/04/1999
16	Cycle Track Formation & Subbase	15/09/1998	15/02/1999
17	Cycle Track Paving	15/10/1998	25/02/1999
18	Carriageway Formation & Subbase	01/10/1998	29/01/1999
19	Profile Barrier/Road Kerb	26/10/1998	25/02/1999
20	Road drainage	01/12/1998	29/03/1999
21	Carriageway Paving	01/01/1999	30/04/1999
22	Roadwork Completion	30/04/1999	30/04/1999
23	Landscaping	21/09/1998	12/05/1999
24	RoadLighting	25/02/1999	09/06/1999
25	Traffic Signs	01/03/1999	25/06/1999
26	Merging Eastern Junction to Existing Road	01/06/1999	15/06/1999
27	Eastern road junction Completed	15/06/1999	15/06/1999
28	Merging Western Junction to Existing Road	01/06/1999	15/06/1999
29	Western road junction Completed	15/06/1999	15/06/1999
30	Road Marking	10/05/1999	28/06/1999
31	E & M Installation	01/02/1999	16/06/1999
32	Noise Barrier	26/11/1998	15/06/1999
33	Completion of work	29/06/1999	29/06/1999



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1 PROJECT DESCRIPTION

Kam Tin Bypass - Proposed Development

1.1 The Bypass location is to the north of Kam Tin San Tsuen and Tai Hong Wai. The alignment spans from the Kiu Tau Tsuen section of Kam Tin Road in the east to the west of Kam Tin Shi. The purpose of the Bypass is to provide an alternative route so that through traffic will not need to enter the Kam Tin area. Environmentally, this will reduce air pollution and traffic noise for a considerable number of residents in Kam Tin. It will also ease the congestion that presently occurs between East and West New Territories.

1.2 The prospective road alignment of the Kam Tin Bypass runs, for the most part, through a stretch of agricultural fields. The area has been reserved for many years and is extensively overgrown. The location and the study area are shown in Figures 1.1 and 1.2.

1.3 The work activities involved in the construction of the Bypass basically include earthworks, drainage works, concreting works and roadworks. It is expected much of the *insitu* material will be top soil or saturated silty pond-mud. Piling, on-site rock crushing and on-site concrete batching are not required. The main access to the Kam Tin Bypass site is Kam Tin Road and three paved private roads Wing Lun Wai, Tai Hong Wai and Kam Tin Shi. The crossroad, slope drainage, pedestrian subway construction and the associated flood mitigation works are expected to be carried out during the early part of the construction of the Kam Tin Bypass. Roadwork construction will follow.

1.4 In the design of the Bypass, an earth bund will be constructed along the southern side of the Bypass. This is the space reserved for the traffic noise barrier and soft landscaping.

Proposed Construction Programme

1.5 Figure 1.3 shows the proposed construction programme for the Kam Tin Bypass as dated the 17th August 1995. The construction period is expected to last from 30th June 1997 to 29th June 1999.

2 ENVIRONMENTAL MONITORING AND AUDIT

Objectives of Environmental Monitoring and Audit (EM&A) Programme

2.1 Monitoring can be most concisely defined as the systematic collection of data through a series of repetitive measurements. In this project this involves the measurement of environmental parameters during project construction and the identification of any changes in these parameters which may be attributed to the project so that proactive mitigation measures can be adopted to avoid the occurrence of adverse environmental impacts.

2.2 Baseline or control monitoring refers to the measurement of environmental parameters during a representative period for the purpose of determining the nature and range of "ambient", or natural, conditions in order to determine whether it is necessary to review or determine the standards with which construction monitoring results are to be compared.

2.3 The environmental audit system is intended to check methodically that the activities of the project are complying with previously defined environmental requirements and that the necessary measures have been identified to remedy any unacceptable or unforeseen environmental impacts. Environmental auditing is a check to reassure management and regulatory agencies that the facilities are being operated in an environmentally acceptable manner. It also enables a post analysis to be carried out to examine the accuracy of the original environmental impact assessment.

2.4 The EM&A Programme consists of a schedule of monitoring and auditing of designated environmental parameters of the Kam Tin Bypass Study Area in order to:

- provide a baseline database of "ambient", or natural, conditions;
- monitor and interpret conditions with respect to acceptance criteria during construction in order to provide an early indication that any of the environmental control measures or construction practices are failing to achieve the required standards;
- provide data to determine the effectiveness of any mitigation or control measures implemented through changes in working practice undertaken if acceptance criteria are exceeded;

- provide a database of conditions during and prior to the construction period for the assessment of the extended effects of construction and for the post-project audit;

- assess compliance with contractual or legislative environmental standards;

- assess the validity of the trigger, action and target levels (TAT levels) set for the event/action plans;

- *Trigger Levels* - levels beyond which there is an indication of a deteriorating ambient environment for which a typical response would be more frequent monitoring;

  Action Limits - levels beyond which appropriate remedial actions may be necessary to prevent environmental quality from exceeding the *Target Limits*, which would be unacceptable;

  Target Limits - statutory limits stipulated in the relevant pollution control ordinances, *Hong Kong Planning Standards and Guidelines* or Environmental quality Objectives established by EPD.

- ensure that only acceptable environmental impact impinges upon nearby sensitive uses and receivers with the aim of minimising adverse impact upon the surrounding environs.

Scope of Audit

2.5 The following points will be considered, as appropriate, for each of the monitored environmental impacts. The audit will:

- check that the approved sampling procedures and analytical techniques are used to collect the data;

- consider wind and weather conditions where appropriate at the time of sampling;

- ascertain whether any extraneous activities, unrelated to the construction works on the site, may have influenced the data. Factors such as nearby construction works should be considered;

- ascertain what activities or operations take place at the site before or during the sampling period;

- compare the data with TAT levels and identify any non-compliance as compared to data provided by baseline and control station monitoring;
- implement action plans where appropriate and communicate with all involved parties;
- review actions taken to deal with non-compliance;
- review the overall monitoring philosophy, in terms of sampling location, frequency, parameter measured, test method, acceptance criteria and control procedure. Revise if necessary;
- revise the scope and frequency of the auditing system to reflect changes in environmental impacts and construction procedures;
- carry out a post project analysis to compare the environmental impacts predicted in the EIA with actual impacts;
- issue regular reports on the monitoring & auditing programme; and
- review actions taken to deal with complaints from the general public and consider whether any fundamental changes are necessary. A clearly defined system shall be established to respond promptly to public complaints.

Identification of Key Responsibilities

2.6 The Client shall be responsible for:

- approving the appointment of the Environmental Monitoring and Management teams.

2.7 The Contractor shall be responsible for:

- providing an environmental Monitoring Team (MT) who will be under the direction of the Engineer;
- providing all necessary monitoring equipment;
- implementing environmental controls and mitigation as set out in this manual as well as any additional measures necessary for compliance with the environmental control standards; and

- following any reasonable directions given by the Engineer or the Engineer's Representative particularly as the result of the implementation of event/action plans.

2.8 The Engineer will be responsible for:

- ensuring that the EM&A programme is fully implemented;
- appointing an Environmental Management Team (EMT);
- ensuring that the Contractor is implementing environmental controls and mitigation as set out in the Manual as well as any additional measures necessary for compliance with the environmental control standards;
- approving and controlling the MT provided by the Contractor;
- ensuring that the Contractor is implementing and enforcing event/action plans when exceedances of TAT levels occur;
- reviewing the monitoring and audit reports submitted by the EMT;
- delegating the above tasks in most instances to his representative on the site: the Engineer's Representative (ER);
- ensuring that monitoring results are sent to both the ER and the EMT as quickly as possible; and
- implementing a "stop work" action if repeated exceedance of target levels justifies this action.

2.9 The ER has a key role to play with the EM&A programme, undertaking:

- an engineering audit of environmental reports;
- site liaison;
- implementing and enforcing event/action plans when exceedances of TAT levels occur; and
- ensuring that measures to protect surface water quality are both sufficient and properly and regularly maintained.

2.10 He will be responsible for circulating reports on:

- a regular monthly basis;
- when action plans are implemented;
- when responding to public complaints.

2.11 The ER will, in most instances, delegate direction of the MT to the EMT. He may choose to delegate other tasks to the EMT.

2.12 The EMT will hold a key position with the EM&A programme, undertaking:

- the direction of the MT;
- the auditing role;
- the main reporting function; and
- the liaison and communication function.

2.13 The EMT will be responsible for:

- reviewing the monitoring data produced taking into account any factors which may influence this data;
- interpreting the reviewed data with reference to TAT levels and baseline and control data;
- ascertaining whether any extraneous activities, unrelated to the construction work on the site, may have influenced the data. Factors such as nearby construction works should be considered;
- implementing event/action plans when exceedances of TAT levels occur;
- liaising and consulting with all relevant parties during the implementation of action plans;
- modifying the EM&A programme in consultation with the Engineer, the ER and EPD if necessary;
- producing reports on:

  (i) a regular monthly basis;
  (ii) when action plans are implemented;
  (iii) when responding to public complaints.

2.14 The MT will be responsible for:

- collecting all the necessary data using the procedures outlined in the Manual;
- ascertaining what activities or operations take place at the site before or during the sampling period;
- recording factors such as wind and weather conditions where appropriate at the time of sampling or data collection;
- ascertaining whether any extraneous activities, unrelated to the construction work on the site, may have influenced the data. Factors such as nearby construction works should be considered;
- undertaking regular maintenance and calibration of equipment so that accurate data is collected with precision;
- reporting to the EM any abnormality in monitoring process and any difficulties encountered.

2.15 Figure 2.1 presents a flowchart of lines of authority for the project EM&A programme.

The Reporting Function

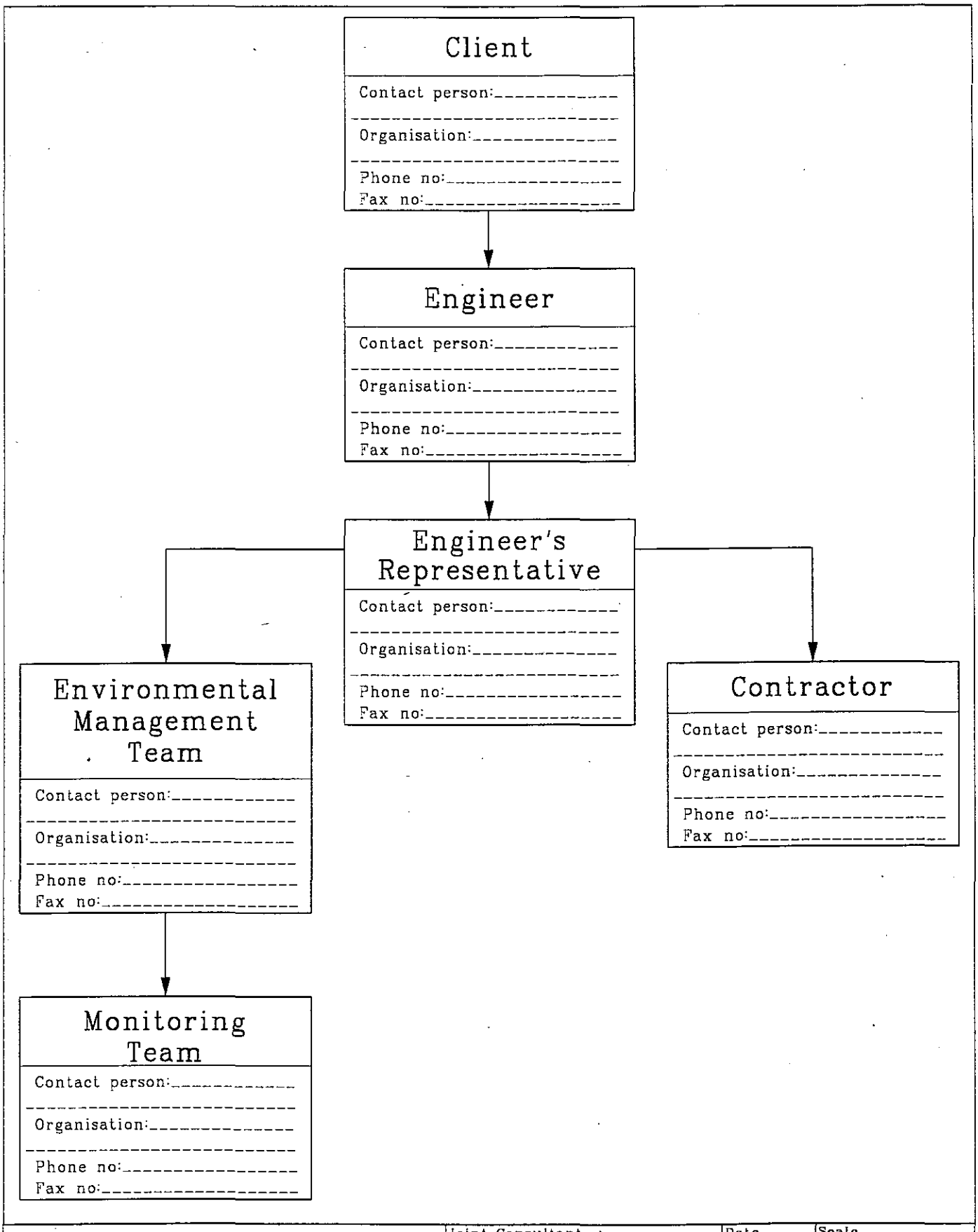
2.16 The manager of the MT shall issue data reports as quickly as possible to:

- the ER; and
- the EMT.

2.17 The format of these reports shall be agreed in consultation between the EMT, the MT and the ER. Presentation of data via modem or on disk will be preferred.

2.18 The EMT shall be responsible for the main reporting function. Both regular monthly and unscheduled incident reports shall be circulated by the ER through the Engineer as appropriate to:

- the EMT;
- the Contractor;
- the MT;
- the Engineer;
- the Client; and
- EPD.



Agreement no. CE 7/94 Kam Tin By-pass EIA - LINES OF AUTHORITY FOR EM & A PROGRAMME	Joint Consultants : Binnie Consultants Limited Wilbur Smith Associates Limited Harris & Sutherland (Far East)	Date SEP. 95	Scale
	HIGHWAYS DEPARTMENT HONG KONG	Initial	Figure No. 2.1

2.19 The flowchart presented in Figure 2.2 summarises the lines of communication for the reporting function.

Complaints Procedures

2.20 A formal procedure for handling complaints about environmental matters is outlined below. All complaints need sensitive handling.

2.21 The ER will be responsible for the implementation of complaints procedures. A flowchart of the tasks is given in Figure 2.3.

2.22 Each complaint will be logged and will include:

- data and time;
- source of complaint;
- complainant's name, telephone or fax number, and address;
- nature of the complaint;
- site situations as observed by complainant;
- results of investigations into the complaints; and
- records of all communications made and actions taken.

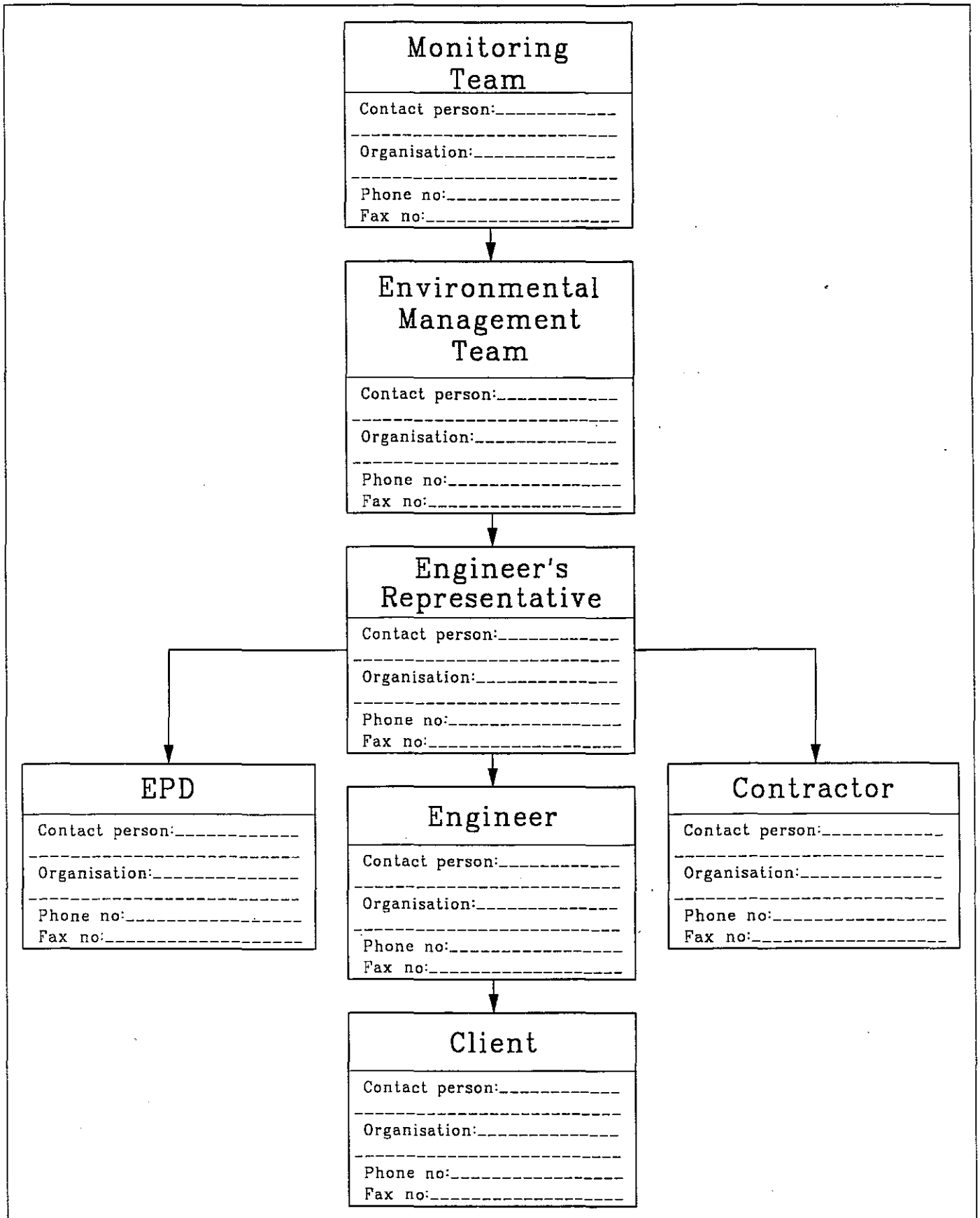
2.23 A copy of this log will form a part of the regular monthly reports and will be accompanied by a review of the circumstances including any recommendations necessary to avoid future repetitions of complaints of a similar nature.

2.24 All complainants will be answered as soon as possible in writing acknowledging receipt of the complaint.

2.25 All complaints will be investigated.

2.26 Additional monitoring may be appropriate.

2.27 The ER will use discretion and liaise with all relevant parties as necessary.



Agreement no. CE 7/94 Kam Tin By-pass EIA - REPORTING FUNCTION FOR EM & A PROGRAMME	Joint Consultants : Binnie Consultants Limited Wilbur Smith Associates Limited Harris & Sutherland (Far East)	Date SEP. 95	Scale
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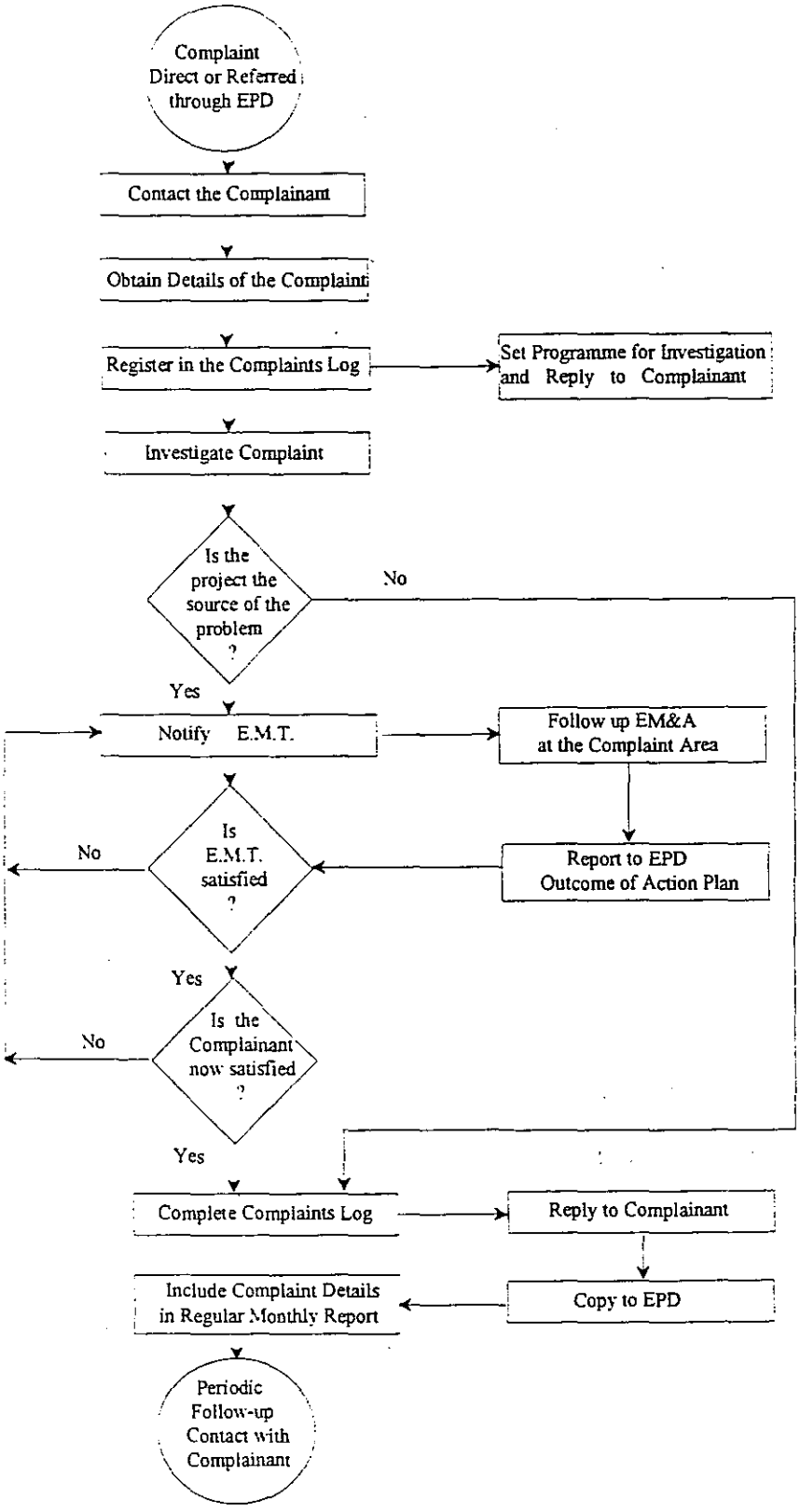


Agreement no. CE 7/94 Kam Tin By-pass EIA - COMPLAINTS PROCEDURE ACTION FLOW CHART FOR EM & A PROGRAMME	Joint Consultants : Binnie Consultants Limited Wilbur Smith Associates Limited Harris & Sutherland (Far East) HIGHWAYS DEPARTMENT HONG KONG	Date SEP. 95 Initial	Scale Figure No. 2.3

Reporting

2.28 The following reports will be prepared by the EMT for the ER.

Baseline Monitoring Report

2.29 The baseline monitoring report should include at least the following:

(i) up to half a page executive summary;

(ii) brief project background information;

(iii) drawings showing locations of the baseline monitoring stations;

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

- monitoring methodology;
- equipment used and calibration details;
- parameters monitored;
- monitoring locations (and depth);
- monitoring data, time, frequency and duration;

(v) 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;

(vi) determination of the Trigger, Action and Target Levels for each monitoring parameter;

(vii) revisions for inclusion in the EM&A Manual; and

(viii) comments and conclusions.

Monthly EM&A Reports

2.30 The results and findings of each audit should be documented in monthly EM&A reports prepared by the EMT. Monthly EM&A reports shall include at least the following:

(i) 1-2 pages executive summary;

(ii) basic project information including a synopsis of the project organisation, programme and management structure, and the work undertaken during the month;

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

- all monitoring parameters;
- environmental quality performance limits (Trigger, Action and Target levels);
- Event-Action Plans;
- environmental mitigation measures, as recommended in the project EIA study final report;
- environmental requirements in contract documents;

(iv) advice on the implementation status of environmental protection and pollution control (mitigation) measures, as recommended in the project EIA study report, summarised in updated implementation schedule;

(v) drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;

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

- monitoring methodology;
- equipment used and calibration details
- parameters monitored;
- monitoring locations (and depth);
- monitoring date, time, frequency, and duration;

(vii) graphical plots of trends of monitored parameters over the past four reporting periods for representative monitoring stations annotated against the following:

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

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

(iv) a summary of noncompliance (exceedances) of the environmental quality performance limits (Trigger/Action/Target levels);

(x) a review of the reasons for and the implications of noncompliance including review of pollution sources and working procedures;

(xi) a description of the actions taken in the event of noncompliance and deficiency reporting and any follow-up procedures related to earlier noncompliance;

(xii) a summary record of all complaints received (written or verbal) for each media, including locations and nature of complaints, liaison and consultation undertaken, actions and follow-up procedures taken and summary of complaints;

(xiii) a forecast of the works programme, impact predictions and monitoring schedule for the next three months; and

(xiv) comments, recommendations and conclusions for the month.

Quarterly EM&A Reports

2.31 The quarterly EM&A summary report which should generally be around 5 pages (including about 3 of text and tables and 2 of figures) should contain at least the following information:

(i) up to half a page executive summary;

(ii) basic project information including a synopsis of the project organisation, programme, contacts of key management, and a synopsis of work undertaken during the quarter;

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

- monitoring parameters;
- environmental quality performance limits (Trigger, Action and Target levels); and
- environmental mitigation measures, as recommended in the project EIA study final report;

(iv) 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;

(v) drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;

(vi) graphical plots of the trends of monitored parameters over the past 4 months (the least 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;

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

(viii) a summary of noncompliance (exceedances) of the environmental quality performance limits (Trigger/Action/Target levels);

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

(x) a summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;

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

(xii) comments, recommendations and conclusions for the quarter; and

(xiii) proponents' contacts and any hotline telephone number for the public to make enquiries.

3 PREREQUISITE RELEVANT ENVIRONMENTAL STANDARDS

Legislative Standards

3.1 The Contractor should comply with and observe all ordinances, by-laws, regulations and rules for the time being in force in Hong Kong governing any form of pollution and the protection of the environment including:

(i) Noise Control Ordinance (Cap 400)

(ii) Air Pollution Control Ordinance (Cap 311)

(iii) Water Pollution Control Ordinance (Cap 358)

(iv) Dumping at Sea Act 1974 (Overseas Territory Order) 1975

(v) Merchant Shipping (Oil Pollution) (Hong Kong) Order 1975

(vi) Summary Offences Ordinance (Cap 228)

(vii) Factories and Industrial Undertakings Ordinance (Cap 59)

(viii) Waste Disposal Ordinance (Cap 354)

(ix) Public Cleansing and Prevention of Nuisances (Regional Council) By-Laws (Cap 132)

(x) Building Ordinance (Cap 123)

(xi) Building Ordinance (Application to New Territories) Ordinance (Cap 121)

(xii) Public Health and Municipal Services Ordinance (Cap 132)

(xiii) Waste Disposal (Chemical Waste) (General) Regulation (Cap 354)

(xiv) Dangerous Goods (General Regulations) (Cap 295)

(xv) Dangerous Goods Ordinance (Cap 295)

Specific Statutory Requirements

Air Quality

3.2 The requisite standards with respect to air pollution at sensitive receivers (SRs) should not exceed the target values given in Table 3.1.

Table 3.1
Target Values for Emission of Air Pollutants
The Hong Kong Air Quality Objectives (AQOs)

Pollutant	Concentration in Micrograms per Cubic Metre[a]				
	Averaging Time				
	1-hour[b]	8-hours[c]	24-hours[e]	3-months[d]	1-year[d]
Sulphur Dioxide	800		350		80
Total Suspended Particulate	500[g]		260		80
Respirable Suspended Particulate[e]			180		55
Nitrogen Dioxide	300		150		80
Carbon Monoxide	30,000	10,000			
Photochemical Oxidant as O_3[f]	240				
Lead				1.5	

Notes : (a) Measured at 298 K and 101.325 kPa (one atmosphere).
(b) Not to be exceeded more than 3 times per year.
(c) Not to be exceeded more than once per year.
(d) Arithmetic means.
(e) Respirable suspended particulate means suspended particulate in air with a nominal aerodynamic diameter of 10 micrometre and smaller.
(f) Photochemical oxidants are determined by measurement of ozone only.
(g) Contractual, recommended by EPD, not an AQO.

Construction Noise

3.3 The Noise Control Ordinance (Cap. 400), NCO, was gazetted in 1988 and specific sections relating to general construction work were implemented in 1989. Ordinance No. 2 of 1994 amended the NCO and provided for larger penalties for offences under the Ordinance. General construction work using powered mechanical equipment is restricted between 1900 and 0700 hours on Sundays and general holidays.

3.4 The standards and limits for noise emanating from construction sites are set out in Technical Memoranda issued by the Secretary from time to time. The current standards are shown below.

Table 3.2
Area Sensitivity Ratings (ASRs)

Degree to which NSR is affected by IF / Type of Area Containing NSR	Not Affected	Indirectly Affected	Directly Affected
(i) Rural area, including country parks or village type developments	A	B	B
(ii) Low density residential area consisting of low-rise or isolated high-rise developments	A	B	C
(iii) Urban Area	B	C	C
(iv) Area other than those above	B	B	C

Source: Technical Memorandum on Noise from Construction Work other than Percussive Piling

Table 3.3
Basic Noise Levels (BNLs) for Construction Noise from Activities other than Percussive Piling in dB(A)

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

Source: Technical Memorandum on Noise for Construction Work other than Percussive Piling

Water Quality

3.5 The standards for water quality are set by the *Water Pollution Control Ordinance* (CAP 358).

3.6 The study area is within the Deep Bay Water Control Zone (WCZ) which was declared in December 1990. The water quality in Kam Tin River should comply with the Water Quality Objectives (WCO) for the inland waters of Deep Bay WCZ; the relevant criteria for the project are given in the following table. The Kam Tin River itself is a sensitive receiver for the Project in that it carries water for downstream uses.

Table 3.4
Water Quality Objectives for Rivers in Deep Bay WCZ

Parameters	WQO Criteria
pH	6.5 - 8.5
Suspended Solids	the annual median shall not exceed 20 mg/L
Dissolved Oxygen	not to be below 4 mg/L
Chemical Oxygen Demand	not to exceed 15 mg/L
Biochemical Oxygen Demand (5 day)	not to exceed 3 mg/L

EPD Internal Practice

Construction Noise

3.7 In addition to the requirements imposed by the *Noise Control Ordinance*, the following requirements or interpretations will also be used as a standard in order to control noise generated from equipment and activities for the purpose of carrying out any construction work other than percussive piling during the time period from 0700 to 1900 hours on any day not being a general holiday:

(i) The noise level measured at 1 m from the most affected external facade of the nearby noise sensitive receivers (NSRs) during any 30-minute period during normal weekly daytime periods between 0700 to 1900 hours will not exceed an equivalent should level (L_{Aeq}) of 75 dB(A) or 70 dB(A) (or 65 dB(A) during examination) for schools.

4 A SUMMARY OF MITIGATIVE MEASURES AND RECOMMENDED POLLUTION CONTROL CLAUSES

Avoidance of Nuisance

4.1 (i) The Contractor should comply with and observe all Ordinances, bye-laws, regulations and rules for the time being in force in Hong Kong governing the control of any form of pollution, including air, noise, water and waste pollution, and for the protection of the environment, and should implement all pollution control measures to the satisfaction of the Engineer and the Director of Environmental Protection.

(ii) All works are to be carried out in such a manner as to cause as little inconvenience as possible to nearby residents, property and to the public in general, and the Contractor shall be held responsible for any claims which may arise from such inconvenience.

(iii) The Contractor shall be responsible for the adequate maintenance and clearance of channels, gullies, etc. and shall also provide and maintain such pedestrian and vehicular access as shall be directed within the Site.

(iv) Water shall be used to prevent dust rising and the Contractor shall take every precaution to prevent the excavated materials from entering into the public drainage system.

(v) Water and liquid waste products arising on Site should be collected and removed from the Site by a suitable and properly designed temporary drainage system and should be disposed of at a location and in a manner that should not cause pollution or a public health nuisance.

(vi) The Contractor should construct, maintain, remove and reinstate temporary drainage works and shall take other precautions necessary to avoid damage by flooding and by silt washed down from the Works. Adequate precautions should be provided to ensure that spoil or debris is not allowed to be pushed, washed down, fall or be deposited on land or in the watercourses adjacent to the Site.

(vii) The Contractor should make provision for the disposal from the Works of all solid waste products such that pollution and nuisance are not caused; the manner and location of disposal shall be as agreed by the Engineer.

(viii) The use of access roads should be kept to a minimum.

(ix) The Contractor should ensure that no earth, rock or debris is deposited on public or private rights of way as a result of activities, including any deposits arising from the movement of plant or vehicles.

(x) In the event of any spoil or debris from the Works being deposited on adjacent land or streambed or any silt being washed down to any area, then all such spoil, debris or material and silt will be immediately removed and the affected land or streambed areas restored to their natural state by the Contractor to the satisfaction of the Engineer.

(xi) Waste collected from grease traps shall be collected and disposed of by a licensed contractor.

Air Quality Protection - including Dust Suppression Measures

4.2 (i) The Contractor shall undertake at all times prevent dust nuisance as a result of his activities. Effective dust suppression measures as are necessary should be installed to ensure that the air quality, at the boundary of the site and at any sensitive receivers, complies with the Hong Kong Air Quality Objectives.

(ii) Construction working areas shall be restricted to a minimum practicable size.

(iii) Stockpiles of sand aggregate or any other dusty materials greater than 20 m^3 shall be enclosed on three sides, with walls extending above the pile and 2 metres beyond the front of the pile.

(iv) Effective water sprays shall be used during the delivery and handling of aggregate, and other similar materials, when dust is likely to be created and to dampen all stored materials during dry and windy weather.

(v) Chemical wetting agents shall only be used on completed cuts and fills to reduce wind erosion.

(vi) Watering of exposed surfaces shall be undertaken at least twice daily and be exercised as often as possible depending on the circumstances.

(vii) Areas within the Site where there is a regular movement of vehicles shall have an approved hard surface and be kept clear of loose surface material. These areas must be regularly watered as often as is necessary for effective suppression of dust or as often as directed by the Engineer.

(viii) Should a conveyor system be used, the Contractor shall implement the following precautionary measures. Conveyor belts shall be fitted with windboards. Conveyor transfer points and hopper discharge areas shall be enclosed to minimise dust emission. All conveyors under the Contractor's control, and carrying materials which have the potential to create dust, shall be totally enclosed and fitted with belt cleaners.

(ix) Where dusty materials are being discharged to vehicle from a conveying system at a fixed transfer point, a three-sided roofed enclosure with a flexible curtain across the entry shall be provided. Exhaust fans shall be provided for this enclosure and vented to a suitable fabric filter system.

(x) The Contractor shall restrict all motorised vehicles within the Site, excluding those on public roads, to a maximum speed of 20 km per hour and confine haulage and delivery vehicles to designated roadways inside the Site.

(xi) Areas of roadway longer than 100 m where movement of motorised vehicles exceeds 100 vehicular movements/day or as directed by the Engineer shall be furnished with a flexible pavement surfacing.

(xii) Wheel washing facilities shall be installed and used by all vehicles leaving the site. No earth, mud, debris, dust and the like shall be deposited on public roads. Water in the wheel cleaning facility shall be changed at frequent intervals and sediments shall be removed regularly. The Contractor shall submit details of proposals for the wheel cleaning facilities to the Engineer prior to construction of the facility. Such wheel washing facility shall be usable prior to any earthworks excavation activity on the Site. The Contractor shall also provide a hard-surfaced road between any washing facility and the public road.

(xiii) If spoil cannot be immediately transported out of the site, stockpiles should be stored in sheltered areas.

(xiv) All site vehicle exhausts should be directed vertically upwards or directed away from ground.

(xv) The Contractor shall frequently clean and water the site to minimise the fugitive dust emissions.

(xvi) The Contractor shall provide and operate two high volume air samplers and associated equipment and shelters in accordance with the USA standard Title 40, Code of Federal Regulations, Chapter 1 (Part 50) Appendix B. Sampling shall be carried out as instructed by the Engineer. The samplers, equipment and shelters shall be constructed so as to be transferable between sampling points to enable monitoring of "dust in air" levels at any sampling point required by the Engineer. The Contractor shall provide all necessary protection fences and the like at sampling points. Testing and analysis of sampled materials shall be carried out by a laboratory approved by the Engineer.

(xvii) The Contractor shall provide and erect in a location agreed with the Engineer wind monitoring equipment which records wind direction and speed as specified in the Environmental Monitoring & Audit Manual.

Noise Control

4.3 (i) The Contractor should consider noise as an environmental constraint in the planning and execution of the Works.

(ii) The Contractor should comply with the Noise Control Ordinance (Cap 400) and with any regulations made under the Ordinance, including restrictions placed on noise from construction work and the requirements to seek Construction Noise Permits. Before commencing work which requires Construction Noise Permits, the Contractor should obtain such permits and display these appropriately.

(iii) The Contractor shall provide an approved integrating sound level meter to IEC 651: 1979 (Type 1) and 804: 1985 (Type 1) and the manufacturer's recommended sound level calibrator for the exclusive use of the Engineer at all times. The Contractor shall maintain the equipment in proper working order and provide a substitute when the equipment are out of order or otherwise not available.

The sound level meter including the sound level calibrator shall be verified by the manufacturers every two years to ensure they perform the same levels of accuracies as stated in the manufacturer's specifications. That is to say at the time of measurements, the equipment shall have been verified within the last two years.

(iv) In addition to the requirements imposed by the Noise Control Ordinance, to control noise generated from equipment and activities for the purpose of carrying out any construction work other than percussive piling during the time period from 0700 to 1900 hours on any day not being a general holiday (including Sundays), the following requirements shall also be complied with:

(a) The noise level measured at 1 m from the most affected external facade of the nearby noise sensitive receivers from the construction work alone during any 30 minute period shall not exceed an equivalent should level (Leq) of 75 dB(A).

(b) The noise level measured at 1 m from the most affected external facade of the nearby schools from the construction work alone during any 30 minute period shall not exceed an equivalent should level (Leq) of 70 dB(A) [65 dB(A) during school examination periods].

The Contractor shall liaise with the schools and the Examination Authority to ascertain the exact dates and times of all examination periods during the course of the contract.

(c) Should the limits stated in the above sub-clauses (a) and (b) be exceeded, the construction shall stop and shall not recommence until appropriate measures acceptable to the Engineer that are necessary for compliance have been implemented.

Any stoppage or reduction in output resulting from compliance with this clause shall not entitle the Contractor to any extension of time for completion or to any additional costs whatsoever.

(v) The Contractor shall devise, arrange methods of working and carry out the Works in such a manner so as to minimise noise impacts on the surrounding environment, and shall provide experienced personnel with suitable training to ensure that these methods are implemented.

(vi) Before the commencement of any work, the Engineer may require the methods of working, equipment and sound-reducing measures intended to be used on the Site to be made available for inspection and approval to ensure that they are suitable for the project.

(vii) The Contractor shall ensure that all plant and equipment to be used on the Site likely to cause excessive noise effectively sound-reduced by means of silencers, mufflers, acoustic linings or shields, acoustic sheds or screens or other means to avoid disturbance to any nearby noise sensitive receivers (NSRs). All hand-held percussive breakers and air compressors will comply with the *Noise Control (Hand-held Percussive Breakers) Regulations and Noise Control (Air Compressors) Regulations* respectively under the *Noise Control Ordinance (Ordinance No. 75/88, NCO Amendment 1992 No. 6).*

(viii) The Contractor shall ensure that all plant and equipment to be used on site are properly maintained in good operating condition.

(ix) It is recommended that construction noise should be mitigated using the following measures:

(a) Noisy equipment and activities should be sited by the Contractor as far from close-proximity sensitive receivers as is practical. Prolonged operation of noisy equipment close to dwellings should be avoided.

(b) Noisy plant or processes should be replaced by quieter alternatives where possible. Silenced diesel and gasoline generators and power units, as well as silenced and super-silenced air compressors, can be readily obtained.

(c) Noisy activities should be scheduled to minimise exposure of nearby sensitive receivers to high levels of construction noise. For example, noisy activities can be scheduled for midday, or at times coinciding with periods of high background noise (such as during peak traffic hours).

(d) Idle equipment should be turned off or throttled down. Noisy equipment should be properly maintained and used no more often than is necessary.

(e) The power units of non-electric stationary plant and earth-moving plant should be quietened by vibration isolation and partial or full acoustic enclosures for individual noise-generating components.

(f) Construction activities should be planned so that parallel operation of several sets of equipment close to a given receiver is avoided. The numbers of operating items of powered mechanical equipment should be minimised.

(g) Construction plant should be properly maintained and operated. Construction equipment often has silencing measures built in or added on, e.g. bulldozer silencers, compressor panels, and mufflers. Silencing measures should be properly maintained and utilised.

(h) Acoustic barriers of sufficient surface mass density (e.g. 20 kg/m^2), should be used to protect the nearest residences from noise emitted by equipment when work is undertaken near these residences.

(x) For the purposes of the above clauses, any domestic premises, hotels, hostel, temporary housing accommodation, hospital, medical clinic, educational institution, place of public worship, library, court of law, performing arts centre or office building shall be considered a noise sensitive receiver.

(xi) Notwithstanding the requirements and limitations set out in clause (iv) above and subject with clauses (v), (vi) and (viii) above, the Engineer may upon application in writing by the Contractor, allow the use of any equipment and the carrying out of any construction activities for any duration provided that he is satisfied with the application which, in his opinion, to be of absolute necessity and adequate noise insulation has been provided to the educational institutions to be affected, or of emergency nature, and not in contravention with the Noise Control Ordinance in any respect.

Water Quality

4.4 (i) The Contractor shall not discharge directly or indirectly (by runoff) or cause or permit or suffer to be discharged into any public sewer, storm-water drain, channel, stream-course or sea any effluent or foul or contaminated water or cooling or hot water without the prior consent of the Engineer who may require the Contractor to provide, operate and maintain at the Contractor's own expense, within the premises or otherwise, suitable works for the treatment and disposal of such effluent or foul or contaminated or cooling or hot water. The design of such treatment works shall be submitted to the Engineer for approval not less than one month prior to the commencement of construction or as agreed by the Engineer.

(ii) Surface run-off from the Sites shall be discharged into storm drains via adequately designed sand/silt removal facilities such as sand traps, silt traps and sediment basins. Channels or earth bunds or sand bag barriers should be provided on Site to properly direct stormwater to such silt removal facilities. Perimeter channels at the Site boundaries shall be provided where necessary to intercept storm run-off from outside the Site so that it will not wash across the Site. Catchpits and perimeter channels shall be constructed in advance of site formation works and earthworks.

(iii) The Contractor shall not permit any sewage, waste water or effluent containing sand, cement, silt or any other suspended or dissolved material to flow from the Site onto any adjoining land or allow any waste mater or refuse to be deposited anywhere within the Site or onto any adjoining land and shall have all such matter removed from the site.

(iv) The Contractor shall be liable for any damages caused to adjoining land through his failure to comply with clause 4.4 (iii).

(v) The Contractor shall be responsible for temporary training, diverting or conducting of open streams or drains intercepted by any works and for reinstating these to their original courses on completion of the Works.

(vi) The Contractor shall be responsible for adequately maintaining any existing site drainage system at all times including removal of solids in sand traps, manholes and stream beds.

(vii) Silt removal facilities, channels and manholes shall be maintained and the deposited silt and grit shall be removed regularly, at the onset of, and after each rainstorm to ensure that these facilities are functioning properly at all times.

(viii) Construction works shall be programmed to minimize works in rainy seasons (April to September). If works cannot be avoided in these months or at any time of year when rainstorms are likely, for the purpose of preventing soil erosion, temporarily exposed slope surfaces shall be covered e.g. by tarpaulin, and temporary access roads shall be protected by crushed stone or gravel, as excavation proceeds. Intercepting channels shall be provided to prevent storm runoff from washing across exposed soil surfaces. Arrangements shall always be in place to ensure that adequate surface protection measures can be safely carried out well before the arrival of a rainstorm.

(ix) Earthworks final surfaces shall be well compacted and the subsequent permanent work or surface protection should be carried out immediately after the final surfaces are formed to prevent erosion caused by rainstorms. Appropriate drainage such as intercepting channels shall be provided where necessary.

(x) Measures shall be taken to minimize the ingress of rainwater into trenches. If excavation of trenches in wet seasons is necessary, they shall be and backfilled in short sections. Rainwater pumped out from trenches or foundation excavations shall be discharged into the site drainage system via silt removal facilities.

(xi) Open stockpiles of construction materials (e.g. aggregates, sand and fill material) on sites shall be covered with tarpaulin or similar fabric during rainstorms. Measures shall be taken to prevent the washing away of construction materials, soil, silt or debris into any drainage system.

(xii) Discharge of surface run-off into foul sewers must always be prevented in order not to unduly overload the foul sewerage system.

(xiii) Any proposed stream course and nullah temporary diversions shall be submitted to the Engineer for agreement one month prior to such diversion works being commenced. Diversions shall be constructed to allow the water flow to discharge without overflow, erosion or washout. The area through which the temporary diversions runs is to be reinstated to its original condition or as agreed by the Engineer after the permanent drainage system has been completed.

(xiv) The Contractor shall furnish, for the Engineer's information, particulars of the Contractor's arrangements for ensuring that material from any earthworks does not wash into the drainage system. If at any time such arrangements prove to be ineffective the Contractor shall take such additional measures as the Engineer shall deem necessary and shall remove all silt which may have accumulated in the drainage system whether within the Site or not.

(xv) Precautions to be taken at any time of year when rainstorms are likely, actions to be taken when a rainstorm is imminent or forecast and actions to be taken during or after rainstorms are summarized in the following:

(1) Precautions to be taken at any time of year when rainstorms are likely

(a) Silt removal facilities, channels and manholes should be maintained and the deposited silt and grit should be removed regularly.

(b) Temporarily exposed slope surfaces should be covered e.g. by tarpaulin.

(c) Temporary access roads should be protected by crushed stone or gravel.

(d) Intercepting channels should be provided (e.g. along the crest/edge of excavation) to prevent storm runoff from washing across exposed soil surfaces.

(e) Trenches should be dug and backfilled in short sections. Measures should be taken to minimize the ingress of rainwater into trenches.

(2) Actions to be taken when a rainstorm is imminent or forecast

(a) Silt removal facilities, channels and manholes should be checked to ensure that they can function properly.

(b) Open stockpile of construction materials (e.g. aggregates, sand and fill materials) on site should be covered with tarpaulin or similar fabric.

(c) All temporary covers to slopes and stockpiles should be secured.

(3) Actions to be taken during or after rainstorms

(a) Silt removal facilities, channels and manholes should be checked and maintained to ensure satisfactory working conditions. Attention should be given to safety when carrying out this work.

(xvi) All vehicles and plant shall be cleaned before they leave a construction site to ensure no earth, mud, debris and the like is deposited by them on roads. A wheel washing bay shall be provided at every site exit if practicable and wash-water shall have sand and silt settled out or removed before discharging into the site drainage system. The section of construction road between the wheel washing bay and the public road shall be paved to reduce vehicle tracking of soil and to prevent site run-off from entering public road drains.

(xvii) The transport of the albeit small quantities of sediment to the fresh water environment shall be minimised by the installation of appropriate sediment traps within the drainage system. Sediment traps should be designed and constructed within the surface water drainage systems at appropriate locations.

(xviii) With the exception of routine inspection and maintenance of the drainage system to ensure that sediment traps within the system are regularly cleared, no other monitoring will be required.

(xix) Compounds in works areas shall be designed to take account of contaminated surface water. This will involve the provision of drainage channels and settlement lagoons where necessary to allow interception and controlled release of settled/treated water; and provision of bunding for all potentially hazardous materials on Site including fuels. The Contractor shall establish emergency procedures in the event of any spills of hazardous materials.

(xx) Any stockpile of spill or fill materials shall be treated to reduce erosion of the stockpile and sediment release. A separate settlement system for a large stockpile will be provided as necessary to collect contaminated surface water prior to release to the works area drainage system.

(xxi) Oil interceptors shall be provided in works area compounds and regularly emptied to prevent release of oils and grease into the surface water drainage system after accidental spillages. The interceptor shall have a bypass to prevent flushing during periods of heavy rain. Oil and fuel bunkers shall be bunded to prevent discharge due to accidental spillages or breaching of tanks.

(xxii) Periodic inspections should be undertaken to ensure that the settlement tanks or lagoons are managed and maintained in optimum performance.

(xxiii) All water and waste products arising on the Site shall be collected and removed from works area via a suitable and properly designed temporary drainage system and disposed of at a location and in a manner that shall not cause any nuisance.

(xxiv) If any office, works area canteen or toilet facilities is erected, foul water effluent should be directed to a foul sewer or to a sewage treatment facility either directly or indirectly by means of pumping or other means approved by the Engineer.

(xxv) The Contractor should be aware of and comply with the *Buildings Ordinance*, the *Water Pollution Control Ordinance* and the *Technical Memorandum Standards for Effluent Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters.*

Waste Control

4.5 (i) In order to reduce the nuisance to the environment and minimise the wastage of resources, management of construction materials and wastes shall be undertaken. The general principles of construction waste management are the minimisation of sources of waste and maximising the reuse of materials.

Construction Wastes

(ii) Site clearance wastes are usually extensively mixed with both inert and non-inert materials. Sorting of construction waste shall be performed before disposal to comply with the EPD's *New Disposal Arrangement for Construction Waste*. Non-inert waste containing not more than 20% inert material by volume will be disposed of at landfill. All inert construction waste material deemed unsuitable for reclamation or land formation shall be disposed of at a public landfill.

Chemical Waste

(iii) Fossil fuels and used lubricants for trucks and machinery are classified as chemical wastes. The Contractor shall register with EPD as a chemical waste producer and observe all the requirements under the storage, labelling, transportation and disposal of chemical waste.

(iv) Spillage of oil and lubricant will lead to heavy contamination of land, underground water, surface streams as well as the coastal waters. Care must be taken to prevent serious spillage:

- the storage area for fuels and lubricants shall be isolated from the current working areas and kept secure;
- use of fuels and lubricants shall be carried out with care;
- any spillage problem due to any truck and machinery shall not be ignored;
- emulsifier and absorbent shall be available on Site, so that immediate action can be taken when there is minor spillage;
- all fuels and lubricants shall be kept away from local surface streams;
- any empty containers shall be stored so as to prevent any spillage of the remaining liquid and disposed of carefully; and
- concepts of 'Site cleanliness' shall be introduced to workers, to gather and store construction waste in an appropriate manner.

Municipal Waste

(v) All municipal waste shall be collected separately and well packed, and delivered to a landfill or nearby RSD refuse collection point.

Wastewater

(vi) All wastewater discharged from lavatories and staff canteen shall be directed to the regional sewage collection system by temporary sewerage. Any discharge of sewage to the local environment must be prevented.

5 EM&A OF AIR QUALITY

Construction Dust

5.1 A system of dust monitoring and auditing of the construction of the Kam Tin Bypass shall be established to ensure that construction takes place with a minimum of adverse impact on nearly sensitive receivers and in compliance with the Air Quality Objectives for Hong Kong.

5.2 The objectives of the EM&A of dust levels are:

- to determine the essential environmental background and control data;
- to collect the data necessary to monitor significant impacts;
- to evaluate the quality and significance of data;
- to compare the measured effects with the acceptance criteria;
- to identify any measures necessary to mitigate unacceptable effects (event/action plans); and
- to report the details of the above on a regular monthly basis.

Dust Monitoring Methodology and Equipment

5.3 Monitoring of dust shall be carried out in accordance with the following standards:

USA Standard Title 40, Code of Federal Regulations Chapter 1 (Part 50) Appendix B and J; and

Hong Kong Government, Air Quality Objectives.

5.4 Total Suspended Particulate (TSP) shall be collected using:

- high volume samplers.

5.5 Wind data including wind speed and wind direction shall also be captured.

High Volume Samplers

5.6 The high volume samplers used shall comply with the specifications given below. A recognised primary standard will be available for regular calibration:

- 0.6 - 1.7 m^3/min (20-60 SCFM) adjustable flow range.
- equipped with a timing/control device with 5 minutes accuracy for 24 hours operation.
- installed with elapsed-time meter with 2 minutes accuracy for 24 hours operation.
- capable of providing a minimum exposed area of 406 cm^2 (63 in^2).
- flow Control Accuracy : 2.5% deviation over 24-hour sampling period.
- equipped with shelter to protect the filter and sampler.
- incorporated with an electronic mass flow rate controller or other equivalent devices;
- equipped with a flow recorder for continuous monitoring;
- provided with a peaked roof inlet.
- have a manometer incorporated;
- able to hold and seal the filter paper to the sampler housing in a horizontal position;
- be easy to change filters;
- be capable of operating continuously for 24-hour period; and
- be transferable between monitoring locations.

5.7 All the equipment, calibration kit, filter papers, etc shall be clearly labelled.

5.8 Filter papers shall be carefully collected and transported to a laboratory. Adequate standardised conditioning of filter papers shall be undertaken before weighing.

Wind Monitoring Equipment

5.9 Wind data monitoring equipment should be set up at a conspicuous location for wind speed and wind direction capturing near to the dust monitoring locations.

5.10 The following points should be observed in the installation and operation of wind data monitoring equipment:

- the wind sensors should be installed on masts, at an elevated level 10 m above ground, so that they are clear of obstructions or turbulence caused by buildings.
- the wind data should be captured by a data logger and be downloaded to a computer for processing at least once a month.
- the wind data monitoring equipment should be recalibrated at least once every six months.
- wind direction should be divided into 16 sectors of 22.5 degrees each.

5.11 The high volume pumps and their accessories shall be properly maintained. Prior to dust monitoring commencing, appropriate checks shall be made to ensure that the equipment and necessary power supply are in good working order.

5.12 The flow rate shall be checked after the monitoring period as well as before and any change from the original setting noted.

5.13 Routine, careful calibration and maintenance of equipment is essential to ensure the validity of the data recorded and, as such, forms an essential part of the laboratory quality, control procedures. The high volume samplers shall be calibrated against a traceable standard.

5.14 The dust monitoring equipment shall be calibrated upon installation and every 2 months thereafter. The calibration data shall be fully documented for future reference and shall be converted into standard temperature and pressure conditions. The standard used shall be traceable to the internationally recognised primary standard and shall itself be recalibrated annually.

Dust Monitoring Locations

5.15 The Engineer can impose additional monitoring or change the position of monitoring stations if he considers it necessary. The location of monitoring stations shall be agreed with the Enigneer before they are installed.

5.16 Three monitoring stations shall be placed so as to cover as many of the following criteria as possible:

- at the Site boundary;
- close to the major dust emission source;
- close to the sensitive receivers;
- nearby residents should not be adversely affected; and
- taking into account predictions made in the EIA and the prevailing meteorological conditions.

5.17 The following points shall also be considered when stations are being set up:

- Continuous, stable power needs to be supplied.
- Security against theft, tampering or inadvertent damage is needed.
- A horizontal platform with appropriate supporting to secure the samplers against gusty wind will be provided.
- Any two samplers must be more than 2 metres apart.
- The distance between the samplers and an obstacle, such as buildings, must be at least twice the height of the obstacle protruding above the samplers.
- Any rooftop sampler used will be placed that a minimum of 2 metres of separation from walls, parapets, and penthouses is maintained.
- A minimum of 2 metres of separation from any supporting structure measured horizontally will be kept.
- No furnace or incinerator flues will be nearby.
- The airflow around the sampler will be unrestricted.
- Every sampler will be more than 20 metres from any dripline.
- Any wire fence or gate used to protect a sampler will not cause any obstruction during monitoring.

5.18 It will undoubtedly be necessary to modify some monitoring locations as construction progresses.

5.19 The suggested monitoring locations are shown in Figure 9.1 at the back of this document.

Dust Monitoring Schedule

5.20 Regular dust monitoring can be divided into 3 stages:

- baseline data collected by the Contractor after Award of Contract before the commencement of works;
- control data, designated as such due to a lack of activity on the site during the construction period;
- monitoring data collected from the Commencement to the Completion of the Works.

5.21 Baseline 24-hour TSP data shall be collected at each site either continuously or intermittently for a total of 15 days.

5.22 Compliance data shall normally, except in the event of exceedances, be collected at each site every six days.

5.23 If an action level is exceeded, the data will be confirmed with 48 hours. If exceedance occurs for two or more consecutive sampler at any station, 24-hour monitoring will be increased to three times a week for two weeks at that station and 1 hour readings will be made each day during the same period.

5.24 If non-compliance occurs all dust monitoring at that station will be increased to daily.

5.25 More details on event/action plans are given in Section 8 of the Manual.

Records and Reporting

5.26 Standard forms shall be used to record all field data, laboratory data and calculations. The sheets shall be kept for at least 6 months after the completion of the Contract. The data recorded shall include at minimum :

- date and time;

- operator name;
- identification of the monitoring station;
- description of the site;
- description of the work progress and activities on site;
- temperature, pressure and weather conditions;
- elapsed-time meter readings;
- flow-rates before and after sampling;
- identification of filter papers; and
- weighing data.

5.27 The information shall be collated and viewed by a competent experienced person, either the RE, or his/her representative or the EMT within 24 hours.

5.28 All data shall be audited before inclusion in the monthly report.

6 EM&A OF NOISE

6.1 A system of noise monitoring and auditing of the construction of the Kam Tin Bypass shall be established to ensure that construction takes place with a minimum of adverse impact on nearby NSRs and in compliance with the *Noise Control Ordinance* and its associated Technical Memoranda.

6.2 Noise monitoring shall be undertaken before the Commencement of the Works until the Completion of the Works:

- to determine essential background and control data;
- to collect sufficient data to ensure that predicted impacts and environmental standards are not exceeded;
- to evaluate and report on the noise levels measured and their significance;
- to identify any measures necessary to mitigate unacceptable effects;
- to provide data to determine the effectiveness of any mitigation measures which may be sought through changes in working practice, plant and equipment, location of plant and equipment, acoustic screens and barriers etc.
- to provide an early indication if any of the environmental control measures or environmental design assumptions might fail to achieve their objectives during construction; and
- to protect the nearby NSRs from unacceptable noise impact.

Noise Monitoring Methodology and Equipment

6.3 Noise monitoring shall be undertaken in accordance with:

- the *Noise Control Ordinance*; and
- as directed by the Engineer.

6.4 Construction noise shall be recorded as the $L_{eq(30\ min)}$ measurements during the daytime on normal weekdays and the average of three consecutive $L_{Aeq\ (5\ min)}$ measurements during restricted hours.

6.5 The construction noise level monitoring shall be carried out at a distance of 1 metre from the external facade of noise sensitive receivers at locations agreed with the Engineer and EPD. For the purposes of this section, any domestic premises, hotel, hostel, temporary housing accommodation, hospital, medical clinic, educational institution, place of public worship, library, court of law, performing arts centre should be considered a noise sensitive receiver.

6.6 The time of day when any monitoring is undertaken shall be appropriate for the activities on Site.

6.7 Where works are to be carried out under the terms of a *Construction Noise Permit*, monitoring shall be carried out in accordance with the conditions and hours permitted in the Permit.

6.8 Noise measurement shall be made in terms of the A-weighted equivalent continuous sound pressure level (L_{Aeq}). Noise measurements shall be carried out with an integrating sound level meter using the "fast" response mode.

6.9 Noise measurements shall be rounded to the nearest whole dB, with values of 0.5 dB or more being rounded upwards.

6.10 Noise measurements shall not be made in the presence of mist, fog or rain or with wind at a steady speed exceeding 5 m/s, or gust exceeding 10 m/s.

6.11 Measurements shall not be made during temperatures outside the range recommended by the equipment manufacturers.

6.12 Noise measurements shall not be made when other intrusive noise sources (other than Influencing Factors) are apparent at the assessment point. If this cannot be practically avoided, due account will be made of such sources in the auditing of the data.

6.13 Sound level meters used shall comply with Type 1 specifications given in the *International Electrical Commission* publications *651:1979* and *804:1985*. Calibration equipment to be used on the site will meet *IEC 942*, Type 1 Specifications.

6.14 The full instrumentation shall be of comparable professional quality. Microphones shall give free-field response and be suitable for outdoor measurements. The instruments shall be treated with great care as they are easily damaged. Protocol for field staff shall include instructions to store the equipment in the protective casing when not strictly in use.

6.15 Equipment shall be used in accordance with the manufacturer's instructions.

6.16 Noise monitoring equipment shall be calibrated at least annually by an accredited calibration laboratory for compliance with the appropriate parts of IEC publications 651 and 804. On-Site calibration equipment shall similarly be tested for compliance with IEC 942.

6.17 Immediately prior to, and following each noise measurement, the accuracy of the sound level meter shall be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. In carrying out this procedure, the necessary barometric pressure corrections will be applied. In cases of long-term monitoring, the accuracy of the noise monitoring system shall be similarly checked on at least a daily basis. Measurements shall be accepted as valid only if the calibration levels before and after the noise measurement agree to within 1.0 dB.

6.18 All noise measuring equipment and necessary accessories (such as windshields and tripods) shall be carefully looked after and properly maintained. Prior to noise measurements being undertaken, appropriate checks shall be made to ensure that all such equipment and the necessary power supply are in good working order.

Noise Monitoring Locations

6.19 Monitoring will be undertaken on a routine basis at minimum at the three closest NSRs within 100 metres distance from the active part of site chosen from the ten shown in Figure 9.1 at the back of the Manual. Monitoring at other locations may be required by the Engineer. The locations will change from time to time as construction progresses.

Noise Monitoring Schedule

6.20 All locations will be monitored for a total of five days with a minimum of three replicates during the baseline monitoring period, prior to commencement of construction. Thereafter the chosen locations will be monitored two times a week during the period 0700 to 1900 hours on normal weekdays.

6.21 If a construction noise permit applies during certain phases of construction the EMT will consult with DEP and the Engineer regarding an appropriate noise monitoring schedule.

6.22 Noise measurements should be scheduled to ensure any particularly noisy activities are monitored.

Records and Reporting

6.23 On recording the results, the following minimum information shall be presented:

- site name;
- the area of the site and/or source and/or activity under investigation;
- the date and time period over which the monitoring is undertaken;
- details of the assessment point, including its locations distance from the construction activity being monitored, description of the intervening topography, height above sea and ground level and distance from any reflecting surface;
- weather conditions including wind speed and direction, rain, mist and fog. Data taken under the latter conditions will be invalidated;
- details of the equipment used including the manufacturer, model/type, serial number and date of last full calibration by an accredited laboratory;
- equipment settings;
- calibration levels before and after measurements;
- battery voltage before and after measurements;
- presence of Influencing Factors; and
- any other information likely to be appropriate (e.g. presence of other noise sources during the monitoring period activities on the Site that are not representative).

6.24 This information shall reviewed by a competent, experienced person within 24 hours.

6.25 Any print-outs produced by the noise monitoring equipment shall be labelled and stored until at least 6 months after the project is completed.

6.26 The relevant data shall be summarized for each monthly report and the details given in appendices.

6.27 All data shall be audited before reporting.

6.28 In the event of non-compliance, special reports shall be issued and these shall be collated and discussed in the monthly reports.

7 PROPOSED ENVIRONMENTAL QUALITY PERFORMANCE LIMITS - TAT LEVELS

The proposed environmental quality performance limits - Trigger, Action and Target (TAT) levels (for Air and Surface Water Quality and Noise) are shown in the following tables.

Air Quality

Table 7.1
TAT Levels for Total Suspended Particulate (TSP)

Parameter	24-hour average TSP
Trigger Level	Baseline[x] + 30%
Action Level	(Target - Trigger)/2*
Target Level	260 $\mu g/m^3$ [+]

x Baseline refers to the average value measured at the combined stations during the baseline period.
* Levels for that sampling day.
\+ *Hong Kong Air Quality Objectives* and Contractual Standard for the Project.

Noise

Table 7.2
TAT Levels for Noise Measured at NSRs during Construction

Period	Weekdays[x] 0700 to 1900 hours $L_{Aeq\ (30\ min)}$ (dB(A))	Evenings[+] 1900 to 2300 hours Sundays and General Holidays $L_{Aeq\ (5\ min)}$ (dB(A))	Night-time[+] 2300 to 0700 hours $L_{Aeq\ (5\ min)}$ (dB(A))
Trigger Level	When a complaint is received	When a complaint is received	When a complaint is received
Action Level	When more than one complaint is received within 2 weeks' time on the same event/location	When more than one complaint is received with 2 weeks' time on the same event/location	When more than one complaint is received within 2 weeks' time on the same event/location
Target Level	75	65*	50*

x At schools TAT levels are 5 dB(A) lower, 10 dB(A) lower during examinations.
* *Technical Memorandum on Noise from Construction Work other than Percussive Piling* issued under the *Noise Control Ordinance*, subject to the location of the SR and its associated Area Rating. Here, levels based on Area Rating 'B' is suggsted as a reference.
\+ Applicable only if working during these hours are necessary.

8 EVENT/ACTION PLANS FOR USE WITH EM&A PROGRAMME

The event/action plans that will be implemented in the event of non-compliance with TAT levels are given in the following three tables:

Table 8.1
Actions in the Event of Exceedance of Trigger Levels

Event	Actions		
	EMT	ER	Contractor
Trigger Level			
Exceedance for one sample at any air monitoring station	1. Notify ER 2. Check monitoring data	1. Identify source 2. Notify Contractor 3. Check Contractor's working methods.	1. Rectify any unacceptable practice.
Exceedance for two or more consecutive samples at any air monitoring station. When a noise complaint is received	1. Notify ER 2. Instruct MT to repeat measurement to confirm findings 3. Check monitoring data and instruct MT to check equipment.	1. Identify source 2. Check Contractor's working methods 3. Discuss and agree remedial works with Contractor, if necessary 4. Inform EMT of remedial works to be undertaken.	1. Rectify any unacceptable practice 2. Check all plant and equipment 3. Consider changes to working methods.

Table 8.2
Actions in the Event of Exceedance of Action Levels

Event	Actions		
	EMT	ER	Contractor
Action Level			
Exceedance for one sample at any air monitoring station	1. Notify ER 2. Instruct MT to repeat measurements to confirm finding 3. Check monitoring data and instruct MT to check equipment.	1. Identify source 2. Check Contractor's working methods.	1. Rectify any unacceptable practice 2. Check all plant and equipment 3. Amend working methods if appropriate.
Exceedance for two or more consecutive samples at any air monitoring station. When more than one noise complaint is received within 2 weeks on the same event or at the same location	1. Notify ER 2. Instruct MT to repeat measurement to confirm findings 3. Check monitoring data and instruct MT to check equipment 4. Instruct MT to increase monitoring frequency 5. If exceedance continues, arrange meeting with ER and Contractor 6. Report to the ER the situation after implementation of remedial actions.	1. Identify source 2. Notify Contractor in writing 3. Check Contractor's working methods 4. Discuss and agree with Contractor for remedial actions to be provided 5. Ensure remedial actions properly implemented.	1. Confirm notification of the exceedances in writing to the ER 2. Submit proposals for remedial actions to the ER within 3 working days upon notification 3. Implement the agreed proposals 4. Amend proposals if appropriate and report to the ER.

Table 8.3
Actions in the Event of Exceedance of Target Levels

Event	Actions		
	EMT	ER	Contractor
Target Level			
Exceedance for one sample at any air monitoring station	1. Notify ER 2. Instruct MT to repeat measurement to confirm finding 3. Check monitoring data and instruct MT to check equipment 4. Instruct MT to increase monitoring frequency to daily 5. Report to the ER the situation after implementation of remedial actions.	1. Identify source 2. Notify Contractor in writing. 3. Check Contractor's Working methods 4. Discuss and agree with Contractor for remedial actions to be provided and report to Engineer and EPD 5. Ensure remedial actions properly implemented 6. Report to the Engineer and EPD the situation after implementation of remedial actions	1. Confirm notification of the exceedance in writing to the ER 2. Take immediate action to avoid further exceedances 3. Check all plant and equipment to ensure completion 4. Submit proposals for remedial actions to the ER within 3 working days upon notification 5. Implement the agreed proposals 6. Amend proposals if appropriate and report to the ER.
Exceedance for two or more consecutive samples at any air monitoring station Exceedance of any noise target level	1. Notify ER 2. Instruct MT to repeat measurement to confirm finding 3. Check monitoring data and instruct MT to check equipment 4. Instruct MT to increase monitoring frequency to daily for two weeks 5. Arrange meeting with ER and EPD to discuss the remedial actions to be taken 6. Report to the ER the situation after implementation of remedial actions 7. Notify EPD (via ER) giving details of mitigation measures implemented or proposed to ensure that reoccurrence will be prevented together with the raw monitoring data.	1. Identify source 2. Notify Contractor in writing 3. Check Contractor's working methods 4. Carry out thorough investigation of the causes for the exceeedance 5. Discuss and agree with Contractor for remedial actions to be provided and report to EPD and the Engineer 5. Ensure remedial actions properly implemented 6. Report to the Engineer and EPD the situation after implementation of remedial actions 7. Discuss with the Engineer and EPD on the necessity of stopping the construction activity if the impacts persist. (The Engineer will discuss the need to stop work with the Client).	1. Confirm notification of the exceedance in writing to the ER 2. Take immediate action to avoid further exceedances 3. Check all plant and equipment to ensure compliance 4. Submit proposals for remedial actions to the ER within 3 working days upon notification 5. Implement the agreed proposals 6. Resubmit proposals if problem still not under control 7. As directed by the Engineer slow down or stop part of or all the construction activities until the situation is rectified.

9 A SUMMARY OF THE PROPOSED REGULAR COMPLIANCE MONITORING PROGRAMME FOR THE CONSTRUCTION OF KAM TIN BYPASS

Dust Monitoring

Parameter : 24 hr TSP

Baseline

At each of the 3 dust sensitive receivers, measurements should be taken for a total of 14 days prior to the commencement of construction works.

Compliance

Throughout the construction period, measurements should be taken once every 6 days at the same 3 sites.

Construction Noise Monitoring

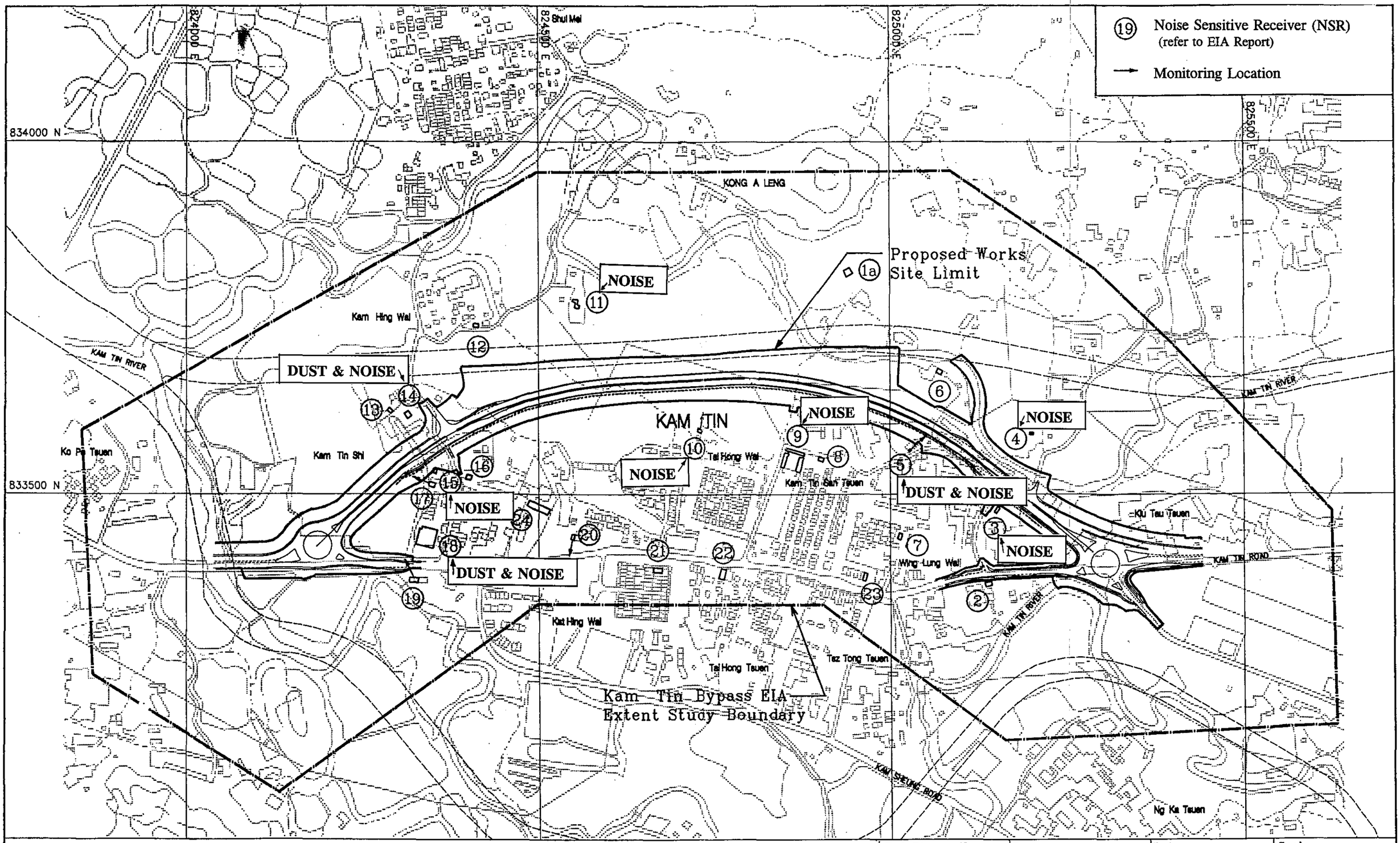
Parameter : L_{eq} (30 min)

Baseline

At each of the 10 noise sensitive receivers, daily measurements should be taken for at least 14 days prior to the commencement of construction works.

Compliance

Throughout the construction period, measurements should be taken twice a week during normal work hours, at the three NSRs closest to active part of site (preferably within a maximum distance of 100 m).



Agreement no. CE 7/94 Kam Tin By-pass	Ref. Figure No.	Rev.	Date : SEP. 95	Scale N.T.S.
Title : SUGGESTED MONITORING LOCATIONS	Joint Consultants : Binnie Consultants Limited Wilbur Smith Associates Limited Harris & Sutherland (Far East)			Figure No. 9.1