RAILWAY DEVELOPMENT STUDY

Phase II (Part 1)
Tai Wai to Ma On Shan
KCR Extension to Tsim Sha Tsui

Report MV4 / KV4

Environmental Feasibility Studies
Final Report

MVA ASIA
MAUNSELL CONSULTANTS ASIA

in association with

Urbis
Parsons Brinckerhoff (Asia)
Design Research Unit
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Date: 14 March 1997

FINAL REPORT

CONSULTING SERVICES BY ENVIRONMENTAL RESOURCES MANAGEMENT

Maunsell/MVA

RDS Phase II Tai Wai to Ma On Shan: *MV4 Environmental Feasibility Study*

14 March 1997

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RDS Phase II Tai Wai to Ma On Shan: *MV4 Environmental Feasibility Study*

14 March 1997

Reference C1435/56433

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Date: 13th March 1997

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Annex A MOS Rail Link Construction Noise Calculations
Annex B MOS Town Centre Alignment Selection

GLOSSARY

ANL	Acceptable Noise Level
AP-42	Compilation of Air Pollutant Emission Factors, 5th Edition, US Environmental Protection Agency, 1996
APC(A)O	Air Pollution Control (Amendment) Ordinance No 13, 1993, Part IX, Sections 69 to 73
APCO	Air Pollution Control Ordinance (Cap 311)
AQO	Air Quality Objective
ASR	Air Sensitive Receiver (*Section* 2)/Area Sensitivity Rating (*Section* 3)
BNL	Basic Noise Level
BOD	5 Day Biological Oxygen Demand
CED	Civil Engineering Department
CNL	Corrected Noise Level
CNP	Construction Noise Permit
DD	District Distributor Road
DO	Dissolved Oxygen
EC	Environmental Checker
ECP	Event Contingency Plan
EFS	Environmental Feasibility Study
EIA	Environmental Impact Assessment
EM&A	Environmental Monitoring and Audit
EMU	Electrical Multiple Unit
EPD	Environmental Protection Department
FDM	Fugitive Dust Model
HKPSG	Hong Kong Planning Standards and Guidelines
KCR	Kowloon - Canton Railway
MOS Rail	Ma On Shan Rail Link
MTRC	Mass Transit Railway Corporation
NCO	Noise Control Ordinance
NSR	Noise Sensitive Receiver
PCW	Prescribed Construction Work
PD	Primary Distributor Road
PME	Powered Mechanical Equipment
PRS	Preliminary Review Study
RAB	Reduced Aspect Block
RDS	Railway Development Strategy

SAB	Single Aspect Block
SPME	Specified Powered Mechanical Equipment
SS	Suspended Solids
SSSI	Site of Special Scientific Interest
SWL	Sound Power Level
TKE	Tseung Kwan O Extension
TM	Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters
TM1	Technical Memorandum on Noise From Construction Work Other Than Percussive Piling
TM2	Technical Memorandum on Noise from Construction Work in Designated Areas
TM3	Technical Memorandum on Noise From Percussive Piling
TM4	Technical Memorandum on Noise from Places Other Than Domestic Premises, Public Places or Construction Sites
TSP	Total Suspended Particulates
WCR	Western Corridor Railway
WCZ	Water Control Zone
WDO	Waste Disposal Ordinance
WPCO	Water Pollution Control Ordinance
WQO	Water Quality Objective
WSR	Water Sensitive Receiver

1 INTRODUCTION

1.1 Background to the Study

1.1.1 The Hong Kong Government announced its Railway Development Strategy (RDS) in December 1994, this set out the framework for the expansion of the Territory's railway network into the next century. The strategy classified proposed new railways in terms of priority and accorded the highest priority to three packages:

- the Western Corridor Railway (WCR);
- the Tseung Kwan O Extension (TKE) of the MTR system; and
- Ma On Shan Rail Link (MOS Rail) and KCR Extension to Tsim Sha Tsui.

1.1.2 The WCR and the TKE are being progressed by the KCRC and MTRC respectively. MOS Rail and the KCR Extension are envisaged by Government as being potentially suitable for private sector participation and as a next step the Railways Development Office of Highways Department has initiated the MOS Rail and KCR Extension Study as Phase II (Part 1) of the Railway Development Study. This new study is a comprehensive Feasibility Study to put forward the preferred railway schemes and, if appropriate, to prepare technical documentation to form part of an invitation for tenders from interested parties. On 30th October 1995 the MVA-Maunsell Joint Venture was appointed to undertake the study.

1.1.3 MOS Rail (see *Figure 1.1a*) is envisaged to be a fully segregated rail line largely following the planned rail reserve as shown on the Outline Zoning Plan between Tai Wai in Sha Tin and Ma On Shan New Town. It was expected that the alignment will be mostly at grade or elevated including 7 or 8 stops and will include a major interchange with KCR East Rail services at Tai Wai station. Two possible one-station extensions are under consideration: from Tai Wai to Hin Keng and from Ma On Shan to Lee On. These have both been assumed in the current report, however, it should be noted that due to the proximity of the chlorine store at Shatin Water Treatment Works the local Hin Keng area is considered to have a high societal risk and a hazard assessment must be undertaken before any further development can be considered. As a hazard assessment is outside the scope of the present Study, all references to the feasibility of Hin Keng Station must be considered provisional at this stage.

1.1.4 The *MOS Rail Transit Systems Options Report (MO2), MVA/Maunsell at al, February 1996,* recommended the operation of MOS Rail with short trains (up to 4-car) of relatively long and wide conventional steel-wheeled "heavy rail" cars, while indicating that there were possible alternatives. In the light of the findings of the RDS Preliminary Review Study (PRS), these alternatives have been ruled out (*MOS Rail: Option Selection Report, MVA/Maunsell et al, October 1996*) and it is assumed that MOS Rail will be operated by trains of similar characteristics to existing Mass Transit Railway Corporation (MTRC) trains. In the light of the Final Demand Forecasts, 4-car trains are proposed and have been assumed in this Report. The possibility of later operation of MOS Rail by longer trains running through from the East Kowloon Route (as proposed in the RDS PRS) is outside the scope of the present Study and has not been considered at this stage. In the event that longer trains are adopted, a full appraisal of environmental mitigation measures will be required.

1.1.5 The RDS accorded high priority to the Project and the Government, in seeking early implementation, is considering inviting tenders from interested parties on a build/operate basis. The next stage of work is to both detail the Project itself and to determine how best to package it for implementation and operation. Government is therefore pursuing this objective through appointing consultants to conduct this comprehensive Feasibility Study and also Financial Advisors to assess the financing aspects.

1.1.6 If the project is subsequently endorsed by Government, this process will lead to the preparation of tender documents, invitation to bid, bid appraisal and negotiations, and ultimately construction and operations. As this would be the first private sector involvement in a rail project in recent years it is vital that the Feasibility Study approach takes into account the ultimate means of implementation. The bid documents must not unduly constrain bidders so as to prevent innovative ideas, but they must set out a framework to enable assessments to be made. They must also ensure that the implemented Project provides the required level of service.

1.1.7 ERM Hong Kong, as part of the Study Team, have carried out a feasibility stage environmental impact assessment (EIA), that is to say an Environmental Feasibility Study (EFS) to provide information on the type and magnitude of impacts which may be caused by the construction and operation of the railway extensions. The findings of the EFS will contribute to the overall Feasibility Study for the railway extensions, providing information on:

- environmental constraints that may affect railway design;
- selection of the preferred railway system;
- options for mitigation measures to control adverse impacts; and
- environmental protection requirements for inclusion the detailed design stage.

1.1.8 The purpose of the EFS is to investigate the suitability of the proposed project in terms of its environmental acceptability and, where necessary, provide recommendations to control any identified adverse impacts. If the project is approved, the findings of the EFS will be used to determine the scope of work required for a full EIA to be carried out through the project design stages.

1.1.9 This draft EFS Report will become the final output from the EFS and sets out the findings of the EFS and recommendations for further work.

1.2 Objectives of the Environmental Feasibility Study

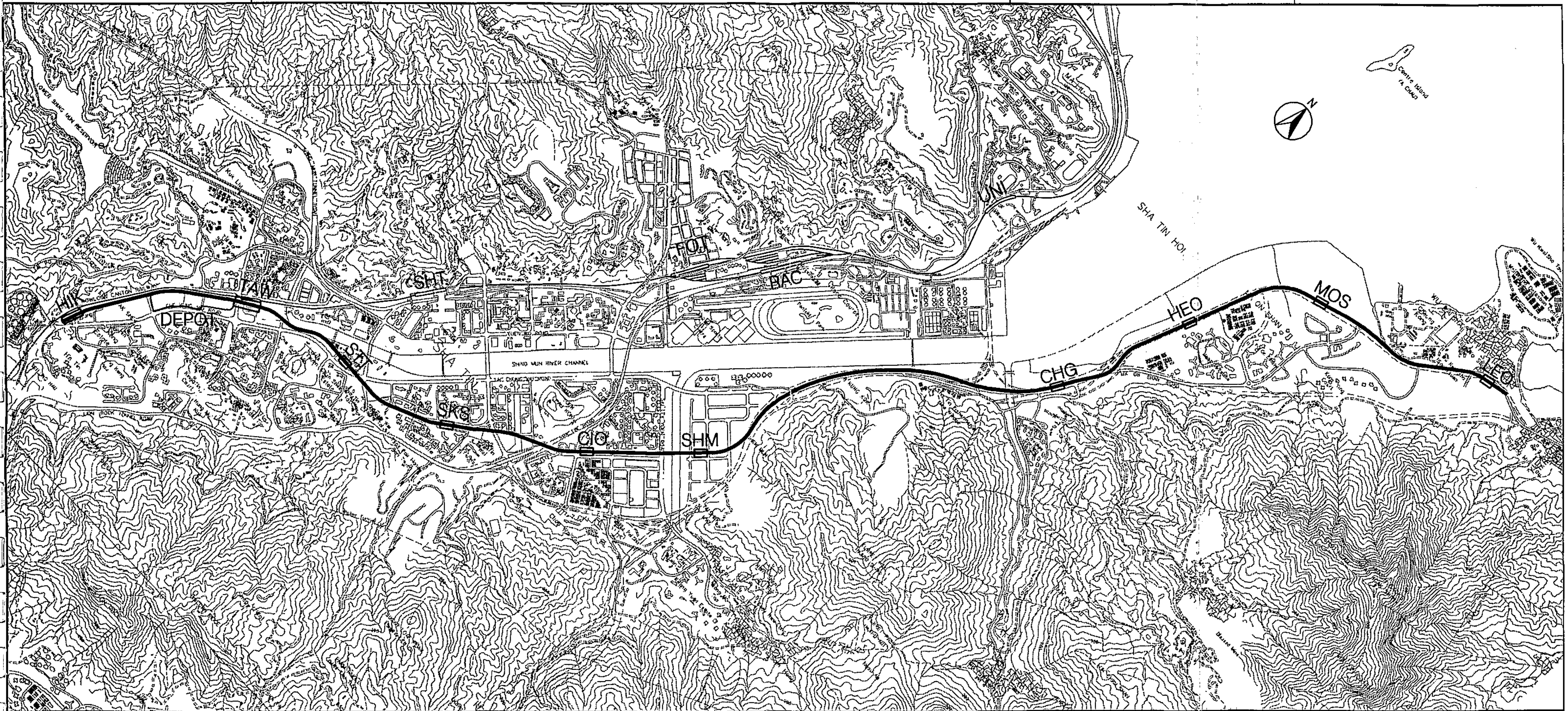
1.2.1 The Feasibility Study Brief sets out the objectives of the Study to be to determine:

- the most appropriate system type(s) and configuration for the MOS Rail and an effective interchange with the KCRC line at Tai Wai;

- how best to extend the KCR to Tsim Sha Tsui and potentially to West Kowloon Reclamation and provide an effective interchange with the MTR; and

- how best to package and phase the lines for implementation.

1.2.2 The Study must also ensure that the Preferred Schemes support and enhance on-going planning and development and do not have any adverse environmental or drainage impacts. Furthermore they should be properly integrated into the Territory's transport system and their implications on other plans and proposals identified.



Highways Department Railway Division RAILWAY DEVELOPMENT STUDY PHASE 2 (PART 1)	FEASIBLILITY STUDY FOR THE TAI WAI TO MA ON SHAN RAIL LINK AND THE KCR EXTENSION TO TSIM SHA TSUI TAI WAI TO MA ON SHAN RAIL LINK MASTER PLAN	© COPYRIGHT RESERVED DATE: DEC 96 SCALE: NTS MVA ASIA MAUNSELL CONSULTANTS ASIA and associated consultants CAD REF : M:/PROJECTS/94595/SKETCH/MOS070.DGN FIGURE No. 1.1a

projects/94595/sketch/mos070.dg Mar. 13, 1997 11:46:52

1.2.3 In addition, the EFS will fulfill the objectives of the Environmental Protection Department's (EPD) Study Brief which are:

i) to describe the proposed railway and associated facilities including railway stations and the requirements for their development;

ii) to identify and describe the elements of the existing and planned community and environment likely to be affected by the proposed railway;

iii) to identity and quantify environmental polluting sources and determine the significance of impacts on sensitive receivers and potential affected uses;

iv) to minimize potential pollution and environmental disturbance arising from the development and its operation and during construction of the railway;

v) to identify, predict and evaluate the residual (ie. after practicable mitigation) environmental impacts and cumulative effects from other pollution emitters expected to arise during the construction, operation phases of the proposed railway in relation to the sensitive receivers and potential affected uses;

vi) to identify, assess and specify methods, measures and standards, to be included in the detailed design, construction and operation of the railway which are necessary to mitigate these impacts and reduce them to acceptable levels;

vii) to design and specify the environmental monitoring and audit requirements necessary to ensure the implementation and the effectiveness of the environmental protection and pollution control measures adopted;

viii) to investigate the extent of side-effects of proposed mitigation measures that may lead to other forms of impacts;

ix) to identify constraints associated with the mitigation measures recommended in the study; and

x) to identify any additional studies necessary to fulfill the objectives to the requirements of the Study Brief.

1.3 Structure of the Environmental Feasibility Study Report

1.3.1 After this introductory section, the remainder of the EFS is arranged as follows:

- *Section 2* identifies the air quality impacts arising from the construction and operation of MOS Rail, assesses their magnitude and puts forward recommendations for appropriate mitigation measures;

- *Section 3* identifies the noise and vibration impacts arising from the construction and operation of MOS Rail, their magnitude and suitable mitigation;

- *Section 4* identifies and reviews the water quality impacts arising from the construction and operation of MOS Rail and puts forward effective mitigation measures;

- *Section 5* addresses the solid waste management implications arising from the construction and operation of MOS Rail, considers waste reduction and disposal options and identifies control and mitigation measures;

- *Section 6* identifies the ecological impacts arising from the construction and operation of the Rail and provides recommendations for suitable mitigation measures;

- *Section 7* reviews the landscape and visual impacts arising from the construction and operation of MOS Rail and puts forward proposals for necessary mitigation;

- *Section 8* identifies the environmental monitoring and audit (EM&A) requirements arising from the assessment of construction and operational impacts from MOS Rail and provides recommendations for their application; and

- *Section 9* discusses the overall conclusions and recommendations arising from the MOS Rail EFS and makes recommendations for further studies.

- *Annex A* contains the construction plant lists and their sound power levels.

- *Annex B* discusses the alignment selection procedure for Ma On Shan Town Centre.

2 AIR QUALITY

2.1 Introduction

2.1.1 This *Section* addresses the air quality impacts associated with the construction and operation of MOS Rail, running from Hin Keng Station to Lee On, via Tai Wai and Ma On Shan. Potential air quality impacts are identified, particularly during the construction phase of the railway extension, stations, depot and station related developments.

2.1.2 During the construction phase, there will be dust impacts from site preparation activities, earthworks and excavations, and construction of super-structure. Exhaust emissions from trucks and powered mechanical equipment may affect the surrounding sensitive uses of the study area. The extent of impact depends on the distances between the work sites and sensitive receivers, the mode of construction and the number of mechanical plant and vehicles employed on site.

2.1.3 It is expected that the impacts from exhaust emissions of construction plant will be limited as relatively small numbers would be employed on site and are not, therefore, addressed further in this study.

2.1.4 During the operational phase, since electrically powered trains will be used, there will be no adverse air quality impacts although there might be some dust generation from abrasion and gaseous and particulate emissions from maintenance operations. There is also potential for ozone generation due to arcing between the power rail and train pick-ups. However, these pollutant sources are expected to have little or no impact on surrounding sensitive uses.

2.1.5 Bus termini will be located within the station developments or near the stations, as a result of which air quality inside the termini may be of concern.

2.2 Government Legislation and Standards

2.2.1 The principal legislation for the management of air quality is the *Air Pollution Control Ordinance* (APCO) (Cap 311). The whole of the Hong Kong Territory is covered by *Air Quality Objectives* (AQOs) which stipulate the statutory limits of seven air pollutants and the maximum allowable numbers of exceedances over specific periods. The AQOs are shown in *Table 2.2a*.

2.2.2 The EPD also recommends a maximum hourly TSP level of 500 $\mu g\ m^{-3}$ at the affected sensitive receivers.

2.2.3 There are no statutory guidelines or limits for public transport termini, however, the EPD has recommended air quality standards inside confined and semi-confined bus termini, as shown in *Table 2.2b*.

Table 2.2a Hong Kong Air Quality Objectives ($\mu g\ m^{-3}$)[(i)]

Pollutant	Averaging Time				
	1 Hour[(ii)]	8 Hours[(iii)]	24 Hours[(iii)]	3 Months[(iv)]	1 Year[(iv)]
Total Suspended Particulates (TSP)	-		260	-	80
Respirable Suspended Particulates[(v)] (RSP)	-		180	-	55
Sulphur Dioxide (SO_2)	800		350	-	80
Nitrogen Dioxide (NO_2)	300		150	-	80
Ozone (O_3)	240		-	-	-
Lead (Pb)	-		-	1.5	-
Carbon Monoxide (CO)	30,000	10,000	-	-	-

Note: (i) Measured at 298°K (25°C) and 101.325 kPa (one atmosphere).
(ii) Not to be exceeded more than three times per year.
(iii) Not to be exceeded more than once per year.
(iv) Arithmetic means.
(v) Respirable suspended particulates means suspended particles in air with a nominal aerodynamic diameter of 10 micrometres and smaller.

Table 2.2b Recommended Air Quality inside Public Transport Termini

Pollutant	Concentration in $\mu g\ m^{-3}$	
	Averaging Time	
	5-minutes	1-hour
NO_2	1,800	300
SO_2	1,000	800
CO	115,00	30,000

2.3 Sensitive Receivers and Baseline Conditions

2.3.1 According to the Hong Kong Planning Standards and Guidelines (HKPSG), sensitive receivers include residential uses, schools and academic institutions, and active and passive recreational uses. The nearest, representative, air sensitive receivers (ASRs) in the vicinity of the MOS Rail work sites are summarised in *Tables 2.3a-i* and their locations are shown in *Figures 2.3a-i*.

2.3.2 The study area is classified as urban and the majority of land uses in the vicinity of the work sites are residential, recreational and institutional. The existing EPD air quality monitoring station in Shatin can provide the baseline air quality of the area. The annual averaged TSP level measured at this station in 1995 was 73 $\mu g\ m^{-3}$. The main sources of pollutants are the traffic on existing roads and highways, industrial uses are only found within Shek Mun Industrial Area (*1994 Air Quality in Hong Kong, EPD, 1995*).

Hin Keng to Tai Wai

2.3.3 The alignment between Hin Keng and Tai Wai will be at grade and construction dust impacts are likely to be highest in the area around Hin Keng Estate and the sports facilities to the south of the existing KCR alignment. Most of the land uses within this area are residential and recreational. Hin Yau House and the commercial complex of Hin Keng Estate are the nearest ASRs to the alignment and the provisional Hin Keng Station sites. Hin Tin Playground would also be impacted during the construction phase.

2.3.4 The background air quality is affected by traffic on the road network in the vicinity. Roadways contributing to the ambient air pollutants include Che Kung Miu Road and Mei Tin Road. *The Annual Traffic Census 1995, Traffic and Transport Survey Division, June 1996*, reported that the averaged daily traffic on Che Kung Miu Road and Mei Tin Road were over 19,000 and 32,000 vehicles respectively, background TSP levels are expected to be high. ASRs within this section are listed in *Table 2.3a* and shown in *Figure 2.3a*.

Table 2.3a Air Sensitive Receivers - Hin Keng to Tai Wai

Air Sensitive Receiver		Distance from Work Site (m)	
		Alignment	Provisional Hin Keng Station
A1	Shatin Water Treatment Works Office	>300	140
A2	Keng Hau Road no. 29	165	43
A3	Keng Hau Road no. 25	123	70
A4	Keng Hau Road no. 22	100	76
A5	Keng Hau Road no. 11	140	140
A6	Keng Hau Road nos. 5-7	176	176
A7	Hin Yau House	218	37
A8	Hin Keng Commercial Complex	100	20
A9	Hin Tin Playground	30	75
A10	Hin Yeung House	155	213

Tai Wai to Sha Tin Tau

2.3.5 The region surrounding the work sites of Tai Wai Station and Depot, and the railway alignment from Tai Wai to Sha Tin Tau currently consists of residential buildings and recreational areas. Traffic on Che Kung Miu Road and Lion Rock Tunnel Road would be the dominant sources of air pollutants in the area. In 1995, the annual averaged daily traffic on these roadways was over 20,000 vehicles. The construction works at Tai Wai Station and depot would affect the ASRs to the north of the alignment.

2.3.6 Hin Tin Swimming Pool, Christian Alliance School, Sha Tin Heights and Tao On Building are the nearest ASRs most likely be impacted during the construction phase. ASRs are listed in *Table 2.3b* and shown in *Figure 2.3b*.

Table 2.3b Air Sensitive Receivers - Tai Wai to Sha Tin Tau

Air Sensitive Receiver		Distance from Work Site (m)	
		Alignment	Tai Wai Station and Depot
A11	Hin Tin Swimming Pool	5	15
A12	Sha Tin Heights	131	13
A13	Tin Sam Village nos. 182-185	>300	45
A14	Sun Ming House	260	65
A15	Christian Alliance School	>300	30
A16	Holford Garden Commercial Complex	>300	38
A17	Grandway Garden Block 2	>300	35
A18	Tao On Building	>300	25
A19	Cheung Wong Wai Primary School	200	67
A20	Sha Tin Tsung Tsin Secondary School	121	64
A21	Tai Wai Playground	180	63
A22	Tai Wai Football Field	60	60
A23	Temple (Che Kung Miu)	46	115
A24	Man Lai Court	85	84

Sha Tin Tau to Sha Kok Street

2.3.7 In the vicinity of the alignment and Sha Tin Tau Station sites, sensitive uses include residential buildings, schools and recreational areas. Open sports facilities are located to the east of Lion Rock Tunnel Road within the railway reserve, Tsang Tai Uk Recreation Ground and Sha Tin Tau no. 3 are the nearest ASRs to the work sites.

Table 2.3c Air Sensitive Receivers - Sha Tin Tau to Sha Kok Street

Air Sensitive Receiver		Distance from Work Site (m)	
		Alignment	Sha Tin Tau Station
A25	Lei Uk Tsuen nos. 12-15	47	90
A26	Sha Tin Government Secondary School	135	155
A27	Shek Fai House	66	50
A28	Shek Yuk House	60	56
A29	Ecclesia Bible College	160	60
A30	Sha Tin Tau no. 3	21	91
A31	Tsang Tai Uk Recreation Ground	5	94
A32	Sham Ha Wai	45	290

2.3.8 The ambient air quality in this area is affected by the traffic on Lion Rock Tunnel Road, Sha Kok Street and the local access roads. The annual averaged daily traffic on Lion

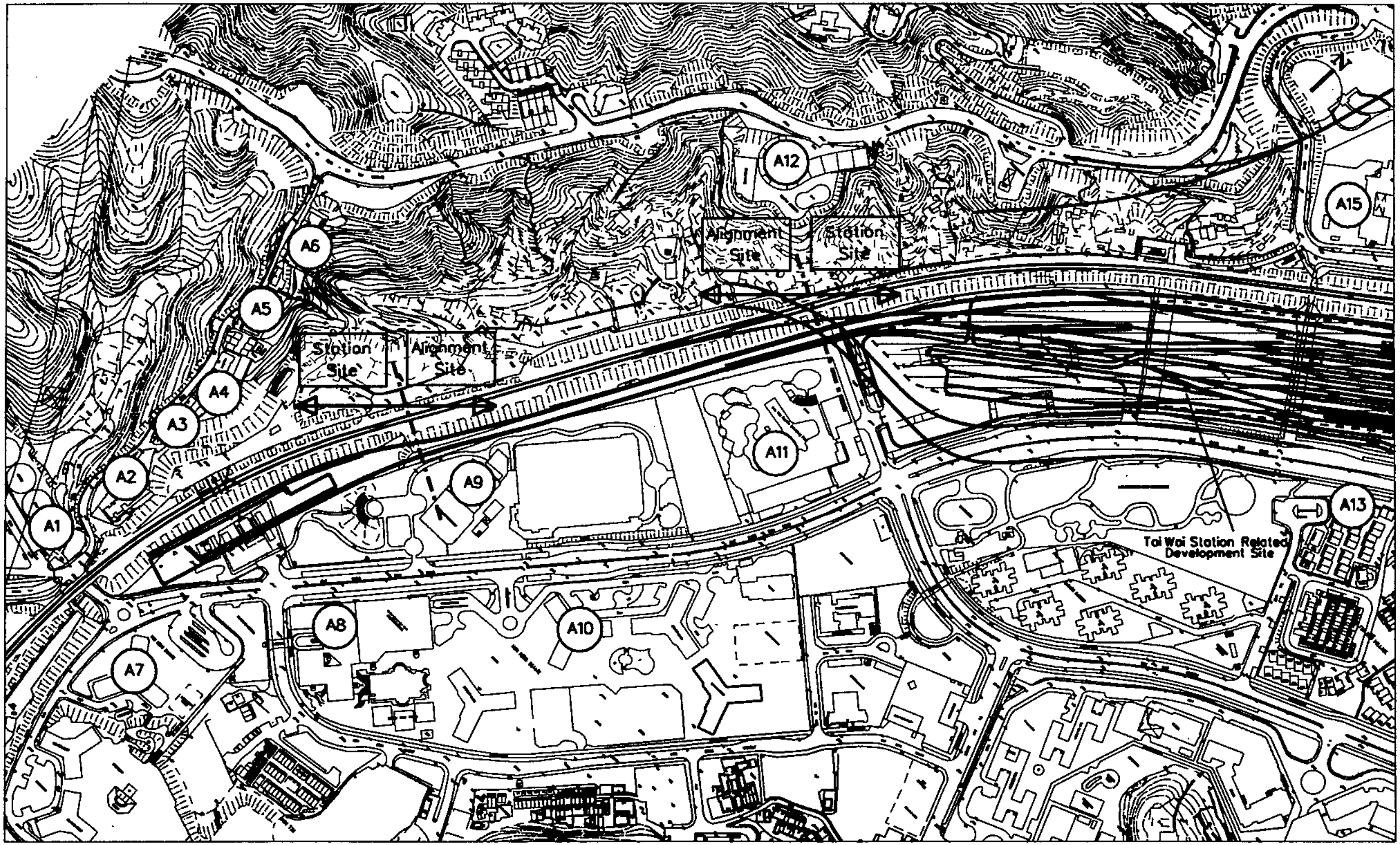


FIGURE 2.3a - Air Sensitive Receiver -

Hin Keng to Tai Wai

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_15
Sources : Base map -	

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- Station Related Development Site
- Station Site
- A1 Air Sensitive Receiver

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Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

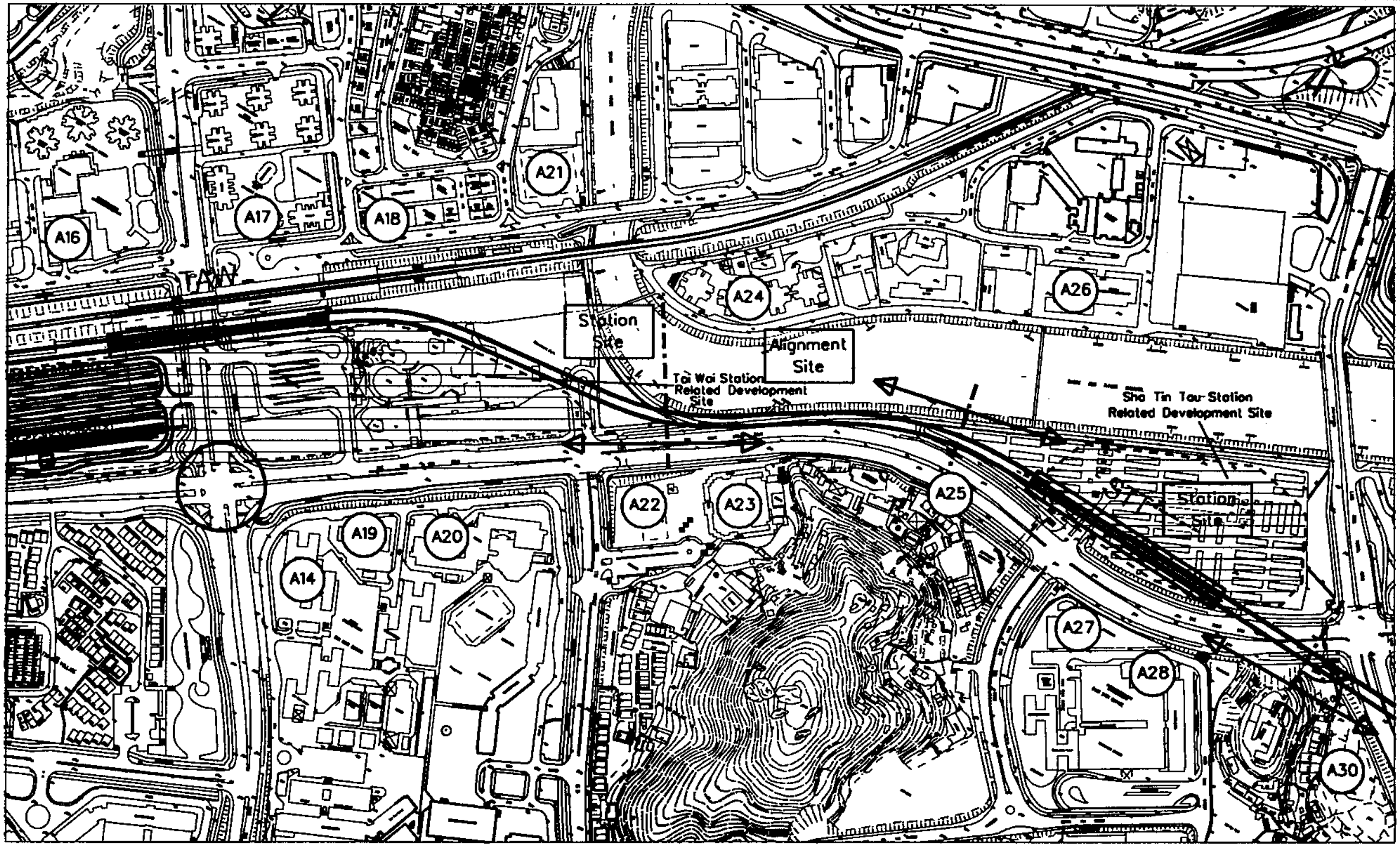

FIGURE 2.3b - Air Sensitive Receiver - Tai Wai to Sha Tin Tau

Date : 15 Oct 1996 | Drawing No.: /Contract/C1435/C1435_16

Sources :

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- Station Related Development Site
- Station Site
- A1 Air Sensitive Receiver

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

FIGURE 2.3c - Air Sensitive Receiver -
Sha Tin Tau to Sha Kok Street

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_17
Sources :	

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- Station Site
- A1 Air Sensitive Receiver

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

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Rock Tunnel Road and Sha Kok Street were over 20,000 and 15,000 vehicles respectively in 1995, with background TSP levels dominated by vehicular exhaust. Representative ASRs closest to the construction sites have been selected and are shown in *Figure 2.3c* and listed in *Table 2.3c* above.

Sha Kok Street to City One, Shatin

2.3.9 The area surrounding the construction sites at Sha Kok Street Station and the alignment section from Sha Kok Street to City One consists of residential buildings and schools. The nearest residential developments are Pok Man House, Ashley Garden and Iris Garden which would be impacted by the construction works of the railway development. Tin Ka Ping Salvation Army Primary School close to the work sites would also be impacted.

2.3.10 Background air quality in this area is affected by the traffic from Shatin Wai Road (annual averaged daily traffic of about 30,000 vehicles in 1995), Tai Chung Kiu Road (annual averaged daily traffic of over 20,000 vehicles in 1995) and other local access roads. Representative ASRs closest to the construction sites have been selected and are shown in *Figure 2.3d* and listed in *Table 2.3d*.

Table 2.3d Air Sensitive Receivers - Sha Kok Street to City One Shatin

Air Sensitive Receiver		Distance from Work Site (m)	
		Alignment	Sha Kok Street Station
A33	Secondary School (between Jat Min Chuen St. & Sha Kok St.)	42	>300
A34	Immaculate Heart of Mary College	34	210
A35	Ming Yan Lau	34	70
A36	Pok Man House	8	260
A37	Tin Ka Ping Salvation Army Primary School	8	196
A38	Pok Hong Estate Commercial Centre	22	110
A39	Pok Yue House	28	56
A40	Pok Yat House	56	58
A41	Pok Tai House	51	34
A42	Sha Kok Estate Office	46	40
A43	Osprey House	90	80
A44	Oriole House	46	50
A45	Sha Tin Wai Playground	8	38
A46	Sha Tin Wai nos. 1-2	46	134
A47	Ashley Garden	16	235
A48	Iris Garden	20	>300

City One, Shatin to Shek Mun

2.3.11 For this section of the alignment, the area surrounding the construction sites consists of residential buildings, hospitals and schools. ASRs in this section are listed in *Table 2.3e* and are shown in *Figure 2.3e*. Ambient air quality in this area is affected by traffic from Chap Wai Kon Street, Tai Chung Kiu Road and air emissions from industrial premises in Shek Mun. Wong Uk Village and the residential properties along Kong Pui Street and to the north of Chap Wai Kon Street are likely to be affected by construction dust. Yue Sui House is the closest ASR to City One Station.

Table 2.3e Air Sensitive Receivers - City One Shatin to Shek Mun

Air Sensitive Receiver		Distance from Work Site (m)	
		Alignment	City One Station
A49	Toi Shan Association College	100	>300
A50	Wong UK Village nos. 17-18	10	>300
A51	Green Leave Garden Block B	29	280
A52	Prince of Wales Hospital	64	211
A53	Pamela Youde Child Assessment Centre/School Dental Clinic	13	32
A54	Yue Sui House	46	26
A55	Yue Kwan House	95	31
A56	Yow Kam Yuen Prevocational School	21	36
A57	Lam Kau Mow Secondary School	32	151
A58	Yuen Chau Kok THA (Cleared)	35	22
A59	City One Sha Tin Block 36	65	226

Shek Mun to Chevalier Garden

2.3.12 Within this section, the alignment and station sites in Shek Mun, major land uses in the vicinity are residential and industrial. Ambient air quality is affected by the traffic on Tate's Cairn Highway, Ma On Shan Road, Tolo Highway Interchange and air emissions from industrial premises in Shek Mun. The daily traffic levels on the nearby highways are high and traffic exhaust would be the dominant source of air pollutants of the area.

Table 2.3f Air Sensitive Receivers - Shek Mun to Chevalier Garden

Air Sensitive Receiver		Distance from Work Site (m)	
		Alignment	Shek Mun Station
A60	City One Sha Tin Block 33	46	290
A61	Sha Tin Industrial Centre	28	185
A62	Siu Lek Yuen Road Playground	39	160
A63	Tat Lee Centre	35	84
A64	Sun Mu Commercial Centre	97	251
A65	JDH Centre	132	236
A66	Garden Vista Block D	227	>300
A67	Pictorial Garden Capilano Court	162	>300
A68	Pictorial Garden Dragon Court	89	>300
A69	Pictorial Garden Juniper Court	48	>300
A70	Sha Tin Hospital	59	>300
A71	Fishermen's New Village no. 113	65	>300
A72	Fishermen's New Village nos. 16-19	81	>300
A73	Fishermen's New Village nos. 5-8	83	>300

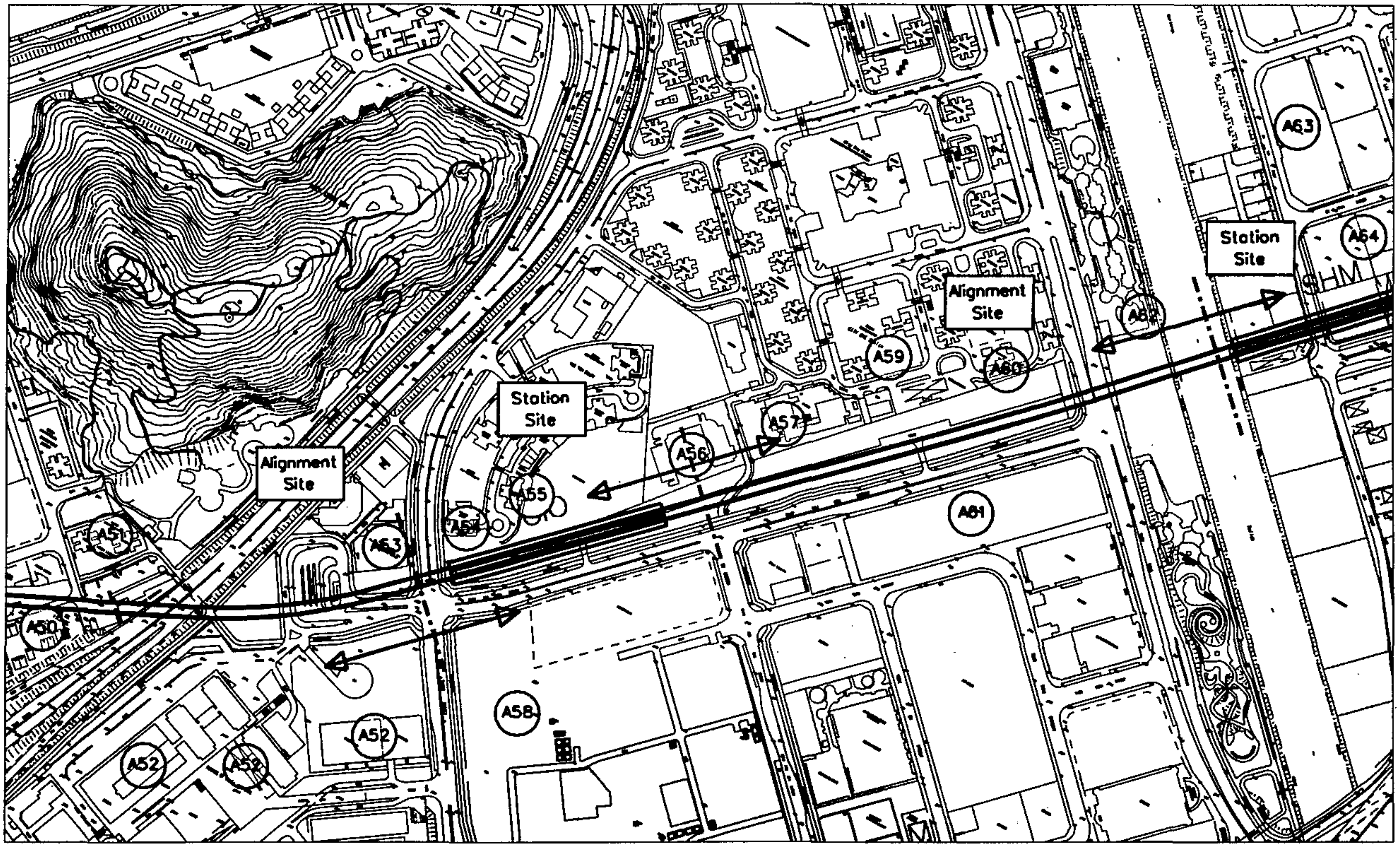

FIGURE 2.3d - Air Sensitive Receiver -

Sha Kok Street to City One Shatin

Date : 15 Oct 1996 | Drawing No.: /Contract/C1435/C1435_18

Sources :

Prepared by ERM's GIS & MAPPING Group

KEY

Alignment

Station Site

A1 Air Sensitive Receiver

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

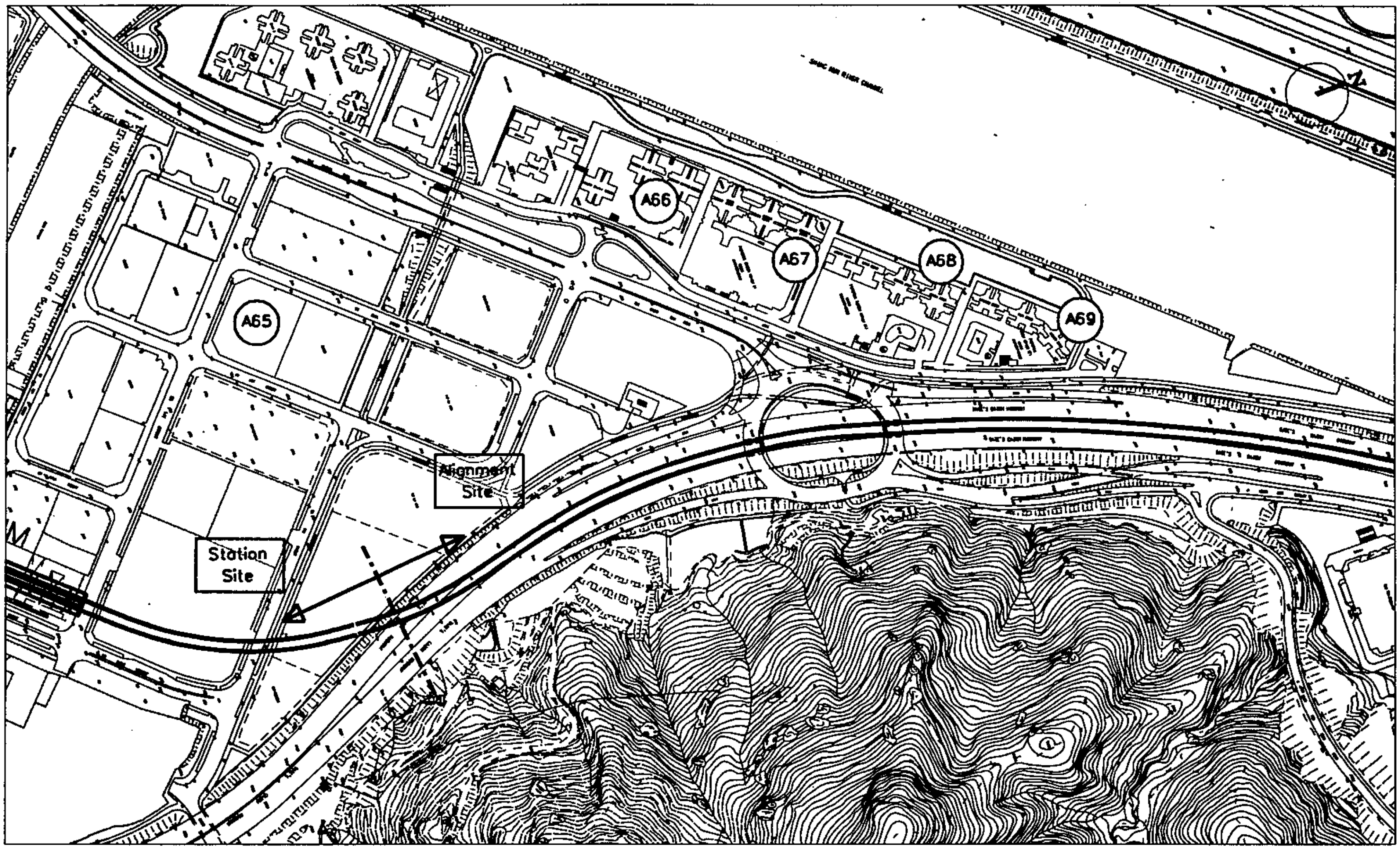

FIGURE 2.3e - Air Sensitive Receiver -

City One Shatin to Shek Mun

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_19
Sources :	

Prepared by ERM's GIS & MAPPING Group

KEY

Alignment

Station Site

A1 Air Sensitive Receiver

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

2.3.13 The nearest ASRs are Tat Lee Centre and Juniper Court of Pictorial Garden. Industrial premises in Shek Mun Industrial Area would also be impacted. Representative ASRs closest to the construction sites have been selected and are shown in *Figure 2.3f* and listed in *Table 2.3f*.

Chevalier Garden to Heng On

2.3.14 Traffic on Ma On Shan Road, Sai Sha Road and the Interchange are responsible for the ambient air quality of the area. Vehicular exhaust from the traffic on these roads is the main source of air pollutants. Representative ASRs have been selected and listed in *Table 2.3g*. *Figure 2.3g* shows the location of the ASRs, and the alignment, Chevalier Garden Station and Heng On Station sites. Sensitive uses within this section of the alignment include residential developments and schools. The Chinese YMCA College is the nearest ASR to the work sites and would be impacted during the construction phase.

Table 2.3g ASR - Chevalier Garden to Heng On

Air Sensitive Receiver		Distance from Work Site (m)		
		Alignment	Chevalier Garden Station	Heng On Station
A74	Ma On Shan Tsung Tsin Secondary School	85	223	N/A
A75	Tai Shui Hang no.1-4	130	92	N/A
A76	Sing On THA	123	>300	N/A
A77	Ngan On House	40	N/A	78
A78	Po On House	51	N/A	49
A79	Chinese YMCA College	40	N/A	10
A80	Hing On THA	56	N/A	153

Heng On to Ma On Shan

2.3.15 Sensitive receivers in the vicinity of the alignment and Ma On Shan Station sites are listed in *Table 2.3h*. *Figure 2.3h* shows the relative position of the ASRs to the work sites. Background air quality in this area is dominated by the traffic exhaust from Sai Sha Road and Ma On Shan Road. In 1995, the annual averaged daily traffic on Ma On Shan Road was over 30,000 vehicles, ambient TSP levels are dominated by road traffic. Most of the sensitive uses are residential buildings. Ma On Shan Centre and Sun Shine City are likely to be impacted by construction dust.

Ma On Shan to Lee On

2.3.16 Within the last section of the railway development, most of the land uses close to the work sites are residential and recreational. Ambient air quality is affected by the traffic on Sai Sha Road and other local access roads. The nearest ASR to Lee On Station is Lee Wing House of Lee On Estate. Other ASRs within this section would also be impacted by alignment construction. ASRs are listed in *Table 2.3i* and shown in *Figure 2.3i*.

Table 2.3h Air Sensitive Receivers - Heng On to Ma On Shan

Air Sensitive Receiver		Distance from Work Site (m)	
		Alignment	Ma On Shan Station
A81	Tsang Pik Shan Secondary School	91	93
A82	Fok On Garden	35	130
A83	Sun Shine City Block L	65	67
A84	Sun Shine City Block K	82	87
A85	Sun Shine City Block M	25	22
A86	Bayshore Towers Block 5	50	45
A87	Bayshore Towers Block 2	49	42
A88	Ma On Shan Centre Block 1	20	21
A89	Ma On Shan Centre Block 2	21	49
A90	Sun Shine City Block E	32	20
A91	Fu Fai Garden Block 1	27	55
A92	Ma On Shan Centre Block 3	80	110
A93	Villa Athena Block 1	44	220

Table 2.3i Air Sensitive Receivers - Ma On Shan to Lee On

Air Sensitive Receiver		Distance from Work Site (m)	
		Alignment	Lee On Station
A94	Villa Athena Block 5	26	>300
A95	Saddle Ridge Garden Block 1	84	>300
A96	Saddle Ridge Garden Block 5	52	>300
A97	Kam Lung Court Lung Yiu House	40	>300
A98	Kam Lung Court Lung Sing House	32	>300
A99	Wu Kwai Sha New Village nos. 1-12	60	>300
A100	Lee On Estate Lee Wing House	24	104

2.4 Construction Impacts

Potential Sources of Impact

2.4.1 The principal source of potential air quality impacts during the construction of the MOS Rail will be dust. Exhaust emissions from site vehicles and powered mechanical equipment (PME) will have minimal impacts on the surrounding area owing to the limited number of potential sources. No batching plants are required as it is envisaged that ready mixed concrete will be delivered by lorry. It is likely that access roads to the work sites will all be paved and therefore, dust will mainly arise within the construction sites themselves. Stockpiling on site would be minimal.

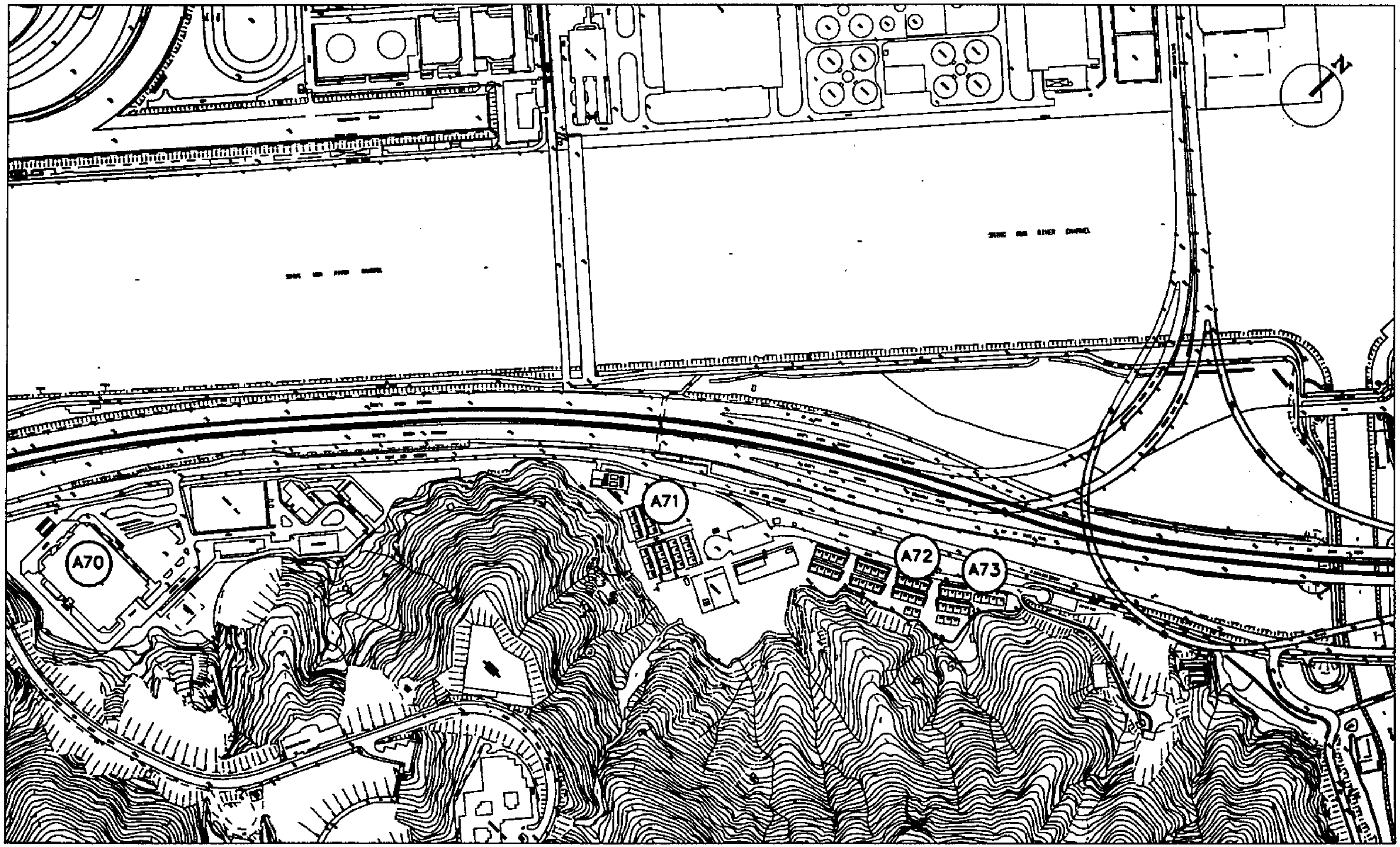

FIGURE 2.3f - Air Sensitive Receiver -

Shek Mun to Chevalier Garden

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_20
Sources :	

Prepared by ERM's GIS & MAPPING Group

KEY

Alignment

Station Site

A1 Air Sensitive Receiver

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

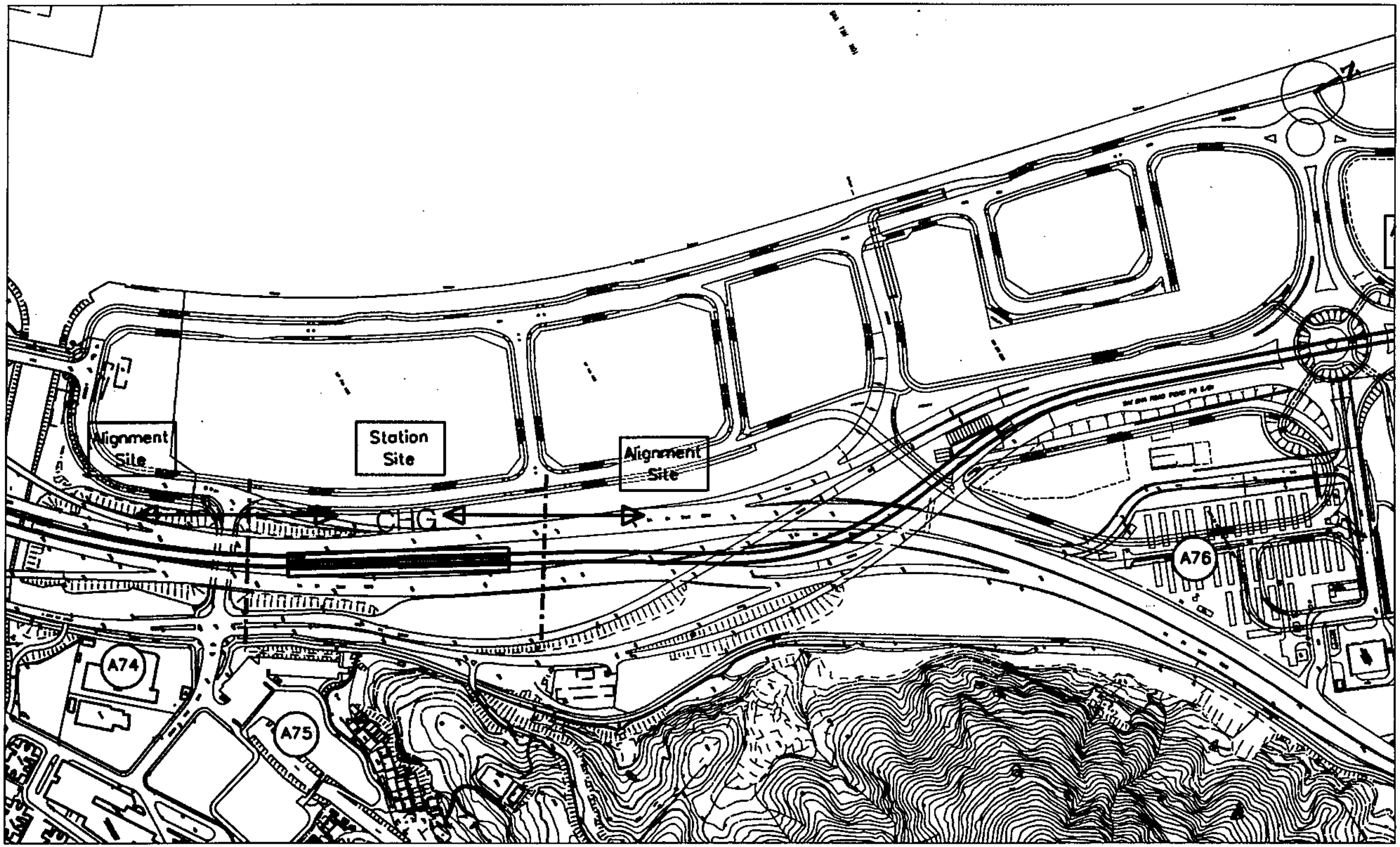

FIGURE 2.3g - Air Sensitive Receiver -

Chevalier Garden to Heng On

Date : 15 Oct 1996 | Drawing No.: /Contract/C1435/C1435_21

Sources :

Prepared by ERM's GIS & MAPPING Group

KEY

Alignment

Station Site

A1 Air Sensitive Receiver

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

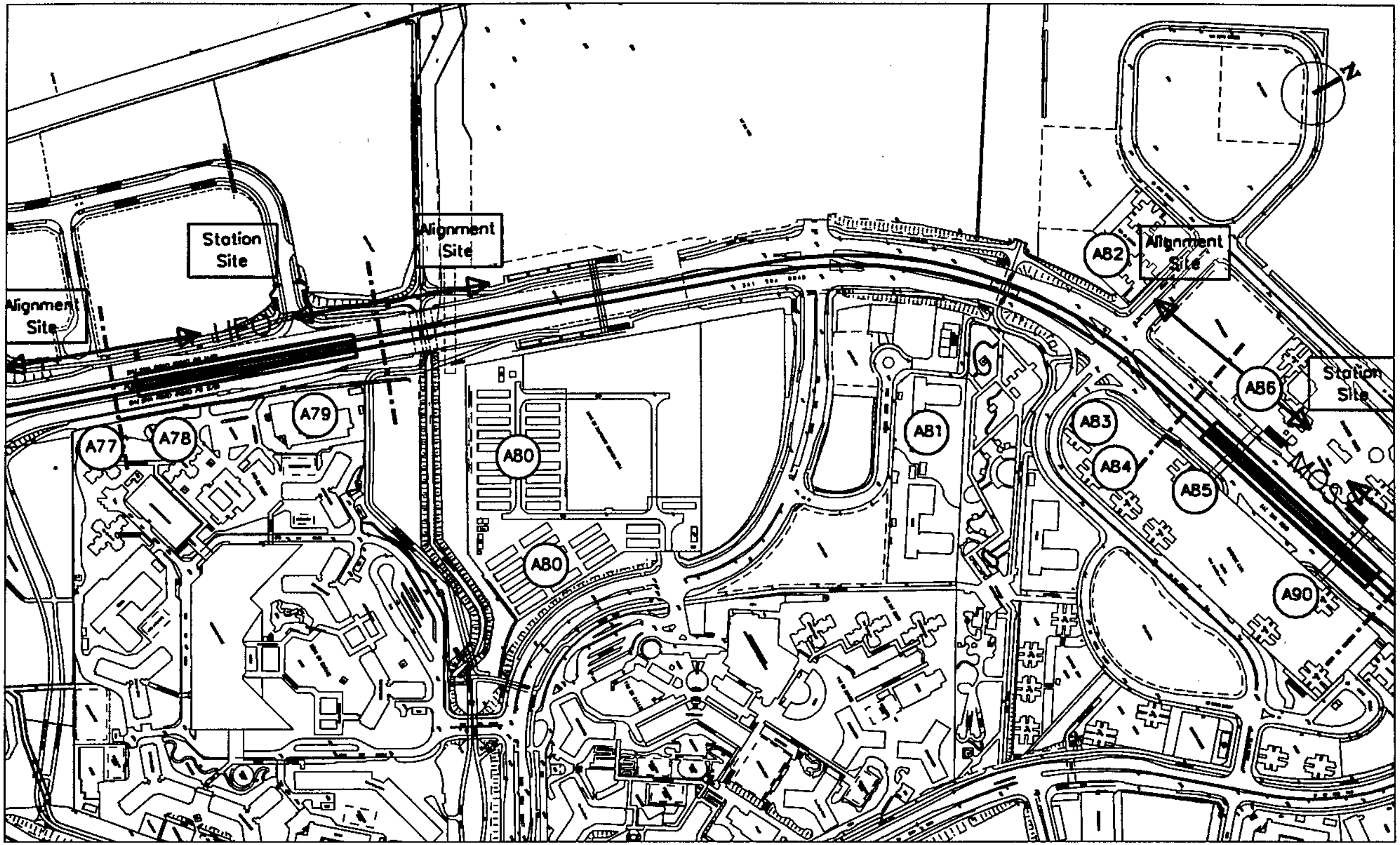

FIGURE 2.3h - Air Sensitive Receiver -

Heng On to Ma On Shan

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_22
Sources :	

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- Station Site
- A1 Air Sensitive Receiver

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

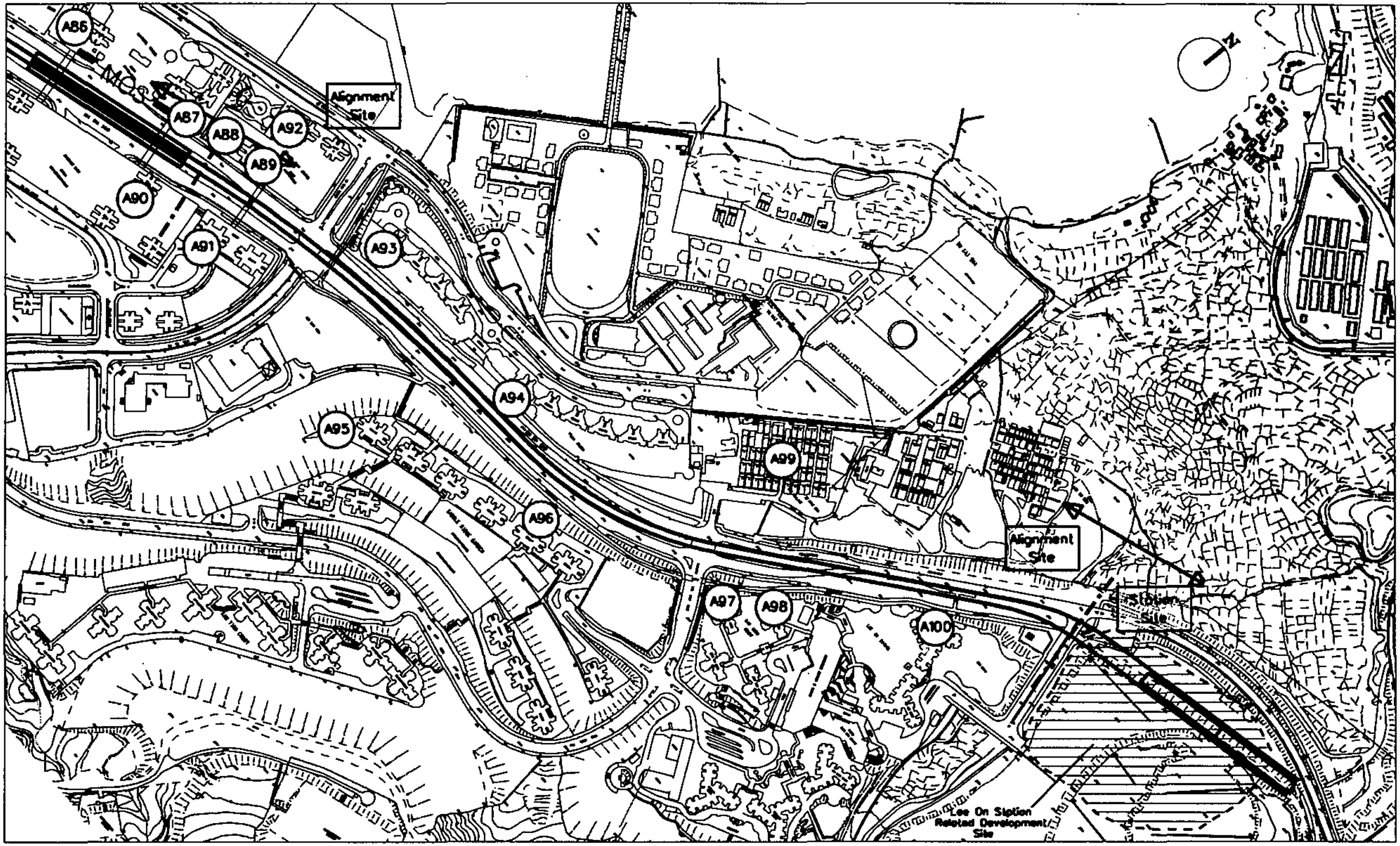

Figure 2.3i - Air Sensitive Receivers - Ma On Shan to Lee On

Date : 15 Oct 1996

Drawing No.: /Contract/C1435/C1435_23

Sources: 1:1000 Digitized Survey Sheet, Buildings and Lands Department

Scale: 1:6000

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- Station Related Development Site
- Station Site
- A1 Air Sensitive Receiver

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

2.4.2 The main construction activities which would generate dust impacts include demolition and site clearance, ground excavation, materials handling and transfer off-site, and vehicle movements within work sites. Viaduct construction for the alignment would impose limited dust impacts on the surrounding areas. However, construction of stations along the alignment and those station related developments would cause air quality impacts on the surrounding environment.

2.4.3 Construction dust would be generated mainly from exposed material during excavation works, handling of spoil and vehicular movements within the construction sites during the site clearance and site formation stages. *Table 2.4a* shows the estimated amount of spoil to be generated within each construction site. Extensive earthworks are expected at Tai Wai Station and Depot site, the Tai Wai to Sha Tin Tau alignment and the Heng On to Ma On Shan and Ma On Shan to Lee On sections. The main types of the spoil will be rock fill material, decomposed granite and marine deposits.

Table 2.4a Estimated Volume of Spoil Generated in Construction Phase

Construction Site	Estimated Spoil Volume (m^3)
Provisional Hin Keng Station	7,000
Hin Keng to Tai Wai	12,000
Tai Wai Station and Depot	171,000
Tai Wai to Sha Tin Tau	33,000
Sha Tin Tau Station	19,000
Sha Tin Tau to Sha Kok Street	18,100
Sha Kok Station	18,100
Sha Kok Street to City One, Shatin	19,400
City One Station	18,100
City One Shatin to Shek Mun	27,200
Shek Mun Station	18,100
Shek Mun to Chevalier Garden	15,500
Chevalier Garden Station	15,100
Chevalier Garden to Heng On	30,600
Heng On Station	12,700
Heng On to Ma On Shan	34,400
Ma On Shan Station	18,100
Ma On Shan to Lee On	43,800
Lee On Station	4,400

Assessment Methodology

2.4.4 The assessment has focused on the potential dust impacts from the construction of stations and the alignment. Excavation works, handling of spoil and construction materials and vehicular movements on unpaved site roads will be the major dusty activities.

2.4.5 Background air quality was referenced to the EPD's monitoring station at Shatin district, with an annual averaged TSP level of 73 $\mu g\ m^{-3}$ in 1995. This value was added to the predicted results to obtain the cumulative dust levels at the ASRs.

2.4.6 It is expected that the stations and alignment will be constructed in discrete sections, cumulative impacts from activities in adjacent alignment sections will not arise, however, they are possible from station and alignment sites. No details are presently available of other concurrent activities which may also generate TSP impacts and, therefore, cumulative impacts have only been assumed to include background levels.

Dispersion Model

2.4.7 The Fugitive Dust Model (FDM) was used to model the extent of impacts from the construction sites on ASRs. Six categories of particle size (100 µm, 30 µm, 15 µm, 10 µm, 5 µm and 2.5 µm) were assumed in the model. The mass fraction of each size range for different dust sources were based on the emission rates listed in the *Compilation of Air Pollutant Emission Factors, Volume I : Stationary Point and Area Sources, US EPA, 5th Edition* (AP-42). Gravitational settling velocities were calculated by the model.

2.4.8 The maximum 1-hour particulate concentrations at the ASRs were modelled to assess the likely worst case impacts. These results will give higher comparative results than those which would be obtained for 24-hour averages using recorded meteorological data. The 1-hour average results presented here assume worst case meteorological conditions, with the worksite upwind of the ASR, throughout the modelling period. However, the meteorological conditions over a 24-hour period will vary considerably and the construction works will only be carried out for half the assessment period (12 hours out of a 24 hour day).

2.4.9 Therefore, the suggested mitigation measures to ameliorate the 1-hour dust levels at the ASRs to below the guideline value will also be effective in controlling the daily dust levels.

Meteorological Input

2.4.10 At this feasibility stage, the likely impacts at downwind distances were assessed with stability class D, which is the typical daytime atmospheric condition in Hong Kong and with wind speeds of 1-5 $m\ s^{-1}$. The worst hourly dust levels were predicted to occur with a wind speed of 5 $m\ s^{-1}$ and the levels at the ASRs under these conditions are presented in this study.

Emission Rates

2.4.11 Dust emission rates from construction works are dependent on the extent of the site area where construction activities are taking place, the levels of construction activities and the daily and weekly construction period. It has been assumed that the effective working area within which dusty operations are undertaking, will be 30% of the total site area. In addition, it was also assumed that for the alignment construction, the site coverage would be divided into 24 m×120 m alignment segments and 10 station sites (the Tai Wai Station site includes the Depot).

2.4.12 Estimations of emission factors employed in the dispersion modelling have been made in accordance with AP-42 and are shown in *Table 2.4b*. The dust density used in the model was assumed to be 2600 $kg\ m^{-3}$. Properties of the excavated spoil such as moisture content and silt content were provided by the Study Team. Dusty activities such as excavation and handling of materials and vehicular movements on unpaved site roads were considered in the modelling study.

Table 2.4b Emission Factors of Dusty Construction Activities

Construction Site	Emission Factor	
	Handling of Excavated Material ($g\ s^{-2}\ m^{-2}$)	Truck Movements on Unpaved Haul Road ($g\ s^{-1}\ m^{-1}$)
Provisional Hin Keng Station	1.73x10-6	0.0057
Hin Keng to Tai Wai	7.72x10-6	N/A
Tai Wai Station and Depot	1.75x10-6	0.0057
Tai Wai to Sha Tin Tau	2.83x10-5	N/A
Sha Tin Tau Station	2.61x10-6	0.0057
Sha Tin Tau to Sha Kok Street	1.55x10-5	N/A
Sha Kok Station	9.58x10-6	0.0057
Sha Kok Street to City One, Shatin	1.66x10-5	N/A
City One Station	9.58x10-6	0.0057
City One Shatin to Shek Mun	2.33x10-5	N/A
Shek Mun Station	9.58x10-6	0.0057
Shek Mun to Chevalier Garden	1.33x10-5	N/A
Chevalier Garden Station	5.33x10-6	0.0057
Chevalier Garden to Heng On	2.62x10-5	N/A
Heng On Station	6.72x10-6	0.0057
Heng On to Ma On Shan	2.95x10-5	N/A
Ma On Shan Station	7.67x10-6	0.0057
Ma On Shan to Lee On	1.33x10-5	N/A
Lee On Station	1.86x10-6	0.0057

Note: The emission rates of handling of excavated material were dependent on wind speed, with assumed moisture content of 0.7%.
Evaluation of the emission factors of unpaved haul roads was based on the assumed peak hour traffic of 10 vehicles.
N/A - No unpaved haul roads are expected to be used during the construction of the alignment sections, since the main access roads would be the adjacent paved roadways. There would, therefore, be limited potential for dust emissions from this source.

Predictions of Impacts

2.4.13 The dust impacts from the construction of the alignment, stations and depot at the ASRs, including the cumulative impact of a background dust concentration of 73 $\mu g\ m^{-3}$, are shown in *Table 2.4c*. Dust impacts from station and alignment construction are shown individually.

Table 2.4c Predicted Ground Level 1-hour TSP Concentrations ($\mu g\ m^{-3}$)

Air Sensitive Receiver		Alignment Construction	Station Construction	Cumulative Station and Alignment Level[1]
Hing Keng to Tai Wai				
A1	Shatin Water Treatment Works Office	N/A[2]	167	167
A2	Keng Hau Road no. 29	75	406	408
A3	Keng Hau Road no. 25	77	291	295
A4	Keng Hau Road no. 22	79	273	279
A5	Keng Hau Road no. 11	76	167	170
A6	Keng Hau Road nos. 5-7	75	141	143
A7	Hin Yau House	75	443	445
A8	Hin Keng Commercial Complex	79	592	598
A9	Hin Tin Playground	101	276	304
A10	Hin Yeung House	76	124	127
Tai Wai to Sha Tin Tau				
A11	Hin Tin Swimming Pool	164	377	468
A12	Sha Tin Heights	77	385	389
A13	Tin Sam Village nos. 182-185	N/A	296	296
A14	Sun Ming House	74	262	263
A15	Christian Alliance School	N/A	330	330
A16	Holford Garden Commercial Complex	N/A	311	311
A17	Grandway Garden Block 2	N/A	318	318
A18	Tao On Building	N/A	344	344
A19	Cheung Wong Wai Primary School	75	259	261
A20	Sha Tin Tsung Tsin Secondary School	88	263	278
A21	Tai Wai Playground	81	265	273
A22	Tai Wai Football Field	117	270	314
A23	Temple (Che Kung Miu)	135	205	267
A24	Man Lai Court	133	237	297
Sha Tin Tau to Sha Kok Street				
A25	Lei Uk Tsuen nos. 12-15	99	183	209
A26	Sha Tin Government Secondary School	86	129	142
A27	Shek Fai House	111	268	306
A28	Shek Yuk House	117	250	294
A29	Ecclesia Bible College	78	240	245
A30	Sha Tin Tau no. 3	151	182	260
A31	Tsang Tai Uk Recreation Ground	255	178	360
A32	Sham Ha Wai	108	96	131
Sha Kok Street to City One				
A33	Secondary School (between Jat Min Chuen St. & Sha Kok St.)	111	N/A	111
A34	Immaculate Heart of Mary College	121	104	152

Air Sensitive Receiver		Alignment Construction	Station Construction	Cumulative Station and Alignment Level[1]
A35	Ming Yan Lau	121	239	287
A36	Pok Man House	219	95	241
A37	Tin Ka Ping Salvation Army Primary School	219	108	254
A38	Pok Hong Estate Commercial Centre	147	160	234
A39	Pok Yue House	132	294	353
A40	Pok Yat House	99	284	310
A41	Pok Tai House	105	453	485
A42	Sha Kok Estate Office	109	396	432
A43	Osprey House	87	211	225
A44	Oriole House	109	326	362
A45	Sha Tin Wai Playground	229	414	570
A46	Sha Tin Wai nos. 1-2	109	137	173
A47	Ashley Garden	176	99	202
A48	Iris Garden	159	N/A	159
City One to Shek Mun				
A49	Toi Shan Association College	85	N/A	85
A50	Wong UK Village nos. 17-18	211	N/A	211
A51	Green Leave Garden Block B	134	91	152
A52	Prince of Wales Hospital	96	102	125
A53	Pamela Youde Child Assessment Centre and School Dental Clinic	191	455	573
A54	Yue Sui House	109	530	566
A55	Yue Kwan House	86	466	479
A56	Yow Kam Yuen Prevocational School	190	415	532
A57	Lam Kau Mow Secondary School	151	124	202
A58	Yuen Chau Kok THA (Cleared)	143	591	661
A59	City One Sha Tin Block 36	105	99	131
Shek Mun to Chevalier Garden				
A60	City One Sha Tin Block 33	124	84	135
A61	Sha Tin Industrial Centre	162	95	184
A62	Siu Lek Yuen Road Playground	135	101	163
A63	Tat Lee Centre	113	145	185
A64	Sun Mu Commercial Centre	83	87	97
A65	JDH Centre	79	88	94
A66	Garden Vista Block D	75	N/A	75
A67	Pictorial Garden Capilano Court	77	N/A	77
A68	Pictorial Garden Dragon Court	85	N/A	85
A69	Pictorial Garden Juniper Court	101	N/A	101
A70	Sha Tin Hospital	94	N/A	94
A71	Fishermen's New Village no. 113	91	N/A	91

Air Sensitive Receiver		Alignment Construction	Station Construction	Cumulative Station and Alignment Level(1)
A72	Fishermen's New Village nos. 16-19	86	N/A	86
A73	Fishermen's New Village nos. 5-8	86	N/A	86
Chevalier Garden to Heng On				
A74	Ma On Shan Tsung Tsin Secondary School	85	114	126
A75	Tai Shui Hang nos. 1-4	79	225	231
A76	Sing On THA	87	N/A	87
A77	Ngan On House	141	248	316
A78	Po On House	123	381	431
A79	Chinese YMCA College	149	967	1043
A80	Hing On THA	123	138	188
Heng On to Ma On Shan				
A81	Tsang Pak. Shan Secondary School	98	236	261
A82	Fok On Garden	162	175	264
A83	Sun Shine City Block L	114	317	358
A84	Sun Shine City Block K	102	250	279
A85	Sun Shine City Block M	199	685	811
A86	Bayshore Towers Block 5	131	438	496
A87	Bayshore Towers Block 2	133	461	521
A88	Ma On Shan Centre Block 1	142	702	771
A89	Ma On Shan Centre Block 2	140	411	478
A90	Sun Shine City Block E	117	720	764
A91	Fu Fai Garden Block 1	126	374	427
A92	Ma On Shan Centre Block 3	87	202	216
A93	Villa Athena Block 1	104	118	149
Ma On Shan to Lee On				
A94	Villa Athena Block 5	128	N/A	128
A95	Saddle Ridge Garden Block 1	86	N/A	86
A96	Saddle Ridge Garden Block 5	98	N/A	98
A97	Kam Lung Court Lung Yiu House	107	N/A	107
A98	Kam Lung Court Lung Sing House	117	N/A	117
A99	Wu Kwai Sha New Village nos. 1-12	94	N/A	94
A100	Lee On Estate Lee Wing House	132	213	272

Note: (1) Cumulative impacts include background level of 73 $\mu g\ m^{-3}$.
(2) N/A - distance separation is greater than 300 m and therefore no impact is predicted.

2.4.14 The 1-hour levels shown in *Table 2.4c* represent the worst case impact, assuming that the wind is blowing from the worksite directly towards the receiver for the entire hour at the wind speed most effective for TSP transport. The 24-hour levels are based on the 1-hour predictions, factored to account for the construction works taking place for not more than 12 hours out of the 24 hour period (ie 50%). Unless the background level is already very high, the predicted levels will have a similar relationship to the 24-hour AQO (260 $\mu g\ m^{-3}$) as to the 1-hour limit (500 $\mu g\ m^{-3}$). However, during the whole day, the wind speed and direction will vary considerably and the actual 24-hour level will be noticeably lower than the corresponding 1-hour value. Therefore, the effective mitigation of the predicted 1-hour levels to within the recommended limit will also control the 24-hour levels to within the AQO.

Evaluation of Impacts

Hin Keng to Tai Wai

2.4.15 There is no AQO for hourly TSP but it is generally accepted that the EPD recommendation of an hourly averaged TSP concentration of 500 $\mu g\ m^{-3}$ should not be exceeded at ASRs. Dust impacts from this section of alignment and station construction would arise mainly from excavation works, handling of spoil and associated vehicular movements over unpaved haul roads. The modelled results showed that most of the hourly dust levels at the ASRs were below the guideline value, except Hin Keng Commercial Complex, at which the maximum dust level was predicted.

2.4.16 The predicted cumulative hourly TSP level at Hin Keng Commercial Complex exceeds the guideline limit by 98 $\mu g\ m^{-3}$. Effective mitigation measures should be adopted in order to reduce the dust level to within the guideline value. Although the predicted values at Hin Yau House and the residential development at 29 Keng Hau Road were within the 500 $\mu g\ m^{-3}$ limit, the hourly dust levels were over 400 $\mu g\ m^{-3}$. Environmental control measures should be considered in order to reduce the likely dust impacts from station construction.

2.4.17 Dust impacts from alignment construction alone would be minimal, as the cumulative level at most of the ASRs will be below 80 $\mu g\ m^{-3}$, almost entirely from background sources.

Tai Wai to Sha Tin Tau

2.4.18 All the predicted cumulative 1-hour TSP levels at the ASRs are below the 500 $\mu g\ m^{-3}$ target. Dust impacts from alignment construction would be low due to the limited extent of the works and the distances from ASRs. However, the predicted hourly dust levels at some of the ASRs from station construction were considered high and mitigation measures should be applied.

2.4.19 Hin Tin Swimming Pool, Sha Tin Heights, Christian Alliance School, Holford Garden Commercial Complex, Grandway Garden and Tao On Building would receive an hourly dust level of over 300 $\mu g\ m^{-3}$ from station construction works. Dust suppression measures should be considered in order to ensure the daily dust levels at these receivers comply with AQO.

Sha Tin Tau to Sha Kok Street

2.4.20 For this section, the modelled dust levels at all the ASRs during the alignment and station construction were within the 500 $\mu g\ m^{-3}$ limit, which indicated that there would be limited impacts on the ASRs because of the greater distance from construction sites. The maximum predicted 1-hour TSP level was 268 $\mu g\ m^{-3}$ at Shek Fai House from station construction, and 255 $\mu g\ m^{-3}$ at Tsang Tai Uk Recreation Ground from alignment construction. Environmental control measures should still be considered to reduce the dust emissions from any dusty activities during the construction phase of the development.

Sha Kok Street to City One Shatin

2.4.21 As shown in *Table 2.4c*, all the predicted hourly dust levels at the ASRs were below the 500 µg m^{-3} limit except Sha Tin Wai Playground. However, the cumulative hourly TSP levels at Pok Tai House and Sha Kok Estate Office were over 400 µg m^{-3}. Environmental control measures in terms of dust suppression should be implemented in order to protect the ASRs from dust impacts, especially those in close proximity to the work sites.

2.4.22 Predicted hourly dust levels from alignment construction were all within the 500 µg m^{-3} limit at the ASRs and adverse air quality impacts from construction activities are considered unlikely.

City One Shatin to Shek Mun

2.4.23 Dust impacts from station construction would be likely and it was predicted that cumulative dust levels at Yuen Chau Kok temporary housing area (661 µg m^{-3}), Pamela Youde Child Assessment Centre and School Dental Clinic (573 µg m^{-3}), Yue Sui House (566 µg m^{-3}) and Yow Kam Yuen Prevocational School (532 µg m^{-3}) exceeded the 500 µg m^{-3} limit. As shown in *Table 2.4c*, the cumulative dust level at Yue Kwan House was above 400 µg m^{-3}. Dust suppression measures should be implemented to ameliorate the likely impacts, as detailed in *Section 2.4.30*.

2.4.24 Air quality impacts from alignment construction, however, would be unlikely since all the predicted hourly TSP levels were well below the 500 µg m^{-3} limit. The maximum predicted dust level was 211 µg m^{-3} at Wong Uk Village.

Shek Mun to Chevalier Garden

2.4.25 Within this section of the alignment, all the predicted dust levels at the ASRs were within the 500 µg m^{-3} guideline value. Since most of the ASRs were distant from the work site of Shek Mun Station, dust impacts would be unlikely. The maximum cumulative dust level predicted was 185 µg m^{-3} at Tat Lee Centre. For alignment construction, all the predicted values were well within the 500 µg m^{-3} limit. The hourly dust levels were all below 170 µg m^{-3} at ASRs, and the maximum predicted dust level was 162 µg m^{-3} at Sha Tin Industrial Centre. Adverse air quality impacts in this area are not expected.

Chevalier Garden to Heng On

2.4.26 Referring to *Table 2.4c*, all the predicted 1-hour TSP levels at the ASRs were below the 500 µg m^{-3} value during the alignment construction. However, the predicted dust levels from station construction indicate that there would be potential construction dust impacts to the surrounding area. The Chinese YMCA College would be impacted by construction dust and a cumulative hourly dust level of 1043 µg m^{-3} was predicted. Mitigation measures will have to be implemented and are suggested in *Section 2.4.30*, in order to reduce the dust level to within the guideline limit.

2.4.27 Po On House of Heng On Estate is predicted to receive a cumulative hourly dust level of 431 µg m^{-3} and mitigation measures should be applied to ameliorate such impacts.

Heng On to Ma On Shan

2.4.28 From Heng On to Ma On Shan, the predicted hourly TSP levels at ASRs were all below the guideline value during the alignment construction stage. Nevertheless, dust impacts would be likely at some of the ASRs during the station construction stage. The highest cumulative 1-hour TSP level predicted was 811 $\mu g\ m^{-3}$ at Sun Shine City Block M. Sun Shine City Block E, Bayshore Towers Block 2 and Ma On Shan Centre Blocks 1 would also receive dust levels above the 500 $\mu g\ m^{-3}$ guideline limit. Dust suppression measures should be undertaken in order to reduce the hourly dust levels at the ASRs as well as the daily exposure to construction dust. Mitigation measures are detailed in *Section 2.4.30.*

2.4.29 The highest hourly TSP level predicted during the alignment construction was 199 $\mu g\ m^{-3}$, which indicated that the air quality impacts from alignment construction would be limited.

Ma On Shan to Lee On

2.4.30 Predicted 1-hour TSP levels at the ASRs are shown in *Table 2.4c,* all the dust levels were below the 500 $\mu g\ m^{-3}$ guideline value and adverse impacts would be considered unlikely within this section of the alignment. Impacts from station construction would also be limited due to the buffer distance. The ASR identified in Lee On Estate (Lee Wing House) would receive the highest cumulative hourly dust level of 272 $\mu g\ m^{-3}$, well within the guideline limit.

Mitigation Measures

2.4.31 Standard dust suppression measures should be incorporated into contract documents and adopted as part of good site practices to minimize potential dust impacts on the ASRs. The following measures should be implemented in order to reduce dust generation:

Earthworks and Excavation Activities

- surface compaction over completed earthworks where practicable to minimize the extent of exposed soil;
- frequent watering of the work site (an effective watering programme, twice daily with complete coverage may reduce dust emissions by up to 50 percent);

Materials Stockpiling and Handling

- all temporary stockpiles of aggregate or spoil larger than 50 m^3 should be enclosed or covered and watered regularly in dry or windy conditions;
- dropping heights for excavated materials should be controlled to a minimum practical height to minimize the fugitive dust arising from loading and unloading;

Vehicle Movements within the Works Site

- covering unpaved roads with a layer of coarse stone;
- avoidance of truck exhaust pipes stirring up dust by directing the outlets upward;

- provision of wheel washing facilities at the exit of the site;
- effective water sprays should be used on the site at potential dust emission sources such as unpaved areas and active construction areas;
- the travelling speed should be controlled in order to reduce the traffic induced dust dispersion and re-suspension within work site from the operating haul trucks; and
- during transportation by truck, materials should not be loaded to a level higher than the side and tail boards, and should be dampened or covered before transport off-site.

2.4.32 For all the assessed sites, the most effective dust control measures should be incorporated into the detailed construction programme to ensure impacts are minimised. The mitigated dust levels are shown in *Tables 2.4d*, with the incorporation of the suggested control measures. In general, dust emissions can be reduced by 50% with the implementation of a regular watering programme on active or inactive work sites and site roads. A further 50% reduction can be achieved by restricting vehicle speeds on site from 20 kph to 10 kph.

Table 2.4d Mitigated Ground Level 1-hour TSP Concentrations ($\mu g\ m^{-3}$)

Air Sensitive Receiver		Alignment Construction	Station Construction	Cumulative Station and Alignment Level[1]
Hin Keng to Tai Wai				
A1	Shatin Water Treatment Works Office	N/A[2]	96	96
A2	Keng Hau Road no. 29	74	156	157
A3	Keng Hau Road no. 25	75	127	129
A4	Keng Hau Road no. 22	76	123	126
A5	Keng Hau Road no. 11	75	96	98
A6	Keng Hau Road nos. 5-7	74	90	91
A7	Hin Yau House	74	165	166
A8	Hin Keng Commercial Complex	76	202	205
A9	Hin Tin Playground	87	124	138
A10	Hin Yeung House	74	86	87
Tai Wai to Sha Tin Tau				
A11	Hin Tin Swimming Pool	118	151	196
A12	Sha Tin Heights	75	154	156
A13	Tin Sam Village nos. 182-185	N/A	130	130
A14	Sun Ming House	74	121	122
A15	Christian Alliance School	N/A	139	139
A16	Holford Garden Commercial Complex	N/A	134	134

Air Sensitive Receiver		Alignment Construction	Station Construction	Cumulative Station and Alignment Level[1]
A17	Grandway Garden Block 2	N/A	135	135
A18	Tao On Building	N/A	142	142
A19	Cheung Wong Wai Primary School	74	120	121
A20	Sha Tin Tsung Tsin Secondary School	81	122	130
A21	Tai Wai Playground	77	122	126
A22	Tai Wai Football Field	95	123	145
A23	Temple (Che Kung Miu)	104	107	138
A24	Man Lai Court	103	115	145
Sha Tin Tau to Sha Kok Street				
A25	Lei Uk Tsuen nos. 12-15	86	101	114
A26	Sha Tin Government Secondary School	79	87	93
A27	Shek Fai House	92	123	142
A28	Shek Yuk House	95	118	140
A29	Ecclesia Bible College	76	116	119
A30	Sha Tin Tau no. 3	112	101	140
A31	Tsang Tai Uk Recreation Ground	164	100	191
A32	Sham Ha Wai	90	79	96
Sha Kok Street to City One				
A33	Secondary School (between Jat Min Chuen St. & Sha Kok St.)	92	N/A	92
A34	Immaculate Heart of Mary College	97	81	105
A35	Ming Yan Lau	97	116	140
A36	Pok Man House	146	79	152
A37	Tin Ka Ping Salvation Army Primary School	146	82	155
A38	Pok Hong Estate Commercial Centre	110	95	132
A39	Pok Yue House	103	130	160
A40	Pok Yat House	86	127	140
A41	Pok Tai House	89	171	187
A42	Sha Kok Estate Office	91	156	174
A43	Osprey House	80	108	115
A44	Oriole House	91	138	156
A45	Sha Tin Wai Playground	151	161	239
A46	Sha Tin Wai nos. 1-2	91	90	108

Air Sensitive Receiver		Alignment Construction	Station Construction	Cumulative Station and Alignment Level[1]
A47	Ashley Garden	124	80	131
A48	Iris Garden	116	N/A	116
City One to Shek Mun				
A49	Toi Shan Association College	79	N/A	79
A50	Wong UK Village nos. 17-18	142	N/A	142
A51	Green Leave Garden Block B	104	78	109
A52	Prince of Wales Hospital	85	81	93
A53	Pamela Youde Child Assessment Centre and School Dental Clinic	132	172	231
A54	Yue Sui House	91	191	209
A55	Yue Kwan House	80	175	182
A56	Yow Kam Yuen Prevocational School	132	161	220
A57	Lam Kau Mow Secondary School	112	86	125
A58	Yuen Chau Kok THA (Cleared)	108	207	242
A59	City One Sha Tin Block 36	89	80	96
Shek Mun to Chevalier Garden				
A60	City One Sha Tin Block 33	99	76	102
A61	Sha Tin Industrial Centre	118	79	124
A62	Siu Lek Yuen Road Playground	104	80	111
A63	Tat Lee Centre	93	92	112
A64	Sun Mu Commercial Centre	78	77	82
A65	JDH Centre	76	77	80
A66	Garden Vista Block D	74	N/A	74
A67	Pictorial Garden Capilano Court	75	N/A	75
A68	Pictorial Garden Dragon Court	79	N/A	79
A69	Pictorial Garden Juniper Court	87	N/A	87
A70	Sha Tin Hospital	84	N/A	84
A71	Fishermen's New Village no. 113	82	N/A	82
A72	Fishermen's New Village nos. 16-19	80	N/A	80
A73	Fishermen's New Village nos. 5-8	79	N/A	79
Chevalier Garden to Heng On				
A74	Ma On Shan Tsung Tsin Secondary School	79	83	89
A75	Tai Shui Hang nos. 1-4	76	112	115

Air Sensitive Receiver		Alignment Construction	Station Construction	Cumulative Station and Alignment Level[1]
A76	Sing On THA	80	N/A	80
A77	Ngan On House	107	117	151
A78	Po On House	98	151	176
A79	Chinese YMCA College	111	299	337
A80	Hing On THA	98	89	114
Heng On to Ma On Shan				
A81	Tsang Pak. Shan Secondary School	85	114	126
A82	Fok On Garden	118	99	144
A83	Sun Shine City Block L	93	135	155
A84	Sun Shine City Block K	88	118	133
A85	Sun Shine City Block M	136	228	291
A86	Bayshore Towers Block 5	102	165	194
A87	Bayshore Towers Block 2	103	171	201
A88	Ma On Shan Centre Block 1	108	232	267
A89	Ma On Shan Centre Block 2	106	159	192
A90	Sun Shine City Block E	95	237	259
A91	Fu Fai Garden Block 1	99	149	175
A92	Ma On Shan Centre Block 3	80	106	113
A93	Villa Athena Block 1	88	84	99
Ma On Shan to Lee On				
A94	Villa Athena Block 5	100	N/A	100
A95	Saddle Ridge Garden Block 1	79	N/A	79
A96	Saddle Ridge Garden Block 5	85	N/A	85
A97	Kam Lung Court Lung Yiu House	90	N/A	90
A98	Kam Lung Court Lung Sing House	95	N/A	95
A99	Wu Kwai Sha New Village nos. 1-12	83	N/A	83
A100	Lee On Estate Lee Wing House	102	108	137

Note: (1) Cumulative impacts includes background level of 73 $\mu g\ m^{-3}$.
(2) N/A - distance separation is greater than 300 m and therefore no impact is predicted.

2.4.33 As shown in *Table 2.4c*, all the mitigated dust levels are within the 500 $\mu g\ m^{-3}$ target. In addition, for most of the ASRs, the predicted dust levels are dominated by the ambient TSP level during the alignment construction stage.

2.4.34 It was noted in *Section 2.4.14*, that 24-hour levels can be expected to be less than 50% of the predicted 1-hour levels. The results in *Table 2.4d* above clearly indicate, therefore, that the proposed mitigation measures will also control 24-hour TSP impacts to within the AQO criterion.

2.4.35 Detailed assessment regarding hourly, daily and annual dust levels should be undertaken at the detailed design stage.

2.5 Operational Phase

2.5.1 No potential air quality impacts during the normal operation of the MOS Rail have been identified since electric trains will be used. However, low levels of dust may be created by the abrasion and wear of track, electrical pick-up gear and rolling stock and from maintenance activities. These emission sources are anticipated to be limited and no air quality impacts from these sources are expected. Railway impacts will be limited to the station ventilation systems and the air quality inside the bus termini within related development structures.

Station Ventilation System

2.5.2 Since detailed layouts of the stations of the MOS Rail are not available in this stage of study, detailed assessment cannot be undertaken. Those stations which would be equipped with noise enclosures or partially enclosing structures for the purposes of noise screening and safety aspects, will need to be supplied with sufficient ventilation. Ventilation fans and louvres, or air ventilation systems should be provided to ensure sufficient local air movement within the station concourse. Smoke extraction vents should also be provided in the event of fire. The vents for all ventilation systems should be directed away from nearby sensitive receivers.

Bus Terminus

2.5.3 The bus termini would be located at Tai Wai Station and at Lee On Station. Since there is no statutory criteria for the air quality inside a transport terminus, the air quality guidelines for public transport interchanges established by the EPD should be followed as shown in *Table 2.2b*.

2.5.4 The transport terminus is recommended to have openings on both sides allowing the best possible cross ventilation of the space. This form of natural ventilation is considered preferable to relying on mechanical ventilation to maintain the air quality inside the terminus within the recommended guidelines.

2.5.5 However, it cannot be assumed that the openings will be adequate, and the design of the ventilation systems should aim at achieving the 1-hour and the 5-minute criteria. In addition, the air inlet and exhaust of the ventilation system should be directed away from the nearby sensitive uses to avoid nuisance.

Station Related Developments

2.5.6 The three proposed station related developments are surrounded by primary distributor (PD) and district distributors (DD) roads and may be affected by vehicular emissions. According to the HKPSG, the residential and recreational uses within the proposed sites are identified as ASRs. The identified ASRs are shown in *Figures 2.5a-c* and the nearest roads to these ASRs are also identified and are listed in *Tables 2.5a-c*.

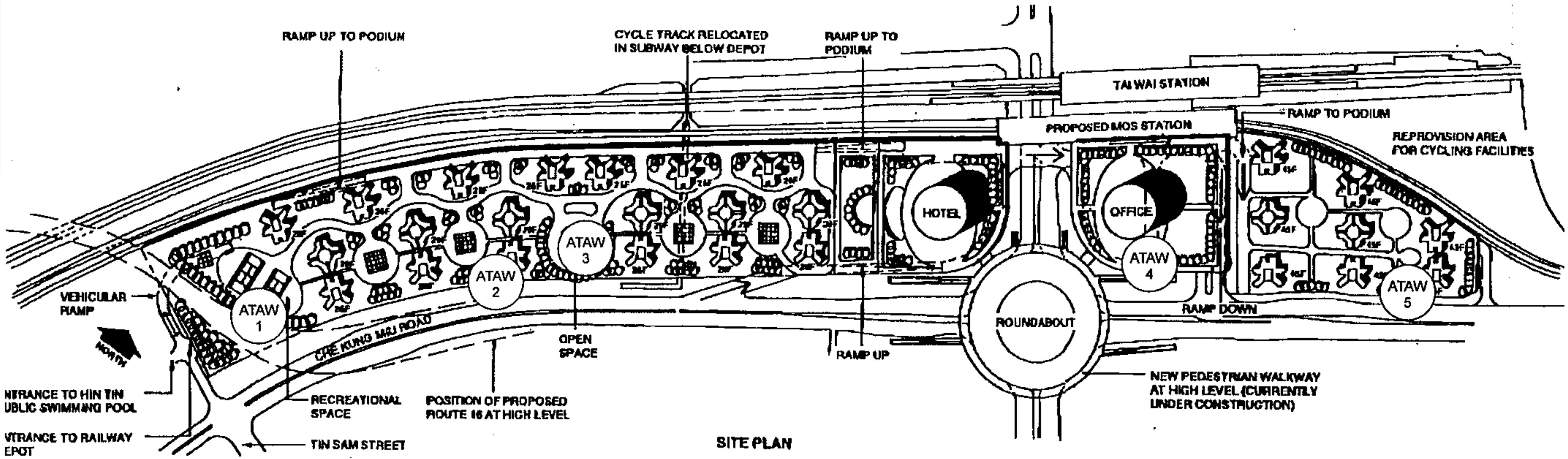

FIGURE 2.5a - LOCATIONS OF AIR SENSITIVE RECEIVERS - THE TAI WAI DEVELOPMENT

ERM-Hong Kong, Ltd
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

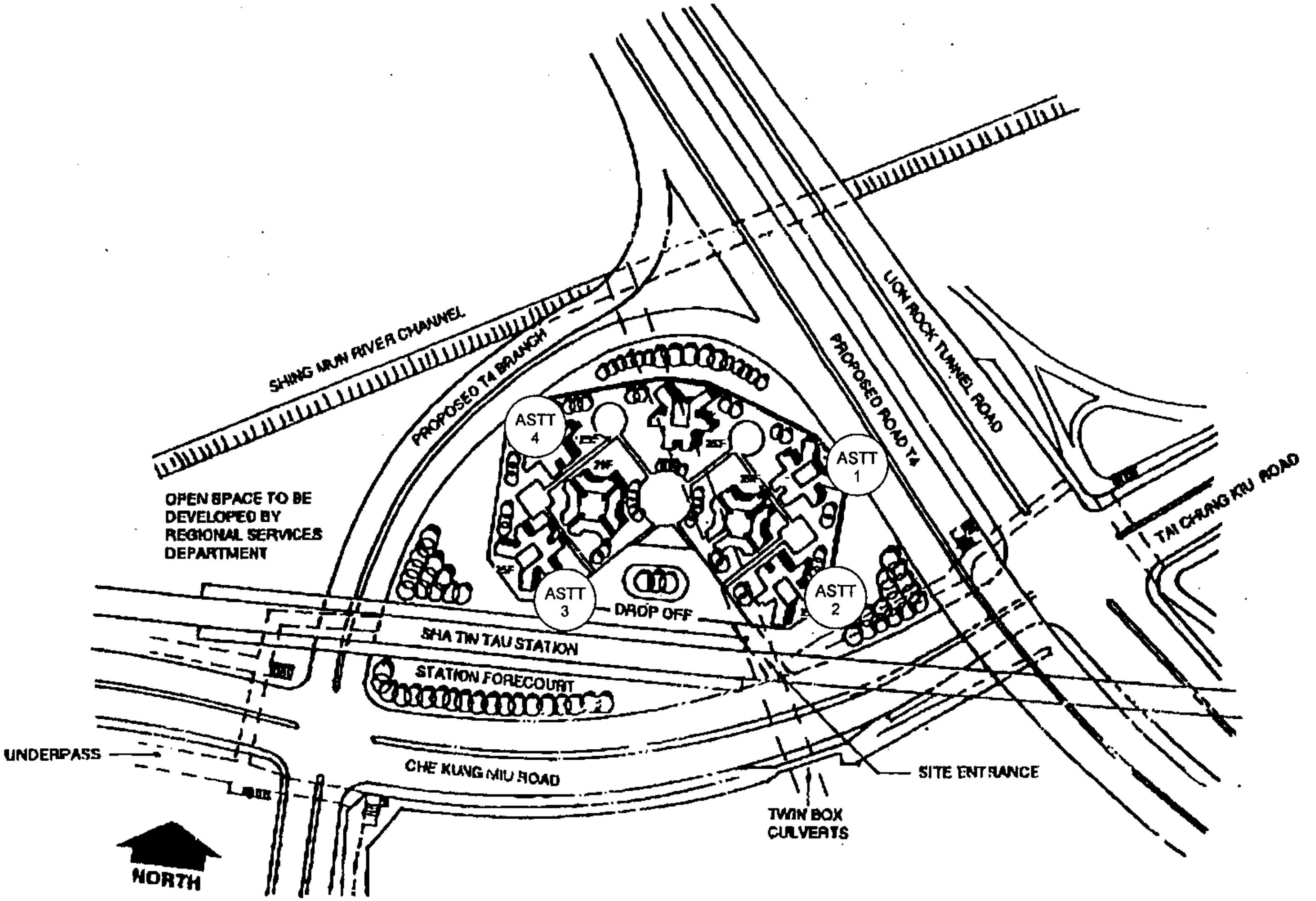

FIGURE 2.5b - LOCATIONS OF AIR SENSITIVE RECEIVERS - THE SHA TIN TAU DEVELOPMENT

ERM-Hong Kong, Ltd
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

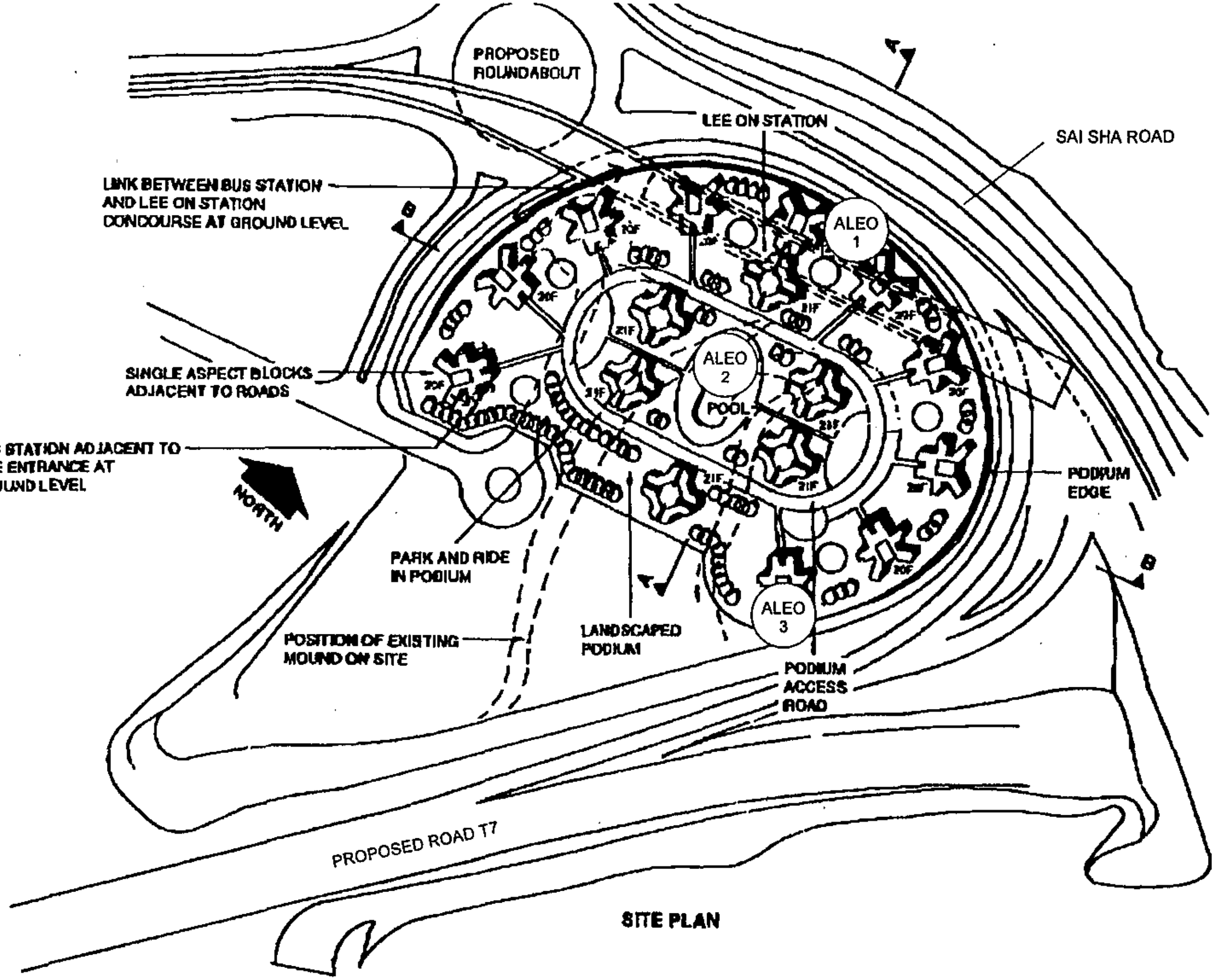

FIGURE 2.5c - LOCATIONS OF AIR SENSITIVE RECEIVERS - THE LEE ON DEVELOPMENT

ERM-Hong Kong, Ltd
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

Table 2.5a *Identification of ASRs and the Nearest Roads - Tai Wai*

	ASRs	Nearest Roads
ATAW1	Tennis Court on the southern boundary	Ramp to Route 16
ATAW2	Reduced aspect block (RAB) along Che Kung Miu Road, southern side of the site	Che Kung Miu Road
ATAW3	Open space on the southern side of the site	Che Kung Miu Road
ATAW4	Open space adjacent to the hotel and office towers	Che Kung Miu Road Mei Tin Road
ATAW5	Single aspect block along Che Kung Miu Road on the northern side of the site	Che Kung Miu Road

Table 2.5b *Identification of ASRs and the Nearest Roads - Sha Tin Tau*

	ASRs	Nearest Roads
ASTT1	RAB on the eastern side of the site	Lion Rock Tunnel Road Proposed Road T4
ASTT2	RAB close to the junction of Tai Chung Kiu Road and Che Kung Miu Road	Proposed Road T4 Che Kung Miu Road
ASTT3	RAB on the southern side of the site	Che Kung Miu Road
ACED	Reduced aspect block on the northern side of the site	Proposed T4 Branch

Table 2.5c *Identification of ASRs and the Nearest Roads - Lee On*

	ASRs	Nearest Roads
ALEO1	RAB on the northern side of the site	Sai Sha Road
ALEO2	Recreational space and pool on the southern boundary of the site	Proposed Road T7
ALEO3	RAB on the southern side of the site	Proposed Road T7 Slip road to Road T7

Evaluation of Impacts

2.5.7 The HKPSG specifies guidelines for the setback or buffer distance for open space for different land uses. The guidelines specify minimum buffer distances of 5-20 m dependent on the size and type of the nearby road. The horizontal distances from the identified ASRs to the nearest roads and the minimum buffer distances recommended in the HKPSG for each road type are listed in *Tables 2.5d-f.* In some cases, the buffer distances are less than the HKPSG recommended distances by 5-15 m. In order to meet the AQOs, the buffer distances should be increased for residential and recreational uses.

Tai Wai

2.5.8 At the proposed Tai Wai site, the horizontal distances between the tennis court (ATAW1) and the proposed elevated ramp to Route 16 is 13 m, less than the HKPSG recommended distance of 20 m. Therefore, the setback should be increased by an additional 7 m through locating non-air sensitive uses, such as a planted area, on the edge of the podium, facing the ramp. The horizontal distances from the open space (ATAW3) and single aspect blocks (ATAW5) to Che Kung Miu Road are 13 m, less than the recommended HKPSG guidelines. However, these air sensitive uses will be located on a podium of 15 m high and the actual distance between the ASRs and the roads will be 20 m, within the guidelines.

2.5.9 For the office and hotel developments, it is likely that central air-condition systems will be provided and air quality impacts will be reduced. Nevertheless, the air inlets should be located away from the pollutant source and the outlets should be facing away from any air sensitive uses.

Table 2.5d Horizontal Distances between ASRs and Surrounding Roads in Tai Wai

ASRs	Roads	Road Type	Horizontal Distance (m)	HKPSG Recommended Buffer Distance (m)
ATAW1	Ramp to Route 16	PD	13	For PD, > 20 m for Active and Passive
ATAW2	Che Kung Miu Road	PD	22	Recreational Uses 3-20 m for Passive
ATAW3	Che Kung Miu Road	PD	13	Recreational Uses
ATAW4	Che Kung Miu Road	PD	22	For DD, > 10 m for Active and Passive
	Mei Tin Road	DD	15	Recreational Uses < 10 m for Passive
ATAW5	Che Kung Miu Road	PD	13	Recreational Uses

Table 2.5e Horizontal Distances between ASRs and Surrounding Road in Sha Tin Tau

ASRs	Roads	Road Type	Horizontal Distance (m)	HKPSG Recommended Buffer Distance (m)
ASTT1	Lion Rock Tunnel Road	PD	35	For PD, > 20 m for Active and Passive
	Proposed Road T4	PD	5	Recreational Uses 3-20 m for Passive Recreational
ASTT2	Proposed Road T4	PD	40	Uses
	Chek Kung Miu Road	PD	18	For DD, > 10 m for Active and Passive
ASTT3	Chek Kung Miu Road	PD	48	Recreational Uses < 10 m for Passive Recreational
ACED	T4 Branch	DD	5	Uses

Sha Tin Tau

2.5.10 At the proposed site in Sha Tin Tau, the buffer distances from the nearest trunk roads are less than the HKPSG recommended distances at all the proposed residential blocks, except the standard blocks in the middle of the proposed site and the RAB close to the junction of Che Kung Miu Road and the proposed T4 Branch (ASTT3). The RABs located at the northern part of the proposed site (ASTT1 and ACED) are only 5 m from the proposed Road T4 and T4 Branch, less than the recommended HKPSG criteria of 20 m for PDs and 10 m for DDs. A further setback of 5 m from the proposed T4 Branch and 15 m from the proposed Road T4 are required. Otherwise, non-air sensitive uses should be located on the lower floors in this area, such as a commercial development provided with central air-conditioning. In addition, the buffer distance between the

RAB located close to the junction of Chek Kung Miu Road and Lion Rock Tunnel Road (ASTT2) is 18 m from Che Kung Miu Road, a further setback of 2 m is also required to meet the HKPSG guidelines.

Lee On

2.5.11 The buffer distances between the air sensitive uses at the proposed site and the nearby trunk roads are in range of 12-140 m and are in compliance with the HKPSG guidelines. The large buffer distances ensure that the proposed layout scheme is considered feasible in term of air quality impacts.

Table 2.5f Horizontal Distances between ASRs and Surrounding Road in Lee On

ASRs	Roads	Road Type	Buffer Distance (m)	HKPSG Recommended Buffer Distance (m)
ALEO1	Sai Sha Road	DD	12	For PD, > 20 m for Active and Passive Recreational Uses 3-20 m for Passive Recreational Uses For DD, > 10 m for Active and Passive Recreational Uses < 10 m for Passive Recreational Uses
ALEO2	Road T7	PD	140	
	Slip Road from T7	DD	120	
ALEO3	Road T7	PD	55	
	Slip Road from T7	DD	35	

2.5.12 Car parks will be provided at the three proposed developments under the podium, the developments should be designed to ensure that air quality within the car park areas is maintained at acceptable levels and that the ventilation exhaust is not discharged towards any sensitive receivers.

2.6 Conclusion

2.6.1 Dust has been identified as the main air quality impact arising from the MOS Rail during the construction phase. In the absence of any mitigation measures, adverse dust impacts are predicted at many of the surrounding sensitive receivers, particularly during station construction. Handling of excavated material and vehicle movements on unpaved haul roads are the main potential sources of dust. The construction works will be undertaken in urban area and the majority of land uses close to the potential sites are identified as ASRs. High dust impacts are predicted for the ASRs close to the provisional Hin Keng, City One, Heng On and Ma On Shan stations, since extensive earthworks would be required with limited buffering distance between the work sites and ASRs.

2.6.2 Sufficient mitigation measures have been identified in this Study and should be incorporated in the planning and design stage to reduce the likely impacts at the ASRs to within the identified criteria. The modelling of 1-hour and 24-hour TSP levels at nearby ASRs should be undertaken at the detail assessment stage using historical meteorological data when detailed information on construction activities are available to provide more accurate impact predictions.

2.6.3 On the basis of the results from the detailed assessment, construction methods should be selected to minimize potential impacts and mitigation measures, such as regular watering on active and inactive work sites and reducing the travelling speed of trucks should be implemented to control dust impacts to acceptable levels. Further mitigation measures should be implemented, where appropriate, to reduce the likely impacts at the ASRs in the vicinity of the station sites.

2.6.4 Air quality impacts during the operational phase of the MOS Rail are not considered to be of concern as limited potential sources have been identified. However, consideration must be given to the layout of the development sites and the design of the ventilation systems for the stations and the bus termini to ensure that the established criteria are met.

3 NOISE AND VIBRATION

3.1 Introduction

3.1.1 This *Section* outlines the noise and vibration impacts arising from the construction and operational phases of MOS Rail. Potential noise impacts are identified and appropriate mitigation measures are recommended in order to mitigate any adverse impacts. The proposed alignment, depot and stations for MOS Rail will be either at grade or on elevated superstructure, activities during the construction phase and operational phase of the proposed railway are likely to cause noise impacts on the surrounding area.

3.2 Government Legislation and Standards

Construction Noise

3.2.1 In Hong Kong, the control of construction noise at any time outside normal daytime, weekday working hours (07.00-19.00, Monday through Saturday, excluding Public Holidays) is governed by the *Noise Control Ordinance* (NCO) and the subsidiary technical memoranda namely the *Technical Memorandum on Noise From Construction Work Other Than Percussive Piling* (TM1), *Technical Memorandum on Noise From Construction Work in Designated Areas* (TM2). Percussive piling during normal hours is controlled under the *Technical Memorandum on Noise From Percussive Piling* (TM3). These technical memoranda prescribe the permitted noise levels for construction work depending upon working hours and the existing noise climate.

3.2.2 The NCO criteria for the control of noise from PME are dependant on the type of area containing the noise sensitive receivers (NSRs) rather than the measured background noise level. The NCO requires that noise levels from construction works at affected NSRs be less than a specified Acceptable Noise Level (ANL) which depends on the Area Sensitivity Rating (ASR).

3.2.3 The ANL is derived from the Basic Noise Levels (BNL) determined in TM1 by applying corrections for the duration of the works and the effect of any other nearby construction sites operating under a Construction Noise Permit (CNP). No information on other sites is currently available and therefore these corrections have been set to zero.

3.2.4 It is intended that the construction activities of the proposed works should be planned and controlled in accordance with the NCO. Works requiring the use of PME during restricted hours (all times other than 07.00-19.00 Monday through Saturday excluding Public Holidays) will require a CNP and will need to achieve the applicable ANL.

3.2.5 The use of specified powered mechanical equipment (SPME), other than percussive piling, and the undertaking of Prescribed Construction Work (PCW) during restricted hours are controlled by TM2. Construction plant or equipment classified as SPME under TM2 are hand-held breaker, bulldozer, concrete lorry mixer, dump truck and poker vibrator. Prescribed construction work includes the: erection or dismantling of formwork or scaffolding; handling of rubble, wooden boards, steel bars, or scaffolding material; hammering; and the disposal of rubble through plastic chutes. More stringent noise limits are stipulated in TM2 to control construction noise generated from SPME and PCW.

3.2.6 Percussive piling is only permitted within the constraints of a CNP. TM3 sets the requirements for working under a CNP and the determination of the permitted hours of operation and other conditions where appropriate. Percussive piling is prohibited during restricted hours unless specifically exempted. ANLs for percussive piling are outlined in TM3 and are dependent on the type of NSR. The ANLs for daytime percussive piling are presented in *Table 3.2a*.

Table 3.2a Acceptable Noise Levels for Daytime Percussive Piling

Type of Receptor	ANL (dB(A))
NSR with no windows or other openings	100
NSR with central air conditioning systems	90
NSR with windows or other openings but without central air conditioning system	85

3.2.7 The ANL for hospitals, clinics, schools, courts of law or other particularly sensitive receivers is 10 dB(A) below that quoted in *Table 3.2a*. The permitted hours of operations are determined by comparing the Corrected Noise Level (CNL) and the ANL at the NSR. *Table 3.2b* presents the permitted hours of operation for percussive piling.

Table 3.2b Permitted Hours of Operation for Percussive Piling

Amount by which CNL exceeds ANL	Permitted hours of operation on any day note being a holiday
more than 10 dB(A)	08.00 - 09.00 AND 12.30 - 13.30 AND 17.00 - 18.00
between 1 dB(A) and 10 dB(A)	08.00 - 0930 AND 12.00 - 14.00 AND 16.30 - 18.00
no exceedance	07.00 to 19.00

3.2.8 Although the NCO does not provide for the control of construction activities during normal working hours, a limit of $L_{Aeq, 30 min}$ 75 dB is proposed in the *Practice Note for Professional Persons - Noise from Construction Activities - Non-statutory Controls, Environmental Protection Department, June 1993* (ProPECC PN2/93). For schools, the ProPECC PN2/93 recommended noise level during normal school days is $L_{Aeq, 30 min}$ 70 dB, and the limit is lowered to 65 dB during examination periods. These limits have been applied on major construction projects and are now generally accepted in Hong Kong. They will, therefore, be adopted in this Study to protect NSRs to an appropriate extent.

3.2.9 The mitigation measures that are recommended later in this *Section* aim to lower noise levels to below the normal level for schools ($L_{Aeq, 30 min}$ 70 dB), additional measures such as reducing the number of plant in use would therefore be required during examination periods, if these occur within any noisy construction stages.

Train Noise

3.2.10 Railway noise is controlled under the NCO and the subsidiary *Technical Memorandum on Noise From Places Other Than Domestic Premises, Public Places or Construction Sites* (TM4) which also describes the appropriate technical principles and assessment procedures. ANLs are stipulated in TM4 as the noise criteria and are dependent on the ASR defined and the time period of the day. The ASR of a NSR is determined by the type of area containing it and the presence of any influencing factors such as industrial areas, major roads and airports.

3.2.11 Since the study areas are classified as urban and all the NSRs are influenced by road traffic noise from major highways, both directly or indirectly, an ASR of C has been assigned in the assessment. *Table* 3.2c shows the ANLs corresponding to an ASR of C.

Table 3.2c Area Sensitivity Rating and Acceptable Noise Level

Area Sensitivity Rating (ASR)	Acceptable Noise Level (ANL), $L_{eq,30\ minutes}$
C	70 dB(A), 0700 - 2300 and 60 dB(A), 2300 - 0700

3.2.12 HKPSG provides further criteria for assessing railway noise. These criteria are specified in terms of the A-weighted maximum noise level and daily railway noise exposure, as shown in *Table 3.2d*. For noise from the proposed scheme to be within the acceptable levels, all criteria given in *Tables 3.2c* and *3.2d* should be met.

3.2.13 In the process of planning, sufficient separation between the proposed rail line and the sensitive uses should be provided in order to protect them from excessive noise exposure. The noise levels at the NSRs are dependant on the rail car characteristics, train frequency, operating speed and the geometry of the relationship between noise sources and receivers.

Table 3.2d HKPSG Railway Noise Criteria

Parameter	Criterion level in dB(A)
Maximum A-weighted sound pressure level, L_{max}	85
Equivalent continuous sound level, $L_{eq\ 24hours}$	65

Fixed Plant Noise

3.2.14 Noise from fixed sources will be evaluated in accordance with HKPSG. The assessment of impacts from fixed noise sources, such as plant noise, will normally be conducted with reference to TM4. All fixed noise sources should be so located and designed such that the noise level at the façade of the nearest NSRs is at least 5 dB(A) lower than the appropriate ANL as stated in TM4.

3.2.15 Thus, the ANL in the daytime and evening periods (0700-1900 and 1900-2300) is 65 dB(A), and in the night-time period (2300-0700) is 55 dB(A).

3.3 Sensitive Receivers and Baseline Conditions

3.3.1 NSRs were identified, based on the HKPSG and NCO. Representative NSRs for the worst affected receivers to be impacted during the construction and operational phases of the proposed development have been considered.

Construction Phase

Hin Keng to Tai Wai

3.3.2 The major land uses close to the proposed alignment and the provisional Hin Keng Station are residential and recreational. Hin Yau House of Hin Keng Estate and residential developments along Keng Hau Road would be likely to be impacted during the construction phase. Most of the NSRs have openable windows and the façade noise levels at the NSRs would depend on the buffer distances to the noise sources. Properties to the north of the proposed alignment will be screened by the embankment of the existing KCR railway, however, some noise impacts from construction activities would still be likely.

3.3.3 The noise climate around the work sites is dominated by the existing KCR railway and the traffic on the nearby road network in the vicinity. Roadways contributing to the background noise include Che Kung Miu Road and Mei Tin Road. Identified NSRs within this section are listed in *Table 3.3a* and shown in *Figure 3.3a*.

Table 3.3a Noise Sensitive Receivers - Hin Keng to Tai Wai

Noise Sensitive Receiver		Distance from Work Site (m)	
		Alignment	Provisional Hin Keng Station
N1	Keng Hau Road no. 29	205	69
N2	Keng Hau Road no. 25	172	82
N3	Keng Hau Road no. 22	145	102
N4	Keng Hau Road no. 11	161	183
N5	Keng Hau Road no. 5-7	183	218
N6	Hin Yau House	250	90
N7	Hin Yeung House	186	274
N8	Sha Tin Heights	139	-

Tai Wai to Sha Tin Tau

3.3.4 The region surrounding the proposed work sites for Tai Wai Station and Depot (and the property development above), and the railway alignment from Tai Wai to Sha Tin Tau currently consists of residential buildings and recreational areas. Noise from traffic on Che Kung Miu Road and Lion Rock Tunnel Road are the dominant noise sources in the area. The existing KCR railway also contributes to the background noise level.

3.3.5 Christian Alliance School and Grandway Garden are the nearest NSRs likely be impacted during the construction phase. Primary and secondary schools in the vicinity of the proposed alignment would also receive considerable noise impacts from construction activities. Most of the NSRs identified within this section have openable windows and they are listed in *Table 3.3b*. *Figures 3.3a* and *3.3b* show their relative location from the proposed work sites.

Sha Tin Tau to Sha Kok Street

3.3.6 In the vicinity of the proposed alignment sites, station sites in Sha Tin Tau (and the associated property development) and Sha Kok Street, major sensitive uses identified include residential buildings and schools. Tin Ka Ping Salvation Army Primary School and Pok Man House of Pok Hong Estate are the nearest NSRs and would be most affected by construction noise. Residential blocks located to the south of Sha Kok Street would also be impacted during the construction phase.

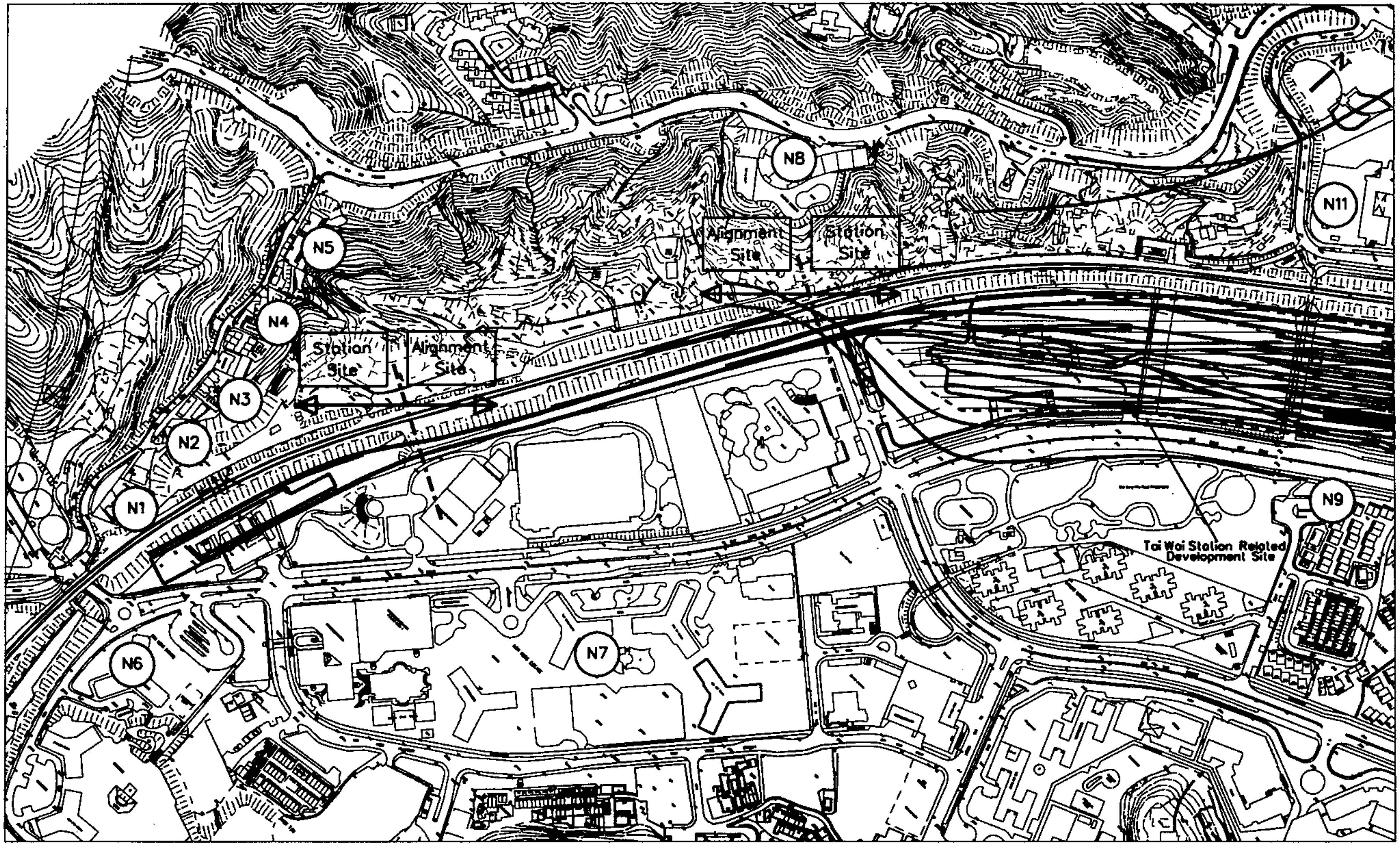

FIGURE 3.3a - Noise Sensitive Receiver -
Hin Keng to Tai Wai

Date : 15 Oct 1996 | Drawing No.: /Contract/C1435/C1435_1

Sources : Base map -

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- Station Related Development Site
- Station Site
- N1 Noise Sensitive Receiver

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
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ERM

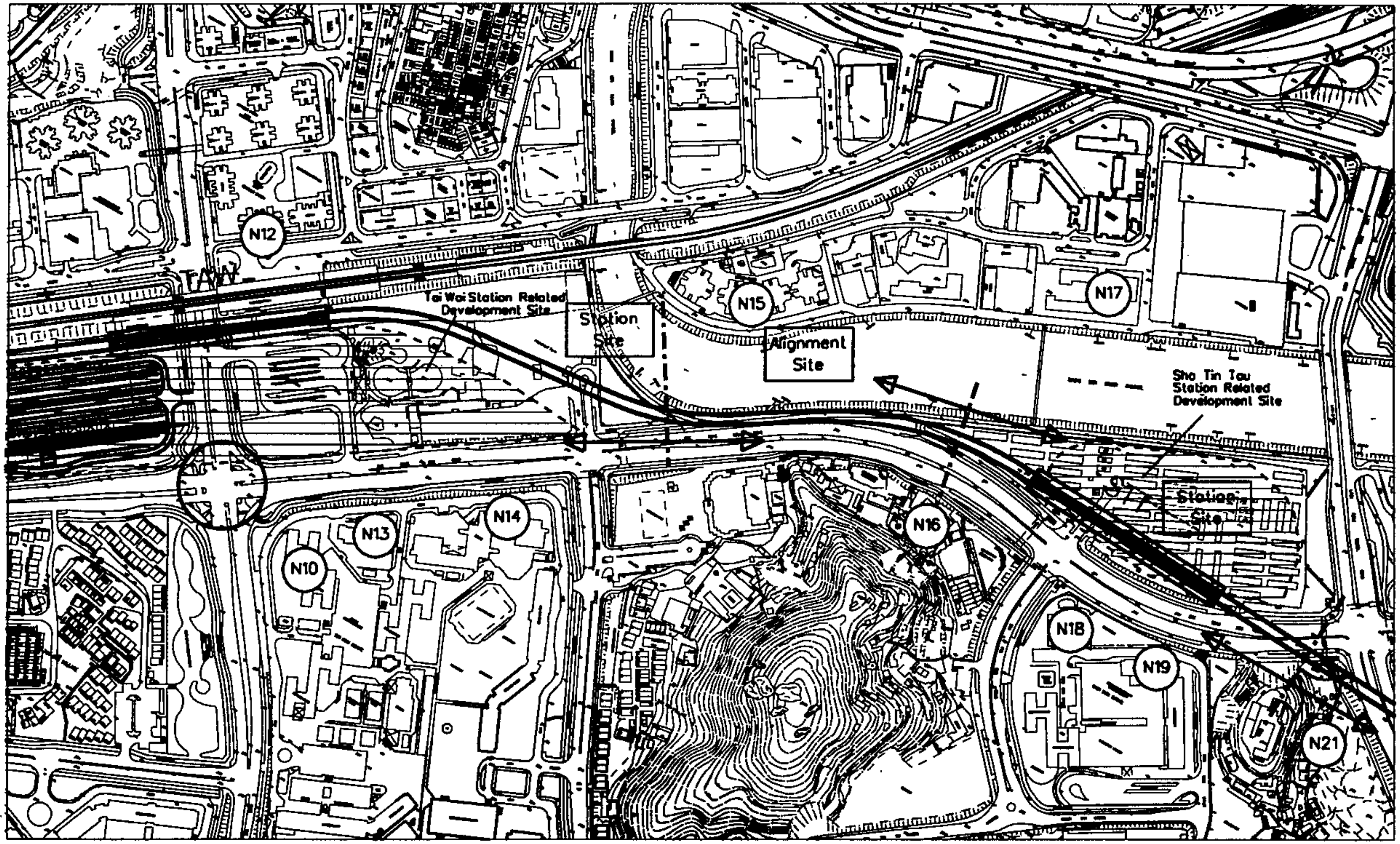

FIGURE 3.3b - Noise Sensitive Receiver -
Tai Wai to Sha Tin Tau

Date : 15 Oct 1996 | Drawing No.: /Contract/C1435/C1435_2

Sources :

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- Station Related Development Site
- Station Site
- N1 Noise Sensitive Receiver

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

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Table 3.3b Noise Sensitive Receivers - Tai Wai to Sha Tin Tau

Noise Sensitive Receiver		Distance from Work Site (m)	
		Alignment	Tai Wai Station and Depot
N8	Sha Tin Heights	-	100
N9	Tin Sam Village nos. 182-185	-	88
N10	Sun Ming House	-	94
N11	Christian Alliance School	-	70
N12	Grandway Garden Block 2	-	80
N13	Cheung Wong Wai Primary School	287	92
N14	Sha Tin Tsung Tsin Secondary School	160	123
N15	Man Lai Court	94	107
N16	Lei Uk Tsuen nos. 12-15	150	-
N17	Sha Tin Government Secondary School	122	-
N18	Shek Fai House	120	-
N19	Shek Yuk House	90	-

Table 3.3c Noise Sensitive Receivers - Sha Tin Tau to Sha Kok Street

Noise Sensitive Receiver		Distance from Work Site (m)		
		Alignment	Sha Tin Tau Station	Sha Kok Street Station
N17	Sha Tin Government Secondary School	-	111	-
N18	Shek Fai House	-	42	-
N19	Shek Yuk House	-	88	-
N20	Ecclesia Bible College	163	136	-
N21	Sha Tin Tau no.3	28	78	-
N22	Sham Ha Wai	74	270	-
N23	Secondary School (between Jat Min Chuen St. & Sha Kok St.)	47	-	-
N24	Immaculate Heart of Mary College	40	-	240
N25	Ming Yan Lau	40	-	108
N26	Pok Man House	16	-	260
N27	Tin Ka Ping Salvation Army Primary School	14	-	224
N28	Pok Yue House	38	-	82
N29	Pok Yat House	106	-	40
N30	Pok Tai House	56	-	70
N31	Osprey House	126	-	90

3.3.7 Background noise levels are mainly from traffic on Lion Rock Tunnel Road, Sha Kok Street and the local access roads in the area. Representative NSRs closest to the proposed construction sites have been selected and are shown in *Figures 3.3b* and *3.3c* and listed below in *Table 3.3c*. All NSRs are assumed to have openable windows and a direct line of sight to the appropriate noise sources.

Sha Kok Street to City One, Shatin

3.3.8 The area surrounding the proposed construction sites between Sha Kok Street and City One consists of residential buildings, hospital and schools. The nearest residential developments are Ashley Garden and Iris Garden which would be impacted by the construction works of the proposed railway development. Wong Uk Village, the CLP sub-station offices and the residential properties along Kong Pui Street and to the north of Chap Wai Kon Street are also likely to be affected by construction noise. The existing noise climate in the area is affected by the traffic noise from Shatin Wai Road, Tai Chung Kiu Road and other local access roads.

3.3.9 Representative NSRs closest to the proposed construction sites have been selected and are shown in *Figures* 3.3*c* and 3.3*d* and listed in *Table* 3.3*d*. All NSRs are assumed to have openable windows and a direct line of sight to the appropriate noise sources.

Table 3.3d Noise Sensitive Receivers - Sha Kok Street to City One, Shatin

Noise Sensitive Receiver		Distance from Work Site (m)		
		Alignment	Sha Kok Street Station	City One Station
N30	Pok Tai House	56	70	-
N31	Osprey House	126	90	-
N32	Oriole House	52	88	-
N33	Sha Tin Wai nos. 1-2	50	159	-
N34	Ashley Garden	20	260	-
N35	Iris Garden	27	-	-
N36	Toi Shan Association College	109	-	-
N37	Wong UK Village nos. 17-18	15	-	-
N38	Green Leave Garden Block B	34	-	-
N39	Prince of Wales Hospital	67	-	232
N40	Pamela Youde Child Assessment Centre and School Dental Clinic	15	-	55
N41	Yue Sui House	60	-	37
N42	Yue Kwan House	101	-	51

City One to Shek Mun

3.3.10 For this section of proposed alignment, the region surrounding the proposed construction sites consists of residential buildings and schools. Identified NSRs in this section are listed in *Table* 3.3*e* and are shown in *Figures* 3.3*d* and 3.3*e*. The existing noise climate in the area is affected by traffic noise from Tate's Cairn Highway and noise emissions from industrial premises in Shek Mun. The nearest NSR is Yow Kam Yuen Prevocational School. Noise impacts from nullah bridge and viaduct construction would be likely at the identified NSRs. All the identified NSRs are assumed to have openable windows and a direct line of sight to the construction sites.

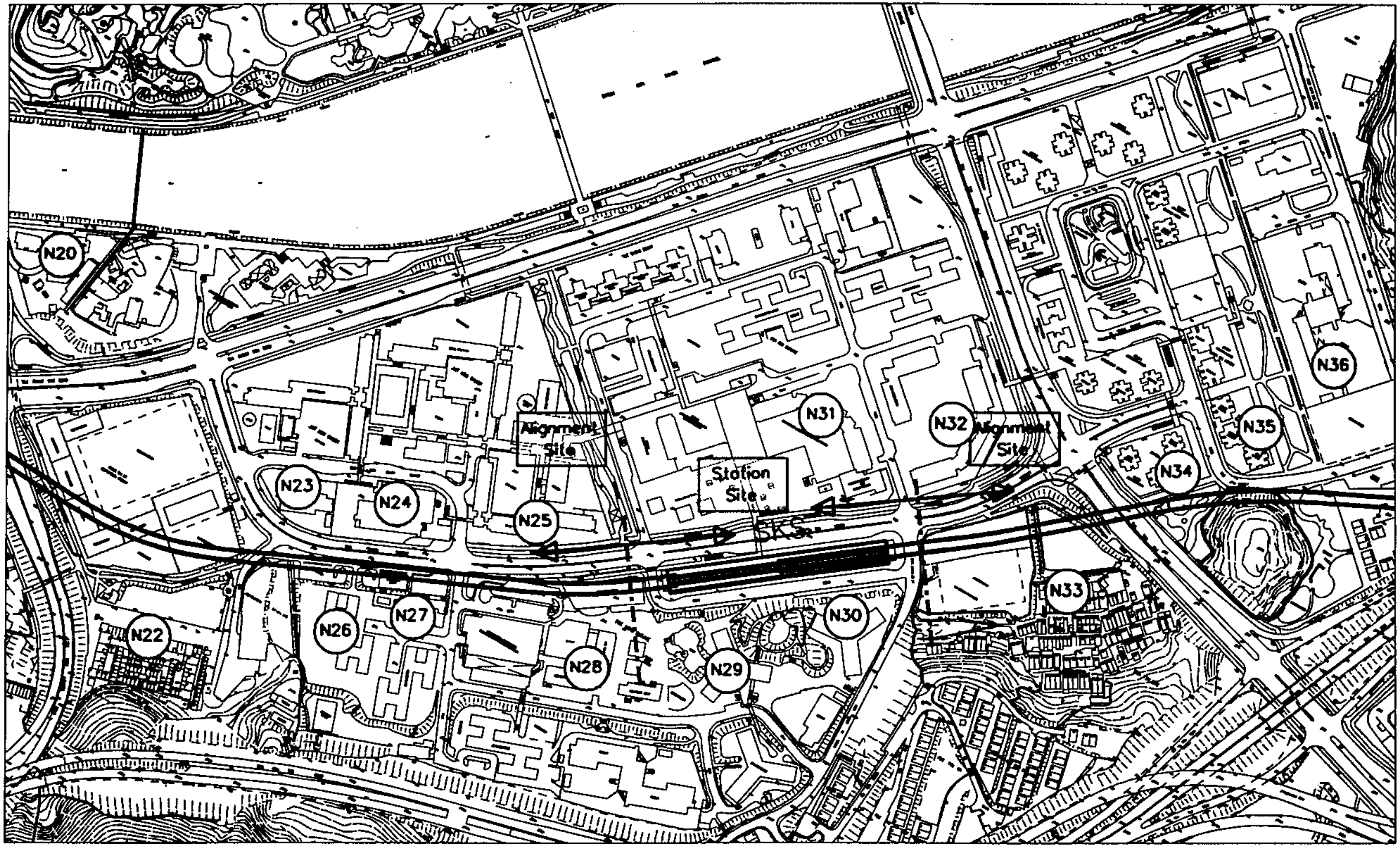

FIGURE 3.3c - Noise Sensitive Receiver -

Sha Tin Tau to Sha Kok Street

Date : 15 Oct 1996 | Drawing No.: /Contract/C1435/C1435_3

Sources :

Prepared by ERM's GIS & MAPPING Group

KEY

Alignment

Station Site

N1 Noise Sensitive Receiver

ERM Hong Kong
6th Floor
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Hong Kong

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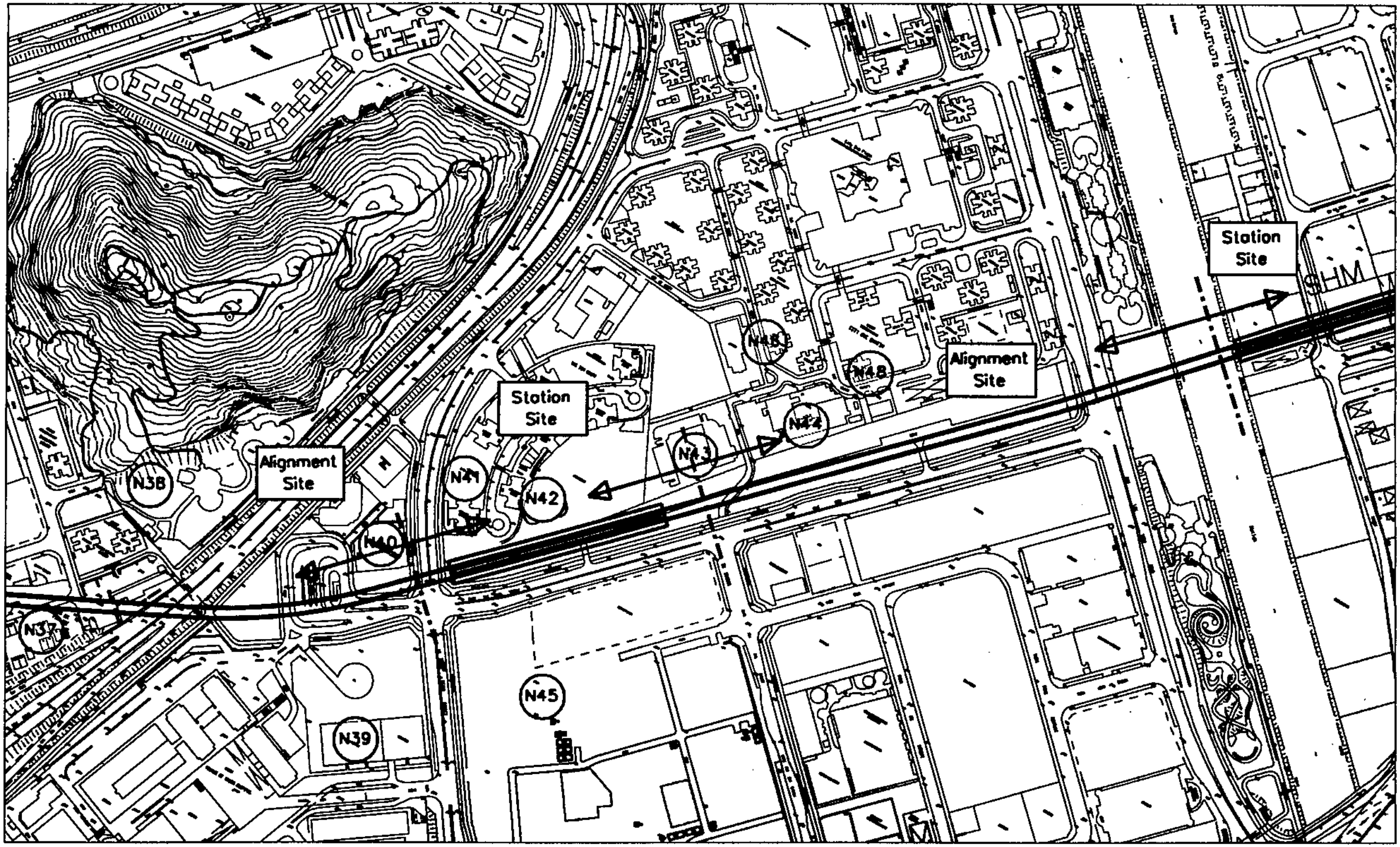

FIGURE 3.3d - Noise Sensitive Receiver - Sha Kok Street to City One Shatin

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_4
Sources :	

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- Station Site
- N1 Noise Sensitive Receiver

ERM Hong Kong
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Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

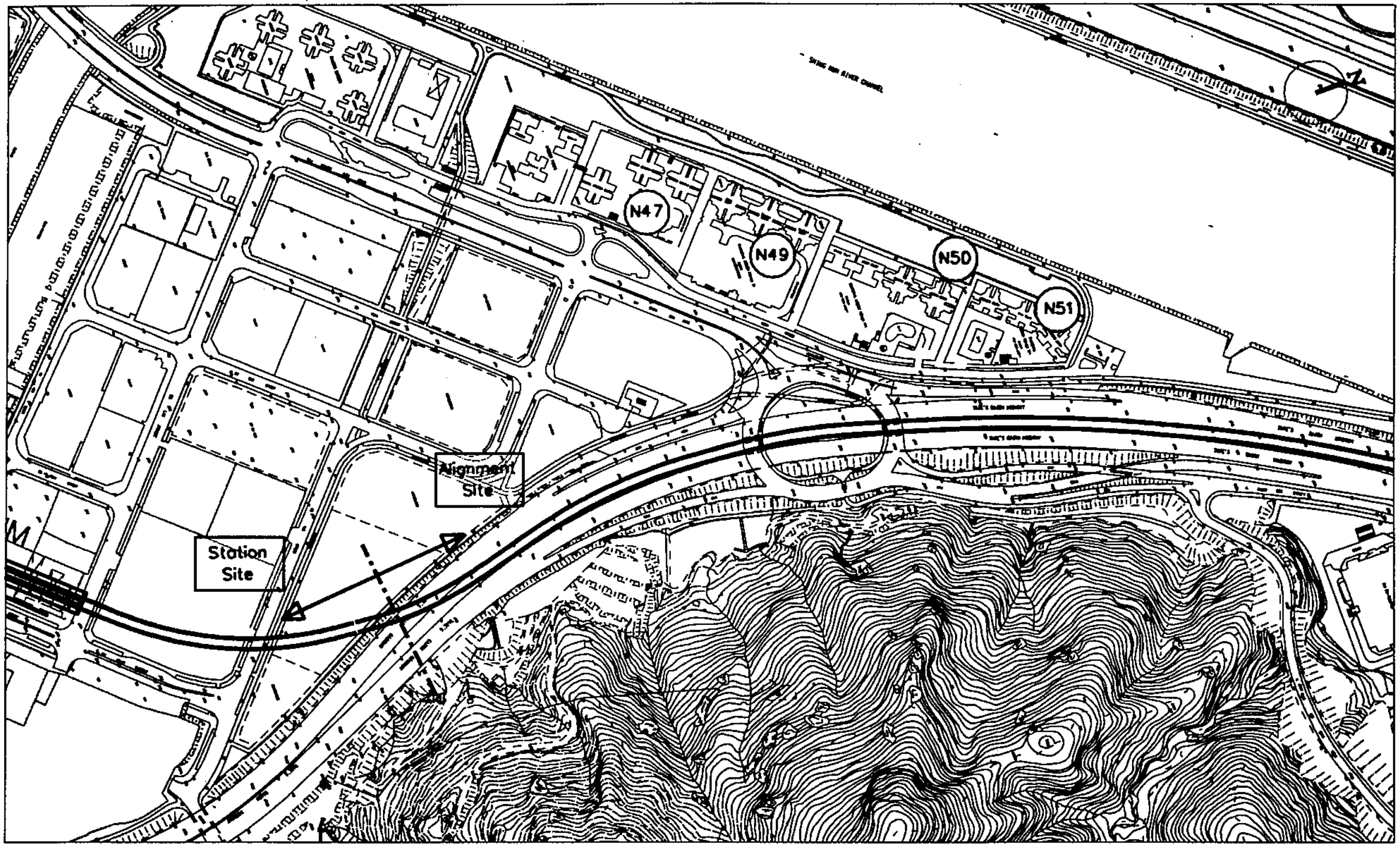

FIGURE 3.3e - Noise Sensitive Receiver -

City One Shatin to Shek Mun

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_5
Sources :	

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- Station Site
- N1 Noise Sensitive Receiver

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

Table 3.3e Noise Sensitive Receivers - City One, Shatin to Shek Mun

Noise Sensitive Receiver		Distance from Work Site (m)	
		Alignment	City One Station
N43	Yow Kam Yuen Prevocational School	33	64
N44	Lam Kau Mow Secondary School	37	175
N45	Yuen Chau Kok THA (Cleared)	50	30
N46	City One Sha Tin Block 36	70	250
N47	Garden Vista Block D	237	-
N48	City One Sha Tin Block 33	53	-

Shek Mun to Chevalier Garden

3.3.11 There are currently two residential developments, namely Pictorial Garden and Fishermen's New Village, which would be impacted during the construction phase of the proposed railway scheme. Traffic on Tate's Cairn Highway, Ma On Shan Road and Tolo Highway Interchange are responsible for the ambient noise level in the area. As the proposed site location of Shek Mun Station is over 300 m away from the main residential developments, noise impacts from station construction will be at least an order of magnitude below the daytime criterion and would not noticeably increase ambient levels. They are not, therefore, considered further. The nearest NSR is Juniper Court of Pictorial Garden which would be impacted by alignment construction.

Table 3.3f Noise Sensitive Receivers - Shek Mun to Chevalier Garden

Noise Sensitive Receiver		Distance from Work Site (m)	
		Alignment	Chevalier Garden Station
N49	Pictorial Garden, Capilano Court	165	-
N50	Pictorial Garden, Dragon Court	93	-
N51	Pictorial Garden, Juniper Court	52	-
N52	Sha Tin Hospital	63	-
N53	Fishermen's New Village no. 113	67	-
N54	Fishermen's New Village nos. 16-19	89	-
N55	Fishermen's New Village nos. 5-8	90	-
N56	Ma On Shan Tsung Tsin Secondary School	89	235
N57	Tai Shui Hang nos. 1-4	136	100
NA	Development north of Chevalier Garden	90	105

3.3.12 Although the NSRs in Pictorial Garden are distant from the work sites, additional noise impacts from the construction works may combine with the existing traffic noise to increase the overall levels. Despite the existing noise barriers along Tate's Cairn Highway, NSRs located to the south of the highway may be impacted by the construction noise, depending on the buffer distance and the strength of noise sources. Representative NSRs have been selected and are listed in *Table 3.3f*. *Figures 3.3e-g* show the location of the NSRs and the proposed work site area. All the identified NSRs are assumed to have openable windows and a direct line of sight to the construction sites.

Chevalier Garden to Heng On

3.3.13 The area surrounding the proposed construction sites from Chevalier Garden to Heng On Station consists of residential buildings and schools. The nearest residential development is Ngan On House of Heng On Estate which would be impacted during the construction phase of the proposed railway development. The existing noise climate in the area is affected by the traffic noise from Ma On Shan Road, Sai Sha Road and the other local access roads.

3.3.14 Representative NSRs closest to the proposed construction sites have been selected and are shown in *Figure 3.3h* and tabulated in *Table 3.3g*. All NSRs are assumed to have openable windows and a direct line of sight to the appropriate noise sources.

Table 3.3g Noise Sensitive Receivers - Chevalier Garden to Heng On

Noise Sensitive Receiver		Distance from Work Site (m)	
		Alignment	Heng On Station
NB	Development north-east of Chevalier Garden	40	-
N58	Sing On THA	127	-
N59	Ngan On House	45	89
N60	Po On House	56	55
N61	Chinese YMCA College	53	16
N62	Hing On T.H.A.	61	165

Heng On to Ma On Shan

3.3.15 From Heng On Estate to Man On Shan Station, most of the identified NSRs close to the railway development are residential buildings, primary and secondary schools. Residential developments likely to be impacted by construction noise include Fok On Garden, Bayshore Garden, Sunshine City, Ma On Shan Centre, Fu Fai Garden and Villa Athena, most of them above commercial podia. Ma On Shan Centre Block 1 is the nearest NSR to the proposed work site and would be most affected by construction noise.

3.3.16 The existing noise climate is dominated by traffic noise from Sai Sha Road and Ma On Shan Road. Representative NSRs in the vicinity of the proposed construction sites have been identified and are shown in *Figures 3.3h* and *3.3i* and listed in *Table 3.3h*. All NSRs are assumed to have openable windows and a direct line of sight to the appropriate noise sources.

Ma On Shan to Lee On

3.3.17 The last section of the proposed railway development runs from Ma On Shan to Lee On Estate and includes the proposed property development at Lee On. Major land uses close to the proposed work sites are mainly residential and recreational. The background noise level is contributed by Sai Sha Road and local assess roads only. The nearest NSRs to be impacted during the construction phase include Villa Athena Block 5 and Lee Wing House of Lee On Estate. NSRs for this section of the proposed railway

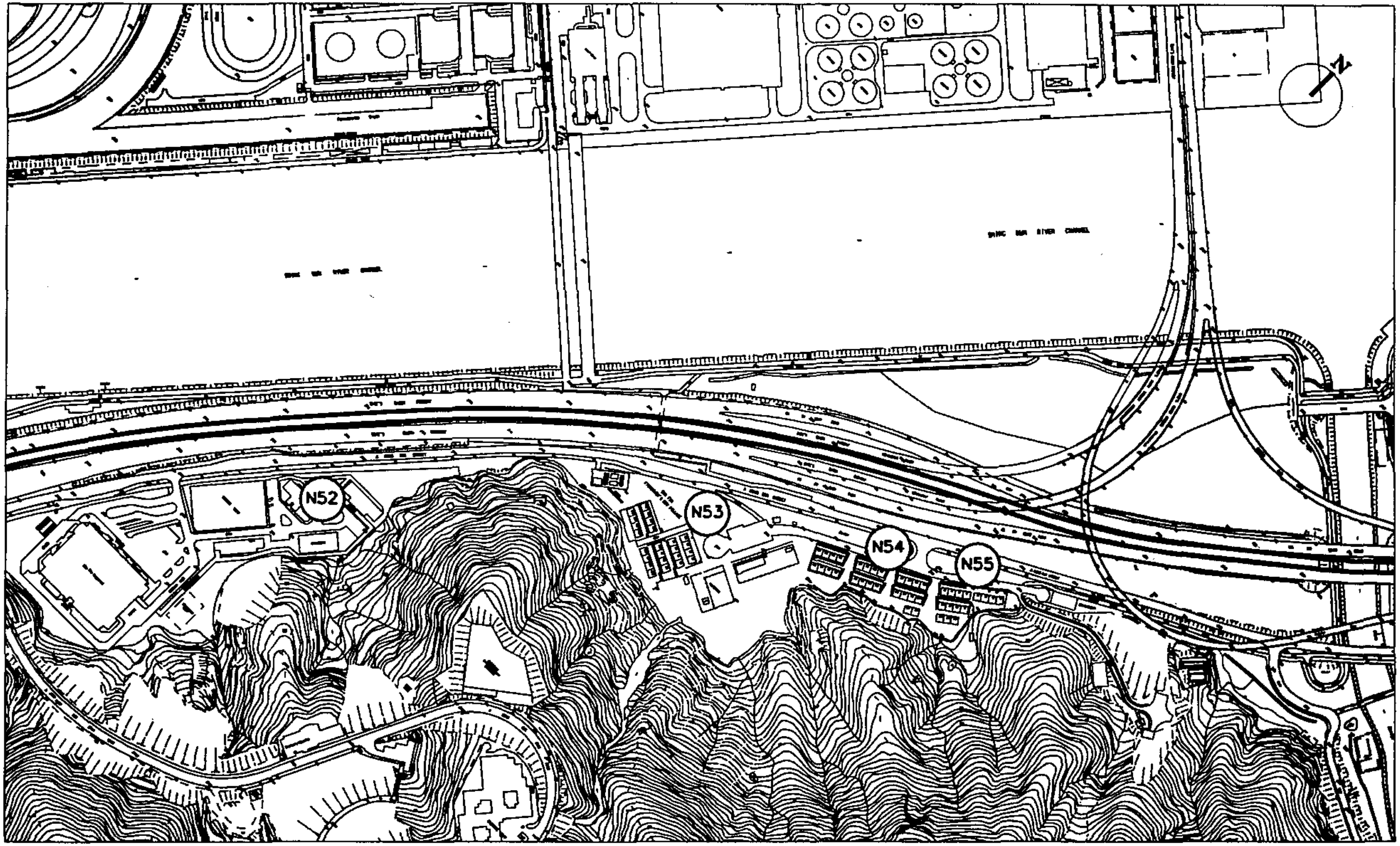

FIGURE 3.3f - Noise Sensitive Receiver -

Shek Mun to Chevalier Garden

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_6
Sources :	

Prepared by ERM's GIS & MAPPING Group

KEY

	Alignment
	Station Site
N1	Noise Sensitive Receiver

ERM Hong Kong
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Tsimshatsui, Kowloon
Hong Kong

ERM

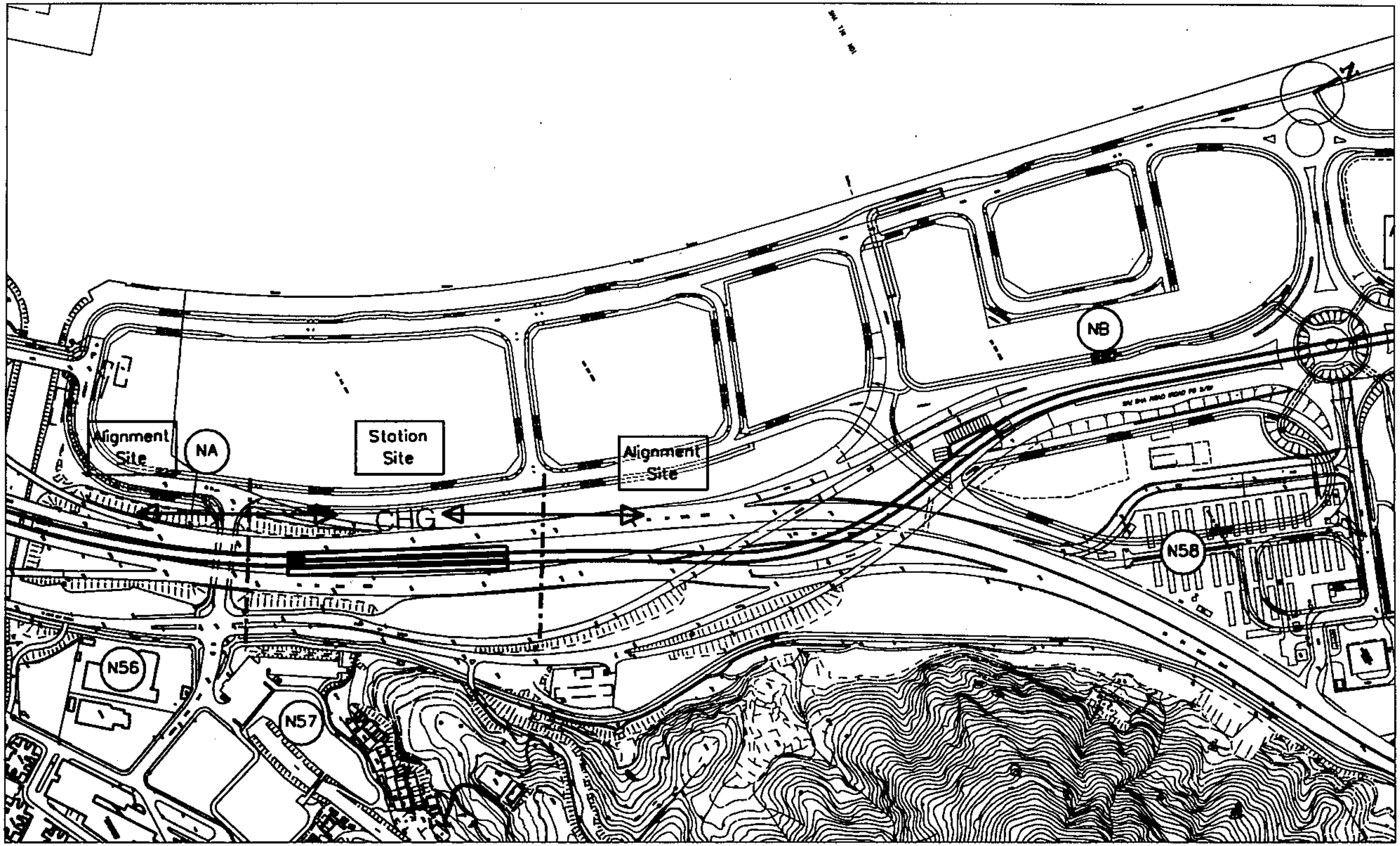

FIGURE 3.3g - Noise Sensitive Receiver -

Chevalier Garden to Heng On

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_7
Sources :	

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- Station Site
- N1 Noise Sensitive Receiver

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

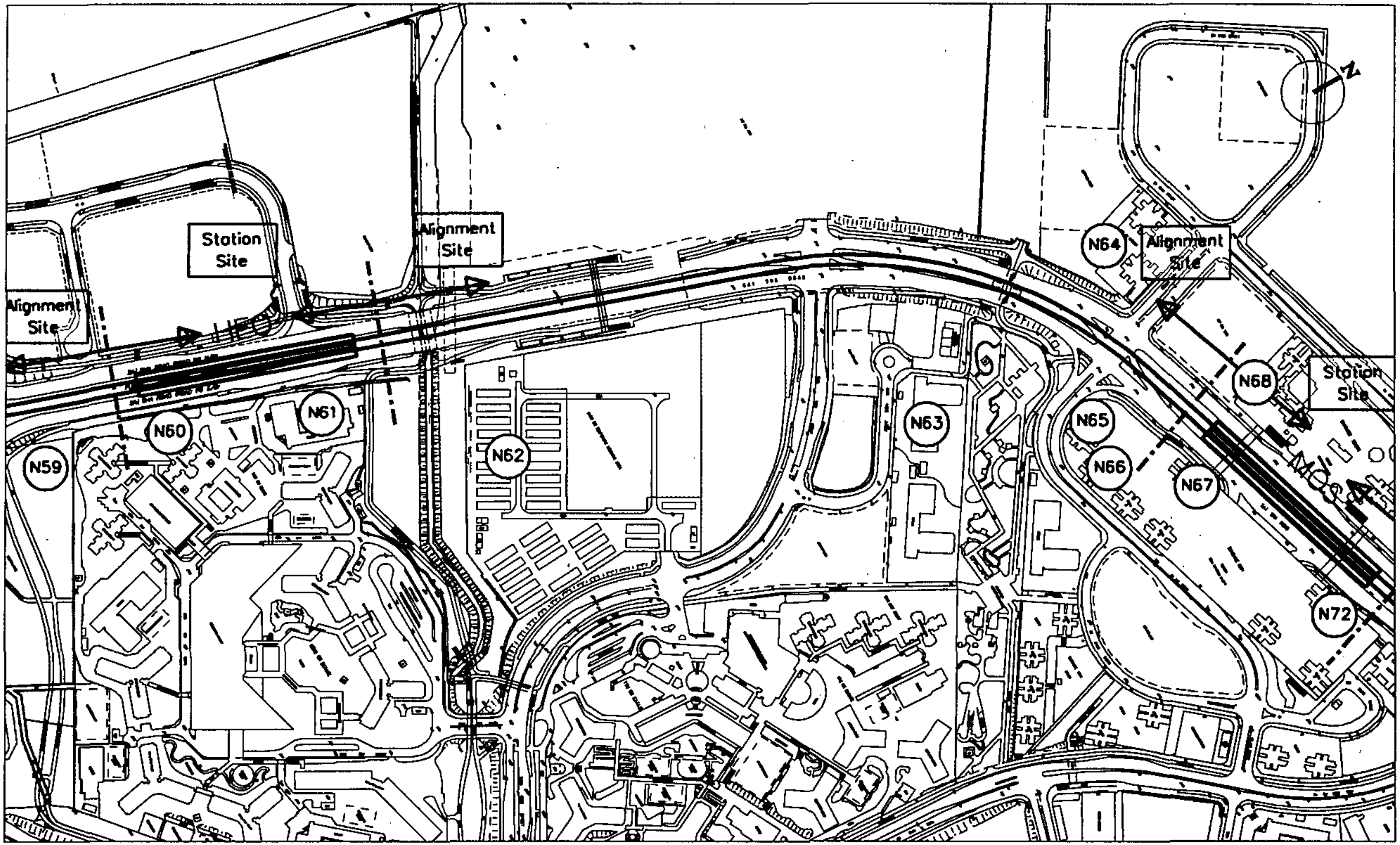

FIGURE 3.3h - Noise Sensitive Receiver -

Heng On to Ma On Shan

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_8
Sources :	

Prepared by ERM's GIS & MAPPING Group

KEY

Alignment

N1 Noise Sensitive Receiver

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

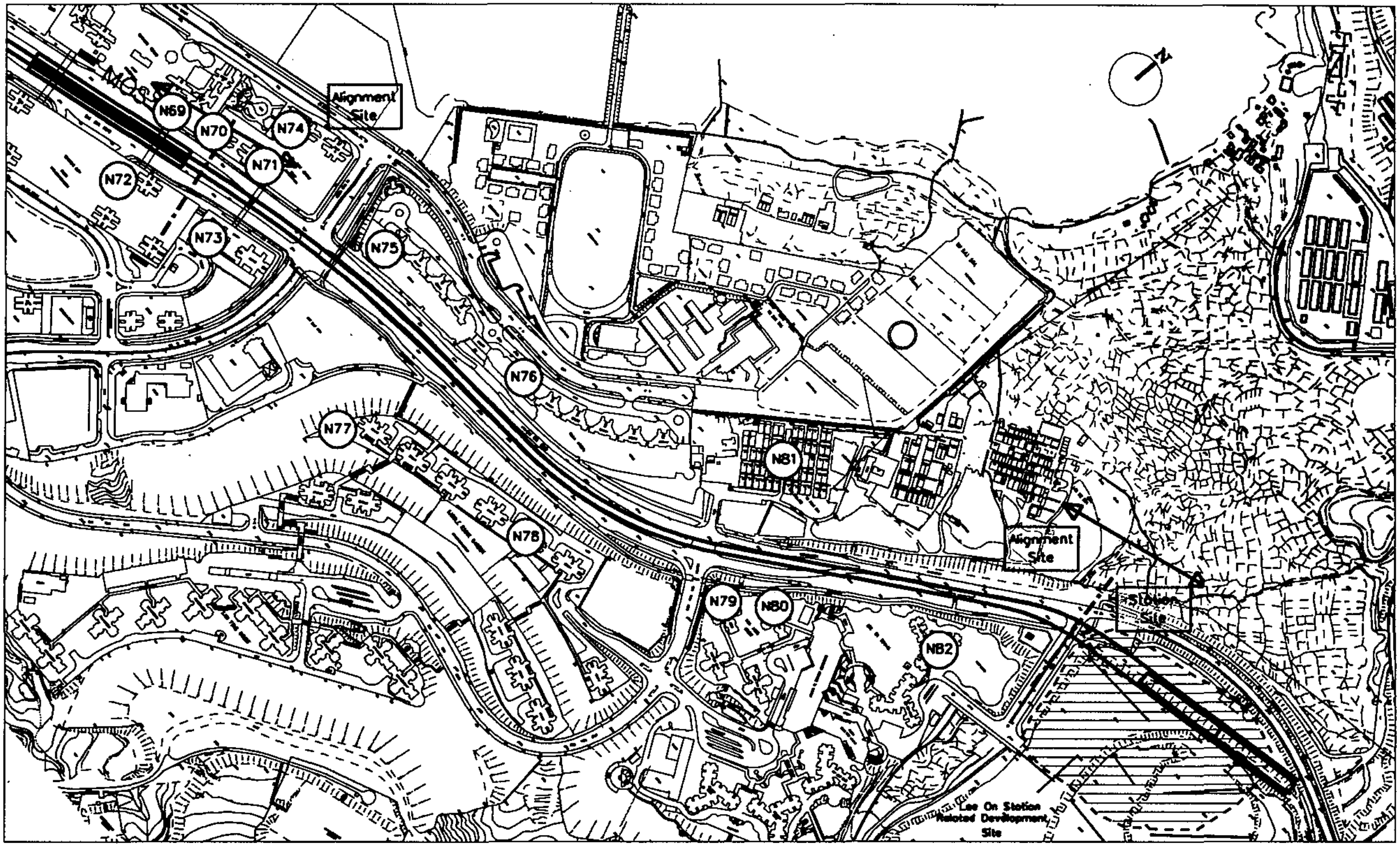

FIGURE 3.3i - Noise Sensitive Receiver - Ma On Shan to Lee On

Date : 15 Oct 1996

Drawing No.: /Contract/C1435/C1435_9

Sources :

Prepared by ERM's GIS & MAPPING Group

KEY	
	Alignment
	Station Related Development Site
	Station Site
N1	Noise Sensitive Receiver

ERM Hong Kong
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Hecny Tower
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Hong Kong

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are listed in *Table 3.3i* and shown in *Figure 3.3i.* All NSRs are assumed to have openable windows and a direct line of sight to the appropriate noise sources.

Table 3.3h Noise Sensitive Receivers - Heng On to Ma On Shan

Noise Sensitive Receiver		Distance from Work Site (m)	
		Alignment	Ma On Shan Station
N62	Hing On THA	61	-
N63	Tsang Pik Shan Secondary School	95	267
N64	Fok On Garden	40	140
N65	Sun Shine City Block L	68	74
N66	Sun Shine City Block K	87	101
N67	Sun Shine City Block M	53	28
N68	Bayshore Garden Block 5	75	50
N69	Bayshore Garden Block 2	66	50
N70	Ma On Shan Centre Block 1	28	50
N71	Ma On Shan Centre Block 2	30	79
N72	Sun Shine City Block E	50	32
N73	Fu Fai Garden Block 1	35	26
N74	Ma On Shan Centre Block 3	86	144
N75	Villa Athena Block 1	50	240

Table 3.3i Noise Sensitive Receivers - Ma On Shan to Lee On

Noise Sensitive Receiver		Distance from Work Site (m)	
		Alignment	Lee On Station
N75	Villa Athena Block 1	50	-
N76	Villa Athena Block 5	30	-
N77	Saddle Ridge Garden Block 1	88	-
N78	Saddle Ridge Garden Block 5	58	-
N79	Kam Lung Court, Lung Yiu House	44	-
N80	Kam Lung Court, Lung Sing House	40	-
N81	Wu Kai Sha New Village nos. 1-12	66	-
N82	Lee On Estate, Lee Wing House	30	136

Operational Phase

3.3.18 *Table* 3.3*j* shows the NSRs and their horizontal separation from the MOS Rail alignment. In the operational phase, train noise as well as noise emissions from the air-conditioning system of the trains could lead to adverse noise impacts on the surrounding NSRs. As mentioned in the previous section, the existing noise climate is dominated by the traffic on nearby road networks. Industrial premises within the Shek Mun Industrial Area would also affect the background noise level.

Table 3.3j Noise Sensitive Receivers for the Operational Phase

Noise Sensitive Receivers		Distance from Alignment (m)
N1	Keng Hau Road no. 29	40
N2	Keng Hau Road no. 25	80
N3	Keng Hau Road no. 22	85
N4	Keng Hau Road no. 11	150
N5	Keng Hau Road nos. 5-7	170
N6	Hin Yau House	80
N7	Hin Yeung House	150
N8	Sha Tin Heights	125
N9	Tin Sam Village nos. 182-185	150
N10	Sun Ming House	185
N11	Christian Alliance School	75
N12	Grandway Garden Block 2	80
N13	Cheung Wong Wai Primary School	185
N14	Sha Tin Tsung Tsin Secondary School	120
N15	Man Lai Court	90
N16	Lei Uk Tsuen nos. 12-15	55
N17	Sha Tin Government Secondary School	135
N18	Shek Fai House	70
N19	Shek Yuk House	70
N20	Ecclesia Bible College	180
N21	Sha Tin Tau no. 3	30
N22	Sham Ha Wai	80
N23	Secondary School (Jat Min Chuen St/Sha Kok St.)	40
N24	Immaculate Heart of Mary College	30
N25	Ming Yan Lau	40
N26	Pok Man House	20
N27	Tin Ka Ping Salvation Army Primary School	20
N28	Pok Yue House	30
N29	Pok Yat House	45
N30	Pok Tai House	40
N31	Osprey House	70
N32	Oriole House	50
N33	Sha Tin Wai nos. 1-2	60
N34	Ashley Garden	10
N35	Iris Garden	15
N36	Toi Shan Association College	100
N37	Wong UK Village nos. 17-18	10
N38	Green Leave Garden Block B	40
N39	Prince of Wales Hospital	50
N40	Pamela Youde Child Assessment Centre and School Dental Clinic	20
N41	Yue Sui House	30

Noise Sensitive Receivers		Distance from Alignment (m)
N42	Yue Kwan House	30
N43	Yow Kam Yuen Prevocational School	20
N44	Lam Kau Mow Secondary School	30
N45	Yuen Chau Kok THA (Cleared)	50
N46	City One Sha Tin Block 36	80
N47	Garden Vista Block D	225
N48	City One Sha Tin Block 33	60
N49	Pictorial Garden Capilano Court	160
N50	Pictorial Garden Dragon Court	90
N51	Pictorial Garden Juniper Court	50
N52	Sha Tin Hospital	45
N53	Fishermen's New Village no. 113	65
N54	Fishermen's New Village nos. 16-19	75
N55	Fishermen's New Village nos. 5-8	75
N56	Ma On Shan Tsung Tsin Secondary School	85
N57	Tai Shui Hang nos. 1-4	130
NA	Development north of Chevalier Garden	90
NB	Development north-east of Chevalier Garden	40
N58	Sing On THA	110
N59	Ngan On House	45
N60	Po On House	55
N61	Chinese YMCA College	40
N62	Hing On THA	55
N63	Tsang Pik Shan Secondary School	90
N64	Fok On Garden	35
N65	Sun Shine City Block L	65
N66	Sun Shine City Block K	85
N67	Sun Shine City Block M	30
N68	Bayshore Towers Block 5	50
N69	Bayshore Towers Block 2	45
N70	Ma On Shan Centre Block 1	25
N71	Ma On Shan Centre Block 2	25
N72	Sun Shine City Block E	30
N73	Fu Fai Garden Block 1	35
N74	Ma On Shan Centre Block 3	85
N75	Villa Athena Block 1	45
N76	Villa Athena Block 5	30
N77	Saddle Ridge Garden Block 1	90
N78	Saddle Ridge Garden Block 5	55
N79	Kam Lung Court Lung Yiu House	45
N80	Kam Lung Court Lung Sing House	40
N81	Wu Kwai Sha New Village nos. 1-12	65
N82	Lee On Estate Lee Wing House	25

3.4 Construction Impacts

Potential Sources of Impacts

3.4.1 Potential impacts on nearby NSRs during the construction phase of the project will mainly arise from PME operating on the construction work sites. The proposed alignment and stations for MOS Rail will be at grade or elevated.

3.4.2 There will be excavation works for site preparation and bored piling for viaduct structures. Above ground construction will also be carried out for site clearance, column construction and beam erection. There will be other noisy activities during the construction of the station structures and the station-related developments. Night-time working is expected for the erection of viaduct units which will be delivered by road transportation.

3.4.3 Particularly noisy activities during the construction phase of the MOS Rail are predicted to be:

- Site Preparation and Clearance - use of earthmoving machinery and vehicles;
- Excavation - use of excavators and loaders for drainage and minor retaining wall construction;
- Piling - use of bored piling machinery for the construction of subsurface retaining structures, and the use of percussive piling for sheet piling;
- Station Structure and Development Construction - use of general construction plant and equipment;
- Pile Cap and Column Construction - use of mobile crane, concrete mixer lorry and other construction plant;
- Beam Erection and Span Construction - use of general construction plant and equipment; and
- Site Traffic - use of heavy vehicles for material delivery and spoil removal, vehicles used by site staff and workers.

Assessment Methodology

3.4.4 The assessment of noise impacts from the construction of MOS Rail has been undertaken based on the procedure outlined in TM1. In general, the methodology is as follows:

- locate NSRs that may be affected by construction work sites;
- determine plant items for corresponding construction activities, based on available information;
- assign sound power levels (SWLs) to plant based on the information in TM1 or other sources;

- calculate the correction factors based on the distance between the NSRs and the notional noise source point at the work sites; and

- calculate the predicted noise levels at NSRs in the absence of any mitigation measures.

3.4.5 The NCO criteria for the control of noise from PME are dependent on the type of area containing the individual NSR rather than the measured background noise level. In this case all NSRs have an ASR of 'C', according to TM1. *Table 3.4a* shows the ANL under the ASR of C during restricted hours.

Table 3.4a Acceptable Noise Levels ($L_{Aeq,\ 30min}$ (dB))

Time Period	ANL
All days during the evening (1900-2300) and general holidays (including Sunday) during the day and evening (0700-2300)	70
All days during the night-time (2300-0700)	55

3.4.6 Since the study area is classified as urban, with heavy traffic flows on the nearby roadways, the noise climate in the study area is dominated by traffic noise. All the NSRs within the study area are either directly or indirectly affected by this influencing factor. The correction factor of distance attenuation for each NSR with respect to each construction activity, is calculated from the distance of the NSR from the work site notional noise source point in accordance with TM1. The construction of MOS Rail will involve different construction activities, and therefore the type of construction plant and equipment used in each stage of construction will vary.

Alignment Construction

3.4.7 The proposed alignment would be either at grade or on elevated viaduct sections. Part of the alignment for the sections between Hin Keng and Tai Wai, and from Shek Mun to Chevalier Garden (section from Tate's Cairn Highway to Tai Sha Hang Channel) would be at grade sections. The vertical alignment for these at grade sections would follow the ground level and the railway would run within the existing railway reserve.

3.4.8 Most of the MOS Rail alignment will be on elevated, standard viaduct structures, special long span viaduct sections will be constructed at critical sections of the alignment. These sections include the segment crossing over the Sui Tan CLP sub-station near Wong Uk Village; the segment over the highway reserve of Tate's Cairn Highway from Shek Mun Station; and the section between Chevalier Garden and Sai Sha Road roundabout, which would cross over the interchange of the Ma On Shan Road and Sai Sha Road.

3.4.9 Information on the plant requirements for the construction activities were provided by the Study Team and the SWL of each plant item was based on the TM1. Construction activities and the total combined SWL of specific operations for at grade sections, standard viaduct sections and the construction of special long span viaducts are listed in *Table 3.4b*, *3.4c* and *3.4d* respectively. The plant inventories for the construction activities are described in detail in *Annex A*.

Table 3.4b Total SWLs for Construction Activities - At Grade Section

Construction Activities	Total SWL (dB(A))
Site Clearance	117
Excavation for and Construction of Drainage	115
Excavation for Minor Retaining Wall	119
Formation Preparation	114

Table 3.4c Total SWLs for Construction Activities - Standard Viaduct Section

Construction Activities	Total SWL (dB(A))
Site Clearance	117
Bored Piling	118
Pile Cap Construction	121
Column Construction	120
Beam Erection	117

Table 3.4d Total SWLs for Construction Activities - Special Long Span Viaduct

Construction Activities	Total SWL (dB(A))
Site Clearance	117
Bored Piling	121
Pile Cap Construction	121
Column Construction	120
Span Construction	120

Station and Development Construction

3.4.10 The MOS Rail station structures would be either at grade or elevated. The proposed stations at Hin Keng (provisional) and Lee On would be at grade, whilst elevated station structures are planned in Tai Wai, Sha Tin Tau, Sha Kok Street, City One Shatin, Shek Mun, Chevalier Garden, Heng On and Ma On Shan. Apart from the proposed depot at Tai Wai, there would also be station related developments at Tai Wai, Sha Tin Tau and Lee On.

3.4.11 Information on the plant requirements for the construction of the depot, station structures and the related developments were provided by The Study Team. The SWL of each plant item was based on the TM1. Construction activities and the total combined SWL of specific operations is listed in *Table 3.4e*. The plant inventories for the construction activities are described in detail in *Annex A*.

Table 3.4e Total SWLs for Construction Activities - Station and Development Construction

Construction Activities	Total SWL (dB(A))
Site Clearance	117
Bored Piling Works for Station Construction	121
Bored Piling Works for Development Construction	123
Pile Cap Construction	121
Column Construction	120
Station/Development Construction	121
Roof Erection for Station Structure	116
Sheet Piling (for Tai Wai Station only)	
• General Construction	117
• Percussive Piling	129

Prediction of Impacts

3.4.12 The predicted noise levels at the identified NSRs during the construction phase of the railway are shown in *Tables 3.4f-h*. Predicted noise levels from station and development construction are listed in *Tables 3.4i-l*. Façade noise levels at the NSRs were calculated based on the SWLs and corrections for distance attenuation given in TM1.

Table 3.4f Predicted Noise Levels (dB(A)) - At Grade Sections

NSR Reference	Construction Activity			
	Site Clearance	Excavation & Construction of Drainage	Excavation for Retaining Walls	Formation Preparation
Hin Keng to Tai Wai				
N1	66	64	68	63
N2	67	65	69	64
N3	69	67	71	66
N4	68	66	70	65
N5	67	65	69	64
N6	64	62	66	61
N7	67	65	69	64
N8	69	67	71	66
Shek Mun to Chevalier Garden				
N52	76	74	78	73
N53	75	73	77	72
N54	73	71	75	70
N55	73	71	75	70
N56(1)	73	71	75	70
N57	69	67	71	66

Note : (1) - School or institutional uses

Table 3.4g Predicted Noise Levels (dB(A)) - Standard Viaduct Sections

NSR Reference	Construction Activity				
	Site Clearance	Piling	Pile Cap Construction	Column Construction	Beam Erection
Tai Wai to Sha Tin Tau					
N13[1]	63	64	67	66	63
N14[1]	68	69	72	71	68
N15	73	74	77	76	73
N16	68	69	72	71	68
N17[1]	70	71	74	73	70
N18	70	71	74	73	70
N19	73	74	77	76	73
Sha Tin Tau to Sha Kok Street					
N20[1]	68	69	72	71	68
N21	83	84	87	86	83
N22	75	76	79	78	75
N23[1]	79	80	83	82	79
N24[1]	80	81	84	83	80
N25	80	81	84	83	80
N26	88	89	92	91	88
N27[1]	89	90	93	92	89
N28	80	81	84	83	80
N29	72	73	76	75	72
Sha Kok Street to City One Shatin					
N30	77	78	81	80	77
N31	70	71	74	73	70
N32	78	79	82	81	78
N33	78	79	82	81	78
N34	86	87	90	89	86
N35	83	84	87	86	83
N36[1]	71	72	75	74	71
N37	88	89	92	91	88
N38	81	82	85	84	81
N39	75	76	79	78	75
N40	88	89	92	91	88
N41	76	77	80	79	76
N42	72	73	76	75	72
City One Shatin to Shek Mun					
N43[1]	82	83	86	85	82
N44[1]	81	82	85	84	81
N45 (Cleared)	78	79	82	81	78
N46	75	76	79	78	75
N48	77	78	81	80	77

NSR Reference	Construction Activity				
	Site Clearance	Piling	Pile Cap Construction	Column Construction	Beam Erection
Shek Mun to Chevalier Garden					
N47	65	66	69	68	65
N49	68	69	72	71	68
N50	73	74	77	76	73
N51	78	79	82	81	78
NA	76	77	80	79	76
Chevalier Garden to Heng On					
NB	81	82	85	84	81
N58	70	71	74	73	70
N59	79	80	83	82	79
N60	77	78	81	80	77
N61[(1)]	77	78	81	80	77
N62	76	77	80	79	76
Heng On to Ma On Shan					
N63[(1)]	72	73	76	75	72
N64	80	81	84	83	80
N65	75	76	79	78	75
N66	73	74	77	76	73
N67	77	78	81	80	77
N68	74	75	78	77	74
N69	76	77	80	79	76
N70	83	84	87	86	83
N71	82	83	86	85	82
N72	78	79	82	81	78
N73	81	82	85	84	81
N74	73	74	77	76	73
N75	78	79	82	81	78
Ma On Shan to Lee On					
N76	82	83	86	85	82
N77	73	74	77	76	73
N78	77	78	81	80	77
N79	79	80	83	82	79
N80	80	81	84	83	80
N81	76	77	80	79	76
N82	82	83	86	85	82

Note : (1) - School or institutional uses

Table 3.4h Predicted Noise Levels (dB(A)) - Special Long Span Viaduct Sections

NSR Reference	Site Clearance	Piling	Pile Cap Construction	Column Construction	Span Construction
Sha Kok Street to City One Shatin					
N30	77	81	81	80	80
N31	70	74	74	73	73
N32	78	82	82	81	81
N33	78	82	82	81	81
N34	86	90	90	89	89
N35	83	87	87	86	86
N36(1)	71	75	75	74	74
N37	88	92	92	91	91
N38	81	85	85	84	84
N39	75	79	79	78	78
N40	88	92	92	91	91
N41	76	80	80	79	79
N42	72	76	76	75	75
Shek Mun to Chevalier Garden					
N49	68	72	72	71	71
N50	73	77	77	76	76
N51	78	82	82	81	81
N58	70	74	74	73	73
Chevalier Garden to Heng On					
N59	79	83	83	82	82
N60	77	81	81	80	80

Note: (1) - School or institutional uses

Table 3.4i Predicted Noise Levels (dB(A)) - Station Construction

NSR Reference	Site Clearance	Piling	Pile Cap Const'n	Column Const'n	Station Const'n	Roof Erection
Provisional Hin Keng Station						
N1	75	79	79	78	79	74
N2	74	78	78	77	78	73
N3	72	76	76	75	76	71
N4	67	71	71	70	71	66
N5	65	69	69	68	69	64
N6	73	77	77	76	77	72
N7	63	67	67	66	67	6
Sha Kok Street Station						
N24(1)	64	68	68	67	68	63
N25	71	75	75	74	75	70
N26	64	68	68	67	68	63

NSR Reference	Site Clearance	Piling	Pile Cap Const'n	Column Const'n	Station Const'n	Roof Erection
N27[(1)]	65	69	69	68	69	64
N28	74	78	78	77	78	73
N29	80	84	84	83	84	79
N30	75	79	79	78	79	74
N31	73	77	77	76	77	72
N32	73	77	77	76	77	72
N33	68	72	72	71	72	67
N34	64	68	68	67	68	63
City One Shatin Station						
N39	65	69	69	68	69	64
N40	77	81	81	80	81	76
N41	81	85	85	84	85	80
N42	78	82	82	81	82	77
N43[(1)]	76	80	80	79	80	75
N44[(1)]	67	71	71	70	71	66
N45 (Cleared)	82	86	86	85	86	81
N46	64	68	68	67	68	63
Chevalier Garden Station						
N56[(1)]	65	69	69	68	69	64
N57	72	76	76	75	76	71
NA	75	79	79	78	79	74
Heng On Station						
N59	73	77	77	76	77	72
N60	77	81	81	80	81	76
N61[(1)]	88	92	92	91	92	87
N62	69	72	72	71	72	67
Ma On Shan Station						
N63[(1)]	63	67	67	66	67	62
N64	69	73	73	72	73	68
N65	75	79	79	78	79	74
N66	72	76	76	75	76	71
N67	83	87	87	86	87	82
N68	78	82	82	81	82	77
N69	78	82	82	81	82	77
N70	78	82	82	81	82	77
N71	74	78	78	77	78	73
N72	82	86	86	85	86	81
N73	84	88	88	87	88	83
N74	69	73	73	72	73	68
N75	64	68	68	67	68	63

Note : (1) - School or institutional uses

Table 3.4j Predicted Noise Levels (dB(A)) - Station and Development Construction in Tai Wai

NSR	Site Clearing	Station Piling	D'ment Piling	Pile Cap Const.	Column Const.	Station/ D'ment Const.	Roof Erection	Sheet Piling (General)	Sheet Piling
N8	72	76	78	76	75	76	71	72	84
N9	73	77	79	77	76	77	72	73	85
N10	73	77	79	77	76	77	72	73	85
N11(1)	75	79	81	79	78	79	74	75	87
N12	74	78	80	78	77	78	73	74	86
N13(1)	73	77	79	77	76	77	72	73	85
N14(1)	70	74	76	74	73	74	69	70	82
N15	71	75	77	75	74	75	70	71	83

Note : (1) - School or institutional uses

Table 3.4k Predicted Noise Levels (dB(A)) - Station and Development Construction in Sha Tin Tau

NSR Reference	Site Clearance	Piling for Station	Piling for Development	Pile Cap Construction	Column Construction	Station/ Development Construction	Roof Erection
N17(1)	71	75	77	75	74	75	70
N18	80	84	86	84	83	84	79
N19	73	77	79	77	76	77	72
N20(1)	69	73	75	73	72	73	68
N21	74	78	80	78	77	78	73
N22	63	67	69	67	66	67	62

Note : (1) - School or institutional uses

Table 3.4l Unmitigated Cumulative Noise Levels (dB(A)) - Station and Development Construction in Lee On

NSR Reference	Construction Activity						
	Site Clearance	Piling for Station	Piling for Development	Pile Cap Construction	Column Construction	Station/ Development Construction	Roof Erection
N82	69	73	75	73	72	73	68

Evaluation of Impacts

3.4.13 Cumulative impacts from the construction works are predicted based on the assumptions that the noisiest construction activity could be undertaken simultaneously at any two construction sites close to the NSR. Thus the predicted noise level is increased by 3 dB(A) to account for the worst case cumulative impact at the NSR.

Hin Keng to Tai Wai

3.4.14 Noise impacts during the at grade alignment construction stage would be minimal as shown in *Table 3.4f*. The maximum noise level predicted was 71 dB(A) at residential development no. 22 at Keng Hau Road (N3) and Sha Tin Heights (N8), and the noisiest activity identified was excavation works for minor retaining walls. Considering the worst case cumulative impacts, the noise level would rise to 74 dB(A) at these NSRs.

3.4.15 High noise levels were predicted at most of the NSRs during the station construction stage. The noisiest phases of construction were considered to be piling work, pile cap construction and station construction. A maximum of 79 dB(A) was predicted at residential development no. 29 at Keng Hau Road (N1), whilst due to the limited buffer distance, the worst case cumulative impacts at the NSR would attain a level of 82 dB(A) if unmitigated.

Tai Wai to Sha Tin Tau

3.4.16 During the construction of the viaduct sections of the proposed alignment, adverse construction noise impacts would be likely at the identified NSRs. Sha Tin Tsung Tsin Secondary School (N14) and Sha Tin Government Secondary School (N17) would be impacted by construction noise (a maximum noise exceedance of 4 dB(A) during the pile cap construction). Residential developments include Man Lai Court (N15) and Shek Yuk House (N19) would also receive a noise level higher than the recommend limit during pile cap and column construction. The worst case cumulative impacts at these NSRs would attain a noise level of 80 dB(A).

3.4.17 Noise impacts during the construction of Tai Wai Station and Depot would also be likely to generate an 11 dB(A) exceedance of the guideline limit at the Christian Alliance School (N11) during the bored piling stage for station development, and the worst case cumulative impacts on the nearby NSRs would cause considerable impacts if unmitigated (a maximum level of 84 dB(A) was predicted at Christian Alliance School).

3.4.18 Percussive sheet piling operations would lead to adverse noise impacts on the surrounding uses. The highest noise level predicted was 87 dB(A) at Christian Alliance School (an exceedance of 12 dB(A) above the ANL stated in TM2), and therefore the piling works should be restricted to 08.00-09.00, 12.30-13.30 and 17.00-18.00 on normal working days.

Sha Tin Tau to Sha Kok Street

3.4.19 Adverse impacts from the construction of the proposed alignment from Sha Tin Tau to Sha Kok Street would be expected. Most of the NSRs would experience noise levels exceeding the daytime limit, particularly during the pile cap construction stage. A maximum level of 93 dB(A) was predicted at Tin Ka Ping Salvation Army Primary School (N27) during the pile cap construction. The worst case cumulative impact at the NSR would attain a level of 96 dB(A).

3.4.20 Construction impacts in the region of 1-11 dB(A) would be likely during the daytime during station construction. An 11 dB(A) exceedance was predicted at Shek Fai House (N18) during the bored piling stage for related development construction.

Sha Kok Street to City One, Shatin

3.4.21 Exceedances of 1-17 dB(A) at the identified NSRs were predicted within this section of the proposed alignment, for both standard viaduct construction or special long span viaduct construction. Wong Uk Village nos. 17-18 (N37) and Pamela Youde Child Assessment Centre and School Dental Clinic (N40) would be the worst impacted. The worst case cumulative noise impact would be increased to 95 dB(A) at these NSRs due to limited buffer distances and noise emissions from PME.

3.4.22 During station construction, the noisiest activities identified were piling, pile cap construction and station construction. Adverse noise impacts in the region of 1-10 dB(A) were predicted. A maximum noise level of 85 dB(A) was predicted at Yue Sui House (N41) and the worst case cumulative impact at this NSR would be 88 dB(A).

City One Shatin to Shek Mun

3.4.23 In the vicinity of the alignment, most of the schools and residential developments would be adversely impacted by construction noise. A maximum of 86 dB(A) was predicted during the pile cap construction stage at Yow Kam Yuen Prevocational School (N43), which exceeds the guideline value by 16 dB(A). The worst case cumulative impact would be 89 dB(A).

3.4.24 In the construction stage of City One Station, the maximum noise level predicted was 86 dB(A) at Yuen Chau Kok THA (N45). Yow Kam Yuen Prevocational School would also be impacted by the construction works within the station site, by a maximum of 10 dB(A) over the guideline value.

Shek Mun to Chevalier Garden

3.4.25 NSRs identified within this section of the proposed alignment would be affected by the at grade alignment. For those NSRs close to the at grade section, 1-5 dB(A) exceedances were predicted. A maximum noise level of 78 dB(A) was predicted at Sha Tin Hospital (N52), a 3 dB(A) exceedance of relevant noise criteria. For those NSRs close to the elevated section, a maximum exceedance of 7 dB(A) was predicted at Juniper Court of Pictorial Garden (N51). Impacts on the developments to the north of the alignment (NA) (which are assumed to be residential properties with openable windows and no setback from the edge of the site) are predicted to exceed the daytime criteria by up to 5 dB(A). The worst case cumulative impact would be 85 dB(A) at Juniper Court of Pictorial Garden.

3.4.26 Tai Shui Hang nos. 1-4 (N57) and the developments to the north of Chevalier Gardens (NA and NB) would be impacted by the station construction works construction at Chevalier Garden. The worst case cumulative impact would increase the noise level to 83 dB(A).

Chevalier Garden to Heng On

3.4.27 Adverse cumulative impacts and noise impacts from individual construction activities would be likely at the NSRs within this section of the alignment. A maximum noise level of 85 dB(A) was predicted at the developments to the north of the alignment (NB) during pile cap construction. An exceedance of 11 dB(A) over the guideline limit was predicted at Chinese YMCA College (N61) during the construction of standard viaduct sections.

3.4.28 During the station construction stage in Heng On, adverse noise impacts of up to 22 dB(A) above the daytime criteria were predicted at the NSRs from construction activities. A maximum noise level of 92 dB(A) was predicted at the Chinese YMCA College during the bore piling operations, pile cap construction and station construction stage.

Heng On to Ma On Shan

3.4.29 Most of the identified NSRs within this section of the proposed development would be impacted by construction noise. Noise exceedances in the region of 1-12 dB(A) were predicted. A maximum noise level of 87 dB(A) was predicted at Ma On Shan Centre Block 1 (N70) in the pile cap construction stage and the worst case cumulative impact would be 90 dB(A).

3.4.30 During the station construction stage, adverse noise impacts would be likely at most of the NSRs. A maximum noise level of 88 dB(A) was predicted at Fu Fai Garden Block 1 (N73) and the worst case cumulative impacts would be 16 dB(A) above the relevant guideline limit.

Ma On Shan to Lee On

3.4.31 Alignment construction would be the dominant noise source for this section and due to the buffer distance from the NSRs, station construction will impose a lesser impact. Villa Athena Block 5 (N76) would be worst affected with a noise level of 86 dB(A) during the pile cap construction. The predicted noise levels at other NSRs were also exceeded the relevant criteria by 1-10 dB(A), depending on the buffer distance and the construction activities on site.

Mitigation Measures

3.4.32 The predicted noise levels in the preceding section show that construction activities are likely to give rise to adverse daytime noise impacts at most NSRs. Substantial mitigation measures are therefore required and the following forms of mitigation have been considered :

- Use of good site practice to limit noise emissions at source and constructing temporary noise barriers.
- Use of quiet plant and working methods (M1).
- Use of movable noise barriers (M2).
- Reduction in the number of plant operating in critical areas close to NSRs (M3).

Good Site Practices and Constructing Temporary Noise Barriers

3.4.33 Whilst the effects are not easily quantifiable, good site practices and noise management can considerably reduce the impact of construction activities on nearby NSRs. The following measures should be followed during each phase of construction:

- only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme;
- machines and plant (such as trucks) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
- plant known to emit noise strongly in one direction, should, where possible, be orientated so that the noise is directed away from nearby NSRs;
- silencers or mufflers on construction equipment should be properly fitted and maintained;
- 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.

3.4.34 The noise benefits of these techniques can vary according to specific site conditions and operations, and while they would provide some attenuation, they cannot be assumed to guarantee a precise level of noise mitigation.

3.4.35 Noise barriers of 3-5 m high, located on the site boundaries between noisy construction activities and NSRs could reduce noise levels by up to 5 dB(A) through partial screening. It should be possible for the Contractor to provide these in the form of site hoardings to achieve this attenuation effect, provided that the barriers have no openings or gaps and have a superficial surface density of at least 20 kg m^{-2}. However, due to the geometry between the NSRs and the sources have not been defined and the design of the hoarding and site boundary wall are not available in this stage of study, the potential benefit of site hoarding could not be assessed in this stage of study.

Use of Quiet Plant and Working Methods

3.4.36 The Contractor would be able to obtain particular models of plant that are quieter than the noise levels given in TM1. The benefits achievable in this way will depend on the Contractor's chosen construction methods, and it is considered too restrictive to specify that the Contractor has to use specific models or items of plant for the construction operations. It is reasonable and practical to set plant noise performance specifications of specific PME. In this way, plant teams would be chosen by the contractor to suit his adopted working methodologies.

3.4.37 Silenced type PME is defined as PME whose actual SWL is less than the value specified in TM1 for the same item of plant, which are known to be available and are given below:

Breaker (Excavator-mounted):	115 dB(A) max;
Bored Piling Rig:	110 dB(A) max;
Bulldozer:	110 dB(A) max;
Dump Truck:	110 dB(A) max;

Breaker (Hand-held):	110 dB(A) max;
Poker vibrator:	110 dB(A) max;
Excavator:	105 dB(A) max;
Concrete Pumps:	105 dB(A) max;
Loader:	105 dB(A) max;
Lorry:	105 dB(A) max;
Mobile Crane:	105 dB(A) max;
Compressors:	100 dB(A) max;
Generators:	100 dB(A) max; and
Water pumps:	88 dB(A) max.

3.4.38 It should be noted that various types of silenced equipment can be found in Hong Kong. However, EPD, when processing a CNP application, will apply the noise levels contained in the relevant statutory TM unless the noise emission of a particular piece of equipment can be validated by certificate or demonstration.

Movable Noise Barriers

3.4.39 Movable barriers that can be located close to noisy plant can be very effective at screening NSRs from particular items. 3 m high movable barriers with skid footing and a small cantilevered upper portion can be located within a few metres of static plant. Barriers of a similar type can be placed within about 5 m of mobile plant such as excavators, mobile cranes etc.

3.4.40 Based on the NSR heights and site geometry, it is estimated that mobile noise barriers of this type can achieve a 10 dB(A) noise reduction for static plant and 5 dB(A) noise reduction for mobile plant if they are properly arranged before any activities proceed. The noise screening benefit for each plant considered in this study is listed as follows:

- stationary plant - 10 dB screening for PME such as air compressor, drilling rig, water pump, generator, concrete pump and poker vibrator; and
- mobile plant - 5 dB screening for PME such as excavator, bulldozer, loader, truck mixer, bar bender, roller and crane.

Reducing the Numbers of Plant Operating in Critical Areas Close to NSRs

3.4.41 In general the numbers of plant should be left to the choice of the Contractor so that in combination with the selection of quiet plant, any further reduction in the total plant noise level, or the site specific maximum site sound power levels, as described above, can be achieved. This method could be more effective for activities associated with foundation work, station box and ventilation building construction and excavation activities in which a large number of PME are anticipated, but not all of them would be utilized at the same time.

Assessment of Construction Noise with Mitigation Measures

3.4.42 Without mitigation measures, construction activities may cause exceedances of the recommended voluntary 75 dB(A) limit at most of the NSRs. The worst cumulative noise levels with the implementation of the proposed mitigation measures have been predicted and investigated. The predicted mitigated noise levels are described below and the results are shown in *Tables 3.4m-3.4r*, the figures in the tables include a +3 dB(A) correction to allow for the worst case cumulative impacts at the NSRs.

3.4.43 A maximum of 4 dB(A) reduction could be achieved from the use of silenced type PME. Quiet PME and the use of movable barriers together could offer a maximum noise reduction of 9 dB(A), especially for stationary PME. A further 4 dB(A) reduction could also be achieved if the number of PME used on site is reduced, as estimated from the predicted values.

3.4.44 As it is considered too restrictive to insist that the Contractor use specific items of plant, recommendations for mitigation to achieve the applicable noise criterion have been specified as a combination of noise barriers and a plant noise performance specification. This performance specification requires the contractor to incorporate 'quiet' plant not exceeding the SWL as given above or reduced plant inventories into construction activities so that noise levels at nearby NSRs are kept below the relevant noise level.

3.4.45 Since the buffer distances between the NSRs and the proposed work sites are limited and a considerable number of PME would be used for the construction of the railway, additional mitigation measures and consideration may also be necessary to protect the NSRs.

Table 3.4m Mitigated Cumulative Noise Levels (dB(A)) - At Grade Sections

NSR Reference	Construction Activity			
	Site Clearance	Excavation & Construction of Drainage	Excavation for Retaining Walls	Formation Preparation
Shek Mun to Chevalier Garden				
N52	72[1]/ -/ -	72/ -/ -	**77/71[2]/ -**	**76/76/76[3]**
N53	71/ -/ -	71/ -/ -	**76/70/ -**	-/ -/ -
N54	69/ -/ -	-/ -/ -	74/ -/ -	-/ -/ -
N55	69/ -/ -	-/ -/ -	74/ -/ -	-/ -/ -
N56[4]	69/ -/ -	69/ -/ -	**74/68/ -**	**73/73/73**

Notes : (1) - Predicted Noise Level with Mitigation M1
(2) - Predicted Noise Level with Mitigation M1 and M2
(3) - Predicted Noise Level with Mitigation M1, M2 and M3
(4) - School or institutional uses
Remark : Figure in **BOLD** face represents noise exceedance of ProPECC limit.

3.4.46 These *Tables* show that the proposed package of mitigation measures are capable of controlling most of the noisy construction works to within the recommended daytime voluntary limit. However, a number of exceedances remain and further options for noise control are discussed below.

Table 3.4n Mitigated Cumulative Noise Levels (dB(A)) - Standard Viaduct Sections

NSR Reference	Site Clearance	Piling	Pile Cap	Column	Beam Erection
Tai Wai to Sha Tin Tau					
N13(4)	-/-/-	-/-/-	67(1)/-/-	-/-/-	-/-/-
N14(4)	64/-/-	70/-/-	72/66(2)/-	71/64/-	66/-/-
N15	69/-/-	75/-/-	77/71/-	76/69/-	71/-/-
N17(4)	66/-/-	72/65/-	74/68/-	73/66/-	68/-/-
N18	-/-/-	-/-/-	74/-/-	73/-/-	-/-/-
N19	69/-/-	75/-/-	77/71/-	76/69/-	71/-/-
Sha Tin Tau to Sha Kok Street					
N20(4)	64/-/-	70/-/-	72/66/-	71/64/-	66/-/-
N21	79/78/75(3)	85/78/75	87/81/78	86/79/77	81/81/81
N22	71/-/-	77/70/-	79/73/-	78/71/-	73/-/-
N23(4)	75/74/71	81/74/71	83/77/74	82/75/73	77/77/77
N24(4)	76/75/72	82/75/72	84/78/75	83/76/74	78/78/78
N25	76/75/-	82/75/-	84/78/75	83/76/74	78/78/78
N26	84/83/80	90/83/80	92/86/83	91/84/82	86/86/86
N27(4)	85/84/81	91/84/81	93/87/84	92/85/83	87/87/87
N28	76/75/-	82/75/-	84/78/75	83/76/74	78/78/78
N29	-/-/-	74/-/-	76/70/-	75/-/-	-/-/-
Sha Kok Street to City One Shatin					
N30	73/-/-	79/72/-	81/75/-	80/73/-	75/-/-
N31	-/-/-	-/-/-	74/-/-	73/-/-	-/-/-
N32	74/-/-	80/73/-	82/76/73	81/74/-	76/76/76
N33	74/-/-	80/73/-	82/76/73	81/74/-	76/76/76
N34	82/81/78	88/81/78	90/84/81	89/82/80	84/84/84
N35	79/78/75	85/78/75	87/81/78	86/79/77	81/81/81
N36(4)	67/-/-	73/66/-	75/69/-	74/67/-	69/-/-
N37	84/83/80	90/83/80	92/86/83	91/84/82	86/86/86
N38	77/76/73	83/76/73	85/79/76	84/77/75	79/79/79
N39	71/-/-	77/70/-	79/73/-	78/71/-	73/-/-
N40	84/83/80	90/83/80	92/86/83	91/84/82	86/86/86
N41	72/-/-	78/71/-	80/74/-	79/72/-	74/-/-
N42	-/-/-	74/-/-	76/70/-	75/-/-	-/-/-
City One Shatin to Shek Mun					
N43(4)	78/77/74	84/77/74	86/80/77	85/78/76	80/80/80
N44(4)	77/76/73	83/76/73	85/79/76	84/77/75	79/79/79
N45 (Cleared)	74/-/-	80/73/-	82/76/73	81/74/-	76/76/76
N46	71/-/-	77/70/-	79/73/-	78/71/-	73/-/-
N48	73/-/-	79/72/-	81/75/-	80/73/-	75/-/-

NSR Reference	Site Clearance	Piling	Pile Cap	Column	Beam Erection
Shek Mun to Chevalier Garden					
N50	69/ -/ -	75/ -/ -	77/71/ -	76/69/ -	71/ -/ -
N51	74/ -/ -	80/73/ -	82/76/73	81/74/72	76/76/76
NA	69/ -/ -	75/ -/ -	77/71/ -	76/69/ -	71/ -/ -
Chevalier Garden to Heng On					
NB	74/ -/ -	80/73/ -	82/76/73	81/74/ -	76/76/76
N58	-/ -/ -	-/ -/ -	74/ -/ -	-/ -/ -	-/ -/ -
N59	75/ -/ -	81/74/ -	83/77/74	82/75/ -	77/77/77
N60	73/ -/ -	79/72/ -	81/75/ -	80/73/ -	75/ -/ -
N61(4)	73/72/69	79/72/69	81/75/72	80/73/71	75/75/75
N62	72/ -/ -	78/71/ -	80/74/ -	79/72/ -	74/ -/ -
Heng On to Ma On Shan					
N63(4)	68/ -/ -	74/67/ -	76/70/ -	75/68/ -	70/ -/ -
N64	76/75/ -	82/75/ -	84/78/ -	83/76/74	78/78/78
N65	71/ -/ -	77/70/ -	79/73/ -	78/71/ -	73/ -/ -
N66	69/ -/ -	75/ -/ -	77/71/ -	76/69/ -	71/ -/ -
N67	73/ -/ -	79/72/ -	81/75/ -	80/73/ -	75/ -/ -
N68	70/ -/ -	76/69/ -	78/72/ -	77/70/ -	72/ -/ -
N69	72/ -/ -	78/71/ -	80/74/ -	79/72/ -	74/ -/ -
N70	79/78/75	85/78/75	87/81/79	86/79/77	81/81/81
N71	78/77/74	84/77/74	87/80/77	85/78/76	80/80/80
N72	74/ -/ -	80/73/ -	82/76/73	81/74/ -	76/76/76
N73	77/76/73	83/76/73	85/79/76	84/77/75	79/79/79
N74	69/ -/ -	75/ -/ -	77/71/ -	76/69/ -	71/ -/ -
N75	74/ -/ -	80/73/ -	82/76/73	81/74/72	76/76/76
Ma On Shan to Lee On					
N76	78/77/74	84/77/74	86/80/77	85/78/76	80/80/80
N77	69/ -/ -	75/ -/ -	77/71/ -	76/69/ -	71/ -/ -
N78	73/ -/ -	79/72/ -	81/75/ -	80/73/ -	75/ -/ -
N79	75/ -/ -	81/74/ -	83/77/74	82/75/ -	77/77/77
N80	76/75/ -	82/75/ -	84/78/75	83/76/74	78/78/78
N81	72/ -/ -	78/71/ -	80/74/ -	79/72/ -	74/ -/ -
N82	78/77/74	84/77/74	86/80/77	85/78/76	80/80/80

Notes : (1) - Predicted Noise Level with Mitigation M1
(2) - Predicted Noise Level with Mitigation M1 and M2
(3) - Predicted Noise Level with Mitigation M1, M2 and M3
(4) - School or institutional uses

Remark : Figure in **BOLD** face represents noise exceedance of ProPECC limit.

Table 3.4o Mitigated Cumulative Noise Levels (dB(A)) - Special Long Span Viaduct Sections

NSR Reference	Site Clearance	Piling	Pile Cap Construction	Column Construction	Span Construction
Sha Kok Street to City One Shatin					
N30	73[1]/ -/ -	83/75[2]/ -	81/75/ -	80/73/ -	81/74/ -
N31	-/ -/ -	76/68/ -	74/68/ -	73/ -/ -	74/ -/ -
N32	74/ -/ -	84/76/74[3]	82/76/73	81/74/ -	82/75/ -
N33	74/ -/ -	84/76/74	82/76/73	81/74/ -	82/75/ -
N34	82/81/78	92/84/82	90/84/81	89/82/80	90/83/78
N35	79/78/75	89/81/79	87/81/78	86/79/77	87/80/75
N36[4]	67/ -/ -	77/69/ -	75/69/ -	74/67/ -	75/68/ -
N37	84/83/80	94/86/84	92/86/83	91/84/82	92/85/80
N38	77/76/73	87/79/77	85/79/76	84/77/75	85/78/73
N39	71/ -/ -	81/73/ -	79/73/ -	78/71/ -	79/72/ -
N40	84/83/80	94/86/84	92/86/83	91/84/82	92/85/80
N41	72/ -/ -	82/74/ -	80/74/ -	79/72/ -	80/73/ -
N42	-/ -/ -	78/70/ -	76/70/ -	75/ -/ -	76/69/ -
Shek Mun to Chevalier Garden					
N50	69/ -/ -	79/71/ -	77/71/ -	76/69/ -	77/70/ -
N51	74/ -/ -	84/76/74	82/76/73	81/74/ -	82/75/ -
N58	-/ -/ -	76/68/ -	74/ -/ -	73/ -/ -	74/ -/ -
Chevalier Garden to Heng On					
N59	75/ -/ -	85/77/75	83/77/74	82/75/ -	83/76/71
N60	73/ -/ -	83/75/ -	81/75/ -	80/73/ -	81/74/ -

Notes : (1) - Predicted Noise Level with Mitigation M1
(2) - Predicted Noise Level with Mitigation M1 and M2
(3) - Predicted Noise Level with Mitigation M1, M2 and M3
(4) - School or institutional uses
Remark : Figure in BOLD face represents noise exceedance of ProPECC limit.

Table 3.4p Mitigated Cumulative Noise Levels (dB(A)) - Station Construction

NSR Reference	Site Clearance	Piling for Station	Pile Cap Const'n	Column Const'n	Station Const'n	Roof Erection
Provisional Hin Keng Station						
N1	71[1]/ -/ -	81/73[2]/ -	79/73/ -	78/71/ -	79/72/ -	70/ -/ -
N2	70/ -/ -	80/72/ -	78/72/ -	77/70/ -	78/71/ -	69/ -/ -
N3	-/ -/ -	78/70/ -	76/70/ -	75/ -/ -	76/69/ -	-/ -/ -
N6	69/ -/ -	79/71/ -	77/71/ -	76/69/ -	77/70/ -	-/ -/ -
Sha Kok Street Station						
N24[4]	-/ -/ -	70/ -/ -	68/ -/ -	-/ -/ -	68/ -/ -	-/ -/ -
N25	-/ -/ -	77/69/ -	75/ -/ -	74/ -/ -	75/ -/ -	-/ -/ -
N27[4]	-/ -/ -	71/63/ -	69/ -/ -	68/ -/ -	69/ -/ -	-/ -/ -
N28	70/ -/ -	80/72/ -	78/72/ -	77/70/ -	78/71/ -	69/ -/ -
N29	76/75/ -	86/78/76[3]	84/78/75	83/76/74	84/77/75	75/ -/ -

NSR Reference	Site Clearance	Piling for Station	Pile Cap Const'n	Column Const'n	Station Const'n	Roof Erection
N30	71/ -/ -	**81/73/ -**	**79/73/ -**	**78/71/ -**	**79/72/ -**	70/ -/ -
N31	69/ -/ -	**79/71/ -**	**77/71/ -**	**76/69/ -**	**77/70/ -**	-/ -/ -
N32	69/ -/ -	**79/71/ -**	**77/71/ -**	**76/69/ -**	**77/70/ -**	-/ -/ -
City One Shatin Station						
N40	73/ -/ -	**83/75/ -**	**81/75/ -**	**80/73/ -**	**81/74/ -**	72/ -/ -
N41	**77/76/73**	**87/79/77**	**85/79/76**	**84/77/75**	**85/78/76**	**76/75/ -**
N42	74/ -/ -	**84/76/74**	**82/76/73**	**81/74/ -**	**82/75/ -**	73/ -/ -
N43(4)	**72/71/68**	**82/74/72**	**80/74/71**	**79/72/70**	**80/73/71**	**71/70/ -**
N44(4)	-/ -/ -	**73/65/ -**	**71/65/ -**	70/ -/ -	**71/64/ -**	-/ -/ -
N45 (Cleared)	**78/77/74**	**88/80/78**	**86/80/77**	**85/78/76**	**86/79/77**	**77/76/76**
Chevalier Garden Station						
N56(4)	-/ -/ -	**71/63/ -**	69/ -/ -	68/ -/ -	69/ -/ -	-/ -/ -
N57	-/ -/ -	**78/70/ -**	**76/70/ -**	75/ -/ -	**76/69/ -**	-/ -/ -
NA	-/ -/ -	**78/70/ -**	**76/70/ -**	75/ -/ -	**76/69/ -**	-/ -/ -
Heng On Station						
N59	69/ -/ -	**79/71/ -**	**77/71/ -**	**76/69/ -**	**77/70/ -**	-/ -/ -
N60	73/ -/ -	83/75/ -	81/75/ -	80/73/ -	81/74/ -	72/ -/ -
N61(4)	**84/83/80**	**94/86/84**	**92/85/83**	**91/84/82**	**92/85/83**	**83/82/82**
Ma On Shan Station						
N64	-/ -/ -	75/ -/ -	73/ -/ -	-/ -/ -	73/ -/ -	-/ -/ -
N65	71/ -/ -	**81/73/ -**	**79/73/ -**	**78/71/ -**	**79/72/ -**	70/ -/ -
N66	68/ -/ -	**78/70/ -**	**76/70/ -**	75/ -/ -	**76/69/ -**	-/ -/ -
N67	**79/78/75**	**89/81/79**	**87/81/78**	**86/79/77**	**87/80/78**	**78/77/77**
N68	74/ -/ -	**84/76/74**	**82/76/73**	81/74/ -	82/75/ -	73/ -/ -
N69	74/ -/ -	**84/76/74**	**82/76/73**	81/74/ -	82/75/ -	73/ -/ -
N70	74/ -/ -	**84/76/74**	**82/76/73**	81/74/ -	82/75/ -	73/ -/ -
N71	70/ -/ -	**80/72/ -**	**78/72/ -**	**77/70/ -**	**78/71/ -**	69/ -/ -
N72	**78/77/74**	**88/80/78**	**86/80/77**	**85/78/76**	**86/79/77**	**77/76/76**
N73	**80/79/76**	**90/82/80**	**88/82/79**	**87/80/78**	**88/81/79**	**79/78/78**
N74	65/ -/ -	75/ -/ -	73/ -/ -	-/ -/ -	73/ -/ -	64/ -/ -
Lee On Station						
N82	-/ -/ -	75/ -/ -	73/ -/ -	-/ -/ -	73/ -/ -	-/ -/ -

Notes :
(1) - Predicted Noise Level with Mitigation M1
(2) - Predicted Noise Level with Mitigation M1 and M2
(3) - Predicted Noise Level with Mitigation M1, M2 and M3
(4) - School or institutional uses

Remark : Figure in **BOLD** face represents noise exceedance of ProPECC limit.

Hin Keng to Tai Wai

3.4.47 Potential adverse noise impacts for all construction works in this section can be controlled with the use of quiet plant (mitigation package M1).

Tai Wai to Sha Tin Tau

3.4.48 Where mitigation is required, all alignment works can be controlled by the use of quiet plant. However, near the work site for Tai Wai Station and Depot, a maximum cumulative noise level of 71 dB(A) was predicted at the Christian Alliance School (N11), even with the implementation of all the suggested control measures (M3). Bored piling operations for both station and development construction were identified to be the critical construction stage. However, the school is provided with air-conditioning and thus the sensitivity to construction noise would be 10 dB(A) lower and no exceedances would be expected providing that quiet plant is used.

3.4.49 Residual cumulative impacts would still be likely from station construction at Shek Fai House (N18) close to Sha Tin Tau Station. The predicted 1 dB(A) exceedance of the daytime criterion should be readily controlled by the proper use of site hoardings, although potential impacts from elevated sources must also be considered.

Sha Tin Tau to Sha Kok Street

3.4.50 Viaduct construction impacts in this section have been identified to generate adverse impacts at schools and residential properties. A maximum exceedance of 87 dB(A) has been predicted at Tin Ka Ping Salvation Army Primary School (N27) even with the application of the full mitigation package (M3) described above. It is recommended that classrooms on the affected facades are provided with secondary glazing and air conditioning as appropriate. This would provide sufficient protection for all schools except N27. Low level noise sources can be effectively controlled by the use of site hoardings which break the line of sight between the noise source and the NSR; cantilever barriers of 3-5 m in height can provide a noise reduction of 5-10 dB(A). Whilst this should provide sufficient protection from low level noise sources, elevated sources are still predicted to exceed the recommended limits at Pok Man House (N26) and further controls should be considered.

3.4.51 The worst case mitigated cumulative noise impact at Pok Yat House (N29) from station construction works in Sha Kok Street was predicted to be 76 dB(A). Bored piling works for station construction would be the noisiest stage and further control measures such as site hoardings should sufficient to reduce noise levels to within the recommended criterion.

Sha Kok Street to City One

3.4.52 There remain a number of viaduct construction noise exceedances of the recommended limit after the application of the proposed mitigation package (M3). Whilst the use of site hoardings will control low level noise sources such as site clearance and piling, the upper column sections and beam erection works are still likely to generate worst case exceedances of up to 86 dB(A) at Wong Uk Village (N37) and the Pamela Youde Child Assessment Centre and School Dental Clinic (N40).

3.4.53 Residual cumulative impacts would still be likely at the NSRs from station construction. Yue Sui House (N41) and Yow Kam Yuen Prevocational School (N43) are located close to the City One Station and would be affected by residual cumulative noise impact. The use of site hoardings and cantilever barrier on the site boundary could provide 5-10 dB(A) of screening of potential noise sources on site which is sufficient to meet the target level.

3.4.54 Viaduct construction exceedances at the same NSRs can generally be controlled by site hoardings, however, the worst impacts after mitigation (M3) of up to 80 dB(A) are during beam erection when elevated noise sources will generate impacts and further mitigation will be necessary. Reductions in noise levels may be achieved by restricting the operational periods of noisy plant or by the use of a quieter construction method.

Shek Mun to Chevalier Garden

3.4.55 The 1 dB(A) exceedance at Juniper Court, Pictorial Garden from viaduct construction can be controlled with site hoardings and no other exceedances for viaduct or station construction at Shek Mun and Chevalier Garden have been identified.

Chevalier Garden to Heng On

3.4.56 The only NSR likely to be adversely affected by the viaduct works for Heng On station construction is the Chinese YMCA College where noise levels after the use of the recommended mitigation package (M3) still exceed the recommended criterion by up to 14 dB(A). The use of site hoardings and cantilevered noise barriers can provide 5-10 dB(A) of noise reduction and it is also recommended that, if not already fitted to reduce traffic impacts, the classrooms on the affected facade are provided with appropriate secondary glazing and air conditioning which will provide a further 10 dB(A) attenuation. The 1 dB(A) exceedance at NB can be readily controlled by site hoardings.

Table 3.4q Mitigated Cumulative Noise Levels (dB(A)) - Station and Development Construction in Tai Wai

NSR Reference	Construction Activity							
	Site Clearance	Piling for Station	Piling for D'ment	Pile Cap Const'n	Column Const'n	Station and D'ment Const'n	Roof Erection	Sheet Piling General Const'n
N8	-/ -/ -	78(1)/70(2)/ -	81/72/ -	76/70/ -	75/ -/ -	76/69/ -	-/ -/ -	-/ -/ -
N9	69/ -/ -	79/71/ -	82/73/ -	77/71/ -	76/69/ -	77/70/ -	-/ -/ -	69/ -/ -
N10	69/ -/ -	79/71/ -	82/73/ -	77/71/ -	76/69/ -	77/70/ -	-/ -/ -	69/ -/ -
N11(4)	71/70/67	81/73/71(3)	84/75/71	79/73/70	78/71/69	79/72/70	70/ -/ -	71/71/69
N12	70/ -/ -	80/72/ -	83/74/ -	78/72/ -	77/70/ -	78/71/ -	69/ -/ -	70/ -/ -
N13(4)	69/ -/ -	79/71/69	82/73/69	77/71/68	76/69/ -	77/70/65	68/ -/ -	69/ -/ -
N14(4)	66/ -/ -	76/68/ -	79/70/ -	74/68/ -	73/66/ -	74/67/ -	-/ -/ -	66/ -/ -
N15	-/ -/ -	77/69/ -	80/71/ -	75/ -/ -	74/ -/ -	75/ -/ -	-/ -/ -	-/ -/ -

Notes: (1) - Predicted Noise Level with Mitigation M1
(2) - Predicted Noise Level with Mitigation M1 and M2
(3) - Predicted Noise Level with Mitigation M1, M2 and M3
(4) - School or institutional uses
Remark : Figure in **BOLD** face represents noise exceedance of ProPECC limit.

Table 3.4r Mitigated Cumulative Noise Levels (dB(A)) - Station and Development Construction in Sha Tin Tau

NSR Reference	Construction Activity						
	Site Clearance	Piling for Station	Piling for D'ment	Pile Cap Const'n	Column Const'n	Station/ D'ment Const'n	Roof Erection
N17(4)	67(1)/ -/ -	77/69(2)/ -	80/71/67(3)	75/69/ -	74/67/ -	75/68/ -	66/ -/ -
N18	**76/75/72**	**86/78/76**	**89/80/76**	**84/78/75**	**83/76/74**	**84/77/75**	**75/74/** -
N19	69/ -/ -	**79/71/** -	**82/73/** -	**77/71/** -	**76/69/** -	**77/70/** -	68/ -/ -
N20(4)	65/ -/ -	**75/67/** -	**78/69/** -	**73/67/** -	**72/65/** -	**73/66/** -	64/ -/ -
N21	70/ -/ -	80/72/ -	**83/74/70**	**78/72/** -	**77/70/** -	**78/71/69**	69/ -/ -

Notes: (1) - Predicted Noise Level with Mitigation M1
(2) - Predicted Noise Level with Mitigation M1 and M2
(3) - Predicted Noise Level with Mitigation M1, M2 and M3
(4) - School or institutional uses
Remark : Figure in BOLD face represents noise exceedance of ProPECC limit.

Heng On to Ma On Shan

3.4.57 Residual cumulative noise impacts in the region of 1-6 dB(A) are predicted at Fok On Garden (N64), Ma On Shan Centre Blocks 1 and 2 (N70 & N71), and Fu Fai Garden Block 1 (N73). The use of cantilever-type site hoardings will be effective in reducing the noise levels, especially at higher receivers, however, to be effective these would require close placement to the operational plant. A noise reduction of 3 dB(A) could be achieved with cantilever barriers. Careful planning to avoid the noisiest construction activities being undertaken simultaneously on adjacent sites; locating noisy PMEs as far away as practicable from NSRs; or limiting the times of use of PMEs on site would also be required to reduce noise levels at the worst affected NSRs to within the criterion.

3.4.58 Construction works associated with the proposed Ma On Shan Station are likely to cause residual noise impacts in the region of 1-3 dB(A) at Sun Shine City Blocks M & E (N67 & N72) and Fu Fai Garden Block 1 (N73). Cantilever-type site hoardings and the careful planning of construction works as described above, would eliminate the residual noise impacts at these NSRs.

Ma On Shan to Lee On

3.4.59 The use of site hoardings and cantilever barriers could provide a maximum of 5-10 dB(A) reduction of the predicted noise levels, which should be sufficient to protect NSRs from low level noise sources. However, the worst exceedances of up to 5 dB(A) at Villa Athena Block 5 (N76) and Lee Wing House (N82) are likely to be caused by elevated noise sources and further noise control measures will be required. Reductions in noise levels may be achieved by restricting the operational periods of noisy plant or by the use of a quieter construction method.

3.4.60 In addition to the construction activities within the proposed development sites, the MOS Rail construction works, including station and alignment construction activities, may take place simultaneously. As the construction programmes for the developments are not yet available it has been assumed that, for the worst case scenario, the noisiest MOS Rail construction activities will take place simultaneously with those for the proposed developments. The noisiest activities are identified to be pile cap construction for alignment construction and piling for station construction. Mitigation measures are proposed for the predicted exceedances at the station related sites in Tai Wai and Sha Tin Tau and the results are shown in *Tables 3.4s-3.4t*. No exceedances of the daytime noise criteria are predicted at Lee On.

Table 3.4s Mitigated Cumulative Noise Levels (dB(A)) - Station Related Development Construction and MOS Link Construction in Tai Wai

NSR Reference	Cumulative				MOS Link	
	Site Clearance	Piling for Development	Reinforced Structure Construction	Sheet Piling (General Construction)	Station Construction	Alignment Construction
N8	-/-/-	**79/74/-**	**76/73/-**	-/-/-	67(3)	71(1)
N9	70(2)/-/-	**79/72/-**	75/-/-	70/-/-	68(3)	-
N10	70/-/-	**79/72/-**	75/-/-	70/-/-	68(3)	-
N11(5)	**71/71(3)/69(4)**	**81/73/71**	**77/72/71**	71/-/-	68(4)	-
N12	71/-/-	**80/73/-**	**76/72/-**	71/-/-	69(3)	-
N13(5)	70/-/-	**79/72/70**	**75/71/70**	70/-/-	66(4)	64(2)
N14(5)	69/-/-	**77/70/-**	**72/69/-**	69/-/-	65(3)	63(3)
N15	-/-/-	**78/72/-**	74/-/-	-/-/-	66(3)	68(3)

Notes:
(1) - Predicted Noise Level with no Mitigation
(2) - Predicted Noise Level with Mitigation M1
(3) - Predicted Noise Level with Mitigation M1 and M2
(4) - Predicted Noise Level with Mitigation M1, M2 and M3
(5) - School or institutional uses

Remark : Figures in BOLD face represents noise exceedance of ProPECC limit.

Table 3.4t Mitigated Cumulative Noise Levels (dB(A)) - Station Related Development Construction and MOS Link Construction in Sha Tin Tau

NSR Reference	Cumulative			MOS Link	
	Site Clearance	Piling for Development	Reinforced Structure Construction	Station Construction	Alignment Construction
N17(5)	70(2)/-/-	**78/71/70**	**74/70/-**	66(3)	65(3)
N18	**77/77(3)/76(4)**	**86/79/77**	**82/78/77**	73(4)	71(2)
N19	72/-/-	**80/74/-**	**76/72/-**	68(3)	68(3)
N20(5)	68/-/-	**76/69/-**	**72/68/-**	64(3)	63(3)
N21	**76/76/76**	**81/77/76**	**79/77/76**	69(3)	75(4)

Notes:
(1) - Predicted Noise Level with no Mitigation
(2) - Predicted Noise Level with Mitigation M1
(3) - Predicted Noise Level with Mitigation M1 and M2
(4) - Predicted Noise Level with Mitigation M1, M2 and M3
(5) - School or institutional uses

Remark : Figures in BOLD face represents noise exceedance of ProPECC limit.

3.4.61 The cumulative noise levels arising from MOS Rail and station development construction can be controlled to within the noise criteria of 75 dB(A) for residential uses and 70 dB(A) for schools at most of the NSRs with the implementation of the standard noise mitigation measures described earlier. However, at the Christian Alliance School (N11) in Tai Wai, the cumulative noise levels exceed the noise criteria by 1 dB(A). The predicted residual exceedance can be readily controlled by ensuring that the railway and development construction works are programmed to avoid simultaneous noisy activities.

3.4.62 At Sha Tin Tau, Shek Fai House (N18) and Sha Tin Tau no.3 (N21), the cumulative noise levels exceed the noise criteria by 1-2 dB(A). The predicted residual exceedances can be readily controlled by ensuring that the railway and development construction works are programmed to avoid simultaneous noisy activities.

3.5 Operational Impacts

Potential Sources of Impacts

3.5.1 The likely impacts during the operation of MOS Rail on the surrounding NSRs may arise from train rolling noise, vibration from rolling stock and noise emissions from the air-conditioning system of the trains. The extent of impacts would depend on the operational characteristics of the trains, the track form and the distance from the surrounding sensitive uses.

Train Noise and Vibration

3.5.2 Train movements can lead to noise and vibration impacts upon the local area. The rolling stock to be used on the MOS Rail would be four-car train type, electric multiple units (EMUs) with disc brakes. The main noise source from the trains will be the interaction of the train wheels with the rails. This interaction results in noise being radiated away from the train wheels and rails and is referred to as rolling noise. Energy is also transferred through the track mounting system into the ground or supporting structure. This energy, if in sufficient quantity, can be perceptible as ground vibration or may radiate from nearby structures as re-radiated noise. Levels of re-radiated noise can be significant for railways on elevated viaduct structures.

3.5.3 However, it is not anticipated that ground vibration or ground-borne noise will cause adverse noise impacts as all sections are above ground. Other sources of noise from trains would be from the air conditioning units, traction motors, gearboxes, motor cooling equipment and compressors for doors and brakes. In light of the anticipated train speeds along the track, the main source of noise from the train is anticipated to be from rolling noise with some augmentation on elevated structures from reradiated noise.

3.5.4 Factors that determine the level of re-radiated noise and vibration for a given train operating under normal conditions are the vibration isolation performance of the track mounting system and the response of the supporting structure. At this stage of the project the track mounting system and the supporting structures are not defined. Hence, ground vibration has been excluded from this study, and will be addressed during the detailed assessment stage.

3.5.5 Noise impacts from wheel squeal may be generated on curves with a radius of less than 300 m where the wheels are forced to slide against the rail on the tight curve. There are several sections of the alignment where this may occur, these are: from Tai Wai Station to the Shing Mun River; on the western approach to Sha Tin Tau Station; the elevated viaduct over Ma On Shan Road; and the final approach to Lee On Station. The likelihood of wheel squeal is dependent upon a number of factors including; the design of the rolling stock; the geometry of the wheel/rail interface; the curve radius; the operational speed of the train; and the standards of track maintenance. All these factors can be modified at the detailed design stage to remove or minimise the occurrence of wheel squeal. If necessary, mitigation in the form of track side lubrication can also be applied to limit noise impacts to within the established criteria.

Stations

3.5.6 Ten MOS Rail stations are planned at: Hin Keng (provisional); Tai Wai; Sha Tin Tau; Sha Kok Street; City One Shatin; Shek Mun; Chevalier Garden; Heng On; Ma On Shan; and Lee On. Noise sources associated with stations include announcements, increases in local traffic, train idling noise, noise emissions from air conditioning units and various human activities. Noise propagation from platform announcements will depend upon the system design and consideration will need to be given to the acoustic design of stations and speaker systems at the detailed design stage to minimise noise at adjacent properties.

3.5.7 The Feasibility Design Standard noise levels from the roof mounted air conditioning system of the proposed trains has been specified as 68 dB(A) at a distance of 5 m. It is possible that this may lead to adverse impacts at surrounding NSRs due to the directivity of the source and the geometry between the site source and the NSR. NSRs close to the proposed stations with a direct line of sight to the trains may be impacted. Since the detailed layout and the design of the proposed stations are not available in this stage of the study, noise attenuation from station structures cannot be accurately assessed and should, therefore, be addressed in the detailed design stage.

Maintenance Work

3.5.8 In general, the main source of noise from maintenance work will be track grinding. This operation will take place along the entire track length before the railway opens, and thereafter periodically. This is an unavoidably noisy operation. Once the railway becomes operational, track grinding is likely to be carried out at night during times of low train frequency. It should be noted that although this is a potentially noisy task, the noise will last only a short time at any one location, whilst the ensuing benefit in reduced rolling noise will be long term.

3.5.9 It is expected that the impacts arising from the maintenance operations at the depot will be controlled under the NCO and that appropriate mitigation will be applied to reduce impacts to similar levels to those experienced from existing Hong Kong railways. Ballast tamping and rail grinding will be required, on average once and twice a year respectively; this work must be carried out at night when the MOS Rail is not operational.

Transformers and Traction Sub-stations

3.5.10 Transformers and substations are needed to provide the power supply for the railway. Magnetostrictive forces inside the transformer core result in noise emissions which can be intrusive, due to their tonal nature. Other noise sources include transformer cooling and motor generator sets. Since information regarding the noise emissions from transformers and traction sub-stations are not available at this stage of the Study, noise assessment on this issue should be carried out at a later design stage when sufficiently detailed information is available.

Tai Wai Depot

3.5.11 The Tai Wai Depot will provide stabling and maintenance facilities for the majority of the MOS Rail trains. The facilities most likely to be a potential noise source in the depot site include the following:

- maintenance shed for passenger stock;
- running maintenance shed;
- heavy maintenance shed for EMUs;
- workshop and stores building;
- underfloor wheel lathe; and
- train washer.

3.5.12 External sources of noise likely to be produced by the depot operation include;

- announcements and human noise;
- train whistles;
- train rolling noise (and potentially wheel squeal) in the fan and stabling areas; and
- noise from train mounted ancillary equipment in the fan and stabling areas.

3.5.13 Information concerning the activities within the depot and the potential noise sources are not available and, therefore, quantitative assessment cannot be undertaken in this feasibility stage. However, the impacts from the depot are expected to fall within the established criteria as the maintenance works will be carried out within the depot building and will be required to meet the NCO requirements.

Station Related Developments

3.5.14 The proposed developments at Tai Wai, Sha Tin Tau and Lee On may be affected by noise from road traffic and train noise from MOS Rail. The development at Tai Wai will also be exposed to noise from the KCR alignment.

Train Noise Assessment Methodology

Source Noise Level

3.5.15 The rolling stock noise emission data used for this assessment are based on the Feasibility Study Design Standards and other similar planned rail systems in Hong Kong. They are as follows:

- L_{Amax} 80 dB at 25 m with a train speed of 80 kph, on continuously welded rail and ballasted track.

3.5.16 A 3 dB(A) increase has been added to the above standard to allow for some operational deterioration of the wheel/rail interface. This results in a sound exposure level (SEL) for a four-car train length of 89.7 dB(A) at 25 m and a train speed of 80 kph. The SEL is the total sound energy of a single train bypass expressed over one second and forms the basis of the calculation of $L_{Aeq(period)}$.

3.5.17 The overall noise levels predicted have been increased by 5 dB(A) to account for possible levels of re-radiated noise arising from structure borne vibration in elevated sections of the railway. The elevated sections are also assumed to be constructed with a 1 m high parapet which will act as a track side noise barrier.

Operating Conditions

3.5.18 A maximum operating speed of 80 kph has been assumed between stations on the proposed MOS Rail. Velocity gradients in the vicinity of stations have been calculated based on typical acceleration profiles for MTRC rolling stock. These preliminary velocity gradients are as follows:

- +1 m s^{-2} from 0 to 40 kph;
- +0.8 m s^{-2} from 40 to 80 kph; and
- -0.8 m s^{-2} from 80 to 0 kph.

3.5.19 The train headways during the peak hour have, based on the Feasibility Design Study, been assumed to be 2.5 minutes, a daytime off-peak headway of 5 minutes and night-time (early morning and late evening) of 6 minutes were also assumed. Thus there would be 24 trains travelling from Hin Keng to Lee On during the morning or evening peak hour.

Modelling Methodology

3.5.20 Train noise assessment is based on the *SoundPLAN* Modelling Package using the *Calculation of Railway Noise, UK Department of Transport, 1995* (CRN) methodology. $L_{Aeq(period)}$ noise levels presented in noise contours were modelled to assess the area of influence of operational train noise from MOS Rail. Noise levels at selected NSRs were then calculated to assess the extent of mitigation required to protect the worst affected NSRs. The night-time NCO limit (ie. 60 dB(A)) is more stringent than the $L_{Aeq\ (24\text{-hour})}$ limit (ie. 65 dB) as defined in HKPSG and, therefore, once the NCO criteria is met, the HKPSG guideline limit will have been satisfied.

3.5.21 The calculations have taken into account the various noise propagation factors identified in CRN, namely noise attenuation due to distance, screening effects from parapet walls and intervening building structures, corrections for angle of view, façade reflections and track bed conditions. Noise levels over 18-hour and 6-hour periods calculated by the CRN procedure have been revised by calculation to suit the time periods specified by the TM (30 minutes during the night-time) and HKPSG (24-hour) and the timetable during these periods.

3.5.22 The Feasibility Study Design alignment of MOS Rail was digitised into the model and the vertical and horizontal alignment was divided into 100 m segments, with the surrounding terrain and built environment input into the model. Buildings close to the proposed alignment were defined in the model to evaluate the effect of screening and reflection of noise. Source noise levels at 25 m and adjusted velocity gradients within the proximity of stations, were inputted to the model for subsequent model runs. Numerical files and the graphical outputs were then studied to identify over which sections of the alignment train movements were predicted to generate noise impacts in excess of the established criteria. Environmental considerations and mitigation measures were then developed to minimize the likely impacts from train noise.

3.5.23 The selection of NSRs for the evaluation of mitigation measures required were based on the predicted noise contours and the distance of NSRs from the alignment within each section of the proposed railway. It is expected that those NSRs close to the proposed stations would not be impacted due to the reduced train speed and the screening effect of the station structure. NSRs located within approximately 70 m of the alignment were found to be potentially impacted by operational train noise. Representative NSRs within this band were then defined in the model for detailed assessment to develop the mitigation measures required to meet the noise criteria.

Prediction of Train Noise Impacts

3.5.24 The results of train noise modelling are shown graphically in the form of noise contours in *Figures 3.5a-3.5i*. These figures show façade noise level contours ($L_{eq,\,30\,min}$ dB(A) for the worst night-time noise impacts at the receiver height over the digital grid map generated by the model.

3.5.25 Since the noise levels at the façade of the NSRs will vary with receiver height, further assessment was undertaken at the representative NSRs located within the predicted mitigation contour ($L_{eq\,30\,min}$ 60 dB(A). Predicted noise levels at the selected NSRs are shown in *Table 3.5a*. Façade noise levels at the NSRs at the worst affected receiver levels were calculated using the *SoundPLAN* model. The night-time $L_{Aeq\,(30\,min)}$ levels as well as the $L_{Aeq\,(24\,hours)}$ levels were compared with the relevant criteria to assess the likely impacts from the railway scheme. The extent of mitigation measures required are then evaluated based on the noise exceedance of the relevant NCO and HKPSG limits at the NSRs.

3.5.26 Although schools in the vicinity of the alignment are not night-time sensitive, the $L_{Aeq\,(24\,hours)}$ level at these NSRs should be within the HKPSG guideline limit.

Table 3.5a Predicted Noise Levels (dB(A)) at Selected NSRs in Operational Phase

Noise Sensitive Receivers		Horizontal Separation (m)	Receiver Height (+mPD)	$L_{Aeq\,(24\,hours)}$	Night-time $L_{Aeq\,(30\,min)}$
Noise Criterion (dB(A))				65	60
Tai Wai to Sha Tin Tau					
N16	Lei Uk Tsuen nos. 12-15	55	21	**66**	**66**
Sha Tin Tau to Sha Kok Street					
N21	Sha Tin Tau no. 3	30	16	61	61
N24	Immaculate Heart of Mary College	30	13	65	N/A
N25	Ming Yan Lau	40	27	**68**	**68**
N26	Pok Man House	20	37	**73**	**73**
N27	Tin Ka Ping Salvation Army Primary School	20	13	65	N/A
Sha Kok Street to City One Shatin					
N32	Oriole House	50	48	63	**62**
N33	Sha Tin Wai nos. 1-2	60	21	65	**65**
N34	Ashley Garden	10	31	**75**	**75**
N37	Wong UK Village nos. 17-18	10	13	**68**	**67**
N38	Green Leave Garden Block B	40	48	**70**	**70**
N39	Prince of Wales Hospital	50	64	**66**	**66**
N40	Pamela Youde Child Assessment Centre and School Dental Clinic	20	21	63	**63**

Noise Sensitive Receivers		Horizontal Separation (m)	Receiver Height (+mPD)	$L_{Aeq\ (24\ hours)}$	Night-time $L_{Aeq\ (30\ min)}$
City One Shatin to Shek Mun					
N43	Yow Kam Yuen Prevocational School	20	13	51	N/A
N45	Yuen Chau Kok THA (Cleared)	50	21	59	59
N48	City One Shatin Block 33	60	59	**68**	**67**
Shek Mun to Chevalier Garden					
N51	Pictorial Garden Juniper Court	50	31	**66**	**65**
N52	Sha Tin Hospital	45	21	64	**64**
N53	Fishermen's New Village no. 113	65	21	65	**65**
NA	Development north of Chevalier Garden	90	49	**66**	**66**
Chevalier Garden to Heng On					
NB	Development north-east of Chevalier Garden	40	49	**68**	**68**
N59	Ngan On House	45	49	65	**65**
N62	Hing On THA	55	21	**66**	**66**
Heng On to Ma On Shan					
N64	Fok On Garden	35	49	**67**	**67**
N65	Sun Shine City Block L	65	62	63	**63**
N70	Ma On Shan Centre Block 1	25	62	63	**62**
N73	Fu Fai Garden Block 1	35	51	62	**62**
N75	Villa Athena Block 1	45	62	64	**64**
Ma On Shan to Lee On					
N76	Villa Athena Block 5	30	40	**68**	**68**
N78	Saddle Ridge Garden Block 5	55	62	57	57
N80	Kam Lung Court Lung Sing House	40	62	61	**61**
N81	Wu Kwai Sha New Village nos. 1-12	65	21	47	47
N82	Lee On Estate Lee Wing House	25	38	**69**	**69**

Note : Figures in Bold represent noise exceedances.

Evaluation of Impacts

3.5.27 The modelling results shown in *Table 3.5a* show that without mitigation, adverse noise impacts, in exceedance of the established criteria, would be likely at some of the NSRs close to the MOS Rail alignment. From Hin Keng to Tai Wai, potential noise impacts from operational train noise are not expected due to the buffer distance and the operational characteristics of the trains. However, within the section from Tai Wai to Sha Tin Tau, Lei Uk Tsuen nos. 12-15 would be impacted by the operational train noise which exceeds the night-time noise limit by 6 dB(A). Suitable mitigation measures should, therefore, be incorporated into the engineering design of the proposed railway.

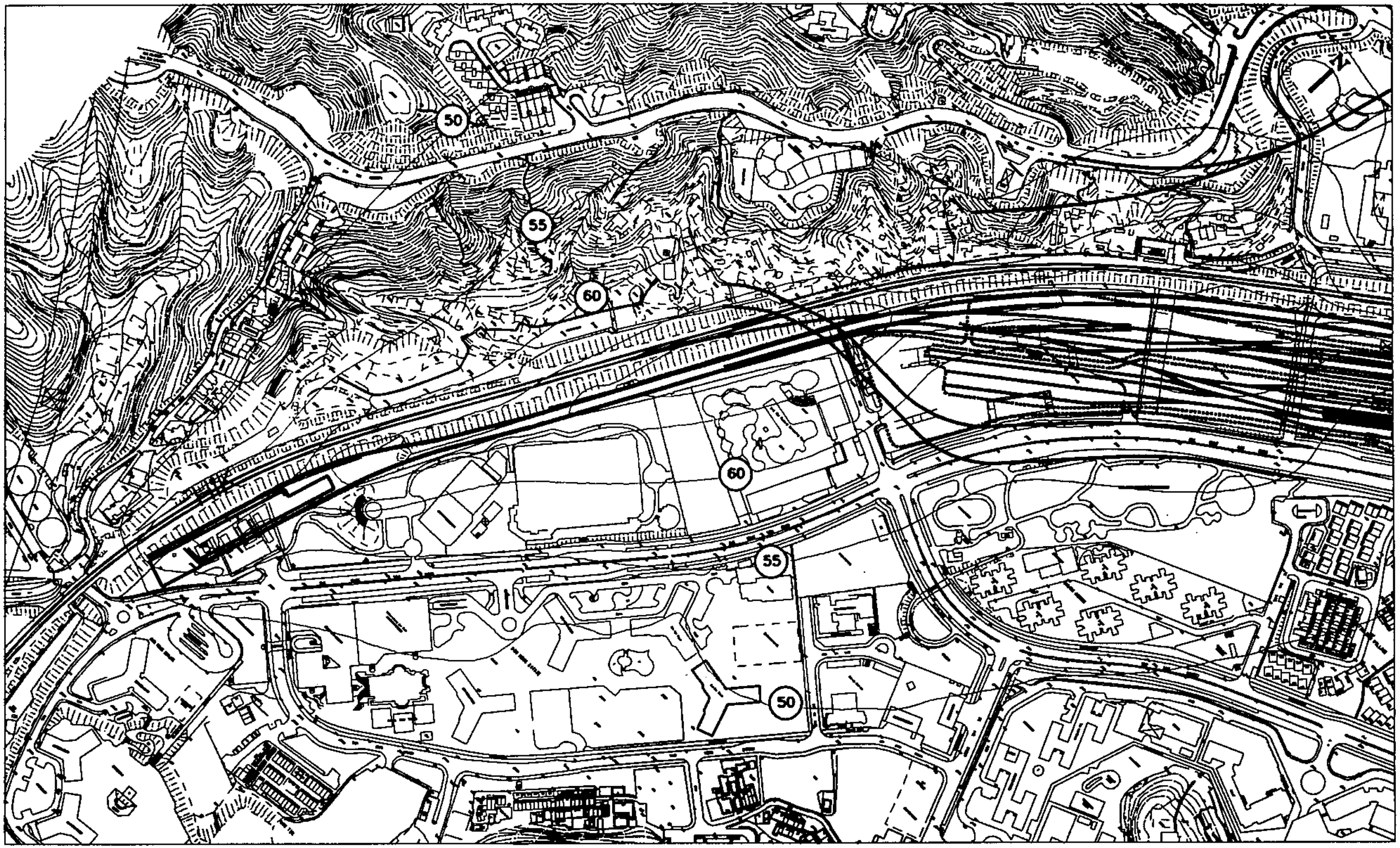

FIGURE 3.5a - Night Time Leq (30 mins) dB(A) Contours

(Hin Keng to Tai Wai)

Date : 15 Oct 1996

Drawing No.: /Contract/C1435/C1435_24

Sources: 1:1000 Digitized Survey Sheet, Buildings and Lands Department

Scale: 1:5000

Prepared by ERM's GIS & MAPPING Group

KEY

(line)	Alignment
(box)	Station Site
(thin line)	Noise Contour
60	Noise Contour dB(A)

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

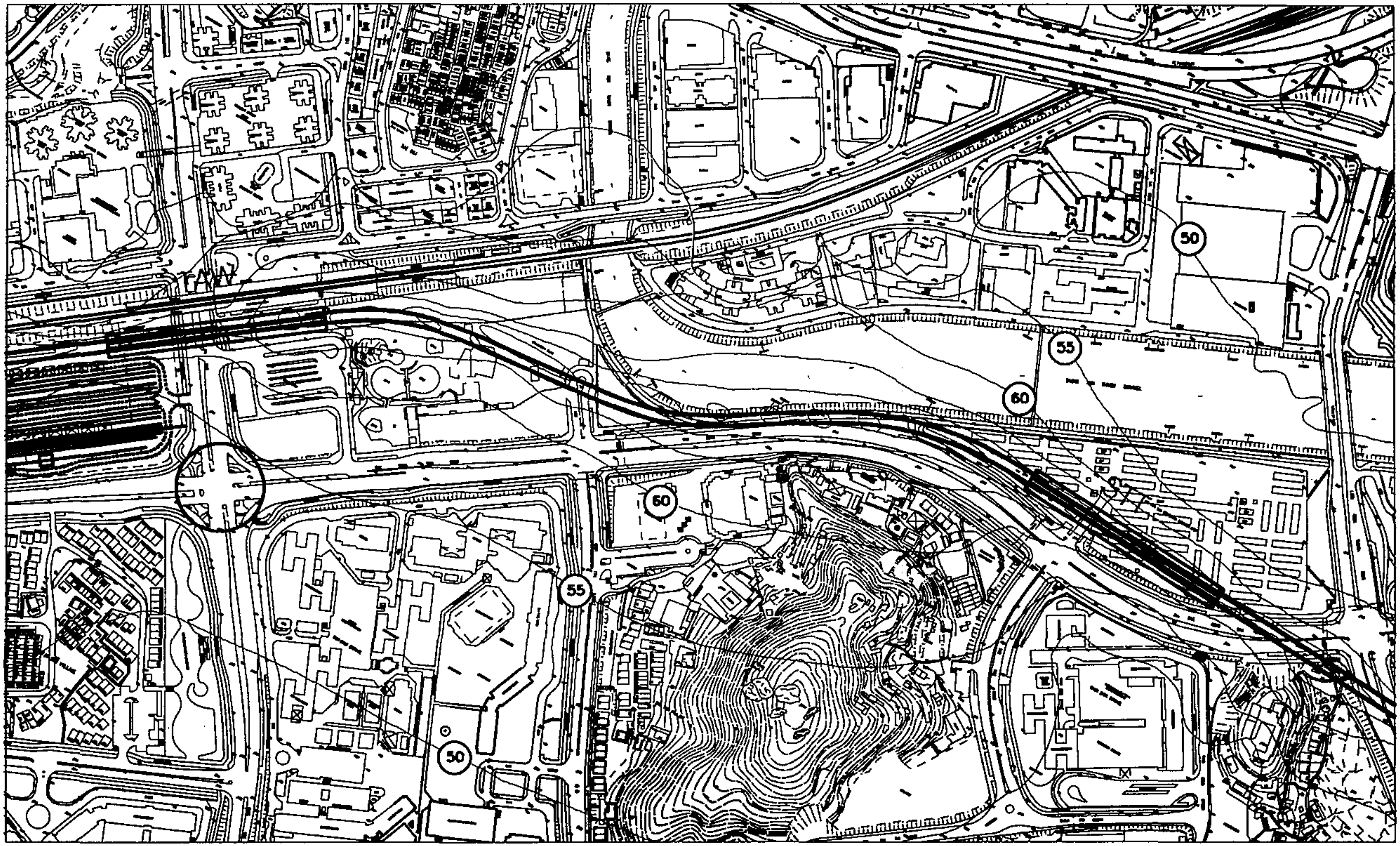

FIGURE 3.5b - Night Time Leq (30 mins) dB(A) Contours

(Tai Wai to Sha Tin Tau)

Date : 15 Oct 1996

Drawing No.: /Contract/C1435/C1435_25

Sources: 1:1000 Digitized Survey Sheet, Buildings and Lands Department

Scale: 1:5000

Prepared by ERM's GIS & MAPPING Group

KEY

	Alignment
	Station Site
	Noise Contour
60	Noise Contour dB(A)

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

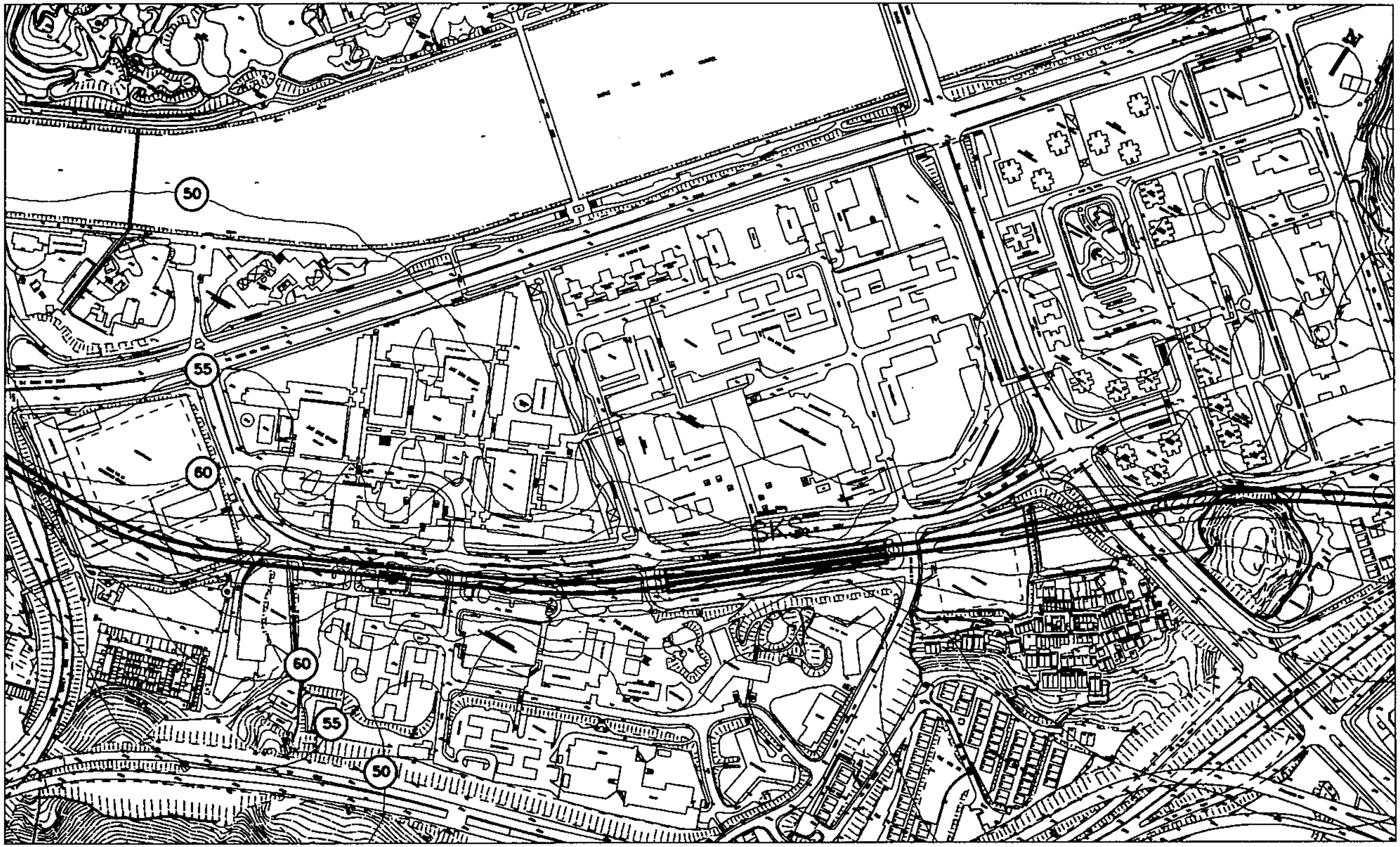

FIGURE 3.5c - Night Time Leq (30 mins) dB(A) Contours

(Sha Tin Tau to Sha Kok Street)

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_26

Sources: 1:1000 Digitized Survey Sheet, Buildings and Lands Department
Scale: 1:5000

Prepared by ERM's GIS & MAPPING Group

KEY

Alignment

Station Site

Noise Contour

60 Noise Contour dB(A)

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

FIGURE 3.5d - Night Time Leq (30 mins) dB(A) Contours

(Sha Kok Street to City One Shatin)

Date : 15 Oct 1996 | Drawing No.: /Contract/C1435/C1435_27

Sources: 1:1000 Digitized Survey Sheet, Buildings and Lands Department

Scale: 1:5000

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KEY

- Alignment
- Station Site
- Noise Contour
- (60) Noise Contour dB(A)

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

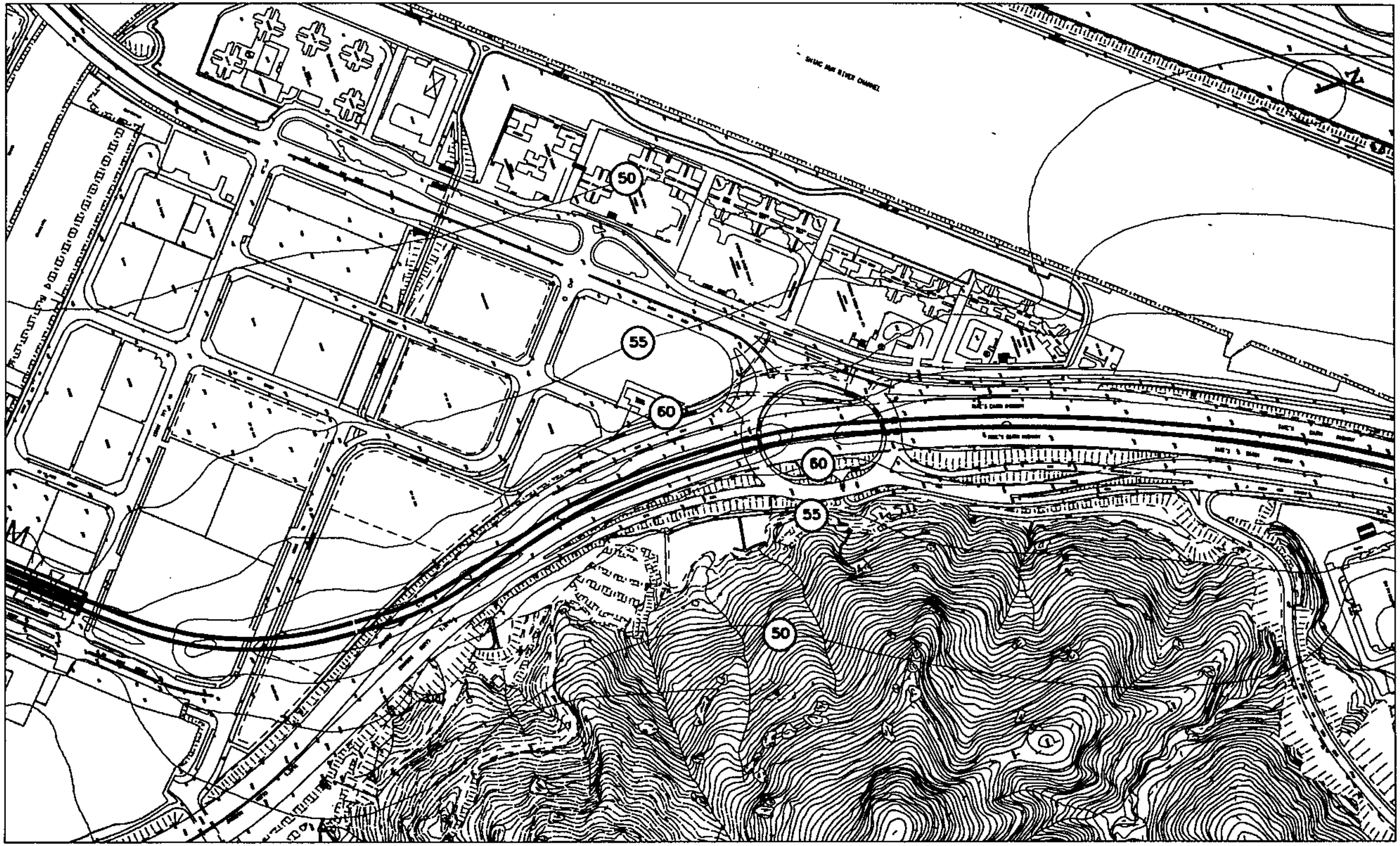

FIGURE 3.5e - Night Time Leq (30 mins) dB(A) Contours

(City One Shatin to Shek Mun)

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_28

Sources: 1:1000 Digitized Survey Sheet, Buildings and Lands Department
Scale: 1:5000

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- Station Site
- Noise Contour
- 60 Noise Contour dB(A)

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

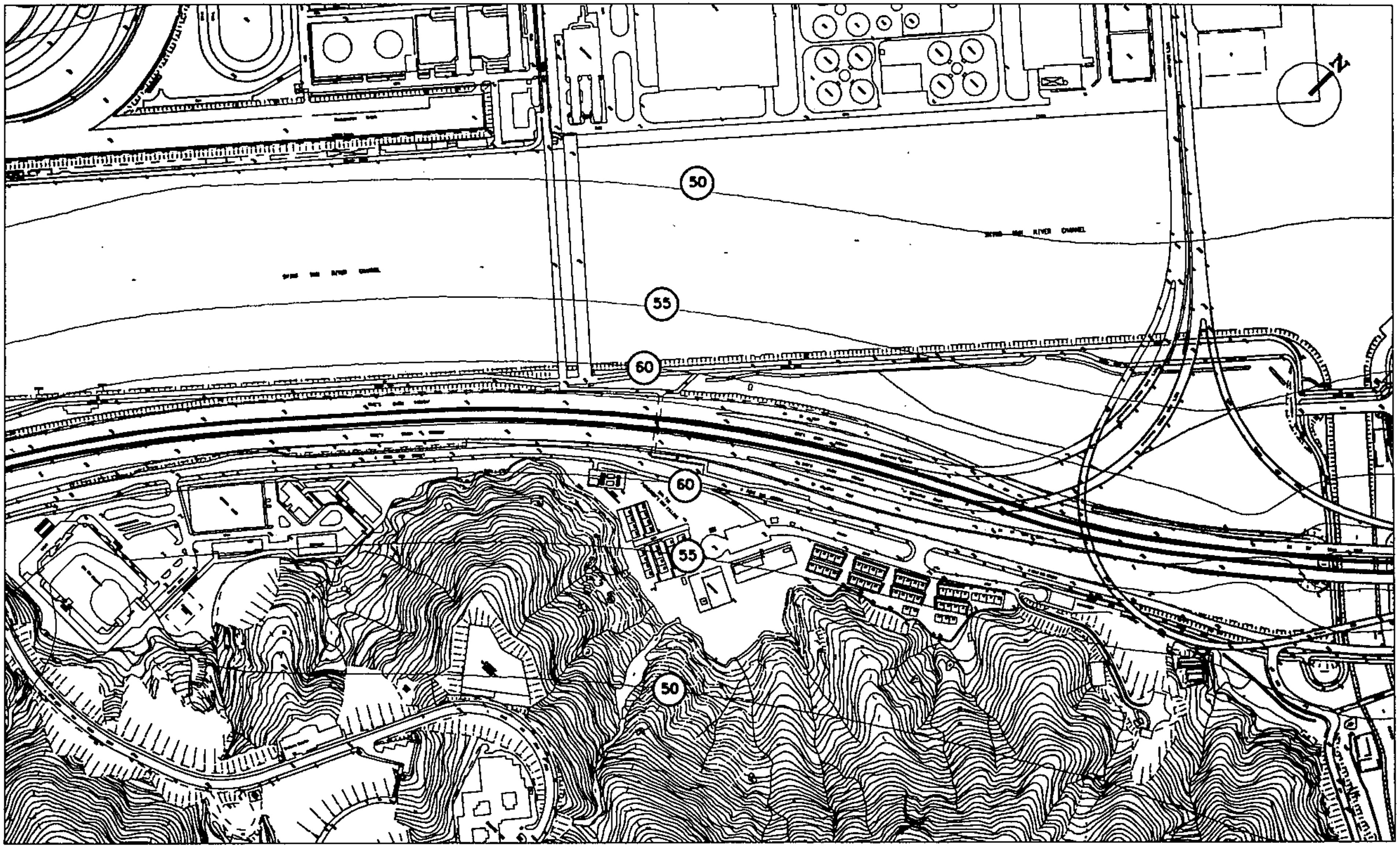

FIGURE 3.5f - Night Time Leq (30 mins) dB(A) Contours

(Shek Mun to Chevalier Garden)

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_29

Sources: 1:1000 Digitized Survey Sheet, Buildings and Lands Department
Scale: 1:5000

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- Station Site
- Noise Contour
- (60) Noise Contour dB(A)

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

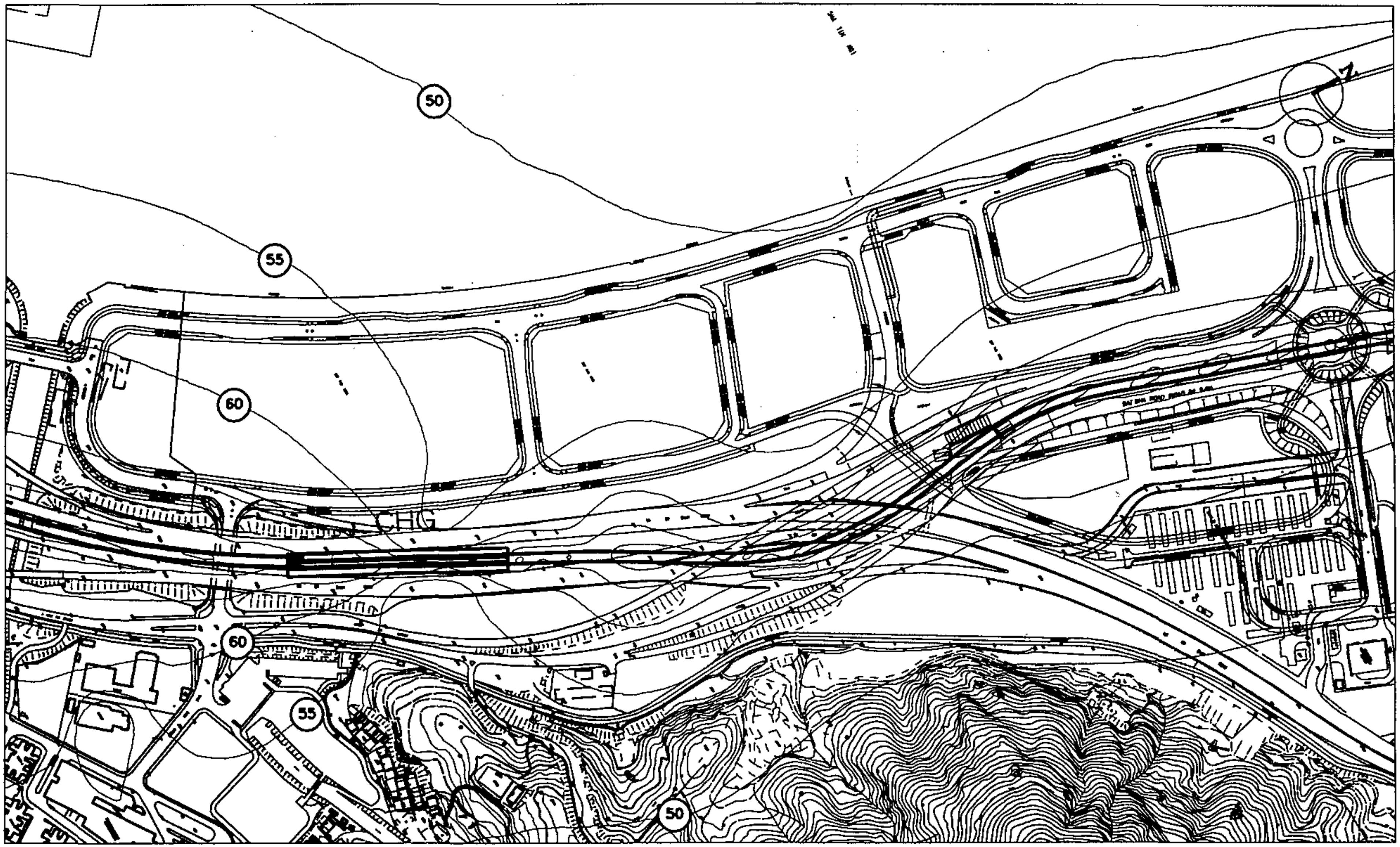

FIGURE 3.5g - Night Time Leq (30 mins) dB(A) Contours

(Chevalier Garden to Heng On)

Date : 15 Oct 1996 | Drawing No.: /Contract/C1435/C1435_30

Sources: 1:1000 Digitized Survey Sheet, Buildings and Lands Department

Scale: 1:5000

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KEY

- Alignment
- Station Site
- Noise Contour
- 60 Noise Contour dB(A)

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

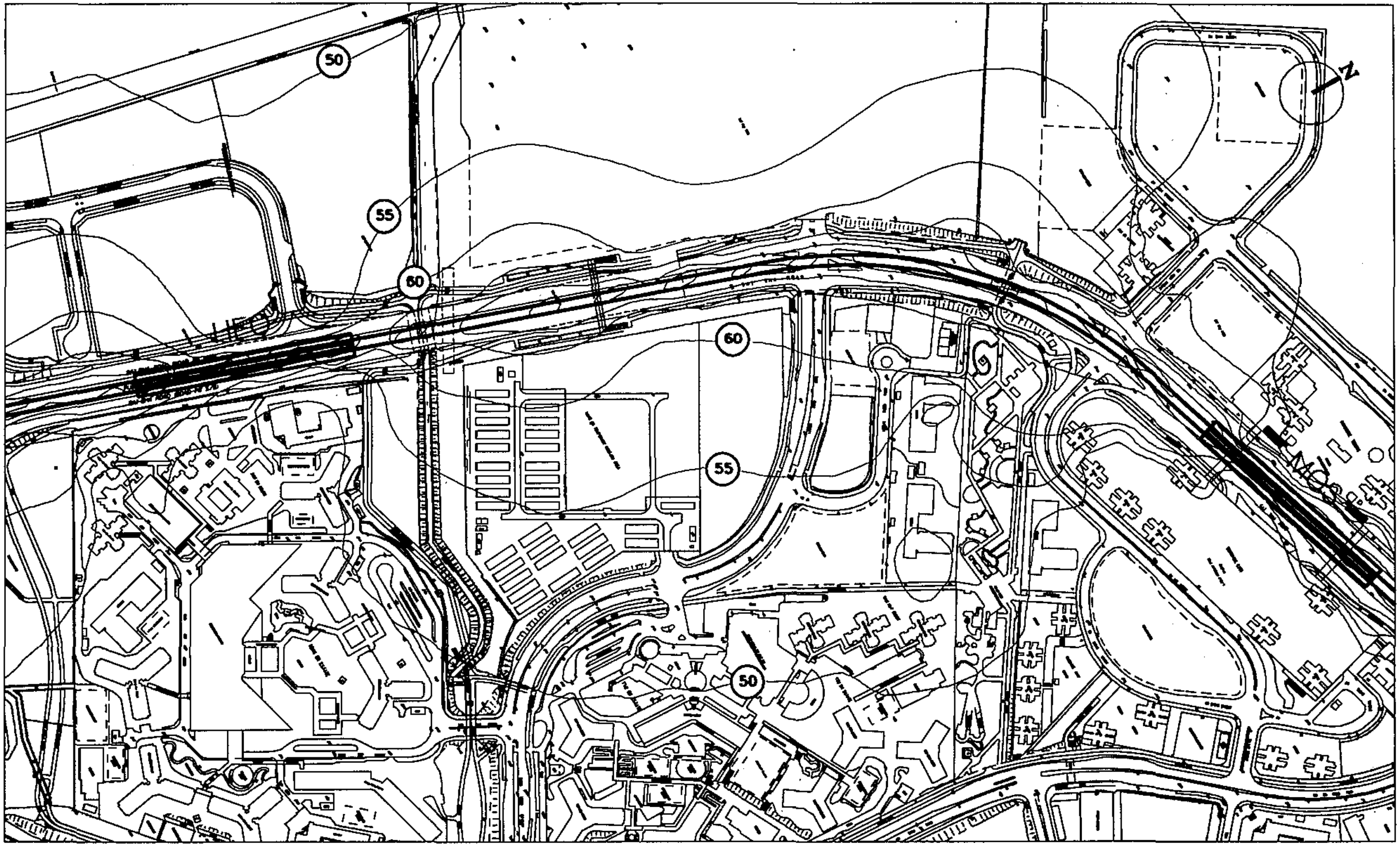


FIGURE 3.5h - Night Time Leq (30 mins) dB(A) Contours

(Heng On to Ma On Shan)

Date : 15 Oct 1996

Drawing No.: /Contract/C1435/C1435_31

Sources: 1:1000 Digitized Survey Sheet, Buildings and Lands Department

Scale: 1:5000

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- Station Site
- Noise Contour
- (60) Noise Contour dB(A)

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

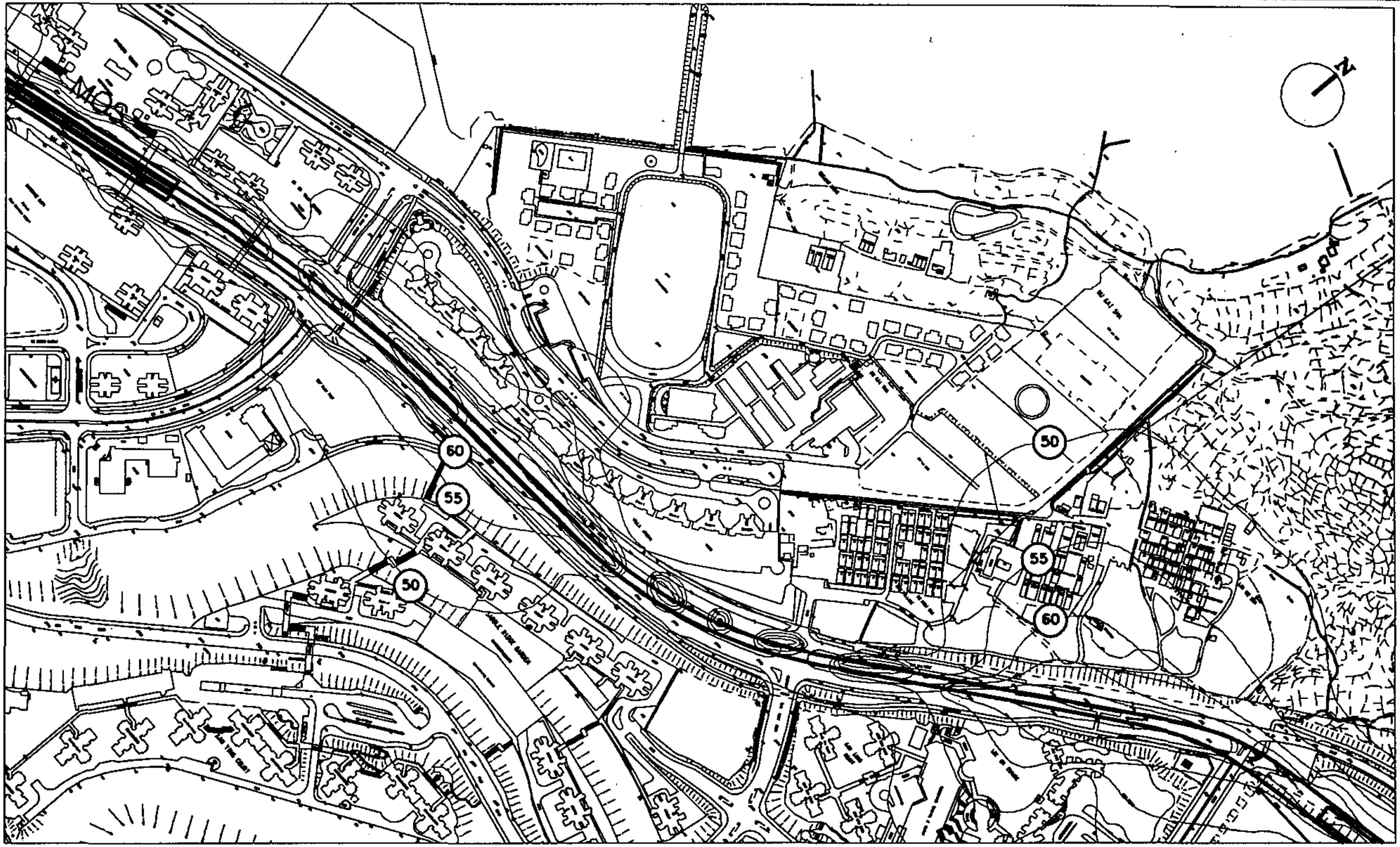


FIGURE 3.5i - Night Time Leq (30 mins) dB(A) Contours (Ma On Shan to Lee On)

Date : 15 Oct 1996

Drawing No.: /Contract/C1435/C1435_32

Sources: 1:1000 Digitized Survey Sheet, Buildings and Lands Department

Scale: 1:5000

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- Station Site
- Noise Contour
- (60) Noise Contour dB(A)

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

3.5.28 Train noise impacts would be significant within the sections from Sha Tin Tau to City One Shatin where the alignment is close to existing residential developments. Noise exceedances up to 15 dB(A) beyond the night-time noise criterion were predicted. A noise level of 75 dB(A) was predicted at Ashley Garden within the section from Sha Kok Street to City One Shatin; and a noise level of 73 dB(A) was predicted at Pok Man House in the section from Sha Tin Tau to Sha Kok Street.

3.5.29 Other areas of concern include: the section from Shek Mun to Chevalier Garden where the trains would be operating under full speed at grade along the central reservation; from Chevalier Garden to Heng On where the alignment could be overlooked by the new developments to the north; the section from Ma On Shan to Lee On over Sai Sha Road where trains will be operating at high speed; and at Lee On Estate. Effective mitigation measures should be applied to protect these NSRs from train noise impacts.

Mitigation Measures

3.5.30 As discussed above, effective mitigation measures are required to reduce predicted noise levels to within the identified criteria. CRN identifies that in order to achieve a noise reduction of up to 20 dB(A), noise barriers should have a superficial density of at least 16 kg m^{-2}. The standard viaduct parapet will provide a 1 m high noise barrier and this will be surmounted by addition barriers as appropriate. 20 mm thick panels of Plexiglas, a proprietary clear acrylic material, have a superficial density of 21.4 kg m^{-2} and would provide sufficient noise mitigation. Where applicable, the lower sections of the barriers will be fitted with a 75 mm thick absorptive lining to reduce impacts from noise reflected back off the inside face of the barriers.

3.5.31 The following forms of mitigation have been considered to control the predicted exceedances:

- standard reflective track side barriers 1.5 m high similar to the 1 m standard viaduct parapet design;

- high-sided track side barriers, 2.5 m to 3.5 m high, with acoustic absorptive lining on the inner face of the lower portion, which is similar to the standard track side barriers of 1.5 m high, the upper section is transparent;

- centerline barriers of 1 or 1.5 m high, both sides lined with absorptive material, in combination with track side barriers of 1.5 m, 2.5 m or 3.5 m high as described above; and

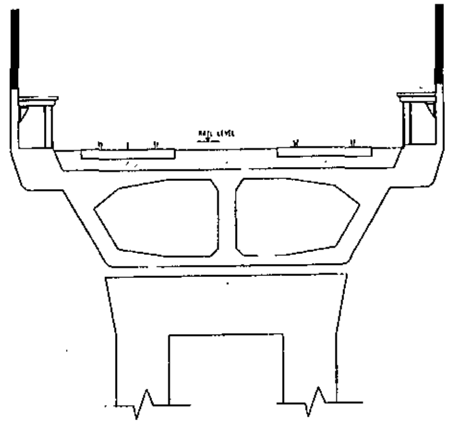
- either partial (ie. absorptive cantilever barriers with one side open) or total enclosure.

3.5.32 The suggested mitigation measures (see *Figure 3.5j*) were incorporated into the SoundPLAN model and the noise levels at the NSRs shown exposed to exceedances in *Table 3.5a* were calculated. The assessment of the mitigated noise levels are presented in *Tables 3.5b-d* below for 1.5 m, 2.5 m and 3.5 m track side barriers.

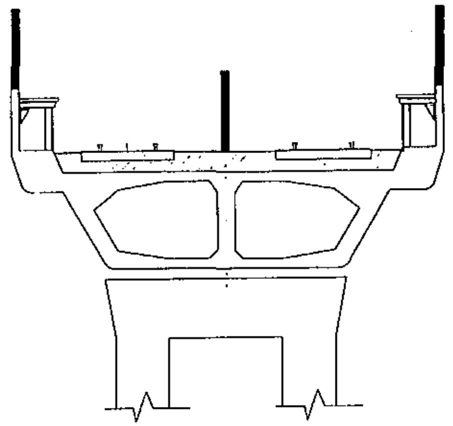
Table 3.5b Mitigated Noise Levels (dB(A)) at Selected NSRs - 1.5 m Track Side Barriers

Noise Sensitive Receivers		Horizontal Separation (m)	Receiver Height (+mPD)	$L_{Aeq\,(24\,hours)}$	Night-time $L_{Aeq\,(30\,min)}$
Noise Criterion (dB(A))				65	60
Tai Wai to Sha Tin Tau					
N16	Lei Uk Tsuen nos. 12-15	55	21	65	**65**
Sha Tin Tau to Sha Kok Street					
N21	Sha Tin Tau no. 3	30	16	58	57
N25	Ming Yan Lau	40	49	**67**	**67**
N26	Pok Man House	20	21.5	**72**	**72**
Sha Kok Street to City One Shatin					
N32	Oriole House	50	59	62	**62**
N33	Sha Tin Wai nos. 1-2	60	21	62	**62**
N34	Ashley Garden	10	26	**75**	**75**
N37	Wong UK Village nos. 17-18	10	13	65	**65**
N38	Green Leave Garden Block B	40	59	**69**	**69**
N39	Prince of Wales Hospital	50	64	**66**	**66**
N40	Pamela Youde Child Assessment Centre and School Dental Clinic	20	21	60	60
City One Shatin to Shek Mun					
N48	City One Shatin Block 33	60	39	**68**	**67**
Shek Mun to Chevalier Garden					
N51	Pictorial Garden Juniper Court	50	44	64	**63**
N52	Sha Tin Hospital	45	42	60	60
N53	Fishermen's New Village no. 113	65	26	58	58
NA	Development north of Chevalier Garden	90	49	65	**65**
Chevalier Garden to Heng On					
NB	Development north-east of Chevalier Garden	40	38	**69**	**68**
N59	Ngan On House	45	38	64	**63**
N62	Hing On THA	55	21	63	**63**
Heng On to Ma On Shan					
N64	Fok On Garden	35	49	**66**	**66**
N65	Sun Shine City Block L	65	62	62	**62**
N70	Ma On Shan Centre Block 1	25	34.5	62	**62**
N73	Fu Fai Garden Block 1	35	40	63	**63**
N75	Villa Athena Block 1	45	62	65	**64**
Ma On Shan to Lee On					
N76	Villa Athena Block 5	30	42	**68**	**68**
N80	Kam Lung Court Lung Sing House	40	51	58	58
N82	Lee On Estate Lee Wing House	25	38	**69**	**69**

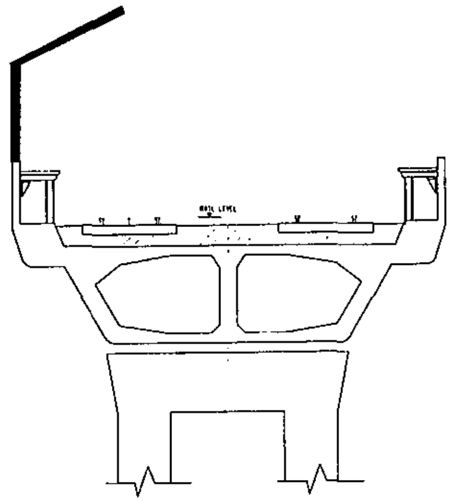
Note : Figures in Bold represent noise exceedances.



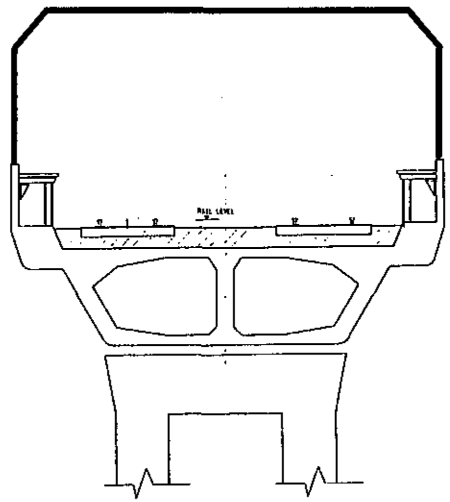
TRACK SIDE BARRIERS (1.5m - 3.5m)



TRACK SIDE BARRIERS (1.5m - 3.5m)
CENTERLINE BARRIERS (1m - 1.5m)



CANTILEVER BARRIERS



NOISE ENCLOSURE

FIGURE 3.5j - Typical Train Noise Mitigation Measures

Date : 19 Nov 1996	Drawing No.: /Contract/C1435/C1435_K

Sources :

Prepared by ERM's GIS & Mapping Group

KEY

Noise Mitigation Structure

ERM-Hong Kong, Ltd

6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

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Table 3.5c Mitigated Noise Levels (dB(A)) at Selected NSRs - 2.5 m Absorptive Track Side Barriers

Noise Sensitive Receivers	Horizontal Separation (m)	Receiver Height (+mPD)	$L_{Aeq\,(24\,hours)}$	Night-time $L_{Aeq\,(30\,min)}$
Tai Wai to Sha Tin Tau	Noise Criterion (dB(A))		65	60
N16 Lei Uk Tsuen nos. 12-15	55	21	61	60
Sha Tin Tau to Sha Kok Street				
N25 Ming Yan Lau	40	49	**68**	**68**
N26 Pok Man House	20	27	**72**	**72**
Sha Kok Street to City One Shatin				
N32 Oriole House	50	48	61	**61**
N33 Sha Tin Wai nos. 1-2	60	21	58	57
N34 Ashley Garden	10	31	**74**	**74**
N37 Wong UK Village nos. 17-18	10	13	62	**62**
N38 Green Leave Garden Block B	40	59	**66**	**66**
N39 Prince of Wales Hospital	50	64	64	**64**
City One Shatin to Shek Mun				
N48 City One Shatin Block 33	60	59	**68**	**68**
Shek Mun to Chevalier Garden				
N51 Pictorial Garden Juniper Court	50	42	63	**63**
NA Development N of Chevalier Garden	90	49	63	**63**
Chevalier Garden to Heng On				
NB Development NE of Chevalier Garden	40	49	**68**	**67**
N59 Ngan On House	45	49	62	**62**
N62 Hing On T.H.A.	55	21	58	58
Heng On to Ma On Shan				
N64 Fok On Garden	35	49	65	**65**
N65 Sunshine City Block L	65	62	56	56
N70 Ma On Shan Centre Block 1	25	42	61	**61**
N73 Fu Fai Garden Block 1	35	51	63	**63**
N75 Villa Athena Block 1	45	62	64	**63**
Ma On Shan to Lee On				
N76 Villa Athena Block 5	30	40	**68**	**67**
N82 Lee On Estate Lee Wing House	25	49	**67**	**67**

Note : Figures in **Bold** represent noise exceedances.

Track Side Barriers

3.5.33 Mitigated noise levels at the selected NSRs with track side noise barriers only are presented in *Tables 3.5b* and *3.5c*. 1.5 m track side barriers would be sufficient to protect: Sha Tin Tau No. 3 (N21); the Pamela Youde Child Assessment Centre and School Dental Clinic (N40); Sha Tin Hospital (N52); Fisherman's New Village No. 113 (N53) and Kam Lung Court Lung Sing House (N80). The mitigated night-time noise level at the NSRs would be reduced to 60 dB(A) or less, in compliance with the noise criterion. However, the criterion would still be exceeded at other identified NSRs, where improved measures would be required.

3.5.34 The use of 2.5 m absorptive track side barriers would mean that, the residential premises of Lei Uk Tsuen (N16), Sha Tin Wai nos. 1-2 (N33), Hing On THA (N62), and Sun Shine City Block L (N65) could be protected with all the noise limits satisfied.

3.5.35 The implementation of a further increase of the absorptive track side barrier height to 3.5 m, would allow Oriole House (N32), Wong Uk Village Nos. 17-18 (N37) and Ngan On House (N59) to be protected from adverse train noise impacts. However, for the remaining NSRs, further mitigation measures should be considered. The noise benefits from the use of centerline barriers with track side barriers, and the use of noise enclosure are discussed in the following sections.

Table 3.5d Mitigated Noise Levels (dB(A)) at Selected NSRs - 3.5 m Absorptive Track Side Barriers

Noise Sensitive Receivers	Horizontal Separation (m)	Receiver Height (+mPD)	$L_{Aeq (24 hours)}$	Night-time $L_{Aeq (30 min)}$
Noise Criterion (dB(A))			65	60
Sha Tin Tau to Sha Kok Street				
N25 Ming Yan Lau	40	49	65	**65**
N26 Pok Man House	20	37	**70**	**70**
Sha Kok Street to City One Shatin				
N32 Oriole House	50	59	60	60
N34 Ashley Garden	10	31	**73**	**73**
N37 Wong Ok Village nos. 17-18	10	13	60	60
N38 Green Leave Garden Block B	40	59	65	**65**
N39 Prince of Wales Hospital	50	64	61	**61**
City One Shatin to Shek Mun				
N48 City One Shatin Block 33	60	59	64	**64**
Shek Mun to Chevalier Garden				
N51 Pictorial Garden Juniper Court	50	52	62	**62**
NA Development N of Chevalier Garden	90	49	62	**61**
Chevalier Garden to Heng On				
NB Development NE of Chevalier Garden	40	49	64	64
N59 Ngan On House	45	49	61	60
Heng On to Ma On Shan				
N64 Fok On Garden	35	49	64	**64**
N70 Ma On Shan Centre Block 1	25	51	61	**61**
N73 Fu Fai Garden Block 1	35	62	62	**62**
N75 Villa Athena Block 1	45	62	61	**61**
Ma On Shan to Lee On				
N76 Villa Athena Block 5	30	50	**68**	**68**
N82 Lee On Estate Lee Wing House	25	49	65	**65**

Note : Figures in Bold represent noise exceedances.

Centerline Barriers with Track Side Barriers

3.5.36 The predicted noise levels with the use of absorptive centerline barriers with absorptive track side barriers in different combinations are shown in *Tables 3.5e-h*. It can be seen that no further NSRs could be protected from train noise impacts with the use of a combination of 1 m absorptive centerline barriers and 1.5 m absorptive track side barriers.

3.5.37 Additional noise benefits could be gained if the barrier height of track side barriers was increased to 2.5 m at Juniper Court of Pictorial Garden (N51) and Block 1 of the Ma On Shan Centre (N70). However, noise exceedances of up to 11 dB(A) over the night-time noise limit would still be likely for other selected NSRs in close proximity to the proposed railway scheme.

Table 3.5e Mitigated Noise Levels (dB(A)) at Selected NSRs - 1.5 m Absorptive Track Side Barriers with 1 m Absorptive Centerline Barriers

Noise Sensitive Receivers		Horizontal Separation (m)	Receiver Height (+mPD)	$L_{Aeq\ (24\ hours)}$	Night-time $L_{Aeq\ (30\ min)}$
Noise Criterion (dB(A))				65	60
Sha Tin Tau to Sha Kok Street					
N25	Ming Yan Lau	40	37	64	**64**
N26	Pok Man House	20	21.5	**72**	**72**
Sha Kok Street to City One Shatin					
N34	Ashley Garden	10	20.5	**73**	**73**
N38	Green Leave Garden Block B	40	59	**67**	**67**
N39	Prince of Wales Hospital	50	53	61	**61**
City One Shatin to Shek Mun					
N48	City One Shatin Block 33	60	39	**66**	**66**
Shek Mun to Chevalier Garden					
N51	Pictorial Garden Juniper Court	50	25.5	63	**63**
NA	Development north of Chevalier Garden	90	49	65	**65**
Chevalier Garden to Heng On					
NB	Development north-east of Chevalier Garden	40	38	**68**	**68**
Heng On to Ma On Shan					
N64	Fok On Garden	35	49	**66**	**66**
N70	Ma On Shan Centre Block 1	25	34.5	61	**61**
N73	Fu Fai Garden Block 1	35	40	62	**62**
N75	Villa Athena Block 1	45	62	62	**62**
Ma On Shan to Lee On					
N76	Villa Athena Block 5	30	29	**67**	**67**
N82	Lee On Estate Lee Wing House	25	38	**68**	**68**
Note :	Figures in **Bold** represent noise exceedances.				

Table 3.5f Mitigated Noise Levels (dB(A)) at Selected NSRs - 2.5 m Absorptive Track Side Barriers with 1 m Absorptive Centerline Barriers

Noise Sensitive Receivers		Horizontal Separation (m)	Receiver Height (+mPD)	$L_{Aeq\,(24\,hours)}$	Night-time $L_{Aeq\,(30\,min)}$
Noise Criterion (dB(A))				65	60
Sha Tin Tau to Sha Kok Street					
N25	Ming Yan Lau	40	49	**66**	**65**
N26	Pok Man House	20	27	**71**	**70**
Sha Kok Street to City One Shatin					
N34	Ashley Garden	10	47	**71**	**71**
N38	Green Leave Garden Block B	40	47	65	**65**
N39	Prince of Wales Hospital	50	64	61	61
City One Shatin to Shek Mun					
N48	City One Shatin Block 33	60	59	**66**	**66**
Shek Mun to Chevalier Garden					
N51	Pictorial Garden Juniper Court	50	52	59	59
NA	Development north-east of Chevalier Garden	90	49	63	**63**
Chevalier Garden to Heng On					
NB	Development north-east of Chevalier Garden	40	49	**67**	66
Heng On to Ma On Shan					
N64	Fok On Garden	35	49	64	**64**
N70	Ma On Shan Centre Block 1	25	42	60	60
N 73	Fu Fai Garden Block 1	35	51	61	**61**
N75	Villa Athena Block 1	45	62	61	**61**
Ma On Shan to Lee On					
N76	Villa Athena Block 5	30	40	65	**65**
N82	Lee On Estate Lee Wing House	25	49	**67**	**67**

Note : Figures in **Bold** represent noise exceedances.

3.5.38 If the track side barriers were increased to 3.5 m high, the Prince of Wales Hospital (N39), Fu Fai Garden Block 1 (N73) and Villa Athena Block 1 (N75) could be protected from exceedances of the statutory criteria. However, the criteria are still exceeded by up to 10 dB(A) at other NSRs.

3.5.39 Adverse impacts are still predicted in all sections from Sha Tin Tau to Lee On. Further control measures will be required and a combination of 1.5 m absorptive centerline barriers with 3.5 m absorptive track side barriers has been modelled (see *Table 3.5h*) to test the effectiveness of the mitigation scenario. However, only City One Shatin Block 33 (N48) could be protected from operational train noise impacts in excess of the statutory criteria with this mitigation measure. Absorptive cantilever barriers or noise enclosures have been considered as the next option.

Table 3.5g Mitigated Noise Levels (dB(A)) at Selected NSRs - 3.5 m Absorptive Track Side Barriers with 1 m Absorptive Centerline Barriers

Noise Sensitive Receivers		Horizontal Separation (m)	Receiver Height (+mPD)	$L_{Aeq\,(24\,hours)}$	Night-time $L_{Aeq\,(30\,min)}$
Sha Tin Tau to Sha Kok Street		Noise Criterion (dB(A))		65	60
N25	Ming Yan Lau	40	49	64	**64**
N26	Pok Man House	20	49	**68**	**68**
Sha Kok Street to City One Shatin					
N34	Ashley Garden	10	26	**70**	**70**
N38	Green Leave Garden Block B	40	59	64	**64**
N39	Prince of Wales Hospital	50	64	57	57
Shek Mun to Chevalier Garden					
NA	Development N of Chevalier Garden	90	49	62	**61**
Chevalier Garden to Heng On					
NB	Development NE of Chevalier Garden	40	37	62	**62**
Heng On to Ma On Shan					
N64	Fok On Garden	35	49	64	**64**
N73	Fu Fai Garden Block 1	35	62	61	60
N75	Villa Athena Block 1	45	62	59	59
Ma On Shan to Lee On					
N76	Villa Athena Block 5	30	50	65	**65**
N82	Lee On Estate Lee Wing House	25	49	65	**65**

Note : Figures in **Bold** represent noise exceedances.

Table 3.5h Mitigated Noise Levels (dB(A)) at Selected NSRs - 3.5 m Absorptive Track Side Barriers with 1.5 m Absorptive Centerline Barriers

Noise Sensitive Receivers		Horizontal Separation (m)	Receiver Height (+mPD)	$L_{Aeq\,(24\,hours)}$	Night-time $L_{Aeq\,(30\,min)}$
Noise Criterion (dB(A))				65	60
Sha Tin Tau to Sha Kok Street					
N25	Ming Yan Lau	40	49	63	**63**
N26	Pok Man House	20	49	**68**	**68**
Sha Kok Street to City One Shatin					
N34	Ashley Garden	10	37	**69**	**69**
N38	Green Leave Garden Block B	40	59	**64**	**64**
City One Shatin to Shek Mun					
N48	City One Shatin Block 33	60	64	**57**	**57**
Shek Mun to Chevalier Garden					
NA	Development N of Chevalier Garden	90	49	**61**	**61**
Chevalier Garden to Heng On					
NB	Development NE of Chevalier Garden	40	49	62	**61**
Heng On to Ma On Shan					
N64	Fok On Garden	35	49	64	**64**

Noise Sensitive Receivers	Horizontal Separation (m)	Receiver Height (+mPD)	$L_{Aeq\,(24\,hours)}$	Night-time $L_{Aeq\,(30\,min)}$
Ma On Shan to Lee On				
N76 Villa Athena Block 5	30	50	65	**65**
N82 Lee On Estate Lee Wing House	25	49	65	**65**
Note: Figures in **Bold** represent noise exceedances.				

Noise Enclosure or Absorptive Cantilever Barriers

3.5.40 The use of absorptive cantilever barriers or a noise enclosure is recommended to protect those NSRs which remain exposed to noise levels in excess of the statutory criteria. *Table 3.5i* shows the predicted noise levels at the NSRs with the use of absorptive cantilever barriers or noise enclosure which are all below the relevant noise limit by at least 4 dB(A).

Table 3.5i Mitigated Noise Levels (dB(A)) at Selected NSRs - Noise Enclosure or Absorptive Cantilever Barriers

Noise Sensitive Receivers	Horizontal Separation (m)	Receiver Height (+mPD)	$L_{Aeq\,(24\,hours)}$	Night-time $L_{Aeq\,(30\,min)}$
Noise Criterion (dB(A))			65	60
Sha Tin Tau to Sha Kok Street				
N25 Ming Yan Lau	40	27	51	50
N26 Pok Man House	20	49	55	54
Sha Kok Street to City One Shatin				
N34 Ashley Garden	10	15	56	56
N38 Green Leave Garden Block B	40	20.5	51	51
Shek Mun to Chevalier Garden				
NA Development N of Chevalier Garden	90	16	51	51
Chevalier Garden to Heng On				
NB Development NE of Chevalier Garden	40	16	51	51
Heng On to Ma On Shan				
N64 Fok On Garden	35	21	47	47
Ma On Shan to Lee On				
N76 Villa Athena Block 5	30	62	52	52
N82 Lee On Estate Lee Wing House	25	16	49	49

3.5.41 *Table 3.5j* summarises the noise insulation requirement for the proposed railway scheme in order to protect the surrounding sensitive uses. The approximate extent of the measures has been identified and *Figures 3.5k-r* show the extent of the suggested mitigation for MOS Rail. However, it is likely that the type, length and height of the recommended barriers will need to be refined during the detailed design stage.

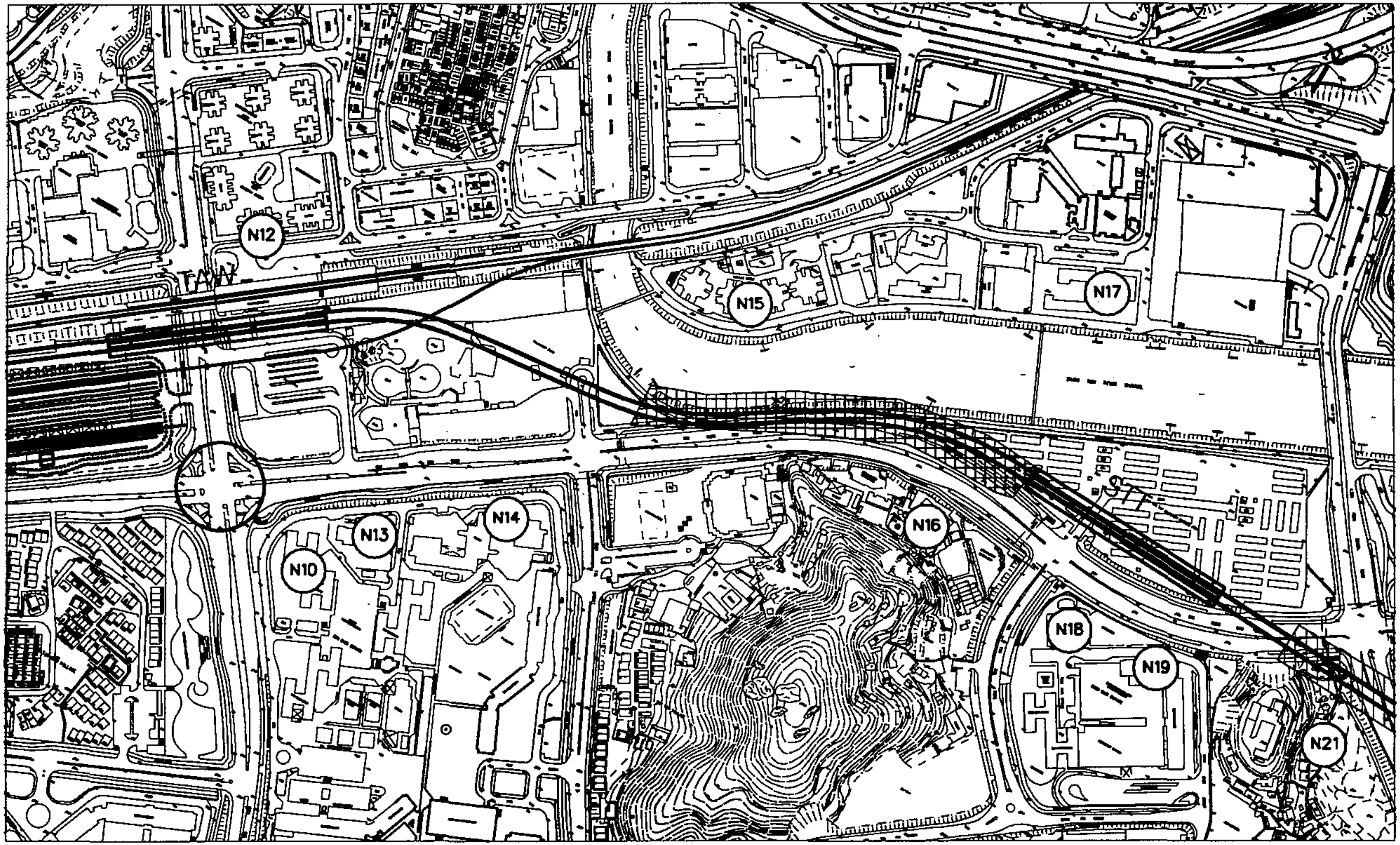

FIGURE 3.5k - Proposed Mitigation Measures -
Tai Wai to Sha Tin Tau

Date : 15 Oct 1996 | Drawing No.: /Contract/C1435/C1435_2a

Sources: 1:1000 Digitized Survey Sheet, Buildings and Lands Department
Scale: 1:5000

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- 1.5m Track Side Barriers
- 2.5m Track Side Barriers
- N1 Noise Sensitive Receiver

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Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

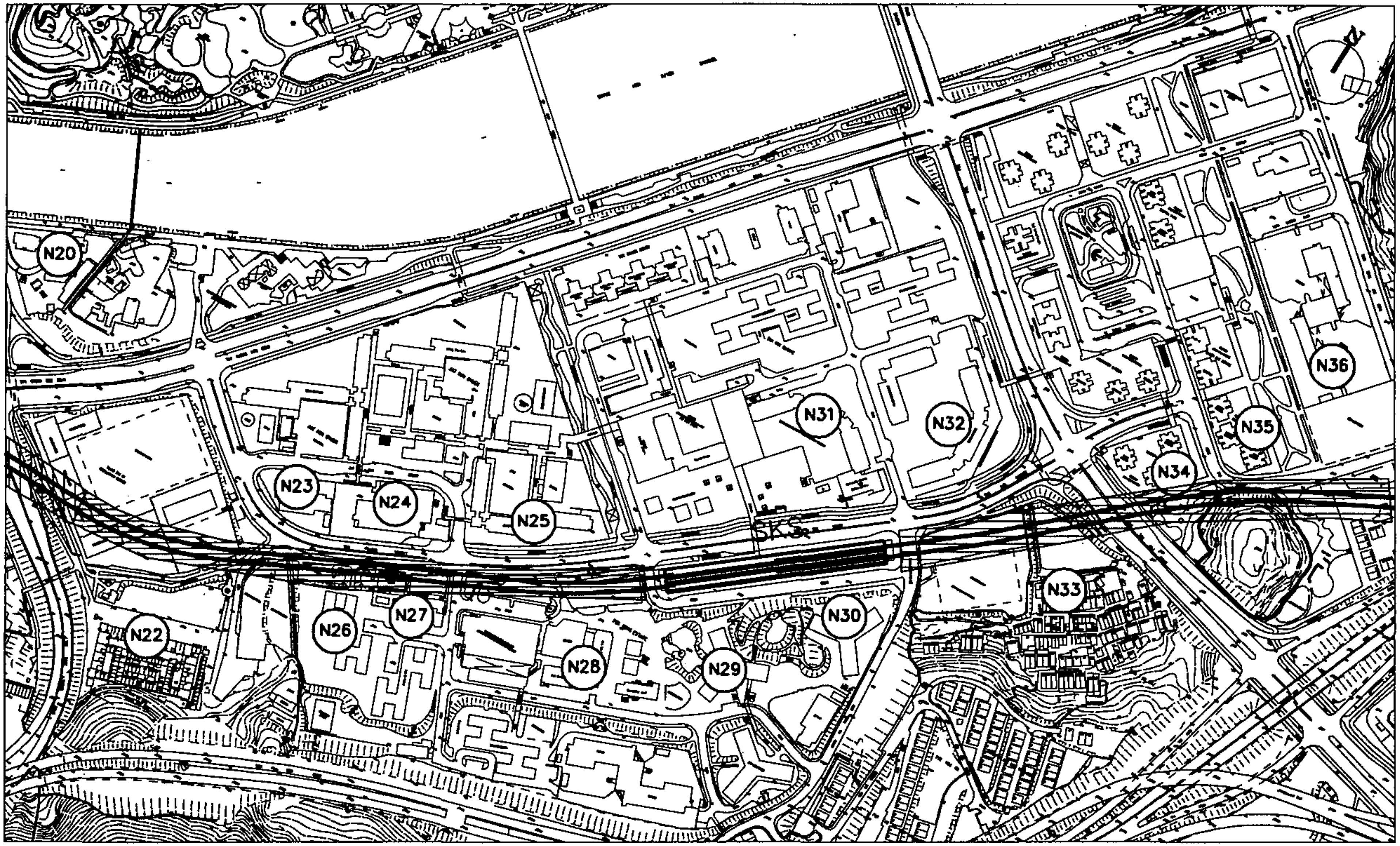

FIGURE 3.51 - Proposed Mitigation Measures -

Sha Tin Tau to Sha Kok Street

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_3a

Sources: 1:1000 Digitized Survey Sheet, Buildings and Lands Department
Scale: 1:5000

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KEY

- Alignment
- 1.5m Track Side Barriers
- Noise Enclosure
- N1 Noise Sensitive Receiver

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9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

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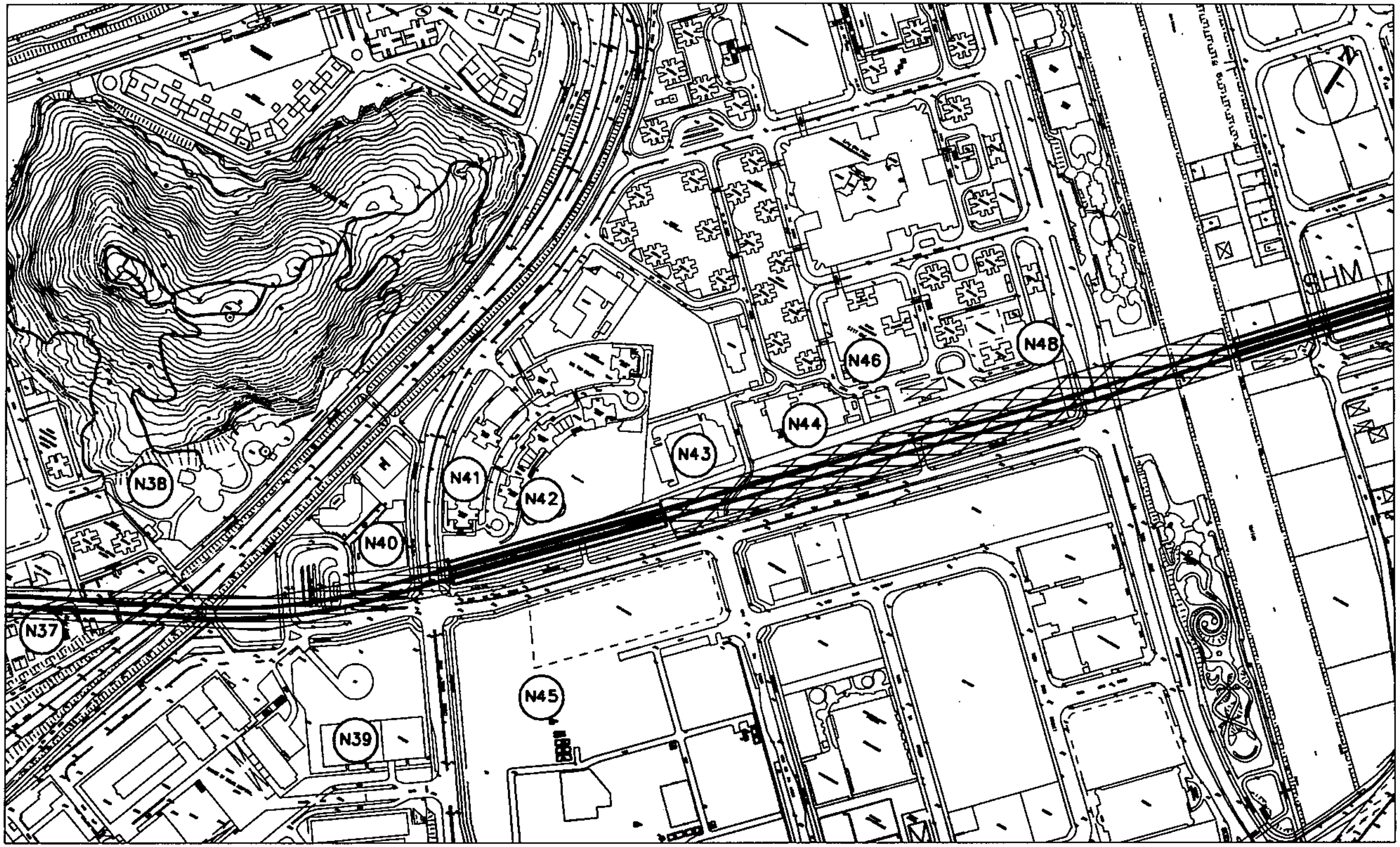

FIGURE 3.5m - Proposed Mitigation Measures -

Sha Kok Street to City One Shatin

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_4a

Sources: 1:1000 Digitized Survey Sheet, Buildings and Lands Department

Scale: 1:5000

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- Noise Enclosure
- 3.5m Track Side Barrier with 1.5m Centerline Barriers.
- N1 Noise Sensitive Receiver

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Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

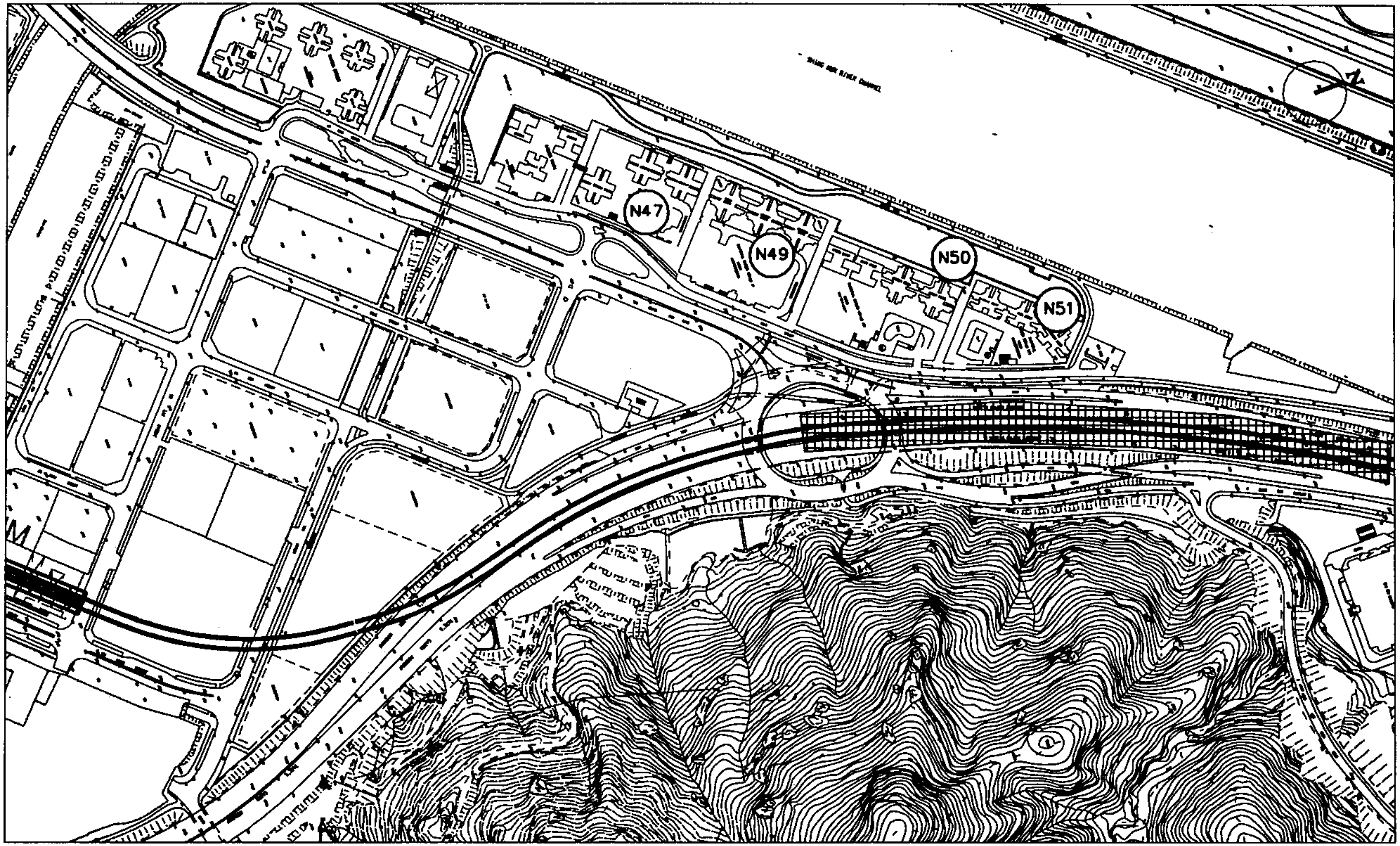

FIGURE 3.5n - Proposed Mitigation Measures - City One Shatin to Shek Mun

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_5a
Sources :	

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- 2.5m Track Side Barriers with 1m Centerline Barriers.
- N1 Noise Sensitive Receiver

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6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

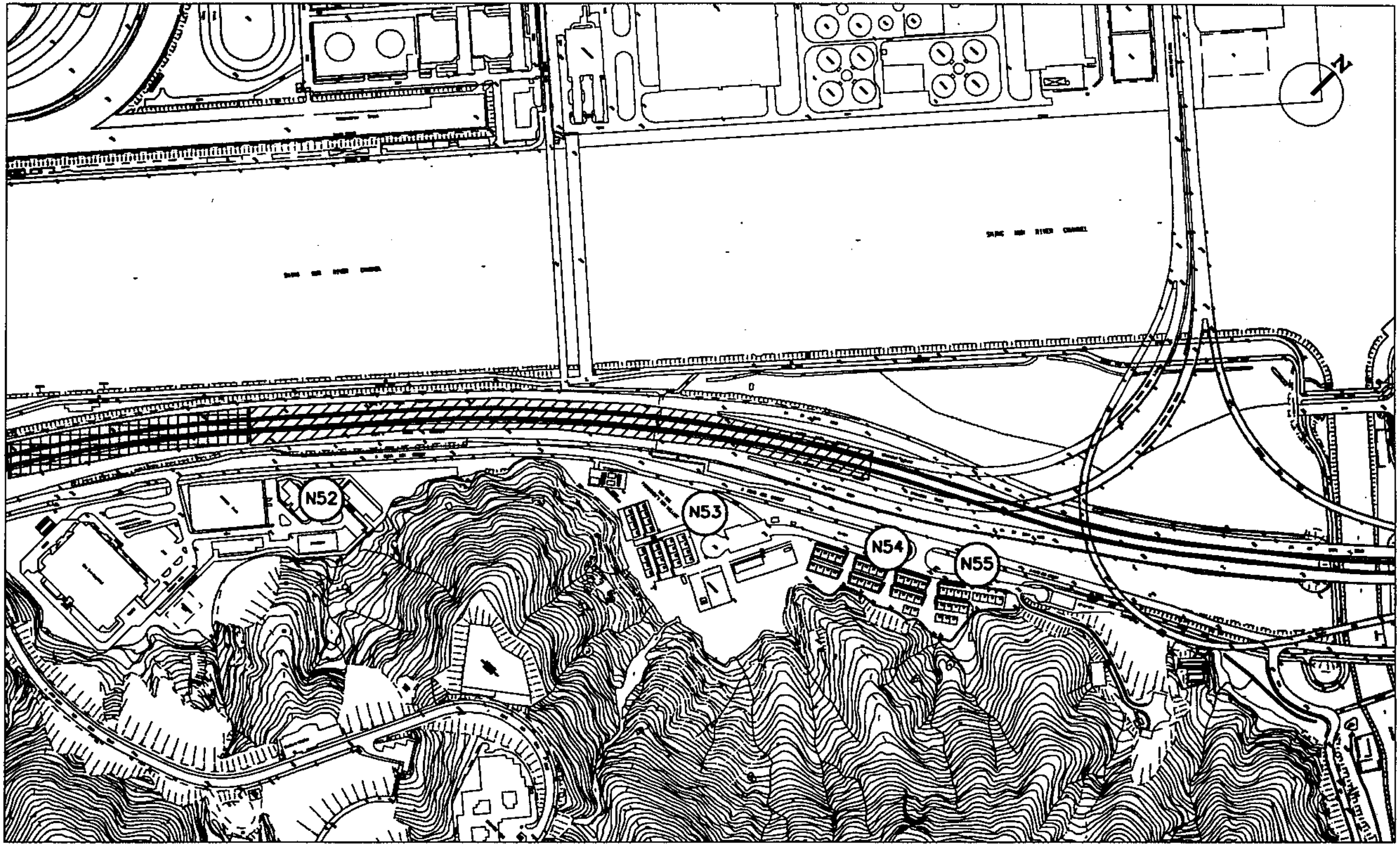

FIGURE 3.5a - Proposed Mitigation Measures -

Shek Mun to Chevalier Garden

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_6a
Sources :	

Prepared by ERM's GIS & MAPPING Group

KEY

Alignment

1.5m Track Side Barriers

2.5m Track Side Barriers with 1m Centerline Barriers

N1 Noise Sensitive Receiver

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Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

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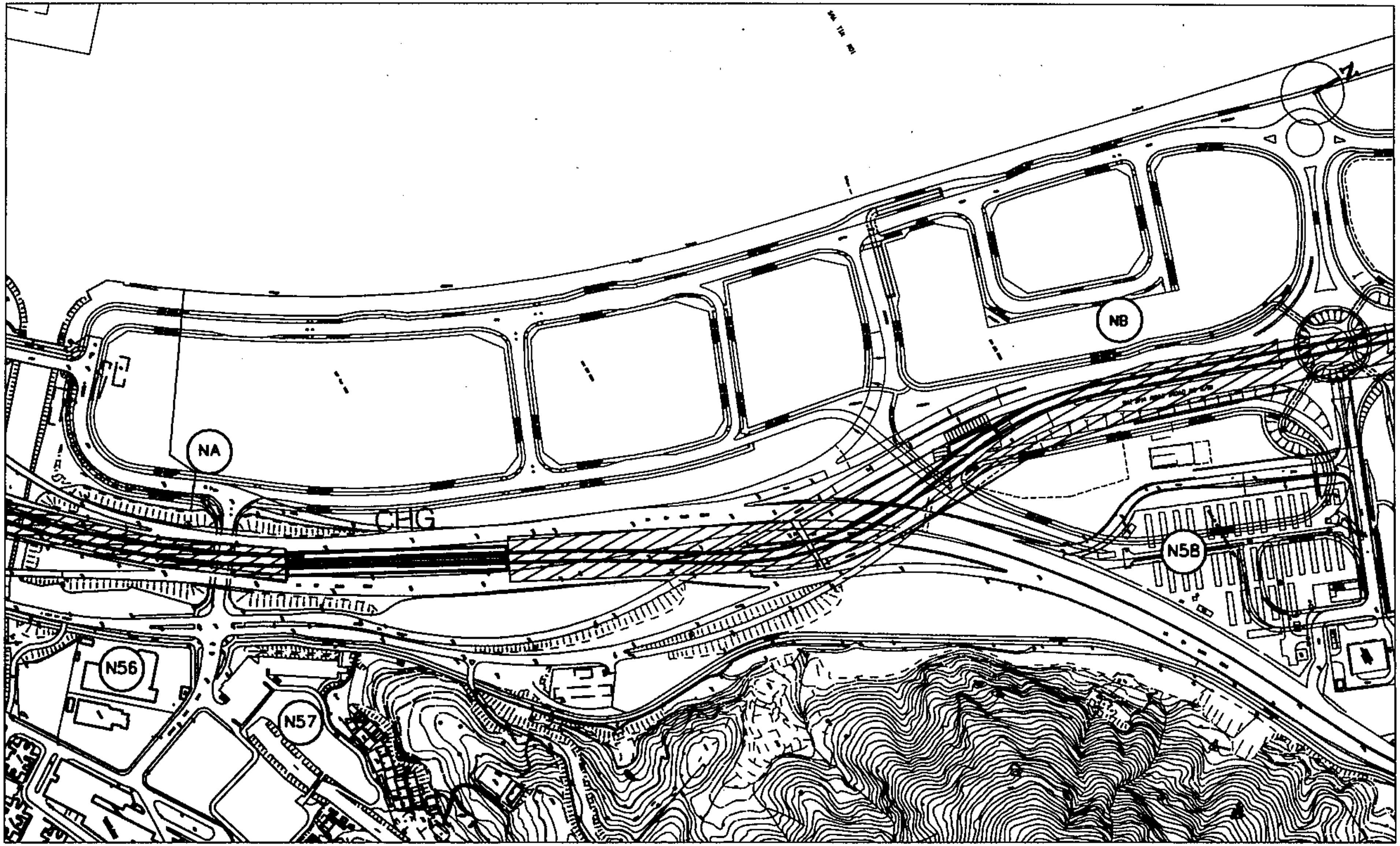

FIGURE 3.5p - Proposed Mitigation Measures - Chevalier Garden to Heng On

Date : 15 Oct 1996 | Drawing No.: /Contract/C1435/C1435_7a

Sources :

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- Cantilever Barrier
- N1 Noise Sensitive Receiver

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

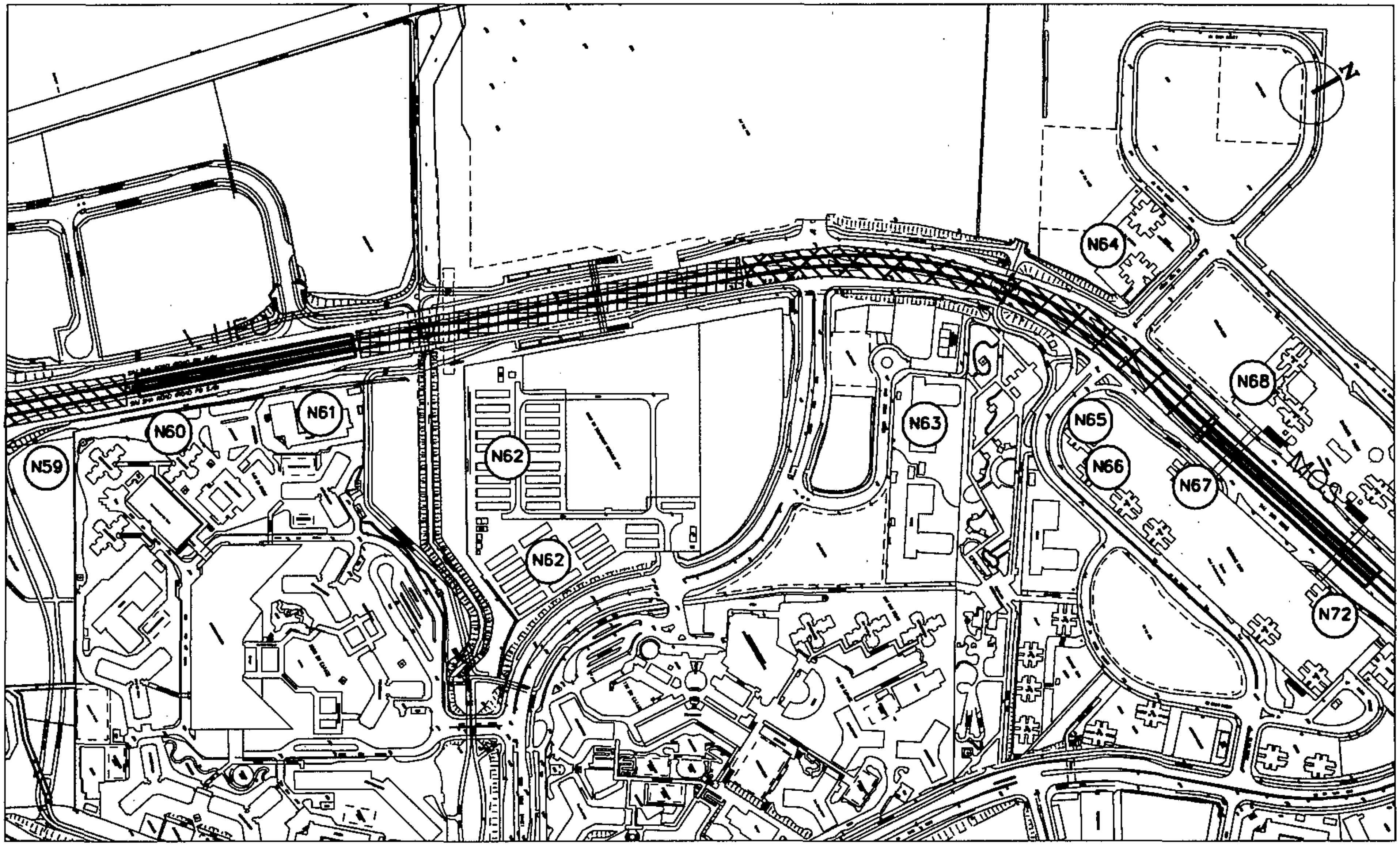

FIGURE 3.5q - Proposed Mitigation Measures -

Heng On to Ma On Shan

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_8a

Sources: 1:1000 Digitized Survey Sheet, Buildings and Lands Department
Scale: 1:5000

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KEY

- Alignment
- 2.5m Track Side Barriers
- 3.5m Track Side Barriers
- Cantilever Barriers
- N1 Noise Sensitive Receiver

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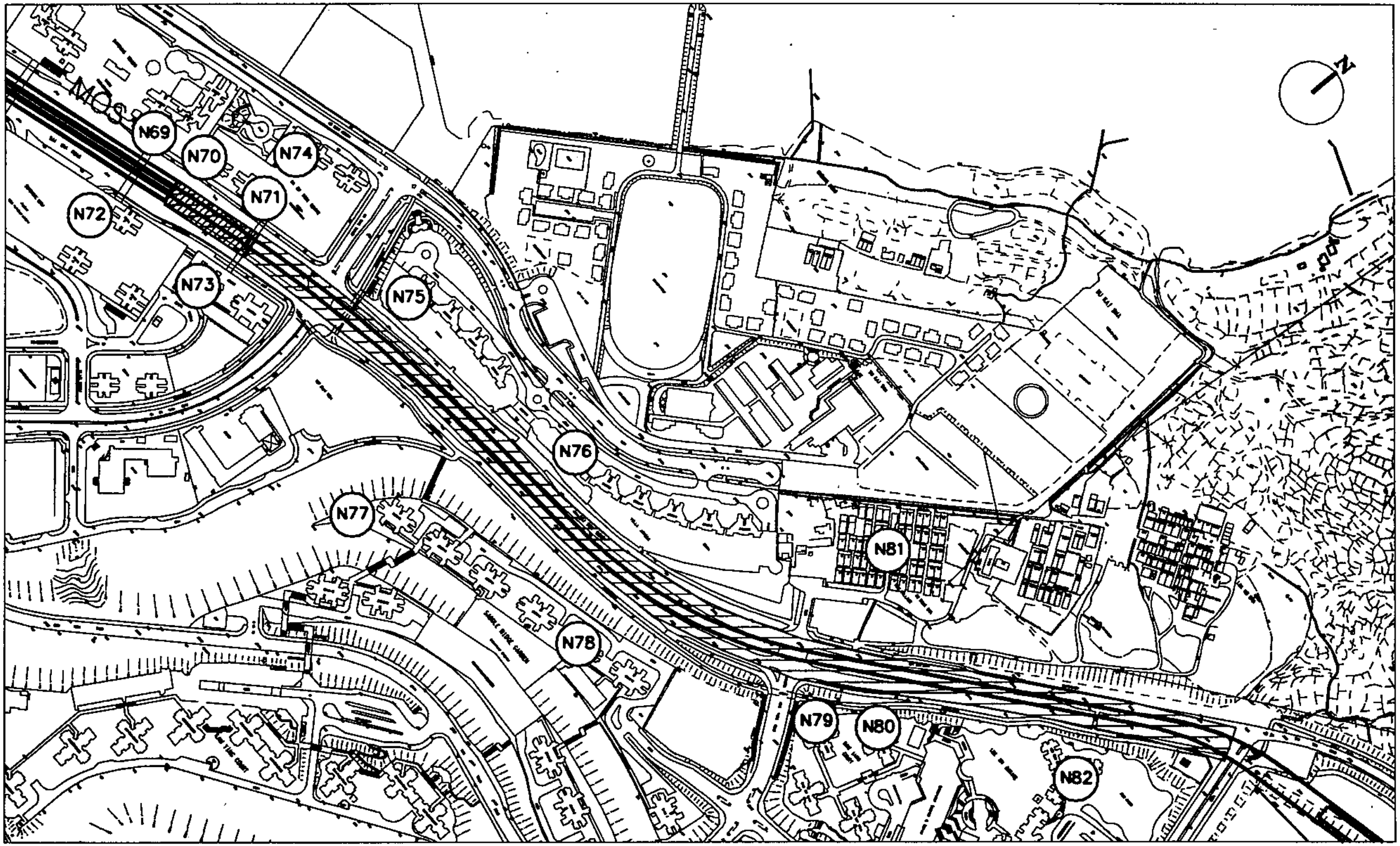

FIGURE 3.5r - Proposed Mitigation Measures - Ma On Shan to Lee On

Date : 15 Oct 1996 | Drawing No.: /Contract/C1435/C1435_9a

Sources: 1:1000 Digitized Survey Sheet, Buildings and Lands Department
Scale: 1:5000

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- 3.5m Track Side Barriers with 1m Centreline Barrier
- Noise Enclosure
- N1 Noise Sensitive Receiver

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Table 3.5j Summary of Required Noise Mitigation Measures

Section	Proposed Mitigation Measures	Length of Noise Barriers or Enclosure	Location
Hin Keng to Tai Wai	No mitigation required	N/A	
Tai Wai to Sha Tin Tau	2.5 m Track Side Barriers	400 m	Chainage 1700-2100
Sha Tin Tau to Sha Kok Street	1.5 m Track Side Barriers	200 m	Chainage 2250-2450
	Noise Enclosure	500 m	Chainage 2450-2950
Sha Kok Street to City One Shatin	Noise Enclosure	900 m	Chainage 3200-4100
City One Shatin to Shek Mun	3.5 m Track Side Barriers & 1.5 m Centerline Barriers	600 m	Chainage 4300-4900
Shek Mun to Chevalier Garden	2.5 m Track Side Barriers & 1 m Centerline Barriers	700 m	Chainage 5700-6400
	1.5 m Track Side Barriers	600 m	Chainage 6400-7000
	Cantilever Barrier	500 m	Chainage 7300-7800
Chevalier Garden to Heng On	Cantilever Barrier	900 m	Chainage 7900-8800
	3.5 m Track Side Barriers	100 m	Chainage 8800-8900
	2.5 m Track Side Barriers	400 m	Chainage 9000-9400
Heng On to Ma On Shan	Cantilever Barriers	500 m	Chainage 9400-9900
Ma On Shan to Lee On	3.5 m Track Side Barriers & 1 m Centerline Barriers	100 m	Chainage 10100-10200
	Noise Enclosure	1100 m	Chainage 10200-11300

Note: The lower 1.5 m of all barriers are fitted with noise absorptive lining 75 mm thick.

Traffic Noise Assessment Methodology

3.5.42 Noise calculations have been carried out in accordance with the UK methodology *Calculation of Road Traffic Noise* (CRTN). Precise predictions of traffic noise require detailed information of the road design such as alignment and elevation. At Sha Tin Tau and Lee On, a number of new roads are being proposed and full design details are not available yet. Therefore, indicative noise levels have been predicted based on a number of assumptions, as described below:

- traffic flows are not available on slip roads and therefore only the nearest trunk roads have been identified in calculations;
- for the Tai Po area, a bypass between Shatin and Ma On Shan is proposed in the *Shatin and Ma On Shan District Traffic Study*, however, as this development is not committed the traffic is assumed to use the existing Chek Kung Miu Road;
- for roads with no information on elevations, it has been assumed that they are at the same levels of the proposed development and no screening effect from podium structures are considered; and
- the podium levels at Tai Wai and Sha Tin Tau were assumed to be 15 m high and 12 m at Lee On, based on information from the Study Team.

3.5.43 Hard ground, as defined in CRTN, was assumed throughout the study areas and all road surfaces were assumed to be impervious bitumen. The speed limit on all roads is assumed to be 50 kph. Peak hour traffic data for the year 2016 was provided by the Study Team and are shown in *Table 3.5k*. The afternoon peak hour traffic flows in Tai

Wai are generally higher than the morning flows and have, therefore, been used for this assessment. In Sha Tin Tau and Lee On, the morning peak hour traffic flows are higher and have, therefore, been used.

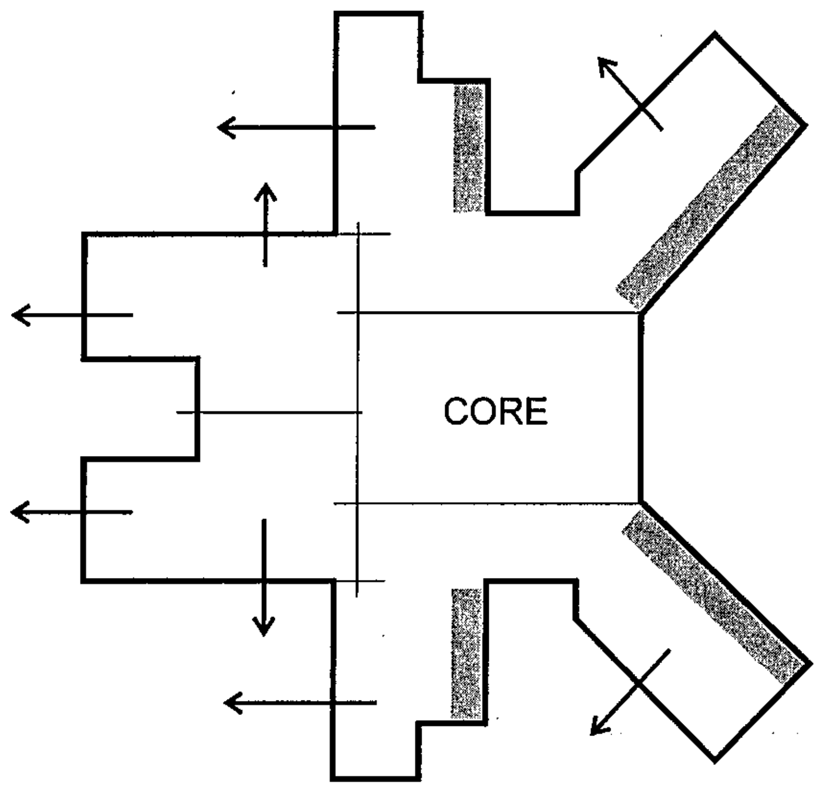
Table 3.5k 2016 Peak Hour Traffic Data

Section	Road	Peak flow (vehicles per hour)	% Heavy Vehicles
Tai Wai	Ramp to Route 16	2900	50
	Che Kung Miu Road (to Ramp to Route 16)	4300	40
	Che Kung Miu Road (to the west of the roundabout)	4300	40
	Che Kung Miu Road (to the east of the roundabout)	4000	40
	Mei Tin Road	2800	40
	Hung Mui Kuk Road	2400	40
Sha Tin Tau	Proposed T4 Branch	1100	40
	Lion Rock Tunnel Road (to the north of Che Kung Miu Road)	2300	40
	Lion Rock Tunnel Road (to the south of Che Kung Miu Road)	1900	40
	Proposed Road T4	7000	40
	Tai Chun Kiu Road	5300	40
	Che Kung Miu Road	3400	40
Lee On	Sai Sha Road	1100	30
	Proposed Road T7	2100	30

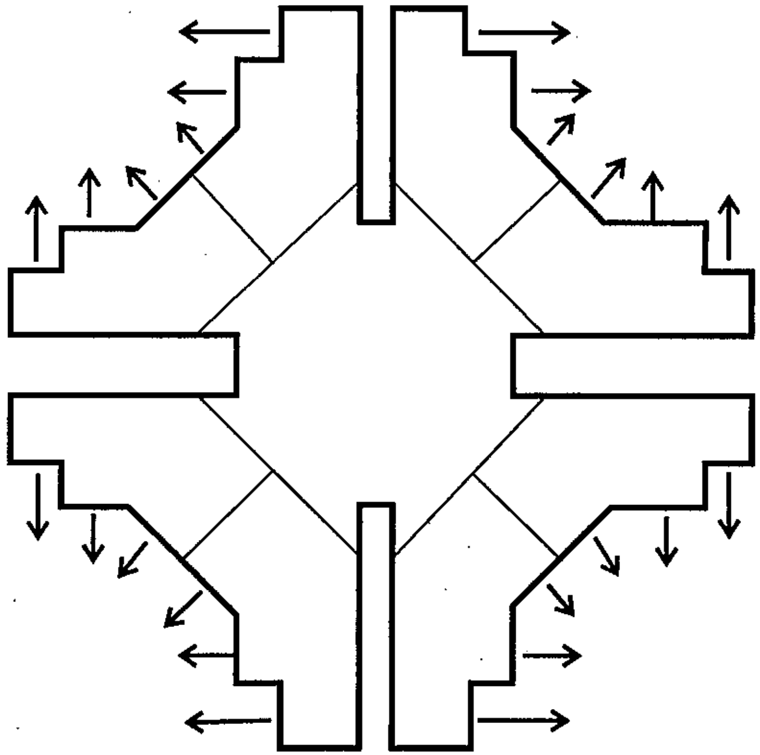
Note: Afternoon peak flows used for Tai Wai, morning peak flows used for Sha Tin Tau and Lee On

3.5.44 The preliminary site layouts have included a number of RABs to control noise impacts. Provisional floor plans for the proposed residential blocks include both standard multi-aspect units and RABs, sketches of the floor plans are shown in *Figure 3.5s*. Based on the floor plans, noise sensitive uses are identified and the NSR locations are shown in *Figures 3.5t-v*. The noise assessment has been based on these provisional layouts and the subsequent reductions in the angle of view to the trunk roads have been considered in the traffic noise calculations. The predicted facade noise levels at the representative NSR locations were modelled at three storey heights (low, medium and high) to identify the range of noise levels affecting the developments. Where necessary, further mitigation measures have been recommended to meet the objectives of the HKPSG criteria.

REDUCED ASPECT BLOCK



STANDARD BLOCK



KEY

THE DIRECTION OF ASPECT FOR PRINCIPAL LIVING SPACES SUCH AS BEDROOMS AND LIVING ROOMS

LOCATIONS OF WINDOWS TO SERVICE SPACES SUCH AS BATHROOMS AND KITCHENS

NOT TO SCALE

FIGURE 3.5s - SKETCH OF STANDARD BLOCK AND REDUCED ASPECT BLOCK FLOOR PLAN

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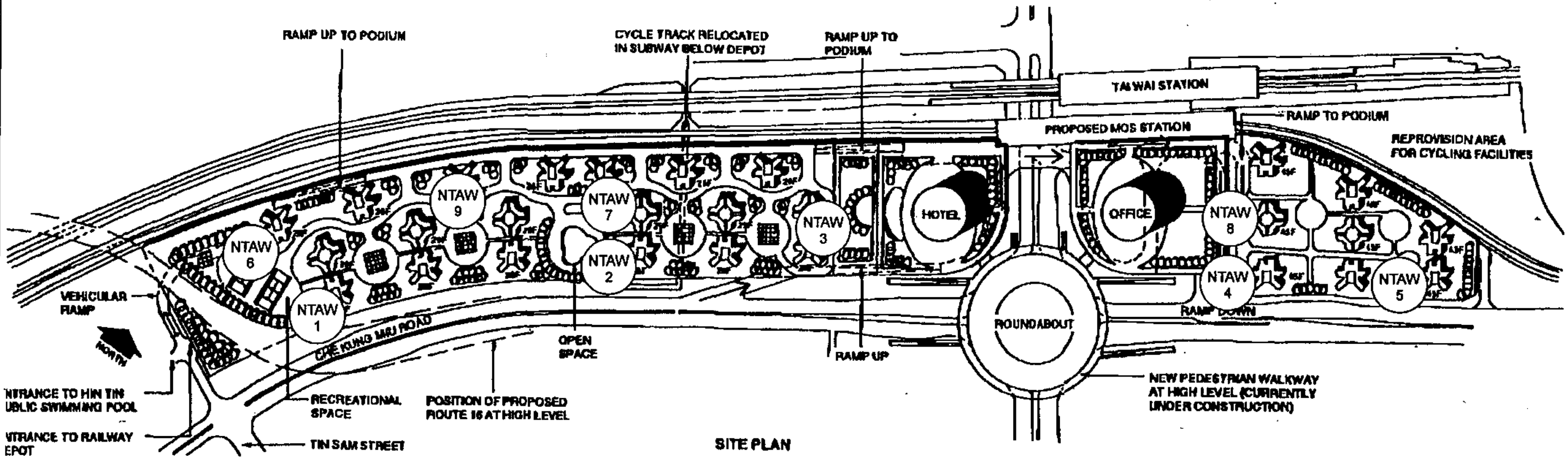

FIGURE 3.5t - LOCATIONS OF NOISE SENSITIVE RECEIVERS - THE TAI WAI DEVELOPMENT

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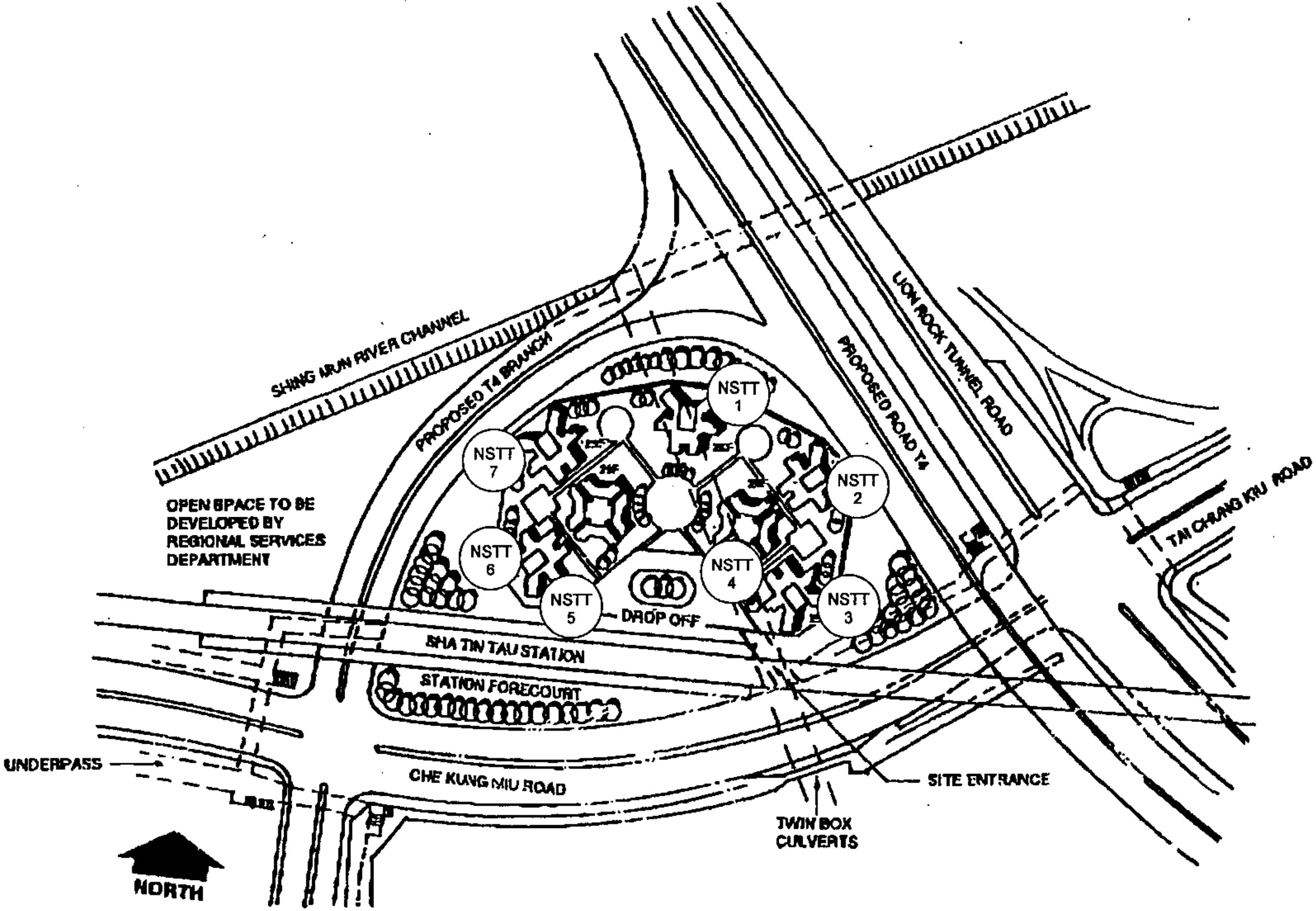

FIGURE 3.5u - LOCATIONS OF NOISE SENSITIVE RECEIVERS - THE SHA TIN TAU DEVELOPMENT

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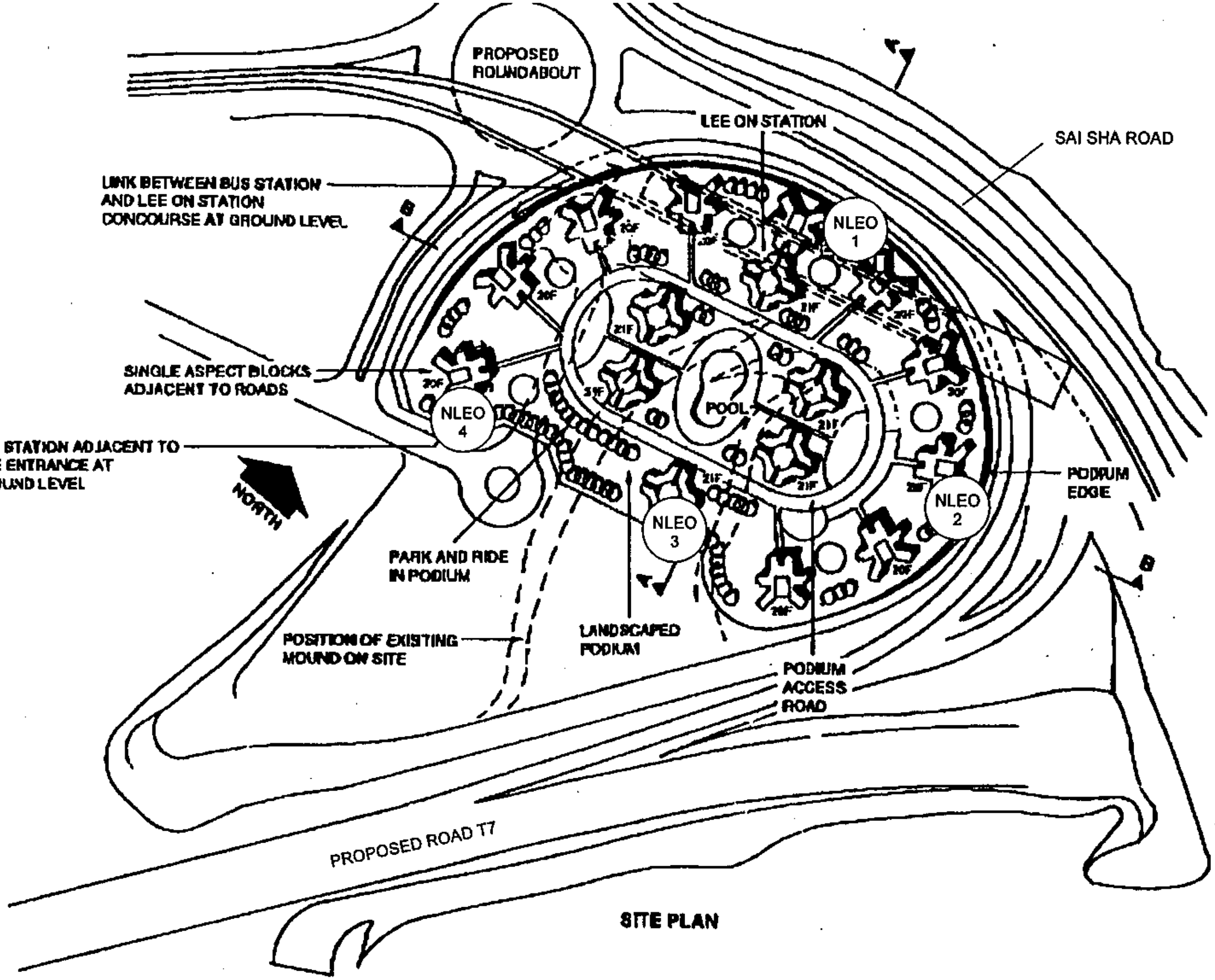

FIGURE 3.5v - LOCATIONS OF NOISE SENSITIVE RECEIVERS - THE LEE ON DEVELOPMENT

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Prediction of Road Traffic Impacts

3.5.45 *Tables 3.5l-n* present the predicted facade road traffic noise levels at representative NSRs.

Table 3.5l Predicted Facade Noise Levels at Tai Wai ($L_{A10\ peak\ hour}$ dB)

NSRs	Predicted Level		
	Low (1/F)	Middle (15/F)	High (30/F)
NTAW1	77	73	71
NTAW2	54	70	68
NTAW3	66(66)[1]	72(71)	71(70)
NTAW4	67	67	68
NTAW5	65	74	72
NTAW6	74	73	72
NTAW7	52	67	70
NTAW8	66(66)	66(66)	69(68)
NTAW9	50	60	69

(1): 69(69) - Noise Levels at NTAW3 and NTAW8 predicted for Option 1 (Option 2)

Table 3.5m Predicted Facade Noise Levels at Sha Tin Tau ($L_{A10\ peak\ hour}$ dB)

NSRs	Predicted Level		
	Low (1/F)	Middle (15/F)	High (30/F)
NSTT1	77	75	73
NSTT2	80	76	74
NSTT3	79	77	76
NSTT4	54	72	71
NSTT5	55	72	71
NSTT6	72	70	68
NSTT7	75	70	68

Table 3.5n Predicted Facade Noise Levels at Lee On ($L_{A10\ peak\ hour}$ dB)

NSRs	Predicted Level		
	Low (1/F)	Middle (10/F)	High (20/F)
NLEO1	54	67	65
NLEO2	67	66	66
NLEO3	69	68	68
NLEO4	66	66	66

Evaluation of Impacts

3.5.46 Analysis of the modelling results indicate that the predicted noise levels at the proposed developments exceed the HKPSG $L_{A10, peak hour}$ 70 dB noise criterion at the Tai Wai and Sha Tin Tau developments even with use of the RABs. The affected facades are those directly overlooking the trunk roads. Mitigation measures in line with the HKPSG recommendations including building setback, extended podium, noise barriers and revised building layouts (i.e. single aspect blocks (SABs)) have been considered for the affected sites.

Tai Wai

3.5.47 As indicated in *Table 3.5l*, the predicted noise levels at NTAW1 and NTAW6 facing the Route 16 ramp exceed the HKPSG $L_{A10, peak hour}$ 70 dB noise criterion at all elevations. Potential opportunities to locate noise barriers alongside the vehicle ramp should be explored as this would be the optimum location for providing screening benefit to the residential blocks at the southern end of the site. The effectiveness of the noise barrier depends on the heights and locations of the barriers and NSRs and will be generally more effective where the barrier is located close to the noise sources and NSRs are at lower elevations. Noise levels at NTAW6 exceed the guideline by 2-4 dB(A) and it is likely that by maximising barrier height and location, the noise levels could be mitigated. Should these barriers not be feasible, it is likely that amendments to the layout of the blocks and floor plans would be required to provide noise mitigation. Use of SABs close to the ramp to Route 16 would be an alternative option to the use of noise barriers.

3.5.48 For NTAW1, the section of ramp to Route 16 is likely to be elevated and the effectiveness of a barrier will be reduced. In light of the 7 dB(A) exceedance, more substantial noise mitigation measures are required. A cantilever barrier or noise enclosure are the two alternative noise control measures as they could eliminate the line of sight of the road and reduce the noise impact. Should a cantilever barrier or noise enclosure not be feasible, SABs would be required.

3.5.49 NSRs facing Chek Kung Miu Road may also be affected by traffic noise. It has been proposed that residential blocks along Chek Kung Miu Road will be RABs with noise sensitive rooms facing inwards away from the noise source. The predicted noise levels at NTAW2 (RAB) are in range of 54-68 dB(A) and within the HKPSG criterion $L_{A10, peak hour}$ 70 dB. Additionally, the RAB's fronting Che Kung Miu Road provide screening to the majority of the standard layout blocks behind; noise levels at NTAW7 are within the HKPSG criterion. No adverse noise impacts are predicted at the proposed RABs along Chek Kung Miu Road and the standard blocks behind.

3.5.50 Two options for the design of the hotel and office blocks have been proposed. In Option 1, the standard blocks adjacent to the proposed hotel and office have a greater angle of view of Chek Kung Miu Road as well as the roundabout junction. Noise levels have been predicted at NTWA3, NTWA4 and NTWA8 for Options 1 and 2. The predicted noise levels for Option 1 at the standard block (NTWA3) are above the HKPSG noise criterion at high elevations whilst the predicted noise levels at the RAB (NTWA4) are just within the HKPSG criterion. In Option 2, the hotel and office blocks are larger and provide more screening of the highways, although exceedances of the HKPSG criterion are still predicted. The predicted noise levels are reduced at the middle and upper elevations and a marginally exceedance of the HKPSG criteria (1 dB(A)) is only predicted at NTAW3 at middle levels. Option 2 is therefore preferred in terms of noise mitigation and could be developed further in subsequent detailed studies, by increasing the size of the hotel and office towers or the use of RABs in place of the standard blocks adjacent to the hotel and office.

3.5.51 Facades facing the roundabout are likely to receive higher noise impacts than those facing other road sections. The predicted noise levels at NTAW4 and NTAW8 are approaching the HKPSG noise criteria of 70 dB(A) at upper levels. The noise impact from the roundabout should be investigated in detail in subsequent studies, when more detailed traffic flow data are available, to ensure that the design scheme will comply with all the noise standards.

Sha Tin Tau

3.5.52 As shown in *Table 3.2m*, the predicted noise levels at the facades facing Road T4 and Lion Rock Tunnel Road (NSTT1-3) exceed the HKPSG criterion by 3-10 dB(A). The lower storeys of NSTT4 and NSTT5 are protected by Sha Tin Tau Station and the predicted noise levels are below the HKPSG criterion. However, the predicted noise levels increase and exceed the HKPSG criterion with height, as screening from the station is reduced. Additionally, predicted noise levels at lower floors at NSTT6 and NSTT7 exceed the noise criteria due to the close proximity of the T4 branch.

3.5.53 RABs are not sufficient to mitigate the potential noise impacts and the use of SABs will be necessary. With a maximum of 10 dB(A) exceedance at the blocks located at the northern and eastern part of the proposed site close to the proposed Road T4, SABs are required for residential uses. For the RABs located in the western part of the site, noise exceedances of 2-5 dB(A) are predicted. It would be possible to reduce the noise levels to the HKPSG noise criteria by maximising the barrier locations and heights, however, the roadside barrier at the road junction might obstruct the road sight. Should a roadside barrier not be feasible, the use of single aspect block is recommended. The standard blocks located in the middle of the proposed site are partially screened from the trunk roads by the RABs and the proposed Sha Tin Tau station. However, a marginal noise exceedance (1 dB(A)) is predicted at the upper levels. Increases of setback distances and use of RABs are recommended to mitigate the noise impacts. A mix of commercial and residential use could also be developed to optimise a layout that provides screening to the residential NSRs. Commercial uses with noise insulation design, such as central air-conditioning and double glazed windows should be considered.

3.5.54 The provision of acoustic insulation for the impacted dwellings at Sha Tin Tau would only be only considered by the EPD as a last resort if all other mitigation measures are either impractical or ineffective. Should this be the case, the final design of the site layout should give consideration to minimising the number of dwellings requiring noise insulation.

Lee On

3.5.55 The proposed site at Lee On is surrounded by a number local roads and trunk roads including Sai Sha Road and Road T7. The predicted traffic noise levels from Sai Sha Road and Road T7 are well within the HKPSG noise criterion of $L_{A10,\, peak\ hour}$ 70 dB. Hence, the traffic noise impact at the proposed site is considered acceptable. At this feasibility stage, traffic flows are only available for the trunk roads. However, it should be noted that other local roads in the vicinity of the proposed site will also contribute to traffic noise impacts and these should be considered in subsequent assessment studies.

Train Noise

3.5.56 As the proposed developments are either located above or adjacent to the MOS link, these developments will be potentially affected by train noise. At Tai Wai, the MOS link will run parallel with the existing KCR line and, therefore, there will be cumulative impacts from the two lines.

3.5.57 At Tai Wai, the modelling results indicate that the predicted noise levels are above the noise criterion of $L_{Aeq, 30min}$ 60 dB by 7-8 dB(A) at the proposed site and that there will be potential noise impacts from MOS Rail and the KCR. RABs have been incorporated in the current layout scheme for mitigation by reducing the angle of view to MOS Rail and the exiting KCRC line. According to the CRN, a maximum noise reduction of 9 dB(A) could be achieved by reducing angle of view to 30°. Therefore, it is feasible to reduce the train noise levels at the proposed site with substantial reduction in angle of view. Additionally, the proposed site is located adjacent to the MOS Rail alignment and cantilever barriers at the edge of the podium could also be effective in noise reduction if required. Therefore, no insurmountable train noise impacts are expected provided appropriate measures are included at the detailed design stage.

3.5.58 At Sha Tin Tau and Lee On, the predicted train noise levels at the proposed development are within the train noise criterion of $L_{Aeq, 30min}$ 60 dB, indicating that there is no adverse noise impact from MOS Rail.

3.5.59 The recommended requirements for mitigation of road and rail noise are shown in *Table 3.5o* below.

Table 3.5o Summary of Required Noise Mitigation Measures

Proposed Site	Locations of Mitigation Measures/Building Blocks to be protected	Proposed Mitigation Measures
Tai Wai	Southern part of the proposed site, along ramp to Route 16	Road-side barrier at the eastern bound of the ramp to Route 16;
	Southern part of the proposed site, along ramp to Route 16	Use of single aspect block
	Standard blocks adjacent to the hotel and office towers	Revise layout of the standard blocks adjacent to the proposed hotel and office in order to reduce the angle of view of the roundabout, such as use of RABs
	Western part of the proposed site, along the existing KCR Rail	Use of single aspect block
Sha Tin Tau	RABs located at the northern and eastern part of the proposed site adjacent to Proposed Road T4, T4 Branch and Che Kung Miu Road	Use of single aspect blocks close to the highways including Lion Rock Tunnel Road, proposed Road T4 and Che Kung Miu Road
	Standard blocks facing Che Kung Miu Road	Increase setback distance or use of RABs
		Mix of commercial use and residential uses.
Lee On		No mitigation measures are required at this stage, however, detailed noise assessment is recommended to investigate the noise impact from slip roads

3.6 Conclusions

3.6.1 This assessment has predicted that unmitigated construction noise associated with the MOS Rail would cause adverse noise impacts at nearby NSRs. Standard mitigation measures have been identified which could reduce the noise levels at identified NSRs. Measures include the use of silenced PME, installation of movable barriers and restrictions on the number of PME in use, which should be incorporated into the Contract Specifications.

3.6.2 However, additional measures are considered necessary in order to control the noise levels to below the appropriate daytime criteria at a number of NSRs. Site hoardings and cantilever barriers should be used along the site boundary to provide screening of noise sources, provision of secondary glazing and air-conditioning for schools in the vicinity of the proposed work sites is also recommended to reduce the likely noise impacts.

3.6.3 Operational noise from the MOS Rail rolling stock would cause noise exceedances of relevant criteria at identified NSRs. Noise mitigation measures in terms of noise barriers and enclosures have been recommended to reduce the likely impacts from operational train noise. It is not anticipated that ground vibration or ground-borne noise will cause adverse noise impacts as all sections are above ground. At this stage of the project the track mounting system and the supporting structures are not defined, therefore, ground vibration has been excluded from this study and will be addressed during the detailed design stage.

3.6.4 Other likely noise impacts have been identified from the proposed railway scheme, however, exceedances of relevant noise criteria are not expected. The construction and operational impact should be reviewed at the detailed design stage when more accurate details of construction methods and operational conditions are available.

3.6.5 During MOS Rail operation, the three development sites may be affected by road traffic noise and the train noise from the KCR and MOS Rail alignments. A preliminary traffic noise assessment has been undertaken to evaluating the feasibility of the proposed station related development scheme layouts. The site layouts have included RABs for noise mitigation. The predicted noise levels at some building facades facing heavy trafficked trunk roads at Tai Wai and Sha Ting Tau exceed the HKPSG criteria and further noise mitigation measures have been recommended. The predicted noise levels from road traffic at Lee On are within the HKPSG criteria and therefore, the proposed layout is feasible in terms of traffic noise. Exceedances of the HKPSG train noise criteria are predicted at Tai Wai and appropriate noise mitigation measures have been identified. No adverse train noise impacts have been predicted at Sha Tin Tau and Lee On.

4 WATER QUALITY

4.1 Introduction

4.1.1 Construction and operation of the MOS Rail could generate wastewater which may cause adverse water quality impacts if not properly controlled or mitigated. This section presents the results of a qualitative study of potential water quality impacts arising from both the construction and operational phases of the MOS Rail from the existing Tai Wai KCR station to Ma On Shan, including a possible extension from Tai Wai to Hin Keng and from Ma On Shan to Lee On. This section also identifies requirements for further water quality impact studies, and outlines potential mitigation requirements.

4.2 Legislation

4.2.1 Under the Water Pollution Control Ordinance (WPCO), Hong Kong waters are subdivided into 10 Water Control Zones (WCZs). Each WCZ has a designated set of statutory Water Quality Objectives (WQO). For this study, the marine water of Tolo Harbour & Channel could be affected by wastewater discharges from the MOS Rail.

4.2.2 The WQOs for the Tolo Harbour & Channel WCZ will be applicable as evaluation criteria for assessing compliance of the Project. The parameters of most concern during the construction phase will be suspended solids (SS) and dissolved oxygen (DO) levels. The associated WQOs against which impacts will be assessed are as follows:

- SS levels: For construction near Tolo Harbour & Channel, human activity should not cause the annual median SS levels to exceed 20 mg l^{-1}.
- DO levels: DO levels should remain above 4 mg l^{-1} in Tolo Harbour at all times.

4.2.3 All discharges during both the construction and operational phases of the MOS Rail are required to comply with the *Technical Memorandum for Effluents discharged into Drainage and Sewerage Systems, Inland and Coastal Waters* (TM) issued under Section 21 of the WPCO, which defines acceptable discharge limits to different types of receiving waters. Under the TM, effluents discharged into the drainage and sewerage systems, inshore and coastal waters of the WCZs are subject to pollutant concentration standards for particular volumes of discharge. These are defined by the EPD and specified in licence conditions for any new discharge within a WCZ. The pertinent discharge limits for Tolo Harbour and Channel WCZ are listed in *Table 3.2a*.

4.3 Water Sensitive Receivers

4.3.1 In order to evaluate the water quality impacts resulting from the MOS Rail, the proximity of Water Sensitive Receivers (WSRs) to the Study Area must be considered. WSRs have been identified in accordance with the HKPSG, which provide criteria for identifying environmental factors influencing development planning.

4.3.2 The receiving water body during the construction and operation of the works will be Tolo Harbour. The Shing Mun River is also considered as a WSR, as construction of the MOS Rail could potentially affect this waterway. The water quality of Tolo Harbour and the Shing Mun River have been improved in recent years, but still show signs of pollution.

Table 4.2a Standards for Effluents Discharged into the Coastal Waters of Tolo Harbour and Channel Water Control Zone

Flow Rate (m^3/day)	≤10	>10 & ≤200	>200 & ≤400	>400 & ≤600	>600 & ≤800	>800 & ≤1000	>1000 & ≤1500	>1500 & ≤2000	>2000 & ≤3000	>3000 & ≤4000	>4000 & ≤5000	>5000 & ≤6000
Determinant												
pH (pH units)	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9
Temp (°C)	45	45	45	45	45	45	45	45	45	45	45	45
Colour	1	1	1	1	1	1	1	1	1	1	1	1
SS	30	30	30	30	30	30	15	15	15	15	15	15
BOD	20	20	20	20	20	20	10	10	10	10	10	10
COD	80	80	80	80	80	80	50	50	50	50	50	50
Oil & Grease	20	20	20	20	20	20	10	10	10	10	10	10
Iron	10	10	10	7	5	4	2.7	2	1.3	1	0.8	0.6
Boron	5	4	3	2.5	2	1.6	1.1	0.8	0.5	0.4	0.3	0.2
Barium	5	4	3	2.5	2	1.6	1.1	0.8	0.5	0.4	0.3	0.2
Mercury	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Other toxic metals individually	1	1	0.8	0.5	0.5	0.4	0.1	0.1	0.1	0.1	0.1	0.1
Toxic metals	2	2	1.6	1	1	0.8	0.2	0.2	0.2	0.2	0.14	0.1
Cyanide	0.1	0.1	0.1	0.1	0.1	0.1	0.05	0.05	0.03	0.02	0.02	0.01
Phenols	0.5	0.5	0.5	0.25	0.25	0.25	0.1	0.1	0.1	0.1	0.1	0.1
Sulphide	5	5	5	5	5	5	2.5	2.5	1.5	1	1	0.5
Total CL	1	1	1	1	1	1	1	1	1	1	1	1
Total N	20	20	20	15	15	15	15	15	10	10	10	10
Total P	8	8	5	5	5	5	5	5	5	5	5	5
Surfactants (total)	15	15	15	15	15	15	10	10	10	10	10	10
E. coli (count/100 ml)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

(All units in mg l^{-1} unless otherwise stated; all figures are upper limits unless otherwise stated)

4.3.3 It will be important to prevent any deterioration in water quality resulting from construction or operation of the MOS Rail.

4.3.4 Tolo Harbour is used for commercial fisheries, and has four designated mariculture zones which could be potentially affected by the MOS Rail construction and operation. Shing Mun River is the main river channel which intercepts the flows from the upland and lowland areas adjacent to Tai Wai and Sha Tin, and drains into Tolo Harbour. Shatin seawater intake located offshore from the Shatin wastewater treatment plant is also one of the WSRs which may be potentially affected by the MOS Rail construction.

4.4 Construction Phase Impacts

4.4.1 The extent of water quality impacts associated with the works will depend upon the construction method chosen, the type of land use that the alignment passes through, and distance from the sensitive receivers. It is considered that the more remote the construction site is from the receiving water bodies, in this case Tolo Harbour and the Shing Mun River, the lower the likelihood of the Project having a direct impact on receiving water quality.

4.4.2 The construction of MOS Rail will involve formation preparation, standard and special long span viaduct sections, tracklaying, ten stations and a depot at Tai Wai and the three station related developments. Water quality impacts arising from the construction of MOS Rail will be similar to those of other land-based construction activities that include:

- construction run-off and drainage;
- excavated and demolition materials;
- sewage effluent; and
- general construction activities.

Construction Runoff

4.4.3 Runoff from construction sites may contain increased sediment loads, other suspended solids and various contaminants. Potential sources of water pollution from MOS Rail site runoff include:

- runoff and erosion from site surfaces, drainage channels and earth working areas;
- wash water from dust suppression sprays and wheel washing facilities; and
- fuel, oil and lubricants from construction vehicles and equipment.

4.4.4 Construction runoff may cause physical, chemical and biological effects. Physical effects could result from the increase in SS from the site leading to siltation, blocked channels, and associated flooding when heavy rainfall occurs. The increased SS in the water column combining with a number of other factors could reduce DO concentrations in the water column, as follows:

- high SS (and turbidity) reduces sunlight penetration, lowers the rate of photosynthesis of phytoplankton (primary productivity) and thus lowers the rate of oxygen production in the water column; and

- high SS causes increased energy retention from sunlight, resulting in higher temperatures, and lower the solubility of oxygen to water. Under extreme conditions this could lead to hypoxia.

4.4.5 Chemical and biological effects could also arise, depending upon the chemical and nutrient levels in construction runoff. Primary chemical effects may result from liquors containing significant quantities of concrete and cement derived materials. These may include localised increases in turbidity and discolouration, localised elevations in pH, and accretion of pH solids. A number of secondary effects may also result in toxic effects to marine biota due to elevated pH values, reduced decay rates of faecal micro-organisms due to decreased light penetration, and localised increase in the proportion of un-ionised ammonia.

Excavated and Demolition Materials

4.4.6 Water quality impacts associated with the disposal of material from excavation and demolition during site formation will be minimal. The excavated material will mainly comprise rock, soil and rubble and no insurmountable water quality impacts are expected to arise from this material. Solid waste management is discussed in *Section 6*.

Sewage Effluent

4.4.7 Sewage is characterized by high levels of biochemical oxygen demand (BOD), ammonia and *E. coli*. Sewage effluents arising from the on-site construction workforce also have the potential to cause water pollution.

General Construction Activities

4.4.8 Construction activities have the potential to cause water pollution from debris and rubbish such as food packaging and used construction materials, entering the water column and resulting in floating refuse in the vicinity of the site that reduces the aesthetic quality of the water body.

4.5 Mitigation Methods

General

4.5.1 The stormwater best management practices, detailed as follows, should be implemented to ensure that runoff from construction areas and storage areas for excavated materials complies with the WPCO and no unacceptable impacts on the WSRs arise due to MOS Rail construction.

Construction Runoff

4.5.2 Construction runoff related impacts can be readily controlled through the use of appropriate mitigation measures which include:

- the use of sediment traps; and
- the adequate maintenance of drainage systems to prevent flooding and overflow.

4.5.3 All temporary and permanent drainage pipes and culverts provided to facilitate runoff discharge should be adequately designed for the controlled release of storm flows. All sediment traps should be regularly cleaned and maintained. The temporary diverted drainage should be reinstated to the original condition when the construction work has finished or the temporary diversion is no longer required.

4.5.4 Sand and silt in the wash water from the wheel washing facilities, which ensure no earth, mud and debris is deposited on roads, should be settled out and removed before discharging into storm drains. A section of the road between the wheel washing bay and the public road should be paved with backfall to prevent wash water or other site runoff from entering public road drains.

4.5.5 Oil interceptors should be provided in the drainage system and regularly emptied to prevent release of oils and grease into the storm water drainage system after accidental spillages. The interceptor should have a bypass to prevent flushing during periods of heavy rain.

Sewage Effluent

4.5.6 Since there are only a relatively small number of workers, appropriate disposal facilities in the form of chemical toilets will be adequate.

General Construction Activities

4.5.7 Debris and rubbish on site should be collected, handled and disposed of properly to avoid entering the water column and cause water quality impacts. The waste management requirement on site to prevent such impact is detailed in *Section 6.*

4.6 Operational Phase Impacts

General

4.6.1 This section assesses potential impacts against the relevant environmental legislation with regard to identified sensitive receivers in accordance with the HKPSG. Legislation and WSRs have been defined and detailed in *Sections* 3.2 and 3.3 respectively.

4.6.2 Operation of the depot could generate wastewater leading to unacceptable water quality impacts if unmitigated.

4.6.3 Additionally, the MOS Rail could lead to impacts on local drainage if unmitigated. Mitigation is described in *Section 4.7.2.*

Drainage

4.6.4 Since there are numerous existing stormwater drains, highway drains and sewers located along the alignment including 13 main channels and culverts and some small natural channels in the Sai Sha Road area, potential impacts upon local drainage systems are a key concern. Material accumulation within drains and nullahs would make adjacent flood-prone areas highly susceptible to flooding.

4.6.5 The *Draft Drainage Impact Assessment, Tai Wai to Ma On Shan, Report MD2, Highways Department, 1996* identified the potential flooding in certain areas without mitigation. The proposed engineering design and mitigation measures described in Report MD2 are summarized in *Section 4.7* and should be applied to ensure no adverse drainage impacts are caused by the MOS Rail operation.

Depot

4.6.6 Maintenance activities will be undertaken at the depot, which could result in unacceptable water quality impacts if unmitigated. Liquid waste will be generated by the detergent wash plant used for the daily external washing of trains. Heavy cleaning using heavy duty floor scrubbers with water extraction will be undertaken on trains every two weeks. Further detergent water will be generated every day by hand cleaning of cab fronts and windscreens. Sewage effluents will also be generated by the on site work force. These effluents could result in physical, chemical and biological impacts within any receiving water bodies if appropriate waste water collection and treatment are not provided.

4.6.7 The waste water generated by the depot, will be collected and transferred to a dedicated on-site treatment plant which will adjust the pH of the effluent in order to meet the criteria specified in the TM, prior to discharge to the sewer. The daily volume of treated effluent and detergent water will be approximately 120,000 l. If acid cleaning is needed, this is relatively infrequent, there will be an additional daily volume of some 3,000 l. The minor amount of detergent water generated from heavy cleaning and hand cleaning works are only some 20 l and 100 l each day respectively.

Stations and Station Related Developments

4.6.8 The operation of stations and further station related developments will generate stormwater and waste water runoff from these above ground structures and sewage effluents from the facilities. These waste waters could lead to adverse water quality impacts if they gained access to a water body without appropriate treatment.

4.6.9 Water quality impacts caused by sewage effluents generated at stations and any station related developments could be effectively controlled through connection to the existing sewerage system and appropriate waste water treatment facilities off site. In addition, runoff related impacts should be effectively controlled through the design and implementation of appropriate silt traps and oil interceptors prior to discharge of storm waters to stormwater drains.

4.7 Mitigation Methods

General

4.7.1 Operational stage mitigation measures to reduce the potential impacts outlined above should comprise the installation of appropriate drainage systems, including oil interceptors where appropriate, prior to discharge to public drainage systems. In addition, regular maintenance procedures should be defined.

Drainage

4.7.2 Along the elevated sections of track, the foundations and columns should be strategically located to avoid disturbance to the existing main drainage pipes, culverts and nullahs. With reference to the Report MD2, a minimum 3 m reserve area to either side of the drains should be provided to comply with the Drainage Services Department's drainage reserve requirement. If disturbance is unavoidable, any diversion or relocation of local drainage or existing sewer, such as the sewer passing through the Tai Wai station and depot site, should comply with both engineering and environmental requirements.

4.7.3 The proposed MOS Rail alignment at Sai Sha Road will be constructed in cutting along the central reserve of this road such that the small natural channels in this area are unlikely to be impacted if the stormwater best management practices to control runoff from the works are implemented effectively during the construction.

4.7.4 Based on the findings of Report MD2, there were flooding records at the southeast side of the junction between Sha Tin Wai Road and Sha Kok Street. However, the MOS Rail will be elevated as it crosses Sha Tin Wai Road, and thus no flooding hazard will be expected.

4.7.5 Report MD2 concluded that the potential drainage impacts of the sections of the MOS Rail will be minimal, as the track will be constructed above the existing drainage system. A minimum 5.6 m vertical clearance between the track and highway level has been adopted to facilitate maintenance of the existing drains at the highway crossing points. The elevated track will not affect the flood flows within the large open channels, such as at chainage 4800 m where the elevated track crosses the Siu Lek Yuen Road Nullah.

Depot

4.7.6 Acidic waste water generated from acid cleaning activities at the depot should be neutralized to within the pH range of 6-10 before discharging to foul sewer. The efficacy of the depot treatment facilities should be investigated in the detailed assessment phase to ensure the adequacy of the treatment facility with regard to all relevant parameters including surfactants (detergents), suspended solids, pH, oil and grease and ensure that all treated effluent will meet the TM criteria before discharge to sewer.

Stations and Station Related Developments

4.7.7 Where staff toilets are provided, appropriate sewerage to transfer effluent to treatment facilities should be built to ensure that all effluents from all MOS Rail stations comply with the standards defined in the TM prior to discharge. The drainage systems for the new developments will need to be designed to cope with the anticipated volumes of waste water ans sewage and provided with suitable connections into the existing systems.

4.8 Conclusions

4.8.1 This preliminary qualitative water quality assessment has determined that no insurmountable water quality impacts should result from the construction and operation of the MOS Rail assuming that the mitigation measures outlined are implemented.

4.8.2 Further assessment will be required to develop and recommend appropriate site specific mitigation measures to minimise impacts of concern. The characteristics of wastewater generated should be determined in the subsequent EIA to ensure the efficacy of the proposed treatment systems in the depot.

4.8.3 Key water quality issues are summarized below:

- general construction activities associated with site preparation activities, earthworks and excavations and construction of super-structure could lead to site runoff containing elevated concentrations of SS and associated contaminants, the best management practices for stormwater and mitigation measures outlined in *Section 4.7* should be implemented to ensure full compliance with the WPCO effluent discharge standards; and

- operational water quality impacts may arise from the depot, where appropriate and dedicated effluent treatment facilities will be required to treat wastewater generated by train cleaning and maintenance activities.

5 WASTE

5.1 Introduction

5.1.1 This Section identifies the potential waste arisings from the construction and operation of MOS Rail and assesses the environmental impacts that may occur.

5.1.2 The options for waste minimisation, recycling, treatment, storage, collection, transport and disposal for waste arisings from MOS Rail have been examined. Procedures for waste reduction and management are considered and mitigation measures for minimising the impacts of the wastes are recommended.

5.2 Legislation

General

5.2.1 The following legislation covers, or has some bearing upon, the handling, treatment and disposal of wastes in Hong Kong:

- *Waste Disposal Ordinance (Cap 354);*
- *Waste Disposal (Chemical Waste) (General) Regulation (Cap 354);*
- *Crown Land Ordinance (Cap 28); and*
- *Public Health and Municipal Services Ordinance (Cap 132) - Public Cleansing and Prevention of Nuisances (Urban Council) and (Regional Council) By-laws.*

Waste Disposal Ordinance

5.2.2 The *Waste Disposal Ordinance* (WDO) prohibits the unauthorised disposal of wastes, with waste defined as any substance or article which is abandoned. Construction waste is not directly defined in the WDO but is considered to fall within the category of "trade waste". Trade waste is defined as waste from any trade, manufacturer or business, or any waste building, or civil engineering materials, but does not include animal waste.

5.2.3 Under the WDO, wastes can only be disposed of at a licensed site. A breach of these regulations can lead to the imposition of a fine and/or a prison sentence. The WDO also provides for the issuing of licences for the collection and transport of wastes. Licences are not, however, currently issued for the collection and transport of construction and/or trade wastes.

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

5.2.4 Chemical waste as defined under the *Waste Disposal (Chemical Waste) (General) Regulation* includes any substance being scrap material, or unwanted substances specified under *Schedule 1* of the *Regulation*, if such a substance or chemical occurs in such a form, quantity or concentration so as to cause pollution or constitute a danger to health or risk of pollution to the environment.

5.2.5 A person should not produce, or cause to be produced, chemical wastes unless he is registered with the EPD. Any person who contravenes this requirement commits an offence and is liable, upon conviction for a first offence, to a fine of up to HK$200,000 and to imprisonment for up to 6 months. The current fee for registration is HK$240.

5.2.6 Producers of chemical wastes must treat their wastes utilising on-site plant licensed by EPD or have a licensed collector take the wastes to a licensed facility. For each consignment of waste, the producer, collector and disposer must sign all relevant parts of a computerised trip ticket. This enables the transfer of waste to be traced from cradle to grave.

5.2.7 The *Regulation* prescribes the storage facilities to be provided on site for chemical wastes including labelling and warning signs. To minimise the risks of pollution and danger to human health or life, the waste producer is required to prepare and make available written procedures to be observed in the case of emergencies due to spillage, leakage or accidents arising from the storage of chemical wastes. He must also provide employees with training in such procedures.

Crown Land Ordinance

5.2.8 Construction wastes which are wholly inert may be taken to public dumps. Public dumps usually form part of land reclamation schemes and are operated by the Civil Engineering Department (CED). The *Crown Land Ordinance* requires that dumping licences are obtained by individuals or companies who deliver suitable construction wastes to public dumps. The licences are issued by the CED under delegated authority from the Director of Lands.

5.2.9 Individual licences and windscreen stickers are issued for each vehicle involved. Under the licence conditions public dumps will accept only inert building debris, soil, rock and broken concrete. There is no size limitation on the rock and broken concrete, and a small amount of timber mixed with inert material is permissible. The material should, however, be free from marine mud, household refuse, plastic, metal, industrial and chemical waste, animal and vegetable matter and other material considered unsuitable by the dump supervisor.

Public Cleansing and Prevention of Nuisances By-laws

5.2.10 These *By-laws* provide a further control on the illegal tipping of wastes on unauthorised (unlicensed) sites. The illegal dumping of wastes can lead to fines of up to HK$ 10,000 and imprisonment for up to 6 months.

Additional Guidelines

5.2.11 Other 'guideline' documents which detail how the Contractor should comply with the regulations are as follows:

- *Waste Disposal Plan for Hong Kong (December 1989), Planning, Environment and Lands Branch Government Secretariat.*
- *Environmental Guidelines for Planning In Hong Kong (1990), Hong Kong Planning and Standards Guidelines, Hong Kong Government.*
- *New Disposal Arrangements for Construction Waste (1992), Environmental Protection Department & Civil Engineering Department.*
- *Code of Practice on the Packaging , Labelling and Storage of Chemical Wastes (1992), Environmental Protection Department.*

5.3 Sensitive Receivers and Baseline Conditions

5.3.1 The sensitive receivers for MOS Rail with respect to waste management, have been identified in *Sections 2, 3 and 4* which relate to air, noise and water impacts respectively. These receivers may be affected by the storage, handling and collection of waste generated by the construction and operation of MOS Rail. Baseline conditions have also been described in the previous sections.

5.3.2 The sensitive receivers with respect to the transport and disposal of wastes have not been identified within this report. At this Feasibility Study Stage it is not possible to define transport routes and disposal points. However, the disposal points will themselves have been the subject of environmental assessments and appropriate mitigation measures should be in place. In addition, the mitigation measures recommended below to be applied to the collection of waste will assist in minimising any potential environmental impact at these sites.

5.4 Construction Impacts

General

5.4.1 The construction of MOS Rail will involve the following construction works:

- formation preparation;
- standard viaduct sections;
- special long span viaduct sections;
- tracklaying;
- the ten MOS Rail stations (new stations);
- Tai Wai Depot; and
- the three station related developments.

Potential Sources of Impact

General

5.4.2 Construction activities will result in the generation of a variety of wastes which can be divided into distinct categories based on their composition, as follows:

- excavated inert material,
- construction and demolition waste;
- chemical waste; and
- general refuse.

5.4.3 The volumes and nature of each of these waste types arising from the construction of MOS Rail are identified below. The calculated waste arisings have been based on the outline design of the MOS Rail and are detailed in *Table 5.4a*.

Excavated Materials

5.4.4 Excavated material is defined as inert virgin or reclamation fill material removed from the ground and sub-surface. The materials arising from the MOS Rail works will comprise cleared vegetation, rock, sand, clay and mud excavated from the construction of the depot, new stations and cuttings along the route of the railway. The estimated volumes and nature of the excavated materials which will be generated from each of the site working areas are detailed in *Table 5.4a*. The estimated total volume of excavated material arising from the construction of the MOS Rail which will require disposal off-site is approximately 500,000 m^3.

Construction and Demolition Waste

5.4.5 Construction waste comprises unwanted materials generated during construction, including rejected structures and materials, materials which have been over ordered or are surplus to requirements and materials used and discarded. Construction waste will arise from a number of different activities carried out by the MOS Rail contractor during construction and maintenance activities, and may include:

- wood from formwork and falsework;
- equipment and vehicle maintenance parts;
- materials and equipment wrappings;
- unusable/surplus concrete/grouting mixes;
- bentonite slurries; and
- damaged/contaminated/surplus construction materials.

5.4.6 The estimated construction waste arisings from each of the working areas are provided in *Table 6.4a*. The total amount of construction wastes generated during the construction phase (the duration of which varies between 4 and 18 months depending on the particular site), will be in the order of 13,000 m^3.

5.4.7 Demolition wastes are generated as a result of the clearance of sites which are currently occupied by man-made structures. Demolition wastes may include:

- brick, concrete, reinforcing bars, pipework and other rubble;
- derelict equipment and plant;
- wood, furniture and general refuse; and
- asbestos bearing materials.

5.4.8 Depending upon the nature of such structures and the nature of the activities which have been undertaken in them, demolition wastes may be inert, mixed with putrescibles, or contaminated.

5.4.9 The structures to be demolished during the construction of the MOS Rail include the dog compound at Hin Keng, the driving school at Tai Wai and other minor structures along the route of the MOS Rail. These structures may contain small quantities of asbestos bearing materials.

5.4.10 The amount of demolition activity for the construction of the MOS Rail will be limited as the routing of the alignment avoids any major structures. The estimated total volume of demolition waste arisings is approximately 6,000 m^3.

Table 5.4a Estimated Waste Arisings During Construction (m^3)

Construction Site	Staff	Excavated	Construction	Demolition	Chemical [1]	Construction Period
1. Provisional Hin Keng Station	24	700	720	200	-	18
2. Hin Keng to TAW Depot	22	12,000	80	-	-	4
3. Depot and Tai Wai Station	180	171,000	960	200	-	18
4. TAW to STT	50	33,000	420	400	-	6
5. STT Station	83	19,000	870	1,000	-	15
6. STT to SKS	80	18,100	600	360	-	18
7. SKS Station	83	18,100	690	800	-	15
8. SKS to CIO	110	19,400	900	1,000	-	18
9. CIO Station	83	18,100	690	100	-	15
10. CIO to SHM	45	27,200	420	200	-	6
11. SHM Station	83	18,100	690	-	-	15
12. SHM to CHG	136	15,500	900	700	-	18
13. CHG Station	93	15,100	690	40	-	15
14. CHG to HEO	110	30,600	11,220	240	-	18
15. HEO Station	83	12,700	690	60	-	15
16. HEO to MOS	40	34,400	420	160	-	6
17. MOS Station	83	18,100	690	60	-	15
18. MOS to LEO	83	43,800	720	160	-	15
19. LEO Station	55	4,400	690	40	-	15
Trackwork	30	-	60	-	-	12
S & C	30	-	90	-	-	18
Overhead	30	-	90	-	-	18
TOTAL	1,556	505,600	13,060	5,960		

(1) Chemical waste will comprise a small quantity of used oil from machinery and chemical waste from portable toilets which will be used on most sites.

Chemical Waste

5.4.11 Chemical Waste, as defined under the *Waste Disposal (Chemical Waste) (General) Regulation*, includes any substance being scrap material, or unwanted substances specified under *Schedule 1* of the *Regulation*. A complete list of such substances is provided under the *Regulation*, however such substances likely to be generated by construction activities will for the most part arise from the maintenance of equipment. These may include, but need not be limited to, the following:

- scrap batteries or spent acid/alkali from their maintenance;
- used engine oil from oil changing;
- hydraulic fluids;
- used air, oil and fuel filters from machinery;
- spent mineral oils/cleaning fluids from machinery, including materials used in tunnel boring; and
- spent solvents/solutions, which may be halogenated, from equipment cleaning activities.

5.4.12 Chemical waste will arise primarily from vehicle maintenance. Estimates suggest that monthly arisings at the MOS Rail site will be in the order of a few litres of used lubricating oils, a few batteries, and small amounts of all other chemical wastes. In addition, small quantities of asbestos waste may arise from the demolition work. The potential impacts and recommended mitigation measures for asbestos waste are described under the *Construction and Demolition Waste* sub-headings of this *Section*.

General Refuse

5.4.13 The presence of a construction site with large numbers of workers and site offices and canteens will result in the generation of a variety of general refuse materials requiring disposal. General refuse may include food wastes and packaging, waste paper, and packaging from construction materials.

5.4.14 MOS Rail is expected to have a maximum of approximately 1600 full time workers spread across the numerous construction sites. Estimates based on these figures suggest that the maximum amount of general refuse produced during MOS Rail construction will be in the order of eight hundred kilograms (80 m^3) per day at a typical waste density of 0.1 kg m^{-3}.

Assessment Methodology

5.4.15 The assessment of environmental impacts from waste generation is based on three factors:

- the type of waste generated;
- the amount of principal waste types generated; and
- the proposed recycling, storage, transport, treatment and disposal methods, and the impacts of these methods.

Prediction and Evaluation of Impacts

General

5.4.16 The nature and amount of the waste arisings from the construction of MOS Rail and the potential environmental impacts from waste handling, storage, transport and disposal are discussed in detail below under the headings of each waste type.

Excavated Materials

5.4.17 Excavated materials will be reused, wherever possible, on site in abutments and miscellaneous works such as landscaping while the excess materials will be taken to reclamation sites. A total quantity of 500,000 m^3 of excavated materials will require disposal off-site taking into account those materials which may be reused on-site. Given the inert nature of this material, reuse on-site or in reclamation works is unlikely to have any unacceptable impacts relating to its disposal. The potential air, noise and water impacts from the excavation works are covered in *Section 2, 3 and 4* respectively.

Construction and Demolition Waste

5.4.18 The storage, handling, transport and disposal of construction wastes have the potential to create similar visual, water, dust and noise impacts as the storage and disposal of excavated materials.

5.4.19 It should be determined, prior to demolition, whether any of the materials comprising the demolition wastes are asbestos bearing materials. If this is the case, specific mitigation measures relating to asbestos must be taken because there is the potential for adverse health effects on workers.

5.4.20 The disposal of construction and demolition wastes is unlikely to raise any long term concerns because of the inert nature of most construction wastes. To conserve void space at landfill sites, construction waste must not be disposed of at a landfill site if it contains more than 20% inert material by volume. It is therefore good practice to segregate wastes at construction sites before disposing of inert materials at public dumps for reclamation works and putrescible materials at a controlled landfill site. The amount of construction waste which is generated should be minimised by the careful control of ordering procedures to avoid the purchase of surplus materials.

5.4.21 Construction and demolition wastes currently form approximately 35% of the annual take-up of the landfill void in Hong Kong, (although this proportion has varied widely over recent years). Therefore, given the very limited total landfill void which is available, it is important to minimise, wherever possible, the wastes being delivered to landfill.

5.4.22 The avoidance of over ordering and the segregation of materials will minimise waste arisings requiring landfill disposal which will also assist in minimising costs if landfill charges are introduced.

Chemical Waste

5.4.23 Chemical wastes may pose serious environmental and health and safety hazards if not stored and disposed of in an appropriate manner as outlined in the *Waste Disposal*

(Chemical Waste) (General) Regulation and the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.* These hazards include:

- toxic effects on workers;
- adverse effects on air, water and land from spills or leakage;
- fire hazards; and
- disruption of sewage treatment works if waste enters the sewage system.

5.4.24 Chemical wastes will arise principally as a result of maintenance activities. It is difficult to quantify the amount of chemical waste which will arise from the construction activities since it will be highly dependent on the MOS Rail contractor's on-site maintenance intentions and the numbers of plant and vehicles utilised. However, it is anticipated that volumes, and hence potential impacts, will be relatively small.

General Refuse

5.4.25 The storage of general refuse has the potential to give rise to a variety of adverse environmental impacts. These include odour if waste is not collected frequently (eg. daily), windblown litter, water quality impacts if waste enters water bodies, and visual impact. The waste may also attract insects, vermin and other animals if the storage areas are not well maintained and cleaned regularly. In addition, disposal of wastes, at sites other than approved landfills, can also lead to similar adverse impacts at those sites.

Mitigation Measures

Introduction

5.4.26 This section sets out recycling storage, transportation and disposal measures which are recommended to avoid or minimise potential adverse impacts associated with waste arisings from the construction of the MOS Rail under the headings of each waste type.

Waste Management Hierarchy

5.4.27 Various options within waste management can be categorised in terms of preference from an environmental viewpoint. The options considered to be preferable have the least impacts and are more sustainable in the long term, hence, the hierarchy is as follows:

- avoidance and minimisation;
- reuse of materials;
- recovery and recycling; and
- treatment and disposal, as the last option to be considered.

5.4.28 The Waste Disposal Authority, which is the EPD, should be consulted by the Contractor about the final disposal of wastes.

5.4.29 The above hierarchy should be used to evaluate and select waste management options. The aim should be to minimise the amount of waste which is generated, which will also usually reduce costs. For example, by reducing or eliminating over-ordering of construction materials, waste is avoided and costs are reduced both in terms of purchasing materials and in disposing of wastes.

Excavated Materials

5.4.30 Any uncontaminated inert materials which cannot be reused on site may be delivered to public dumps and fill sites. Excavated materials should be segregated from other wastes to avoid contamination thereby ensuring acceptability at fill sites or public dumps and avoiding the need for disposal at landfill.

Construction and Demolition Wastes

5.4.31 Careful planning and good site management can minimise over ordering and waste of materials such as concrete, mortars and cement grouts. The design of formwork should maximise the use of standard wooden panels so that high reuse levels can be achieved. More durable alternatives such as steel formwork or plastic facing should be considered in order to increase the potential for reuse.

5.4.32 The requirements for the handling and disposal of bentonite slurries should follow the *Practice Note For Professional Persons, Construction Site Drainage Professional Persons Consultative Committee, 1994 (ProPECC PN 1/94).*

5.4.33 Asbestos containing materials should be removed, handled and disposed of in accordance with the *Air Pollution Control (Amendment) Ordnance No. 13 of 1993 (APC (A) O), Part IX, Section 69 to 73*, and the *Code of Practice on the Handling, Transportation and Disposal of Asbestos.*

5.4.34 The Contractor should recycle as much as possible of the construction waste on-site. Proper segregation of wastes on site will increase the feasibility of recycling certain components of the waste stream by recycling contractors. Concrete and masonry, for example, can be ground up and used as fill and steel reinforcing bar can be used by scrap steel mills. Different areas can be designated for the storage and processing of the various materials which may be recycled depending on site specific conditions.

5.4.35 In accordance with the *New Disposal Arrangements for Construction Waste, Environmental Protection Department and Civil Engineering Department, 1992*, disposal of construction waste can either be at a specified landfill, or at a public dump, with the latter being the preferred option. Construction wastes should be segregated from other wastes to avoid contamination thereby ensuring acceptability at public dumps and avoiding the need for disposal at landfill.

5.4.36 If landfill disposal has to be used, the wastes will most likely be delivered to the North East New Territories Landfill.

Chemical Waste

5.4.37 Chemical waste that is produced, as defined by *Schedule 1* of the *Waste Disposal (Chemical Waste) (General) Regulation 1992*, should be handled in accordance with the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.*

General Refuse

5.4.38 General refuse generated on-site should be stored in enclosed bins or compaction units separate from construction and chemical wastes. A reputable waste collector should be employed by the Contractor to remove general refuse from the site, separately from construction and chemical wastes, on a daily or every second day basis to minimise odour, pest and litter impacts. The burning of refuse on construction sites is prohibited by law.

5.4.39 General refuse is generated largely by food service activities on site, so reusable rather than disposable dishware should be used if feasible. Aluminium cans are often recovered from the waste stream by individual collectors if they are segregated or easily accessible, so separate, labelled bins should be provided if feasible.

5.4.40 Office wastes can be reduced through recycling of paper if volumes are large enough to warrant collection. Participation in a local collection scheme should be considered if one is available.

Summary

5.4.41 This section describes waste management requirements and provides practical actions which can be taken to minimise the impacts arising as a result of the generation, storage, handling, transport and disposal of wastes.

5.4.42 Specifically, it is recommended that:

- wastes should be handled and stored in a manner which ensures that they are held securely without loss or leakage thereby minimising the potential for pollution;
- only reputable waste collectors authorised to collect the specific category of waste concerned should be employed;
- removal of demolition wastes should be carefully timed to coincide with the demolition work;
- appropriate measures should be employed to minimise windblown litter and dust during transportation by either covering trucks or transporting wastes in enclosed containers;
- the necessary waste disposal permits should be obtained from the appropriate authorities, if they are required, in accordance with the *Waste Disposal Ordinance (Cap 354), Waste Disposal (Chemical Waste) (General) Regulation (Cap 354)* and the *Crown Land Ordinance (Cap 28)*;
- collection of general refuse should be carried out frequently, preferably daily;
- waste should only be disposed of at licensed sites and site staff and the civil engineering Contractor should develop checking procedures to ensure that illegal disposal of wastes does not occur;
- waste storage areas should be well maintained and cleaned regularly; and
- records should be maintained of the quantities of wastes generated, recycled and disposed, determined by weighing each load or by another method.

5.4.43 Training and instruction of construction staff should be given at the site to increase awareness and draw attention to waste management issues and the need to minimise waste generation. The training requirements should be included in the site waste management plan.

5.5 Operational Impacts

General

5.5.1 This section describes the likely waste streams arising from the operation of the MOS Rail, the potential impacts and the waste management mitigation measures which are recommended.

Potential Sources of Impact

General

5.5.2 The sources, including facilities and activities, which may generate wastes during operation of the MOS Rail include:

- the public;
- Tai Wai Depot;
- MOS Rail offices, canteen and staff;
- commercial retailers within the new stations;
- maintenance of building services at the new stations; and
- any renovation or modification to the new stations.

5.5.3 Waste arisings will typically consist of general refuse, industrial waste and chemical waste, some construction wastes may arise from renovation or modification works.

General Refuse

5.5.4 General refuse will be generated by the public and commercial retailers and the MOS Rail offices, canteens and staff at Tai Wai Station. Based on similar operations, the general refuse is likely to be composed of food waste, wood, plastic containers/bottles, office wastes, paper, aluminium cans, old tins/containers, cleaning materials and miscellaneous other wastes produced during daily activities. It has been estimated from experience that each of the new stations may generate up to 5 m^3 per day of such waste.

5.5.5 Tai Wai Depot will generate less than 5 m^3 of general refuse per day, primarily consisting of litter from trains, cotton waste from workshops, paper towels, rags, empty containers and packaging materials. Approximately 170 staff comprising train operators, supervisors, cleaners and maintenance staff will be based at the depot.

Industrial Waste

5.5.6 Industrial waste will be generated from the maintenance activities in the depot and the maintenance and upkeep of the building services of the new stations.

5.5.7 The depot will carry out all the maintenance activities for the MOS Rail and its facilities include two running maintenance berths, with one berth having a carriage lifting facility, and a small heavy repair workshop. Due to the small train fleet size, the generation of waste materials will be correspondingly lower than that generated at existing MTRC depots.

5.5.8 Waste arisings during carriage maintenance activities in the depot will usually be limited to cleaning wastes, including sediment sludge settled out from external train detergent washing water which will be removed periodically by a "sludge gulper".

5.5.9 It is anticipated that the depot will generate less than 10 m^3 of ferrous and non-ferrous scrap metal per month.

Chemical Waste

5.5.10 Chemical wastes may be generated from the depot maintenance activities, maintenance of building services and railway maintenance. These may include, but need not be limited to the following types of waste:

- waste oils and solvents;
- spent solvents/solutions, which may be halogenated, from equipment cleaning activities; and
- waste batteries.

5.5.11 It is considered that only small quantities of chemical wastes will arise during the operation of the MOS Rail consisting primarily of an estimated 120 litres of waste oil per month removed from train gearboxes.

Assessment Methodology

5.5.12 The assessment of environmental impacts from waste generation is based on three factors:

- the type of waste generated;
- the amount of principal waste types generated; and
- the proposed recycling, storage, transport, treatment and disposal methods, and the impacts of these methods.

Prediction and Evaluation of Impacts

General Refuse

5.5.13 The MOS Rail may generate approximately 5 m^3 of general refuse per day from the public and commercial retailers and the MOS Rail offices, canteen and staff at Tai Wai Station. It is considered that a significant proportion of the general refuse waste arisings will be paper and packaging from the offices and commercial retailers respectively.

5.5.14 There are a variety of impacts associated with the storage and handling of waste which can largely be controlled by good practice. Litter may accumulate on or near to the MOS Rail site if waste is not properly collected, stored, handled, transported and disposed of in accordance with good management practice.

5.5.15 Contaminated water or leachate may arise if the waste is not properly stored in enclosed bins or the refuse collection point or if it is not entirely emptied during collections.

5.5.16 Pests and vermin may be attracted to the waste if it is not properly contained, and if the storage area is not regularly cleaned and well maintained. Odour problems may be caused if the refuse collection point is not properly cleaned and emptied frequently. Other impacts may occur if wastes other than the approved types are allowed to be deposited at the refuse collection point (such as chemical or hazardous wastes).

Industrial waste

5.5.17 It is anticipated that the maintenance activities undertaken at the new stations and depot will generate only small amounts of waste which will usually be limited to cleaning wastes, such as rags and empty detergent containers and which will be handled in the same way as general refuse. The waste arisings from the depot will be small because of the limited maintenance activities that will be required.

5.5.18 Maintenance or renovation work at the new stations may generate larger amounts of waste, on an irregular basis, depending on particular needs and projects.

5.5.19 Industrial wastes have the potential to create similar environmental impacts to general refuse as described above.

Chemical waste

5.5.20 Chemical waste may be generated from the maintenance activities at the depot, building service maintenance and equipment cleaning, although the volumes will be small.

5.5.21 It is considered that no unacceptable environmental impacts will occur provided that chemical wastes are handled in accordance with the *Waste Disposal (Chemical Waste) (General) Regulation* and delivered to a facility licensed to receive chemical wastes.

Mitigation Measures

General

5.5.22 This Section sets out the recycling, treatment, storage, transportation and disposal options which may be implemented to avoid or minimise potential adverse impacts associated with waste arisings from the operation of the MOS Rail under the headings of each waste type.

Waste Management Hierarchy

5.5.23 The waste management strategy for the MOS Rail operation should follow the waste management hierarchy described in *Section 5.5.4*.

5.5.24 Based on the principles of the waste management hierarchy, mitigation measures for the three operational waste types are given below.

General Refuse

5.5.25 Considerable scope exists to take waste reduction and management into account at the detailed design stage of the MOS Rail, particularly within the waste management area, by providing spaces or facilities for the segregation and storage of recyclable materials.

5.5.26 Waste collection bins should be strategically located around the new stations for the collection of wastes. The bins should be emptied frequently throughout the day and the waste taken to a central refuse collection point. Guidelines for the design of refuse collection points are given in the HKPSG. Waste should be collected daily for disposal by a reputable waste collector.

5.5.27 The arisings of general refuse at the MOS Rail may contain recyclable elements. Aluminium, paper and paperboard may be present in quantities large enough to warrant the provision of separate bins for their collection, the contents of which could be collected by or sold to recycling contractors.

5.5.28 General refuse from the MOS Rail would most likely be taken directly to the NENT Landfill by private contractors.

Industrial Waste

5.5.29 Ferrous and non-ferrous scrap metal wastes should be collected and stored separately for collection by, or sale to, a recycling contractor.

5.5.30 Industrial wastes should be handled, transported, collected and disposed in the same way as that for general refuse described above.

Chemical Waste

5.5.31 Under the *Waste Disposal (Chemical Waste) (General) Regulation*, chemical waste producers should register with EPD. Chemical wastes should be transported by a registered chemical wastes collector to a facility licensed to receive chemical wastes.

5.5.32 Chemical waste should be stored in safe and suitably resistant containers, labelled, and in an appropriate store area, in accordance with the *Waste Disposal (Chemical Waste)(General) Regulation*, as discussed in *Section 6.4.5*. Enviropace, the operator of the Chemical Waste Treatment Facility on Tsing Yi, supplies approved containers for chemical waste which can be replaced with each collection.

5.6 Conclusions

5.6.1 It is likely that large quantities of excavated materials will arise from the MOS Rail. A total volume of approximately 13,000 m^3 of construction waste and 6,000 m^3 of demolition wastes will also be generated. It is therefore important that the mitigation measures relating to good practice which have been recommended are followed to ensure that adverse impacts are prevented and that the opportunities for waste minimisation and recycling are taken. The recommendations made in *Sections 2, 3 and 4* covering the handling, storage and transport of construction wastes are also applicable.

5.6.2 The level of general refuse produced by the MOS Rail operation is not expected to be unduly high but all feasible measures should be taken to avoid, minimise and recycle wastes. Industrial and chemical waste arisings from maintenance activities will be low and limited to plant and equipment maintenance at the depot and new stations.

5.6.3 Provided that the recommendations put forward in this report are conscientiously acted upon, no waste related regulatory non-compliances should occur as a result of the storage, handling, collection, transport, and disposal of wastes arising from the construction and operation of MOS Rail.

6 ECOLOGY

6.1 Introduction

6.1.1 This section assesses and evaluates potential impacts to ecological resources arising from MOS Rail.

6.2 Legislation

6.2.1 The relevant regulations, legislation and guidelines which provide the framework for the protection of species and habitats of ecological importance in Hong Kong are described in detail below.

6.2.2 Hong Kong legislation provides for the protection of animals and plants and special areas through the following relevant ordinances and guidelines:

- Forests and Countryside Ordinance (Cap 96) of the Revised Edition 1994;
- Wild Animals Protection Ordinance (Cap 170);
- Animals and Plants (Protection of Endangered Species) Ordinance (Cap 187) of the Revised Edition 1994;
- Town Planning Ordinance (Cap 131); and
- Hong Kong Planning Standards and Guidelines.

6.2.3 The Forests and Countryside Ordinance (Cap 96) prohibits felling, cutting, burning or destroying of trees and growing plants in forests and plantations on government land. Its subsidiary Regulations prohibit the picking, felling or possession of listed rare and protected plant species. The list of protected species in Hong Kong was last amended under the Forestry (Amendment) Regulation 1994 made under section 3 of the Forests and Countryside Ordinance (Cap 96).

6.2.4 Under the Wild Animals Protection Ordinance (Cap 170), designated wild animals are protected from hunting, whilst their nests and eggs are protected from injury, destruction and removal. All birds and most mammals are protected under this Ordinance. Prior approval from the Director of Agriculture and Fisheries is required for permission to destroy any of the protected wild animals listed in the Ordinance. The Second Schedule of the Ordinance which lists all the animals protected was last revised in June 1994.

6.2.5 The Animals and Plants (Protection of Endangered Species) Ordinance controls the local possession of any endangered species of animals and plants listed in its schedules. It is designed to control trade in endangered species and to restrict their local possession. In addition, there are measures which cover the retention, removal and replacement of trees on development sites, and is therefore relevant to this Study.

6.2.6 The recently amended Town Planning Ordinance provides for the designation of coastal protection areas, Sites of Special Scientific Interest (SSSIs), green belt or other specified uses that promote conservation or protection of the environment, eg Conservation Areas. Where SSSIs are covered by statutory town plans, the land uses therein are controlled by the provision of the Town Planning Ordinance. The authority responsible for administering the Town Planning Ordinance is the Town Planning Board (Planning Department).

6.2.7 The revised Chapter 10 of the HKPSG covers "Landscape and Conservation". This chapter details the principles of conservation, the conservation of natural landscape and habitats, historic buildings, archaeological sites and other antiquities. It also addresses the issue of enforcement. The Appendices list the legislation and administrative controls for conservation, other conservation related measures in Hong Kong and Government Departments involved in Conservation.

6.3 Baseline Conditions and Sensitive Receivers

6.3.1 With reference to the vegetation map prepared by World Wide Fund for Nature, Hong Kong, almost all the area covered by the proposed extension falls within the "High Density Urban" category. Virtually no natural habitats have been identified along the proposed alignment. The vegetation found are mostly exotic species and associated with landscaped planting. No sites within or in the immediate vicinity of the work areas are identified to have ecological importance. The only potential ecological sensitive receiver identified is a Fung Shui woodland near Wong Uk in Shatin (see *Figure 6.3a*). An ecological field survey of the woodland area was undertaken on 30th August 1996.

6.3.2 The woodland is surrounded by a public garden, from which it is partially fenced off. It is small and occupies only about 0.5 ha. It is considered that the woodland has been modified extensively in the past, as indicated by the presence of several abandoned huts, graves, and fruit trees within the woodland. The species found in the peripheral area include *Castanopsis fissa* and *Casuarina equisetifolia*. Other species dominant in this area include those common pioneer tree species such as *Sapium discolor, Sapium sebiferum, Mallotus paniculatus* and *Macaranga tanarius*, which indicates that this part of the woodland is quite young. Within the woodland core, the species found are typical of other lowland woodlands all over the Territory, such as: the trees *Bridelia tomentosa, Ficus microcarpa, Bischofia javanica* and *Antidesma bunius*; the shrubs *Ligustrum sinense, Sageretia theezans, Psychotria rubra* and *Phyllanthus reticulatus*; and the climbers *Uvaria microcarpa, Uvaria grandiflora* and *Desmos cochinchinensis*. A list of species recorded in the woodland during the field visit is shown in *Table 6.3a*. No rare or endangered plant species were identified.

6.3.3 Birds observed within the woodland during the survey were only ubiquitous species (eg Tree Sparrow *Passer montanus* and Crested Bulbul *Pycnonotus jocosus*) that are well-adapted to disturbed conditions. Although the survey was undertaken during the breeding season, no signs of nesting activities were observed.

6.3.4 Based on observations during the field survey, animal groups protected under the current legislation are not expected to be supported in the woodland because of the frequent human activities, and the isolated nature and small size of the woodland. The woodland is considered to be of low ecological value.

6.4 Construction Impacts

Potential ecological impacts will arise from land clearance, and construction activities affecting the edge of the woodland (see *Figure 6.3a*). This will entail the removal of vegetation within the work areas. However, since the woodland area affected is only small (0.02 ha, about 8% of the woodland edge) and the periphery of the woodland has

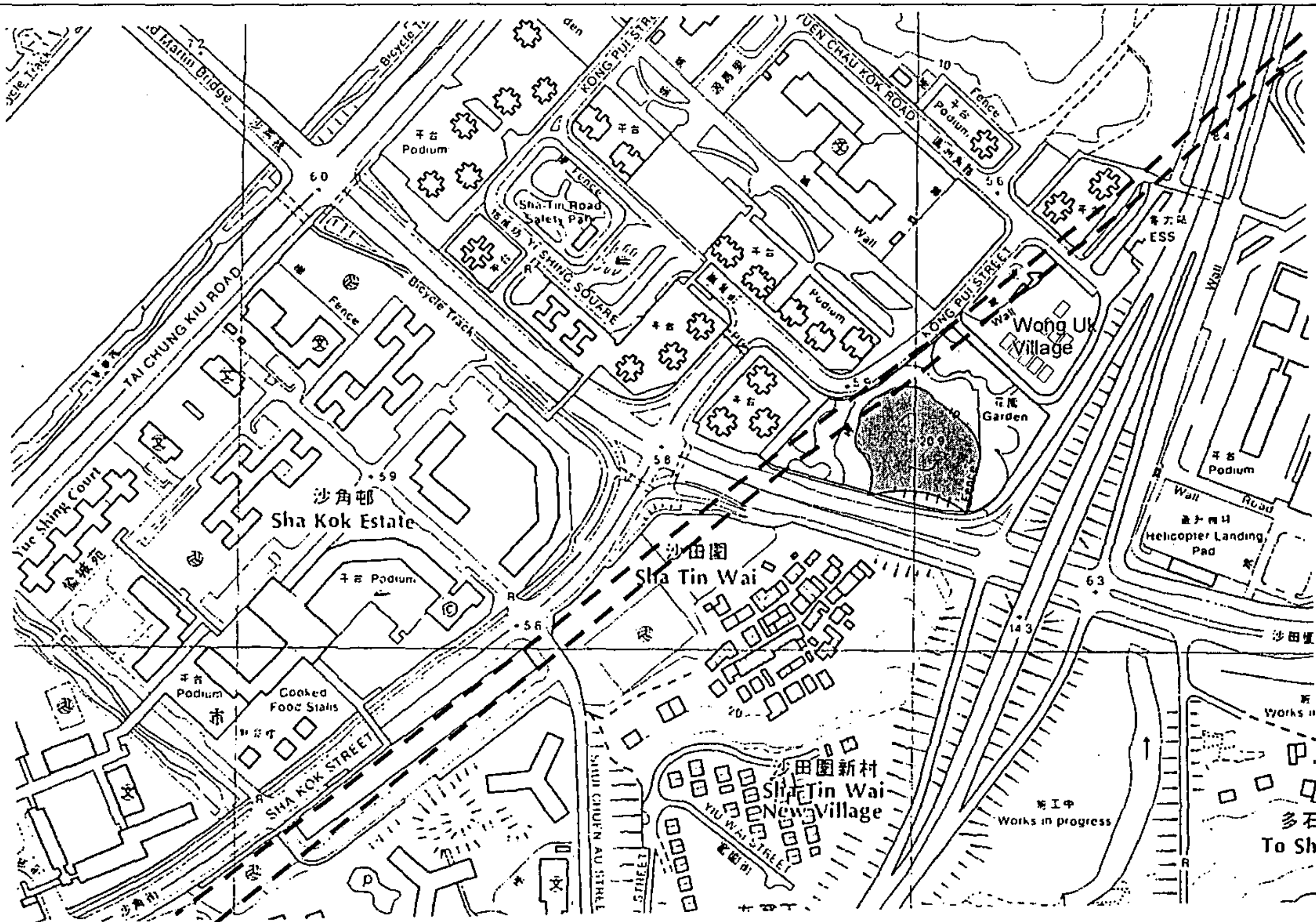


FIGURE 6.3a - FUNG SHUI WOODLAND LOCATION

KEY

WOODLAND

GARDEN

RAILWAY ALIGNMENT

SCALE NTS

ERM-Hong Kong, Ltd
6th Floor
Heeny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

already been managed as part of a public garden for aesthetic use, the ecological impact is considered to be low.

Table 6.3a Plant Species Recorded At the Woodland (30th August, 1996)

Ailanthus fordii	*Ficus hispida*	*Morinda umbellata*
Alchornea trewioides	*Dimocarpus longan*	*Machilus chinensis*
Alocasia macrorrhiza	*Elephantopus tomentosa*	*Mallotus paniculatus*
Antidesma bunius	*Ficus microcarpa*	*Mussendanea pubescens*
Aporusa chinensis	*Ficus variegata*	*Paederia scandens*
Bischofia javanica	*Ficus virens*	*Passiflora foetida*
Bridelia tomentosa	*Ilex asprella*	*Phyllanthus cochinchinensis*
Caesalpinia spp.	*Ilex rotunda*	*Phyllanthus reticulatus*
Callicarpa loureiri	*Illigera celebica*	*Psychotria rubra*
Castanopsis fissa	*Ipomoea carica*	*Pueraria phaseoloides*
Casuarina equisetifolia	*Lantana camara*	*Sageretia theezans*
Celtis philippensis	*Leucanea leucocephala*	*Sapium discolor*
Celtis sinensis	*Liriope spicata*	*Sapium sebiferum*
Clematis spp.	*Litsea glutinosa*	*Sterculia lanceolata*
Cratoxylum ligustrinum	*Lygodium japonica*	*Symplocos glauca*
Dalbergia balansae	*Macaranga tanarius*	*Syzygium jambos*
Desmos cochinchinensis	*Microcos paniculata*	*Thunbergia spp.*
Dicranopteris linearis	*Mikania micrantha*	*Uvaria grandiflora*
Embelia longifolia	*Miscanthus floridulus*	*Uvaria microcarpa*

6.4.1 There may be indirect disturbance from the construction works on the woodland habitat from uncontrolled dust and noise impacts.

Mitigation Measures

6.4.2 The following mitigation measures should be implemented during the construction, as good practice, to minimize disturbance to the woodland habitat:

- erect fences along the boundary of construction sites before the commencement of works to prevent tipping, vehicle movements, and encroachment of personnel into the woodland;

- check regularly to ensure that the work site boundaries are not exceeded and that no damage is being caused to the surrounding areas;

- employ dust and noise control measures to minimize disturbance; and

- where the areas around the station and alignment remain the responsibility of the proponent, maintain planted areas and ensure the survival of trees for at least the first two years after the completion of the construction works.

6.5 Operational Impacts

6.5.1 Operational impacts on ecological resources are considered to be minimal, given the existing developed nature of the surrounding area.

6.6 Conclusions

6.6.1 The only potential ecological impact will be associated with the loss of a small edge of the woodland near Wong Uk. However considering the low ecological value of the affected area, which is managed as part of the adjoining garden, the potential impact would be low. Good construction practices are recommended to minimize disturbance to the main part of the woodland.

7 LANDSCAPE AND VISUAL IMPACTS

7.1 Introduction

7.1.1 This Section of the report outlines the landscape and visual impacts associated with the construction and operation of the MOS Rail alignment as well as the stations, depot and related developments at their preferred locations.

7.1.2 The assessment initially identifies the existing landscape features of the depot and station sites as well as the features of the alignment corridor. The locations from where the development would be visible are then described. People in the surrounding areas who would potentially be able to see the proposed development are identified and categorised according to their predicted sensitivity to the visual intrusion that would be generated by the proposed development.

7.1.3 The potential landscape and visual impacts that would result from the development are then identified and the level of the potential impacts are assessed according to whether they are high, medium or low. Measures are identified that would help reduce the level of these potential impacts on the landscape and on the identified visual receivers.

7.2 Legislation

7.2.1 There is no legislation in Hong Kong that relates directly to the assessment of the landscape or visual impacts of new developments or construction sites. A degree of control is achieved through the requirement to address visual issues as part of an environmental review and assessment process. The EPD advice note relating to the *Application of the EIA Process to Major Private Sector Projects (2/90), EPD, 1990,* identifies visual impact as being an issue of concern to be addressed. In addition, HKPSG (Chapter 10 - Landscape and Conservation), outlines those criteria which should be considered when planning in an urban environment. Government restrictions on the preservation and felling of trees in Hong Kong are detailed in Government General Regulation 740.

7.3 Sensitive Receivers and Baseline Conditions

Hin Keng Estate to Sha Tin Tau Road

7.3.1 The site for Tai Wai Station and Depot is located immediately to the south-west of the Tai Wai KCR Station. It is bounded on its southern side by Che Kung Miu Road, on its eastern side by Mei Tin Road, on its northern side by the KCR alignment and on its western side by a public park that is located opposite Hin Keng Estate.

7.3.2 The site comprises three distinct parts. The western part of the site is currently occupied by the Hong Kong School of Motoring. The central part of the site is currently used as a sports pitch. The eastern part of the site is, at present, partly used as a cycling area and partly as a contractor's compound.

7.3.3 The embankment adjacent to the KCR is covered in grass and ornamental shrubs. There are some groups of mature and immature trees located on the lower edge of this embankment especially in the western section. Large groups of mature and semi-mature trees are located to the south of the existing Tai Wai KCR station. The sports pitches are grassed and elsewhere there are occasional groups of scrub and patchy grass scattered around the area. The KCR station entrance building, approximately 10 m high, is located at the far north-east corner of the site. A cycle track and footpath, and associated amenity planting run along the eastern and southern boundaries.

7.3.4 After leaving the station and depot site the alignment veers north-east and passes immediately adjacent to the eastern end of Tai Wai KCR Station. It passes across the Happy Dragon Recreation Park and then joins the cycle track and walkway that passes along the southern bank of the Shing Mun River Channel.

7.3.5 A number of residential developments have clear views of the site and adjacent section of alignment including Tim Sam Village and Carado Gardens, Sun Choi Estate, Lung Hang Estate and Hin Keng Estate (all located to the south) as well as Holford Gardens and Grandview Gardens (both located to the north). More distant views of the site are available from Sha Tin Heights (located to the west) and from Tai Wai New Village (located to the north). Che Kung Temple is located to the south of the alignment on the southern side of Che Kung Miu Road. This temple is a Grade 2 listed building and is protected by the Antiquities and Monuments Ordinance. Sensitive receivers in this section of alignment include not only residents of the above properties but also pedestrians, cyclists and other road-users.

Sha Tin Tau Road to Sha Tin Wai Road

7.3.6 The site for Sha Tin Tau Station is located within the Sha Tin Wai THA. This area is boarded on its southern and western sides by Che Kung Miu Road, on its eastern side by Lion Rock Tunnel Road and on its northern sides by the Shing Mun River Channel and its associated footpath and cycle track. The THA comprises approximately 45 low-rise housing units which are built from wood and corrugated iron. A hard-paved area surrounds these units and a large number of mature and semi-mature trees are spread around the units. Views of the proposed station site and adjacent sections of alignment are available from Manlai Court and Hilton Plaza on the opposite side of the river as well as from Chun Shek Estate, Lei Uk Tsuen Village, Sha Tin Tau Village and the Jat Min Chuen Estate. Sensitive receivers in this section of alignment include not only residents of the above properties but also pedestrians, cyclists and other road-users.

7.3.7 The alignment between Sha Tin Tau station and the next station at Sha Kok Street runs west over Che Kung Miu Road and Lion Rock Tunnel Road (with its well-vegetated embankments). It passes over a wooded mound that is located at the junction of these two roads and several temporary structures are located amongst this vegetation. This wooded mound is probably of fung shui significance. The High Rock Christian Camp at 102 Sha Tin Tau Village, is located on the top of the mound and is a Grade 3 listed building.

7.3.8 Thereafter, the alignment passes over the Tsang Tai Uk Recreation Ground before running parallel to, and immediately to the east of, Sha Kok Street on its way to Sha Kok Street Station. This recreation ground comprises six tennis courts, a full-size football pitch, a playground and several basketball courts. The boundary of the recreation ground is generally well-vegetated with mature and semi-mature trees and these provide a strong sense of enclosure for this attractive area. Immediately before reaching Sha Kok Road, the track alignment passes over the access road to Sha Ha Wai village and a footpath and cycle track which connects Sha Kok Street with Lion Rock Tunnel Road. Groups of mature and semi-mature trees line this footpath and cycle track and one particularly large group of Acacia and Bauhinia trees is located at the junction with Sha Kok Street. People living in the historic Shan Ha Wai (Tsang Tai Uk)Village as well as users of the Tsang Tai Uk Recreation Ground and the adjacent footpath and cycle track will have clear views of this section of alignment.

7.3.9 The track alignment between Tsang Tai Uk Recreation Ground and Sha Kok Street station passes over a series of open spaces that are located immediately to the south of Sha Kok Street. These open spaces contain two basketball courts, one large car-parking area and two separate parks and sitting-out spaces. A belt of shrubs and immature trees is located between these facilities and also between the facilities and Sha Kok Street. A cycle track and footpath is also located between these open spaces and Sha Kok Street. The station site is located in a reserve that was set aside for the proposed MOS Rail development. This reserve comprises a large rectangular area of grass and has immature trees growing along its edges. An elevated walkway (with access ramp) passes across Sha Kok Street at a point immediately to the north of the site. Several large housing estates are located on either side of Sha Kok Street and these include the Jat Min Chuen residential area, the Pok Hong Estate and the Sha Kok Estate. Views of the station site and adjacent sections of alignment will be available from these areas. Other sensitive receivers in this area include pedestrians, park-users, cyclists and other road-users.

7.3.10 From Sha Kok Street, the alignment passes over Shui Chuen Au Street and along a large linear and well-vegetated open space on its way to Sha Tin Wai Road. A particularly tall group of trees is located at the junction of Sha Tin Wai Road and Sha Kok Street. Immediately to the south of this open space lies a large football pitch and Sha Tin Wai Village is located up slope of this pitch.

7.3.11 The alignment heads north-west from Sha Tin Wai Road on its way to the City One Station site located adjacent to Chap Wai Kon Street. A small open space and sitting area and a well-vegetated mound are located immediately to the north-west of Sha Tin Wai Road. This vegetated mound contains six graves on its southern and western edges and is of fung shui significance. The proposed track alignment passes over this open space, over the mound and over another open space located to the south-east of the mound before reaching an area of undeveloped ground located to the north of Wong Uk Village. An historic Tsz Tong building is located in the eastern corner of Wong Uk Village.

7.3.12 The alignment of the proposed track then reaches a China Light and Power Substation located to the north of Shatin Road. The proposed track alignment then passes over Shatin Road and its well-vegetated embankments. The existing Old House at Wong Uk (a Grade 2 protected building) is located approximately 500 m to the north-west of the proposed alignment and would not be affected by the project. Thereafter, the alignment passes over a bus terminus and a small open space located between the bus-terminus and Ngan Shing Street. Visually sensitive receivers along this section of alignment include the residents of Shatin Park residential blocks, Wong Uk Village, Sha Tin Wai Village and the users of the

Prince of Wales Hospital. Other visually sensitive receivers along this section of alignment include pedestrians, park-users, cyclists and other road-users.

7.3.13 The site for City One Station is located at the junction of Ngan Shing Street and Chap Wai Kong Street. The site is located in a long linear reserve set aside for the MOS Rail development immediately to the west of, and parallel to, Chap Wai Kong Street. This railway reserve is currently used as a plant nursery and is well stocked with trees. A footpath and cycle track is located between Chap Wai Kong Street and this nursery. A 1.5 m wide vegetated strip is located immediately inside the boundary fence of the nursery and this strip contains a large number of immature trees. This railway reserve, located between Chap Wai Kong Street and Siu Lek Yuen Road is approximately 600 m long. It is bounded to the north-west by schools and residential developments (Yue Tin Court and City One Plaza) and the south-east by industrial buildings (mostly godowns). Sensitive receivers along this section of alignment include not only users of the above schools, godowns and residential properties but also pedestrians, cyclists and other road-users.

Siu Lek Yuen Road to Chevalier Garden

7.3.14 A large area of recreational open space, undeveloped land and a nullah are located to the north-west of Siu Lek Yuen Road. The proposed track alignment passes across this open space and nullah before entering an industrial area that is set in a triangle of land located between the nullah, Tate's Cairn Highway and Tai Chung Kiu Road. The proposed track alignment then passes parallel to, and immediately to the north-west of, On Ming Street before reaching the site of Shek Mun Station which is located at the junction of On Ming Street and On Lai Street.

7.3.15 The site of Shek Mun Station is a hard-paved area, currently used for the storage of trucks and containers. A small amount of scrub vegetation is located along the boundary of the site. Other areas for the storage of containers and trucks are located around the site whilst a concentration of industrial buildings is located several hundred metres to the west. Sensitive receivers along this section of alignment include not only users of the above industrial properties but also pedestrians and other road-users.

7.3.16 The proposed track alignment then veers due north to join the Tate's Cairn Highway. A reserve, approximately 12 m wide has been set aside for the MOS Rail development along the centre of the highway from this point until the track alignment reaches Chevalier Garden Station. The section of reserve between the Shek Mun Industrial Estate and Chevalier Garden is well grassed and has occasional groups of immature trees. Visually sensitive receivers along this section of alignment include residents of Pictorial Gardens and Sha Tin Fishermen's New Village as well as users of Shatin Hospital. Other sensitive receivers along this section of alignment include pedestrians, cyclists and other road-users.

Chevalier Garden to On Luk Street

7.3.17 The site for Chevalier Garden Station is located within a central reserve that was set aside for the MOS Rail project within the Ma On Shan Road corridor. This reserve, approximately 27 m wide at the station site, is well grassed and contains occasional groups of immature trees. An intertwining system of highway flyovers and slipways is located approximately 200 m to the north of the station site. Large areas of grass and shrubs are located underneath and to the side of these structures. The Shing Mun River Channel is located approximately 600 m to the west of the site and a recently completed reclamation (mostly grass covered with occasional clumps of scrub) is located between the river channel and the highway. Dense woodland is located to the east of the highway corridor and this woodland extends up to the middle and upper slopes of the hills that enclose the eastern side of the Shatin Valley. A few small residential developments (e.g. Tai Shui Hang Village and Chevalier Garden) are located within side-valleys set amongst these vegetated hill slopes. The relative absence of buildings in this area combined with the relatively flat landform immediately surrounding the site both contribute to a sense of openness in the area. Visually sensitive receivers of the station site and adjacent sections of alignment include not only residents of the above properties but also pedestrians and hill walkers, as well as cyclists and other road-users.

7.3.18 The proposed track alignment passes over the flyover system and joins the Sai Sha Road where it again follows a wide central reservation (with patchy grass cover only in this section) set aside for the MOS Rail project. The proposed track alignment then continues north across a large road junction and roundabout located immediately to the south-west of Heng On Estate and from there onwards to the site for the Heng On Station. Earthworks associated with the road junction are still in progress and large areas of earth are exposed. The site is overlooked by the adjacent Heng On Estate. Vegetated hillsides and occasional residential developments are located in the distance on the western side of the Shing Mun River Channel.

7.3.19 The station site is located within a central reserve that was set aside for the MOS Rail project within the Sai Sha Road corridor. This reserve, approximately 15 m wide at the station site, has a patchy grass cover and is enclosed by railings. The Heng On residential estate is located immediately to the east of the station site and the high-rise buildings within this estate overlook the site. A school and associated playground is located between these high-rise buildings and the Sai Sha Road. Visually sensitive receivers along this section of alignment include not only residents and users of the above properties but also pedestrians, cyclists and other road-users. Wide belts of tree and shrub planting are located along the boundary of the estate where it fronts the road. Large areas to the west of the Sai Sha Road are set aside for residential development and Government / Institution / Community development. Foundation construction works are in progress in many of these areas.

7.3.20 The alignment then continues north along the central reserve towards Ma On Shan Station. A large footbridge passes over the central reserve at a point 300 m to the north of Heng On Station. Immediately adjacent to this footbridge lies the Hing On THA which contains a large number of low-rise temporary structures. Large areas of bare undeveloped land surround this THA. The high-rise buildings of the Yiu On Estate may be seen on the other side of this undeveloped land. To the west of the footbridge, lies the Chung On Shopping Centre and the Toi Shan Association Memorial School and there are several large residential blocks located behind these buildings. Visually sensitive receivers in this section of alignment include not only residents and users of the above properties but also pedestrians, cyclists and other road-users.

7.3.21 The railway central reserve then veers to the east towards the On Yuen Street and Sai Sha Road junction. A large residential estate is under construction to the north of Sai Sha Road in this area. Two schools and a park are located to the south of the road in the section of proposed alignment between Hang Hong Street and On Yuen Street. The railway central reserve then continues to the east as it approaches Ma On Shan Station.

On Luk Street to Lee On Estate

7.3.22 The site for Ma On Shan Station is located within a central reserve that was set aside for the MOS Rail project within the Sai Sha Road corridor. The central portion of this reserve, which varies between 15 m and 25 m wide at the MOS site, is covered with grass. It is however, well-vegetated with trees, grass and shrubs on its periphery and is enclosed by railings. The Sunshine City development (residential towers on podium deck with a bus station and commercial properties below) is located immediately to the south of Sai Sha Road at this point and the Ma On Shan Centre (residential towers on podium deck with commercial properties below) is located immediately to the north of the road. Thereafter, the track alignment continues along the MOS Rail reserve in a westerly direction on towards Lee On Station.

7.3.23 Heading west after On Chiu Street, the track alignment passes through an area of residential properties (Villa Athena to the north and Saddle Ridge Gardens together with the Ma On Shan Health Centre to the south). The central reserve in this section of the route is well-vegetated with grass together with avenues of immature trees. A cycle track and footpath with associated amenity planting is located along the southern edge of Sai Sha Road. Saddle Ridge Gardens is located on a hill and the slopes leading down to the road are densely vegetated with trees. Visually sensitive receivers in this section of alignment include not only residents of the above properties but also pedestrians, cyclists and other road-users.

7.3.24 The track alignment then crosses Kam Ying Road along the central reserve, passing the Lee On residential estate which is located on the south-east of Sai Sha Road and also Wu Kwai Sha New Village which is located to the north-west. The central reserve in this section of the route is grass only, whilst the roadside embankments on the north-western side of Sai Sha Road are well-vegetated with trees and shrubs. This vegetation effectively screens views to the north-west at street-level. Having reached the access road for the Lee On Estate, the track alignment veers due east toward the site for Lee On Station. A cycle track and footpath are located along the south-eastern side of Sai Sha Road and this route passes across this access road and then on past the site for the Lee On Station.

7.3.25 The Lee On Station site is located approximately 100 m to the east of the access road to the Lee On Estate and is located within a former borrow area. This borrow area site comprises a series of flat platforms which are separated by rock outcrops. The platforms are unvegetated except for sparse grass growth, whilst the boundary of this borrow area, where it faces the adjacent roads, is well vegetated with dense tree growth. The trees are young plantation species and of little ecological value. Clear views of the station site are available from the Lee On Housing Estate. Visually sensitive receivers in this section of alignment include not only residents of the above property but also pedestrians, cyclists and other road-users.

7.4 Construction Impacts

Potential Sources of Impact

7.4.1 The proposed MOS Rail development project would involve the construction of a railway depot, ten stations and approximately 10.5 km of railway track. The elevated sections of track would be built on a 10 m wide viaduct supported on columns. The sides of the viaduct structure would be approximately 3 m deep and columns for the support of noise barriers would be fixed, as appropriate, to the sides of this structure. Each station would be approximately 20 m wide with the platforms located on either side of the tracks. Escalators would be provided for pedestrian access up to the station which would be provided with a roof structure.

7.4.2 A total of 7.5 km of the railway would be provided with noise barriers where it is located particularly close to residential properties, the barrier types and locations are described in detail in *Section 3*. The viaduct would generally be built approximately 5.6 m above ground but would be raised further above any structures over which it passes. At the proposed site of the Ma On Shan Station, the viaduct and station platform would be raised to approximately 17.3 m above ground level to avoid conflict with existing pedestrian bridges. High-rise residential blocks and a transport terminus will be developed in association with the proposed station at Lee On. A hotel or medium-rise residential blocks would probably be developed at Sha Tin Tau. In addition, a depot is proposed at Tai Wai and this is likely to have podium-deck residential development associated with it.

7.4.3 The elements of the proposed development would create varying levels of impact on the physical landscape and on the visual amenity of the surrounding areas during the construction stage. Potential impacts on the physical landscape would result from general site preparation and excavation works for the construction of foundations. Visual impacts would result from the above site preparation works together with the implementation of the piling works. Visual impacts would also be generated during the construction stage by the presence of equipment and new structures. There would, in addition, be visual impacts at all of the proposed construction sites during the night as a result of the presence of security lighting.

Assessment Methodology

7.4.4 The method for identifying potential landscape and visual impacts has initially involved identification of the sources of impact that would be generated by the scheme i.e. the elements of the construction works and operational procedures that would generate landscape and visual impacts. Site visits were initially conducted to gain an overview of the existing landscape (topography, vegetation cover, as well as landscape features) through which the proposed alignment and stations would be located. Baseline conditions and visually sensitive receivers have been established not only through these site visits to the study area but also by inspection of topographical maps and aerial photographs. Potential impacts on the landscape and on the identified visual receiver groups were identified for both the construction and operational stages of the scheme. These identified landscape and visual impacts are detailed and assessed below.

Prediction of Impacts

7.4.5 The site preparation and excavation works associated with the proposed development would result in disturbance to existing vegetation, structures and other landscape features. Areas of disturbed land, the construction operations, as well as the presence of the rail track, the stations, the depot (and any associated residential development) at their various stages of construction, would all have a visual impact on the surrounding areas and their populations at the construction stage.

Hin Keng Estate to Sha Tin Tau Road

7.4.6 Development of a depot and station at Tai Wai would involve the loss of the area used by The Hong Kong School of Motoring in the western part of the site, as well as the central part of the site currently used as a sports pitch and the eastern part of the site which is, at present, partly used as a cycling area and partly as a contractor's compound. The cycling area is much valued by the local population, not only as a recreational facility, but also on account of the open aspect of the site and the wide panorama of the views available of Shatin and its enclosing hillsides. Development of buildings on this site would result in the loss of an open space that contributes greatly to the sense of openness of this part of the Shatin landscape. The loss of these open space areas would represent a high loss in terms of landscape amenity for the local population.

7.4.7 Development of the station and depot (and approximately 30 high-rise residential blocks associated with the depot development) would involve the loss of some groups of mature and immature trees located close to the embankment, around the sports area and to the south and east of the cycling area. These losses would represent a high impact on the local landscape. There would be further loss of the mature and semi-mature trees located immediately to the south of the existing Tai Wai KCR Station. Only a limited proportion of the trees located to the south of the existing station would be lost as the track alignment through this area would be a viaduct construction. Trees and other vegetation may be retained beneath and to the side of the structure in this location.

7.4.8 After leaving the Tai Wai station and depot site, the track alignment veers north-east and passes immediately adjacent to the eastern end of Tai Wai KCR Station and on through the Happy Dragon Recreation Park. A high level of landscape disturbance to the Happy Dragon Recreation Park is predicted as the proposed railway development would involve the redevelopment of the whole of this recreation park. A high level of landscape disturbance is also predicted on the section of cycle track and walkway that passes along the southern bank of the Shing Mun River Channel and is located to the west of the Sha Tin Tau Temporary Housing Area. Columns for the viaduct would be located within this cycle track area and this would involve the loss of one large group of trees and shrubs as well as the partial closure of this facility whilst the construction works are being carried out.

7.4.9 People living in nearby residential developments would have clear views of the construction elements identified above and would experience a moderate to high level of visual impact depending on their distance away from the site and the variable quality of their existing views which include the presence of construction sites and a contractor's compound at present. These visually sensitive receivers include residents of Tim Sam Village and Carado Gardens, Sun Choi Estate, Lung Hang Estate and Hin Keng Estate (all located to the south) as well as Holford Gardens and Grandview Gardens (both located to the north). More distant views of the site are available from Sha Tin Heights (located to the west) and from Tai Wai New Village (located to the north) where residents would experience low levels of visual impact. Other visually sensitive receivers in this section of alignment (i.e. pedestrians, cyclists and users of the parts of the recreation facilities that would remain during the construction stage) would experience high levels of visual impact. Users of the surrounding road system would, by virtue of their transient nature, experience low levels of visual impact.

Sha Tin Tau Road to Sha Tin Wai Road

7.4.10 The development of a station at the THA site would involve the loss of approximately 15 mature and semi-mature trees along the southern boundary of the site. The existing low-rise housing units on the site are likely to be cleared by the Housing Authority before any railway development works commence and this clearance would be unrelated to this project. The tree losses would represent a medium level landscape impact. An elevated station and adjacent sections of track are proposed over the THA at approximately 5.6 m above ground-level. Medium-rise residential blocks or a hotel are likely to be developed in association with Sha Tin Tau Station. Views of the construction works and the structures under construction would be available from Manlai Court and Hilton Plaza on the opposite side of the river as well as from Chun Shek Estate, Lei Uk Tsuen Village, Sha Tin Tau Village and the Jat Min Chuen Estate. The construction works would generate a moderate level of visual impact on these sensitive receivers. Other visually sensitive receivers in this section of alignment (i.e. pedestrians and cyclists) would experience high levels of visual impact.

7.4.11 The proposed track alignment between Sha Tin Tau and the next station at Sha Kok Street heads west over a wooded mound that is located at the junction of Che Kung Miu Road and Lion Rock Tunnel Road. The section of the viaduct (at approx. 17.9 mPD) over these roads is located in an area that has a relatively open aspect and would be particularly visible to surrounding sensitive receivers. These sensitive receivers include users of the adjacent road system who would, partly by virtue of their transient nature, experience medium levels of visual impact. Residents of the low-rise housing located on the nearby wooded mound would experience high level visual impacts. There would be no disturbance to High Rock Christian Camp.

7.4.12 Thereafter, the track alignment passes over the Tsang Tai Uk Recreation Ground before running parallel to, and immediately to the east of, Sha Kok Street on its way to Sha Kok Street Station. This recreation ground comprises six tennis courts, a full-size football pitch, a playground and several basketball courts. Some of the tennis courts and structures would have to be relocated as a result of constructing columns within this recreation ground although there would be no physical impact on the football pitch. Groups of mature trees that are located beneath the track alignment, and are either on the boundary of the recreation ground or at the junction of the adjacent footpath and cycle track and Sha Kok Street, would be lost as a result of the construction works. The loss of these trees and recreational facilities would represent a high level landscape impact. People living in Shan Ha Wai Village as well as users of the Tsang Tai Uk Recreation Ground and the adjacent footpath and cycle track will experience a high level of visual impact as a result of construction works along this section of alignment.

7.4.13 Development of the proposed railway track between Tsang Tai Uk Recreation Ground and Sha Kok Street would involve construction of a viaduct adjacent to a series of open spaces that are located immediately to the south of Sha Kok Street. These open spaces contain two basketball courts, one large car-parking area and two separate parks and sitting-out spaces. These construction works would involve the loss of a long belt of shrubs and immature trees that is located between these facilities and Sha Kok Street. This belt of trees and shrubs provides important visual screening to users of these open spaces and helps visually soften the appearance of this section of street. Loss of this belt of trees and shrubs would represent a high landscape impact to the local area.

7.4.14 The proposed construction of Sha Kok Street Station in the grass reserve located immediately to the south of Shui Chuen Au Street would involve the loss of this large rectangular area of grass and the lines of immature trees growing along its edges. This loss would represent a low level landscape impact.

7.4.15 The proposed development would generate medium to high level negative visual impacts on residents of the housing estates that are located on either side of Sha Kok Street. These include the Jat Min Chuen residential area, the Pok Hong Estate and the Sha Kok Estate. The level of visual impact on residents that live on the lower floors of these estates would be particularly high. Other visually sensitive receivers in this section of alignment (i.e. pedestrians, cyclists and users of the parts of the recreation facilities that would remain during the construction stage) would experience high levels of visual impact. Users of the surrounding road system would, by virtue of their transient nature, experience low levels of visual impact.

7.4.16 From Sha Kok Street, the track alignment passes over Shui Chuen Au Street and along a large linear and well-vegetated open space on its way to Sha Tin Wai Road. Low level landscape impacts are predicted on this open space as the vegetation that would be lost is mostly grass. However, the loss of the particularly tall group of trees located at the junction of Sha Tin Wai Road and Sha Kok Street would represent a high level landscape impact. The proposed vertical alignment of the track rises from +14.3 m PD to +15.4 m PD as it passes over Sha Tin Wai Road. This relatively high section of the proposed track would generate a high level of visual impact on the adjacent Sha Tin Wai Village and Shatin Park Estate. It would however, generate a moderate to low level of visual impact on users of the road system.

7.4.17 High level visual impacts and low level landscape impacts are predicted on the small open space and sitting area that is located immediately to the north-west of Sha Tin Wai Road. A re-design of the footpath layouts within this open space would be necessary as some of the proposed viaduct columns would be located within the pedestrian circulation zones. The proposed location of the track above the adjacent vegetated mound, involving the construction of one supporting column within this mound, would represent a high-level fung shui impact on three of the six graves that are located on the western edge of this area. Construction of these columns would however, represent a low level landscape impact on this area. Views of the proposed track would be seen against the backdrop of a vegetated hillside. This section of the proposed track would generate a moderate to high level of visual impact on the adjacent Shatin Park Estate. The level of visual impact on residents that live on the lower floors of this estate would be particularly high.

7.4.18 The proposed track alignment would have low landscape impacts (the existing Tsz Tong building would not be disturbed) and high level visual impacts on the residents of Wong Uk Village. The proposed track alignment then passes over the China Light and Power Substation located to the east of Wong Uk Village and then on over Shatin Road and its well-vegetated embankments.

7.4.19 Thereafter, the alignment passes over a bus terminus and a small open space located between the bus-terminus and Ngan Shing Street. This section of track would generate high levels of visual impact on users of this bus station and adjacent facilities. It would also generate a high level landscape impact on the adjacent open space as the proposed construction of columns in this area would involve the loss of a large group of semi-mature trees. High-level visual impacts are predicted on the residents of Shatin Park residential blocks, Wong Uk Village, Sha Tin Wai Village and the users of the Prince of Wales Hospital. The level of visual impact on residents that use the lower floors of these buildings would be particularly high. Other visually sensitive receivers in this section of alignment (i.e. pedestrians, cyclists and users of the nearby areas of open space) would experience high levels of visual impact. Users of the surrounding road system would, by virtue of their transient nature, experience low levels of visual impact.

7.4.20 The proposed development of City One Station in a long linear reserve set aside for the MOS Rail development would represent a low level landscape impact as the area is predominantly hard-paved and used as a plant nursery. However, loss of the trees in the 600 m long, 1.5 m-wide vegetated strip located immediately inside the boundary fence of the nursery would represent a medium to high level landscape impact. Medium to high level visual impacts are predicted on the adjacent schools and residential developments (Yue Tin Court and City One Plaza). The level of visual impact on residents that use the lower floors of these buildings would be particularly high. Low level visual impacts are predicted on the adjacent industrial buildings (mostly godowns). Other visually sensitive receivers in this section of alignment (i.e. pedestrians and cyclists) would experience high levels of visual impact. Users of the surrounding road system would by virtue of their transient nature, experience low levels of visual impact.

Siu Lek Yuen Road to Chevalier Garden

7.4.21 The proposed track alignment to the west of Shek Mun Station passes across a large area of recreational open space, undeveloped land and a nullah. The construction of a viaduct over the nullah would generate a high level of visual impact on the adjacent City One Shatin residential blocks. The level of visual impact on residents that live on the lower floors of this estate would be particularly high.

7.4.22 Development of the station, in the hard paved area that is currently used for the storage of trucks and containers, would represent a low level landscape impact. The small amount of scrub vegetation located along the boundary of the site is likely to be lost and would represent a low level landscape impact. Users of the nearby industrial buildings, by nature of their daily work, would experience low to medium levels of visual impact. Sensitive receivers along this section of alignment include not only users of the above residential and industrial properties but also pedestrians and nearby road-users. Users of the surrounding road system would, by virtue of their transient nature, experience low levels of visual impact. Pedestrians in the vicinity of the proposed development would experience high levels of visual impact.

7.4.23 The alignment then veers due north to join the Tate's Cairn Highway. The proposed viaduct construction would generate low level landscape impacts on the 12 m wide, grassed reserve (with occasional groups of immature trees) that is located along the centre of the highway from this point until the track alignment reaches Chevalier Garden Station. The proposed track is on a viaduct structure at approximately 18.5 mPD as it joins Tate's Cairn Highway. It then descends gradually down to ground level at a point close to the roundabout adjacent to Pictorial Gardens. It then remains at ground level until it passes underneath the road flyover system located to the east of Sha Tin Fishermans Village. Low to medium level visual impacts are predicted on residents of Pictorial Gardens. However, medium to high level visual impacts are predicted on residents of Sha Tin Fishermen's New Village as well as users of Shatin Hospital. Other visually sensitive receivers in this section of alignment (i.e. pedestrians and cyclists) would experience high levels of visual impact. Users of the surrounding road system would in spite of the relatively transient nature of their views, experience medium to high levels of visual impact as the proposed development would be clearly visible and would involve the loss of the vegetated strip in the centre of the road. Any safety-fences that are erected along this long stretch of highway would impinge on views of a relatively open and attractive landscape and this would result in high levels of visual impact on road users.

Chevalier Garden to On Luk Street

7.4.24 The elevation of the proposed track rises immediately to the east of the flyover system located near Sha Tin Fishermen's New Village. It rises from ground level to approx. 22.5 mPD at Chevalier Garden and from there it continues up to 25.7 mPD and then down to 17.9 mPD as it crosses over the flyover system some 440 m to the north of the station site.

7.4.25 The proposed development of a station at Chevalier Garden in a well-grassed central reserve (with occasional groups of immature trees), approximately 27 m wide, would represent a low level landscape impact.

7.4.26 The relative absence of buildings in this area, combined with the relatively flat landform immediately surrounding the site, both contribute to a sense of openness in this well-vegetated and scenic area. Low to medium level visual impacts are predicted on users of the Ma On Shan Tsung Tsim Secondary School, on residents of Tai Shui Hang Village which is located in a nearby side-valley and on residents of the developments that are located in the distance on the western side of the Shing Mun River Channel. This is on account of either the visual screening provided by nearby landform and vegetation or their distance away from the proposed development combined with the fact that the station structure and adjacent sections of viaduct would be seen against a backdrop of vegetated hills. However, high-level visual impacts are predicted on residents of Chevalier Garden as the proposed development would be seen against a backdrop of Tolo Harbour. Pedestrians and cyclists in this section of alignment would experience high levels of visual impact. Users of the surrounding road system would, in spite of the transient nature of their views and the presence of an intertwining system of highway flyovers located to the north of Chevalier Garden, experience medium to high levels of visual impact. This is because the proposed structure would continue along a long stretch of highway and its location at high level would impinge on views of a relatively open and attractive landscape.

7.4.27 The proposed track alignment then passes over the highway flyover system and joins the Sai Sha Road where it again follows a wide central reservation (with patchy grass cover only in this section) set aside for the MOS Rail project and from there onwards to the site for the Heng On Station.

7.4.28 Development of Heng On Station (at 20 mPD) within the 15 m wide central reserve (with grass cover only) would represent a low level landscape impact. The proposed construction of a footbridge between the station and Heng On Estate would involve the loss of approximately 200 m^2 of tree and shrub planting that is located along the western boundary of the estate. This would represent a medium level landscape impact. High level visual impacts are predicted on residents of the Heng On Estate located immediately to the east of the site. These visual impacts would be generated, not only by the construction of the station, but also by the construction of the two associated footbridges adjacent to the station. The level of visual impact on residents that live on the lower floors of this estate would be particularly high.

7.4.29 Medium to high level visual impacts are predicted on the school that is located between these high-rise buildings and the Sai Sha Road. Residents of the Hing On THA would experience low to medium level visual impacts due to the distance from the proposed railway and the visual screening provided by other structures in the area. Other visually sensitive receivers in this section of alignment (i.e. pedestrians and cyclists) would experience high levels of visual impact. Users of the surrounding road system would by virtue of their transient nature, experience low levels of visual impact.

7.4.30 The alignment then continues north along the central reserve to Ma On Shan Station (see *Annex B*). High-level landscape impacts are predicted along this section of the route as a large number of immature trees would be lost from this reserve as a result of the proposed construction works. Medium to high levels of visual impact are predicted on existing residents of the high-rise residential buildings and schools that are located along this section of the route, including Yiu On Estate and the Toi Shan Association Memorial School, as well as on the future residents of the developments that are currently under construction to the west of Sai Sha Road. Low levels of visual impact are predicted on users of the adjacent Chung On Shopping Centre. Other visually sensitive receivers in this section of alignment (i.e. pedestrians and cyclists) would experience high levels of visual impact. Users of the surrounding road system would by virtue of their transient nature, experience low levels of visual impact.

On Luk Street to Lee On Estate

7.4.31 Development within the 15-25 m wide central reserve (well vegetated with trees, grass and shrubs) that was set aside for the MOS Rail project, would generate high impacts on the physical landscape as a result of the loss of these trees and shrubs. It is unlikely that there will any impact on the three pedestrian footbridges that cross Sai Sha Road in this area. High level visual impacts are predicted on residents of the adjacent Sunshine City and Ma On Shan Centre. The level of visual impact on residents that live on the lower floors of these estates would be particularly high. Other visually sensitive receivers in this section of alignment (i.e. pedestrians and cyclists) would experience high levels of visual impact. Users of the surrounding road system would, by virtue of their transient nature, experience low to medium levels of visual impact.

7.4.32 Heading west after On Chiu Street, the track alignment passes through an area of residential properties (Villa Athena to the north and Saddle Ridge Gardens together with the Ma On Shan Health Centre to the south). Medium to high visual impacts are predicted on residents of these properties. The central reserve in this section of the route is well-vegetated with grass together with avenues of immature trees. The loss of a high proportion of these trees and shrubs would represent a high impact on the local landscape.

7.4.33 The alignment then crosses Kam Ying Road along the central reserve, passing the Lee On residential estate which is located on the south-east of Sai Sha Road and also passing Wu Kwai Sha New Village which is located to the north-west of Sai Sha Road. Having reached the access road for the Lee On Estate, the track alignment veers due east towards the site for Lee On Station. A cycle track and footpath is located along the south-eastern side of Sai Sha Road and this route would require diversion during the construction works, at a point located close to the access road to the Lee On housing estate. This diversion would represent a medium level landscape impact. The central reserve in this section of the route is vegetated with grass only and development of the proposed railway would generate a low impact on the physical landscape in this area.

7.4.34 Low to medium-level visual impacts are predicted on the residents of the above developments on account of either their distance away from the proposed railway, their relatively high level compared to the proposed railway, or the visual screening provided by the roadside vegetation. Other visually sensitive receivers in this section of alignment (i.e. pedestrians and cyclists) would experience high levels of visual impact. Users of the surrounding road system would, by virtue of their transient nature, experience low to medium levels of visual impact.

7.4.35 Development of Lee On Station within the former borrow area would generate low level impacts on the local landscape as only limited excavation works would be carried out on this largely unvegetated site. A small area of the mature and dense tree growth located along the western edge of this borrow area would however, be lost to make way for the section of viaduct immediately to the west of the station. Approximately 10 high-rise residential blocks are proposed in association with the station and clear views of the construction works would be available from the Lee On Housing Estate and these would represent medium to high levels of visual impact to those residents who have views of this area. Medium level visual impacts would be generated by the high-rise residential developments on the more distant Saddle Ridge Gardens and Villa Athena. Other visually sensitive receivers in this section of alignment (i.e. pedestrians and cyclists) would experience high levels of visual impact. Users of the surrounding road system would, by virtue of their transient nature and the visual screening of the site provided by the vegetation on the edge of the borrow area, experience low to medium levels of visual impact.

7.5 Operational Impacts

7.5.1 There are no additional landscape impacts that would be generated at the operational stage of the project. The potential visual impacts of the project at operational stage would be limited to visual impacts of the structures that would be built above ground and the operation of the trains on the proposed viaducts.

7.5.2 These structures include the stations themselves, the interconnecting sections of viaduct, views of the footbridges associated with the various stations, one or more small substations associated with the power transmission system, as well as the presence of noise enclosure structures associated with the viaduct structure. Other structures that are likely to be completed by the start of the operational stage of the project and would generate visual impacts on the surrounding sensitive receivers at operational stage include the depot at Tai Wai, the hotel or residential development associated with Sha Tin Tau Station and the presence of a transport terminus at Lee On. The sensitive receivers, as well as the level of potential visual impact generated on those receivers at the operational stage, would be largely the same as those identified for the construction stage.

7.5.3 Other development works may take place in the areas surrounding the proposed alignment and these may expand the visually sensitive receiver population in the future. However, as any such developments are not committed, they cannot be taken into account in the evaluation of potential visual impacts.

7.6 Mitigation Measures

7.6.1 Mitigation measures to control, reduce or remove landscape impacts which arise from the project are described below. The natural features of the area, particularly large trees, are considered to be of concern for their landscape and visual importance. Landscape and visual impact mitigation measures arising during the construction phase should include the following:

- the external appearance of all above-ground structures should be carefully detailed in terms of form, colour and finishes such that they are visually integrated as much as possible into the surrounding landscape, stations, viaducts and noise mitigation measures will be the most visually dominant elements, in particular the form and surface detailing should aim towards;
    - minimising the width of viaduct sides and the supporting columns as far as possible to provide a lightness of appearance,
    - reducing the impact of noise barriers and enclosures through the use of clear or translucent upper sections wherever practicable, and
    - softening the visual appearance of the railway structures through screen planting wherever possible;
- the existing cycle track on the southern side of Sha Kok Street should not be relocated toward the existing basketball court as this would remove an existing planting strip, consideration should be given to its relocation to the north of Sha Kok Street;

- as much as possible of the existing vegetation, in particular mature trees within the sites, should be fenced off and retained if site area requirements permit;

- mature trees of good form and health could be transplanted prior to works commencing and returned to the general area after construction works have been completed;

- boundary fences should be erected around construction sites before the commencement of works to reduce the potential visual impacts of the proposed works and to prevent tipping, vehicle movements and encroachment of personnel off site;

- site boundaries should be regularly checked to ensure that the works are properly controlled and that no damage is being caused to the surrounding areas;

- high standards of dust control should be applied to protect vegetation adjacent to work sites;

- locate supporting infrastructure as far away from natural, undisturbed vegetation as possible;

- ensure restoration and aftercare of temporary construction sites to standards as good as, or better than, the original condition;

- replanting of disturbed vegetation should be undertaken and this should use predominantly native plant species

- footpath and cycle track diversions should be provided to minimise impact on pedestrian and cyclists' movements; and

- the locations of work sites associated with the proposed developments should be carefully selected to minimise the potential landscape and visual impacts of the proposed construction works.

7.7 Conclusions

7.7.1 The proposed development would generate high impacts on the physical landscape of many of the areas in which it would be located. These impacts generally take the form of tree losses, particularly those trees that are mature specimens and provide a valuable role in the landscape amenity of the areas in which they are located.

7.7.2 The proposed above-grade stations, adjacent sections of viaduct and noise control structures would generate high visual impacts on surrounding areas and their populations. Not only would these structures impinge on existing views, but also development of the stations and viaducts would dramatically change the landscape of many of the areas in which they are located. There would, in addition, be high visual impacts generated by the proposed residential and hotel developments associated with the depot and station developments at Tai Wai, Sha Tin Tau and Lee On.

7.7.3 Implementation of the proposed landscape and visual impact mitigation measures will help to reduce the level and quantity of these impacts. The most important mitigation measures will be those incorporated into the design of the railway structures, particularly the viaducts and noise barriers. Public consultation will be carried out prior to the tendering process. Public views will be taken into account during the consultation process.

8 ENVIRONMENTAL MONITORING AND AUDIT

8.1 Introduction

8.1.1 In this *Section*, recommendations for the MOS Rail EM&A programme are outlined, taking account of the findings of the EFS. These preliminary recommendations are based on the current MOS Rail Feasibility Study Design which is likely to undergo considerable changes before the construction works for the Project commence and are, therefore, only for guidance and will need to be thoroughly revised during the subsequent more detailed design stages of the Project.

8.1.2 The EFS has identified that EM&A will only be necessary for air quality and noise impacts during the construction of the MOS Rail. No water sensitive receivers will be affected during either the construction or operation of the MOS Rail as any potential impacts on the local drainage system will be controlled by the requirements of the wastewater discharge licence. No adverse impacts have been identified during the operational phase which cannot be effectively controlled through specified design criteria. However, the efficacy of operational noise control measures, in the form train noise barriers and ventilation silencing, will need to be confirmed at the commissioning stage. Monitoring for increased levels of train noise from wear to the rails and rolling stock will be necessary throughout the lifetime of the railway.

8.1.3 The roles and responsibilities of the Proponent, Contractor and Environmental Checker (EC), will be related through the application of Event Contingency Plans (ECPs) to deal with any exceedance of the established criteria, either in the course of normal construction working or through unforseen circumstances. *Figure 8.1a* shows the inter-relationships between the implementation of mitigation measures, the EM&A programme and the ECPs.

8.1.4 More detailed recommendations for the EM&A programme will be set out in the MOS Rail EM&A Manual which will be produced as part of the subsequent EIA Programme. The Manual should follow the recommendations of the *Generic Environmental Monitoring and Audit Manual, Environmental Protection Department, May 1996*. The outline elements presented here are based on the current information available from the MOS Rail Feasibility Study and these are expected to undergo a number of revisions during the subsequent EIA process.

8.2 Environmental Monitoring and Audit

8.2.1 The overall objectives of the EM&A programme which will be undertaken during the construction and operation of the MOS Rail are as follows:

- to monitor the performance of the project and to provide an early indication if any of the environmental mitigation measures fail to meet the established standards and guidelines;
- to take remedial action if unexpected problems or unacceptable impacts arise;
- to provide data to enable an environmental audit to be undertaken;

- to provide a data base against which the short or long term environmental effects associated with the MOS Rail may be determined; and

- to verify the environmental impacts predicted in the MOS Rail EFS and subsequent EIA.

8.2.2 The monitoring will consist of the following elements.

- In the construction phase, the EFS has identified sensitive receivers near the MOS Rail worksites where noise and dust monitoring will be required. Impacts on water sensitive receivers will not be monitored as part of the EM&A programme as the site discharges will be monitored, as necessary, in accordance with the site discharge licences.

- In the operational phase train noise; and noise, and in emergencies exhaust air, from the ventilation systems have been identified as potential adverse impacts. These can be effectively controlled so that sensitive receivers are not adversely affected and their effects will be checked against the established criteria during commissioning. However, wear to the rolling stock and tracks, particularly at the wheel/rail interface can increase train noise considerably and monitoring of any increases should be undertaken to ensure that maintenance work is undertaken as necessary.

8.2.3 In order that the environmental monitoring may be audited, the Proponent should establish strict procedures and protocols for carrying out, recording and reporting this work in the tender requirements. These procedures, protocols and reporting formats should be set out in the EM&A Manual.

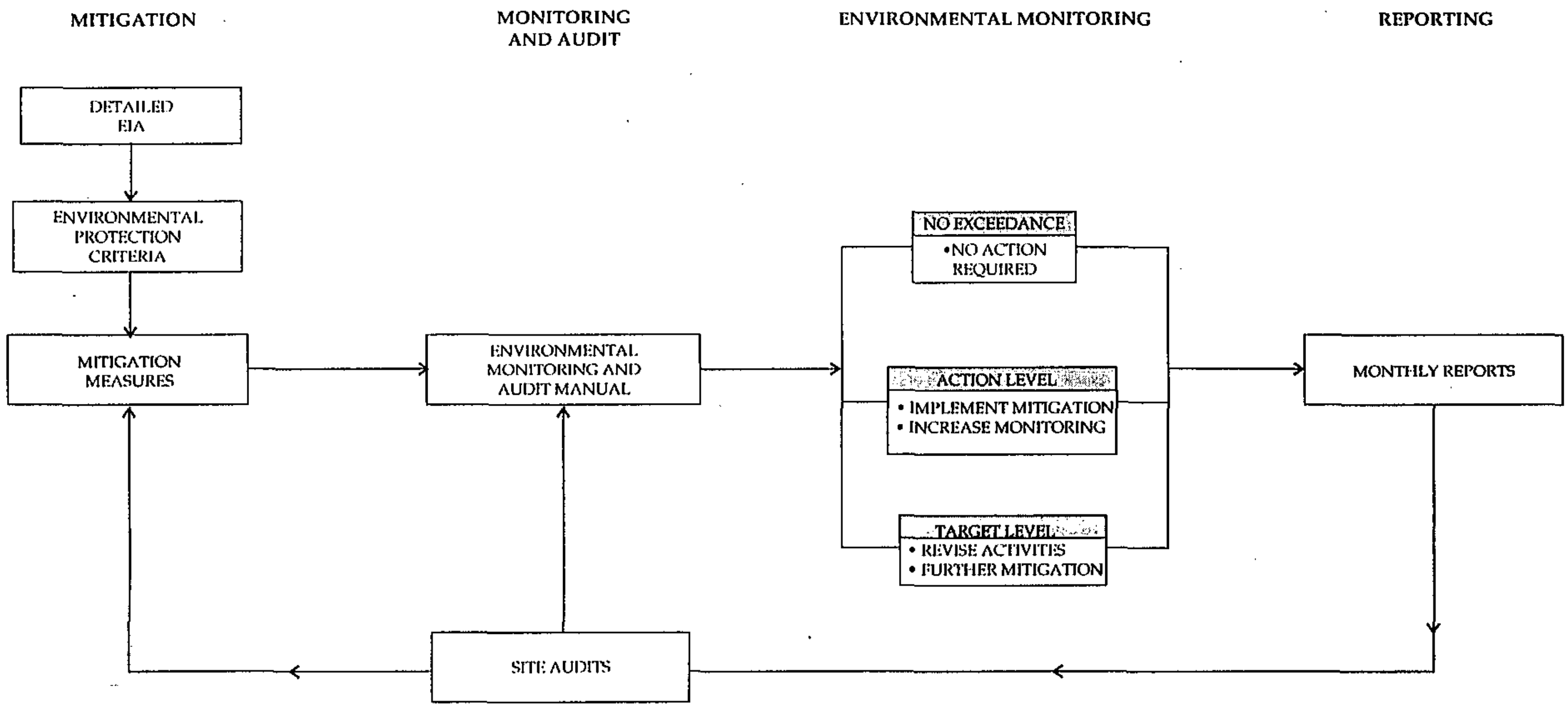
8.3 Event Contingency Plans

8.3.1 The purpose of the ECPs is to provide, in association with the monitoring and audit activities, procedures for ensuring that if any deterioration of environmental quality occurs as a result of the MOS Rail works, either accidentally or through inadequate implementation of mitigation measures on the part of the contractor, that the cause can be promptly identified and remedied, and that the risk of a similar event re-occurring is reduced.

8.3.2 The principle upon which the ECPs are based is the prescription of procedures and actions associated with the measurement of certain defined levels of pollution by environmental monitoring, established prior to the commencement of the MOS Rail construction works. These are:

- *Action Level*, beyond which appropriate remedial actions may be necessary to prevent environmental quality deteriorating further; and

- *Limit Level*, the limits stipulated in the relevant Hong Kong statutes and guidelines, if these are exceeded, works should not proceed without appropriate remedial action, including a critical review of plant and working methods.



IMPLEMENTATION OF MITIGATION AND ENVIRONMENTAL MONITORING AND AUDIT

MAUNSELL CONSULTANTS ASIA LTD

DATE: APR 96

SCALE:

FIGURE No. 8.1a

Maunsell

8.4 Air Quality Monitoring

8.4.1 Monitoring of dust, in the form of TSP, shall be undertaken to ensure that deteriorating air quality can be readily detected and timely action taken to remedy its cause. 24-hour TSP levels shall be measured to indicate the extent of construction dust impacts on sensitive receivers. 1-hour TSP levels shall be monitored in response to complaints, exceedances or under other circumstances as directed by the EC.

8.4.2 Concurrent with the undertaking of 24-hour and 1-hour TSP monitoring, the recording of wind conditions in the vicinity of the construction sites shall also be undertaken. The measurement of wind speed and direction may enable the environmental team to distinguish between on site and external sources of dust during the evaluation of TSP monitoring results.

8.4.3 24-hour TSP concentrations shall be measured by the *High Volume Method for Total Suspended Particulates, Part 50 Chapter 1 Appendix B, Title 40 of the Code of Federal Regulations of the USEPA*. 1-hour sampling can be undertaken using a direct reading dust meter such as the MIE Data-Ram Portable Real Time Aerosol Monitor.

8.4.4 The criteria against which air quality shall be assessed are the statutory AQOs for daily TSP of 260 $\mu g\ m^{-3}$ and the non-statutory EPD recommended 1-hour TSP limit of 500 $\mu g\ m^{-3}$.

8.4.5 Equipment shall be properly maintained and calibrated at all times in accordance with the requirements stated in the manufacturers operating manual.

Air Sensitive Receivers

ASRs have been identified in the vicinity of the construction sites during the course of the MOS Rail EFS. The locations where it is recommended that air quality monitoring is undertaken during the construction works are listed below in *Table 8.4a*. The selection of ASRs for monitoring should be reviewed during the EIA and agreed with the EPD.

Table 8.4a Location of Air Sensitive Receivers

Site Name	ASR Location
Hing Keng to Tai Wai	A2 29 Keng Hau Road
	A7 Hin Yau House
Tai Wai to Sha Tin Tau	A12 Sha Tin Heights
	A24 Man Lai Court
Sha Tin Tau to Sha Kok Street	A27 Shek Fai House
	A29 Ecclesia Bible College
Sha Kok Street to City One	A37 Tin Ka Ping Salvation Army Primary School
	A41 Pok Tai House
City One to Shek Mun	A54 Yue Sui House

Site Name	ASR Location
	A58 Yow Kam Yuen Prevocational School
Shek Mun to Chevalier Garden	A64 Sun Mu Commercial Centre
	A69 Juniper Court, Pictorial Garden
Chevalier Garden to Heng On	A77 Ngan On House
	A79 Chinese YMCA College
Heng On to Ma On Shan	A85 Block M, Sun Shine City
	A88 Block 1, Ma On Shan Centre
Ma On Shan to Lee On	A94 Block 5, Villa Athena
	Lee Wing House, Lee On Estate

Baseline Monitoring

8.4.6 Sufficient numbers of HVSs and MIEs shall be provided by the Proponent to complete the necessary 24-hour and 1-hour baseline sampling at the agreed monitoring locations before the commencement of any site works which may affect the monitoring results. Details of the baseline, Action and Limit TSP levels will be reported prior to the commencement of impact monitoring.

8.4.7 24-hour baseline monitoring shall be carried out for a continuous period of at least two weeks with daily ambient measurements taken at all the agreed monitoring locations. General meteorological conditions (wind speed and direction, precipitation, air pollution index, etc) and notes regarding any significant adjacent dust producing sources shall also be recorded throughout the baseline monitoring period. 1-Hour TSP sampling using the agreed instrument shall also be undertaken at least three times per day during normal working hours (07.00-19.00) concurrently with the 24-hour TSP baseline sampling.

8.4.8 Ambient conditions may vary seasonally and therefore baseline checking of dust levels shall be carried out every six months at all the agreed monitoring locations when construction activities are not taking place or when the contractor's activities are not generating dust in the proximity of the monitoring stations. Detailed notes shall be provided by the monitoring personnel as to significant dust producing sources during the baseline checking periods. The baseline monitoring activities will provide data for the determination of the appropriate A/L levels which shall be agreed with the EPD.

Impact Monitoring

8.4.9 Regular 24-hour impact monitoring shall be carried out throughout the duration of the construction works at a frequency of at least once every six days at all monitoring stations.

8.4.10 In cases of non-compliance with the air quality criteria, additional monitoring as specified in the ECP shall be conducted within 24 hours of the results being obtained. The additional monitoring shall be continued until the excessive dust emission or the deterioration in air quality abates.

Compliance Assessment

8.4.11 The A/L Levels provide an appropriate framework for the interpretation of monitoring results. The air quality monitoring data shall be checked against the agreed A/L Levels as listed in *Tables 8.4b* and *8.4c*.

Table 8.4b Derivation of Action and Limit Levels for 24-Hour Air Quality Monitoring

Level	Total Suspended Particulates (μg m^{-3})
Baseline	Derived from physical measurements prior to construction commencing
Action	For baseline <108 μg m^{-3}, average of 130% of baseline and the Limit level 108< baseline >154, 200 μg m^{-3} For baseline >154 μg m^{-3}, 130% of baseline level
Limit	AQO for TSP: 260 μg m^{-3} averaged over 24 hours

Table 8.4c Derivation of Action and Limit Levels for 1-hour Air Quality Monitoring

Level	Total Suspended Particulates
Baseline	Derived from physical measurements prior to construction commencing
Action	For baseline <154 μg m^{-3}, average of 130% of baseline and the Limit level 154< baseline >269, 350 μg m^{-3} For baseline >269 μg m^{-3}, 130% of baseline level
Limit	500 μg m^{-3}

Event Contingency Plan

8.4.12 The principle on which the ECP is based is the prescription of procedures and actions associated with the measurement of defined levels of air pollution recorded by the environmental monitoring process and defined in the *Tables* above. In cases where exceedance of these criteria occurs, Proponent, Contractor and EC shall strictly observe the relevant actions of the ECP shown in *Table 8.4d*.

Table 8.4d Event Contingency Plan for Air Quality

Exceedance	Action: Environmental Checker	Action: Proponent	Action: Contractor
ACTION LEVEL	Repeat measurement to confirm findings. Identify the source(s) of impact.	Confirm receipt of notification of exceedance and notify Contractor.	Submit proposals for remedial actions to EC within three working days of notification.
	Inform Contractor and Proponent in writing and discuss remedial actions required.	Check monitoring data trends and Contractor's working methods.	Amend proposals if required by the EC.
	Increase monitoring frequency to assess efficacy of remedial measures.	Remind the Contractor of his contractual obligations and discuss remedial actions to be implemented.	Implement the remedial actions immediately upon instruction from the Proponent.

Exceedance	Action: Environmental Checker	Action: Proponent	Action: Contractor
	If exceedence continues, arrange meeting with Proponent to review implementation and identify further appropriate mitigation measures. If exceedence stops, cease additional monitoring.	Assess the efficacy of remedial actions and keep the Contractor informed.	Liaise with the EC to optimise the effectiveness of the agreed mitigation.
LIMIT LEVEL	Repeat measurement to confirm findings.	Confirm receipt of notification of exceedance and notify Contractor.	Take immediate action to avoid further exceedence.
	Identify the source(s) of impact. Inform Contractor and Proponent in writing.	Check monitoring data trends and Contractor's working methods.	Submit proposals for remedial actions to EC within three working days of notification.
	Discuss remedial actions required with Proponent. Increase monitoring frequency to assess efficacy of remedial measures.	Discuss with Contractor the remedial actions to be implemented.	Amend proposals if required by the EC. Implement remedial actions immediately upon instruction from the Proponent.
	If exceedence continues, arrange meeting with Proponent to identify further appropriate mitigation measures.	Assess the efficacy of remedial actions and keep the Contractor informed.	Liaise with the EC to optimise the effectiveness of the agreed mitigation.
	If exceedence stops, cease additional monitoring.		

8.5 Noise Monitoring

8.5.1 Whilst the NCO does not provide for the statutory control of construction activities occurring on weekdays during normal working hours (i.e. Monday to Saturday 07.00-19.00, excluding Public Holidays), a voluntary daytime limit of $L_{Aeq, 30\,min}$ 75 dB for residential premises was proposed in ProPECC PN2/95 as the appropriate criterion. For educational establishments, a level of 70 dB(A) has been proposed and this would be further reduced to 65 dB(A) during examination periods. On all days during the evening (19.00-23.00) and night-time (23.00-07.00) and Sundays and Public Holidays (07.00-23.00), the statutory noise limits shall be applied.

8.5.2 Sound level meters and pistonphone calibrators shall comply with the *International Electrotechnical Commission Publications 651:1979 (Type 1)* and *804:1985 (Type 1)* specifications as referred to in the TM. The sound level meters shall be supplied and used with the manufacturers recommended wind shield and mounted on a tripod. Hand-held wind speed anemometers shall also be supplied for the measurement of wind speeds during noise monitoring periods. The maintenance of calibration of monitoring equipment shall be carried out in accordance with the manufacturer's requirements and verified by the manufacturers once every two years.

8.5.3 Noise level measurements shall be carried out by suitably qualified personnel using the methodology set out in Section 3 of the *Technical Memorandum on Noise from Construction Work other than Percussive Piling.*

8.5.4 NSRs have been identified in the vicinity of the construction sites during the course of the MOS Rail EFS. Those where it is recommended that noise quality monitoring is undertaken are listed below in *Table 8.5a.*

Table 8.5a Location of Noise Sensitive Receivers

Site Name	NSR Location
Hin Keng to Tai Wai	N1 29 Keng Hau Road
	N11 Christian Alliance School
Tai Wai to Sha Tin Tau	N15 Man Lai Court
	N17 Sha Tin Government Secondary School
Sha Tin Tau to Sha Kok Street	N27 Tin Ka Ping Salvation Army Primary School
	N29 Pok Yat House
Sha Kok Street to City One	N34 Ashley Garden
	N37 17-18 Wong Uk Village
City One to Shek Mun	N40 Pamela Youde Child Assessment Centre and School Dental Clinic
	N41 Yue Sui House
Shek Mun to Chevalier Garden	N51 Juniper Court, Pictorial Garden
	N57 1-4 Tai Shui Hang
Chevalier Garden to Heng On	N59 Ngan On House
	N61 Chinese YMCA College
Heng On to Ma On Shan	N64 Fok On Garden
	N73 Block 1, Fu Fai Garden
Ma On Shan to Lee On	N76 Block 5, Villa Athena
	N82 Lee Wing House, Lee On Estate

Baseline Monitoring

8.5.5 The Proponent shall provide and install sufficient numbers of noise meters and support equipment to complete the necessary baseline sampling at the agreed monitoring locations before the commencement of any site works which may affect the monitoring results.

8.5.6 General meterological conditions, including a measurement of wind speed shall be recorded for each baseline measurement. Where the steady wind speed exceeds 5 m s^{-1} or gusts above 10 m s^{-1}, or in the presence of fog or rain or evidence thereof, measurements shall be treated as invalid and repeated as soon as possible.

8.5.7 Baseline noise levels shall be measured over two consecutive 7-day calendar weeks at a minimum logging interval of 15 minutes. The quantities L_{Aeq}, L_{10} and L_{90} shall be recorded at the specified interval. The logger shall be visited for a period not less that one hour every two days to ensure its continued operation and to identify and record specific noise sources audible at the monitoring location. Observations of noise sources and weather conditions shall be made and reported on all monitoring occasions or at the minimum specified interval.

8.5.8 Checking for changes in the baseline noise levels shall be carried out by taking "sample" noise measurements every six months when no noisy MOS Rail construction activities are in progress. On other occasions, the monitoring staff shall note any operational construction equipment or other activities, arising from either the Contractor or any other sources noted to be emitting "dominant", "audible" or "noticeable" noise levels during the time of the measurement for the analysis and audit process.

8.5.9 The baseline monitoring results, agreed with EPD, will be used in conjunction with the A/L Levels to determine the validity of complaints, the significance of impact monitoring results and the requirements for action under the ECP.

Construction Impact Monitoring

8.5.10 During normal construction working hours (07.00-19.00 Monday to Saturday excluding Public Holidays), monitoring of $L_{Aeq, 30min}$ noise levels (as six consecutive $L_{Aeq, 5\,min}$ readings) shall be carried out at the agreed monitoring locations once every six days in accordance with the methodology in the TM. If restricted hours works are undertaken, monitoring of $L_{Aeq\ 15min}$ noise levels (as three consecutive $L_{Aeq, 5\,min}$ readings) shall be carried out at the agreed monitoring stations at the same frequency as specified for normal working hours.

8.5.11 In relation to the monitored noise levels, other noise sources such as road traffic may make a significant contribution to the overall noise environment. The EC, shall, therefore interpret the results of noise monitoring activities in the light of such influencing factors where such factors were not present during the baseline monitoring period.

Event Contingency Plan

8.5.12 The principle on which the ECP is based is the prescription of procedures and actions associated with the measurement of defined levels of noise impact recorded by the environmental monitoring process and defined in the tables above. In cases where a complaint is received or an exceedance of these criteria is measured, the Proponent, Contractor and EC shall strictly observe the relevant actions of the ECP shown in *Table 8.5c*.

Table 8.5c Event Contingency Plan for Construction Noise

Exceedance Event	Action: Environmental Checker	Action: Proponent	Action: Contractor
ACTION LEVEL	Undertake measurement to establish validity of complaint.	Confirm receipt of notification of complaint and notify Contractor if proven.	Submit proposals for remedial actions to EC within three working days of notification.
	Identify the source(s) of the complaint.	Check monitoring data trends and Contractor's working methods.	Amend proposals if required by the EC.
	Inform Contractor and Proponent in writing and discuss remedial actions required.	Remind the Contractor of his contractual obligations and discuss remedial actions to be implemented.	Implement the remedial actions immediately upon instruction from the Proponent.
	Increase monitoring frequency to assess efficacy of remedial measures.	Assess the efficacy of remedial actions and keep the Contractor informed.	Liaise with the EC to optimise the effectiveness of the agreed mitigation.
	If exceedence continues, arrange meeting with Proponent to review implementation and identify appropriate mitigation measures.	Inform complainant of actions taken.	
	If exceedence stops, cease additional monitoring.		
LIMIT LEVEL	Repeat measurement to confirm findings.	Confirm receipt of notification of exceedance and notify Contractor.	Take immediate action to avoid further exceedence.
	Identify the source(s) of impact.	Check monitoring data trends and Contractor's working methods.	Submit proposals for remedial actions to EC within three working days of notification.
	Inform Contractor and Proponent in writing and discuss remedial actions required.	Discuss with Contractor the remedial actions to be implemented.	Amend proposals if required by the EC.
	Increase monitoring frequency to assess efficacy of remedial measures.	Assess the efficacy of remedial actions and keep the Contractor informed.	Implement remedial actions immediately upon instruction from the Proponent.
	If exceedence continues, arrange meeting with Proponent to identify appropriate mitigation measures.		Liaise with the EC to optimise the effectiveness of the agreed mitigation.
	If exceedence stops, cease additional monitoring.		

Operational Impact Monitoring

8.5.13 The construction of the MOS Rail will include provision for the building of a number of noise mitigating structures, such as wayside barriers and noise covers. These have been designed to control train noise to meet levels of acceptability at NSRs close to the alignment. However, train noise can increase noticeably during operation if the maintenance programme is not sufficient and it will, therefore, be important to monitor train noise in order to protect NSRs from unacceptable noise levels. The operator will need to establish a regular monitoring programme to check the efficacy of the noise barriers and protect NSRs from localised increases from wheel and rail wear. The recommended monitoring locations in *Table 8.5b* have been selected to represent the sensitive receivers identified in the EFS.

8.5.14 It is recommended that occasional short term noise monitoring at specified NSRS should carried out, to check for exceedances of the established criteria. All monitoring of train noise should be carried out by suitably trained personnel, and with equipment conforming to the *Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites*

8.5.15 $L_{Aeq, 30\ min}$ and L_{AMax} noise levels should be measured at the most affected facade of the NSRs listed in *Table 8.5b* for a single period from 06.30 - 07.00, immediately after the opening of the railway and periodically thereafter. Sections of track likely to be subject to high rates of wear, such as tight curves, should also be monitored for increased noise levels on a regular basis. It is envisaged that, as more monitoring data is collected, the number of monitoring locations may be reduced to allow the operator to concentrate on those sections of track suffering premature wear and thus most effectively control noise increase from wheel and rail wear.

Table 8.5b Operational Phase Noise Monitoring Locations

Alignment Section	NSR Location
Tai Wai to Sha Tin Tau	N16 12-15 Lei Uk Tsuen
Sha Tin Tau to Sha Kok Street	N26 Pok Man House
Sha Kok Street to City One	N34 Ashley Garden
City One to Shek Mun	N48 Block 33, City One
Chevalier Garden to Heng On	N59 Ngan On House
Heng On to Ma On Shan	N64 Fok On Garden
Ma On Shan to Lee On	N82 Lee Wing House, Lee On Estate

8.5.16 These noise measurements will unavoidably include contributions from other noise sources in the vicinity of the NSR, for example traffic noise from the local road network. The results will need careful interpretation as it may be difficult to establish if train noise from MOS Rail is at acceptable levels, or indeed if train noise is contributing significantly to the measured levels at all.

8.5.17 The train operator will be able to identify increased noise levels on board the train and report these to the maintenance staff, which will allow additional maintenance work such as extra wheel grinding to remove flat spots and reduce wheel/rail noise. If this fails to provide sufficient noise control, an automated system designed to detect wheel flats can be installed on the depot approach tracks.

8.6 Environmental Auditing

8.6.1 The EFS has identified noise and dust emissions as the key potential impacts associated with the construction of MOS Rail and train noise as the only likely impact from the operation of the system. Other potential impacts, including those on water quality, waste and amenity, are amenable to mitigation subject to the effective implementation of recommended measures. The environmental auditing programme will focus on the regular assessment of the effectiveness of management systems, practices and procedures in ensuring that the required mitigation measures are routinely implemented and maintained.

8.6.2 The auditing of onsite environmental performance will be undertaken on the basis of criteria and methodologies contained within an Audit Protocol developed in advance of the commencement of construction works.

8.6.3 The criteria against which the audits will be undertaken will be derived from the recommendations of the EIA process and the environmental protection clauses within the Contractual Documentation. In addition, the management systems established by the onsite Project management team to monitor the Contractor's compliance with Contractual requirements will be included within the audit protocols.

8.6.4 The audit protocols will be included in the EM&A Manual. The protocols will include the auditing of the following activities:

- the allocation of responsibility for fulfilling environmental requirements and the effectiveness of lines of communication with regard to environmental issues;
- compliance with procedures established to enable an effective response to environmental incidents, exceedances or non-compliances;
- the extent and accuracy of record-keeping related to environmental performance indicators;
- the effectiveness of staff training in ensuring high levels of awareness with regard to environmental requirements; and
- the effectiveness of environmental management activities.

8.6.5 The protocols will comprise checklists of auditable requirements and will be amended, over the lifetime of the construction phase, to focus on areas of frequent non-compliance and to reflect the potential impacts associated with specific activities within the construction programme.

8.6.6 The findings of site audits will be made known to site staff at the time of the audit to enable the rapid resolution of identified non-compliances. Non-compliances, and the corrective actions undertaken, will also be reported in the monthly EM&A Report.

8.7 Reporting

8.7.1 A Monthly Report will be produced as part of the MOS Rail EM&A programme which should include a brief account of construction activities during the month, an interpretation of the significance of the monitoring results by verifying compliance and highlighting any failure to comply with the target levels and an account of any necessary remedial measures recommended by the Proponent and implemented by the Contractor.

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 Introduction

9.1.1 The impacts identified in this EFS were derived from an assessment based on the MOS Rail Feasibility Study Design and construction methodologies are likely to be subject to change, being dependent on subsequent more detailed studies and ultimately the preferred methodology of the successful Proponent. However, the current findings clearly demonstrate that practicable mitigation measures are available to control the worst case scenarios identified in Sections 2-7.

9.1.2 Whilst varying levels of construction impacts have been predicted, no insurmountable environmental problems have been identified at any of the locations considered in this assessment. No adverse operational impacts have been identified provided that the measures that have been identified to achieve the established environmental protection criteria are incorporated in the railway design.

9.1.3 As stated in *Section 1.1*, the development of a station at Hin Keng can only be considered further after the completion of a hazard assessment of risks associated with the chlorine store at the Shatin Water Treatment Works.

9.2 Conclusions

Air Quality

9.2.1 Since the station, depot and alignment construction sites will be located in a developed or developing urban area, and the majority of land uses close to the potential sites are residential and educational, dust impacts are unavoidable. However, sufficient mitigation measures and control can be incorporated in the planning and design stage to reduce the likely dust impacts at the ASRs to within the acceptable limits of the 24-hour AQO and the EPD 1-hour guideline. A summary of the recommended mitigation measures is included in *Table 9.2a*.

9.2.2 1-hour TSP predictions at a number of ASRs are close to the recommended limit of 500 $\mu g\ m^{-3}$, however, additional mitigation measures with the potential for improved dust control have been identified.

9.2.3 Adverse impacts on air quality from the operation of MOS Rail are not expected as no likely sources were identified.

9.2.4 Potential adverse impacts on air quality from vehicle exhaust at the station related developments have been identified and appropriate mitigation measures recommended.

9.2.5 Should the option to develop a station at Hin Keng be taken up at the detailed design stage, a hazard assessment, to the satisfaction of the Director of Environmental Protection, of the impact of Shatin Water Treatment Works will be required before the development can be considered.

Noise and Vibration

9.2.6 This assessment has predicted that unmitigated construction noise associated with MOS Rail would cause adverse noise impacts at the nearby NSRs. Mitigation has been recommended to alleviate the high levels of construction noise to within the ProPECC guidelines. A summary of the proposed measures is shown in *Table 9.2a*.

Table 9.2a Implementation of Mitigation Measures

Mitigation Measure	Site Preparation	Alignment	Stations	Developments	Commissioning
Air Quality					
Good Site Practice	All sites	All sites	All site	All sites	
Site Watering & Compaction	All sites	All sites	All sites	All sites	-
Vehicle Speed Control	All sites	All sites	All sites	All sites	-
Vent Orientation	-	-	-		Stations, developments and depot
Noise					
Good Site Practice	All sites	All sites	All sites	All sites	
Use of Quiet Plant	SKS	TAW-STT	HIK & CHG	-	-
Quiet Plant and Moveable Barriers	CIO & MOS, CHG-HEO, HEO-MOS & MOS-LEO	-	SKS	TAW & STT	-
Quiet Plant, Moveable Barriers and Limited Numbers of Plant	HEO, STT-SKS, SKS-CIO, CIO-SHM	All sites from STT east.	CIO, HEO & MOS	-	-
Site Hoardings	-	STT-SKS, SKS-CIO, SHM-CHG, CHG-HEO, HEO-MOS	STT & HEO	-	
Glazing for Schools	TAW	STT-SKS & CHG-HEO	HEO	-	-
Acoustic Control of Vents	-	-	-		Stations, developments and depot
Water Quality					
Site Boundary Drainage	All sites	All sites	All sites	All sites	-
Site Runoff Control and Drainage	All sites	All sites	All sites	All sites	-
Operational Drainage	-	-	-		Stations developments and depot
Landuse and Visual					
Site Boundary Fencing	All sites	All sites	All sites	All sites	-
Vehicle Movement Controls	All sites	All sites	All sites	All sites	-

9.2.7 There will be no significant noise impacts at the NSRs from fixed plant noise during the operational phase of the MOS Rail provided that the recommended maximum noise levels are incorporated into the design of the fixed plant.

9.2.8 Where necessary, mitigation measures in the form of track side noise barriers and covers have been recommended to control train noise to within the established criteria. A summary of the types and locations of the recommended barriers is shown in *Table 9.2b*. The operator will need to ensure that an effective maintenance programme is in place to control wear to rolling stock and track such that the operational train noise remains within the criteria.

Table 9.2b Summary of Required Noise Mitigation Measures

Section	Proposed Mitigation Measures	Length of Noise Barriers or Enclosure	Location
Hin Keng to Tai Wai	No mitigation required	N/A	
Tai Wai to Sha Tin Tau	2.5 m Track Side Barriers	400 m	Chainage 1700-2100
Sha Tin Tau to Sha Kok Street	1.5 m Track Side Barriers Noise Enclosure	200 m 500 m	Chainage 2250-2450 Chainage 2450-2950
Sha Kok Street to City One Shatin	Noise Enclosure	900 m	Chainage 3200-4100
City One Shatin to Shek Mun	3.5 m Track Side Barriers & 1 m Centerline Barriers	600 m	Chainage 4300-4900
Shek Mun to Chevalier Garden	2.5 m Track Side Barriers & 1 m Centerline Barriers 1.5 m Track Side Barriers Cantilever Barrier	700 m 600 m 500 m	Chainage 5700-6400 Chainage 6400-7000 Chainage 7300-7800
Chevalier Garden to Heng On	Cantilever Barrier 3.5 m Track Side Barriers 2.5 m Track Side Barriers	900 m 100 m 400 m	Chainage 7900-8800 Chainage 8800-8900 Chainage 9000-9400
Heng On to Ma On Shan	Cantilever Barriers	500 m	Chainage 9400-9900
Ma On Shan to Lee On	3.5 m Track Side Barriers & 1.5 m Centerline Barriers Noise Enclosure	100 m 600 m	Chainage 10100-10200 Chainage 10700-11300

Note: The lower 1.5 m of all barriers are fitted with noise absorptive lining 75 mm thick.

9.2.9 It is not anticipated that ground vibration or ground-borne noise will cause adverse noise impacts as all sections are above ground. At this stage of the project the track mounting system and the supporting structures are not defined and, therefore, ground vibration has been excluded from this study, and will be addressed during the detailed design stage.

9.2.10 Appropriate mitigation measures, including modified block layouts, have been recommended to control traffic noise impacts upon the station related developments to within the established criterion.

Water Quality

9.2.11 Based on the separation distance of the alignment and station work sites from the Shatin River and the few local watercourses, it is considered that there will be no adverse impacts upon WSRs from either the construction or operation of the MOS Rail.

9.2.12 The most likely potential area of concern is the discharge of waste wasters with excessive SS loadings that may disrupt the local drainage system. It is considered that

- the quantities of water involved can be readily controlled by the recommended measures, such that the quality of waste water leaving the site will be of a sufficient standard to meet the discharge licence requirements.

9.2.13 Operational water quality impacts could be readily mitigated through the installation and maintenance of appropriate interceptors and drainage. Provided there is compliance with the WPCO effluent discharge standards, there will be no unacceptable water quality impacts associated with MOS Rail. A summary of the recommended mitigation measures is included in *Table 9.2a*.

Waste

9.2.14 Provided that the recommendations put forward in this report are followed, no unacceptable waste related environmental impacts as a result of the storage, handling, collection, transport, and disposal of wastes arising from the MOS Rail construction and operation are predicted. Available capacity, in excess of the project requirements, has been identified both at public dumps and fill sites, ensuring that disposal of excavated materials will not be a problem.

9.2.15 The level of general refuse produced by the MOS Rail operation is not expected to be unduly high, but all feasible measures should be taken to minimise wastes. Industrial and chemical waste from maintenance activities will be limited to the depot and station maintenance and the disposal of these wastes will have to meet the requirements of the relevant legislation.

Ecology

9.2.16 This study has shown that there are no ecological concerns associated with the project. Where practicable, protective measures to minimise impacts on existing vegetation are recommended, however, based on these preliminary findings, unacceptable impacts to ecological resources are not anticipated.

Landuse and Visual Impacts

9.2.17 Although temporary, the land use impacts of the proposed construction sites are generally high, due to the proximity of sensitive land uses; for some sites there will also be traffic issues to be considered and mitigation measures should be introduced to alleviate these impacts. Wherever possible, construction sites should be restored to their previous uses which are generally compatible with the existing developments in the vicinity. There will be, however, no mitigation measures needed during the operational stage.

9.2.18 The proposed construction works will generate a high level of temporary visual impact irrespective of which sites are selected for the works, however, a number of opportunities exist to mitigate these impacts. No significant potential impacts are predicted at the operational stage of the project. A summary of the recommended mitigation measures is included in *Table 9.2a*.

9.3 Recommendations

9.3.1 The purpose of the EFS is to assess the Feasibility of the RDS Phase II in terms of potentially adverse environmental impacts arising from the various construction and operational activities and options for their effective control. Further changes to the design of MOS Rail may affect the predictions of the EFS and will need to be revised at the preliminary and detailed design stages. Recommendations for further environmental impact assessment are provided below.

Air Quality

9.3.2 Air quality impacts will need to be reassessed in the light of any changes to the construction programme and methodology described in the EFS. The following updated and definitive information will then be required:

- location and layout of construction sites;
- construction schedules and plant inventories;
- quantities of excavated material;
- identification of all ASRs; and
- records of wind speed and direction and background TSP levels.

Noise and Vibration

9.3.3 Noise impacts will also need to be reassessed in the light of any changes in the final construction programme and methodology. The following information will then be required:

- location and layout of construction sites;
- construction schedules and plant inventories;
- identification of all NSRs; and
- local background noise levels.

9.3.4 Operational train noise and vibration will also need to be reassessed in the light of:

- changes in NSR locations or their degree of exposure;
- alterations to the railway alignment;
- the detailed design of railway structures and trackform;
- changes to the rolling stock source noise specifications; and
- revisions to the design and layout of track side noise barriers or covers.

9.3.5 Details will also be required of the precise location and orientation of vent louvres to check operational noise impacts.

9.3.6 The operator will need to develop a programme for monitoring increases in noise from the operational railway resulting from wear to the system, particularly wheel rims and rail heads which will increase noise generated by the wheel/rail interface. The programme should include detailed monitoring and additional maintenance procedures which will ensure that operational noise levels do not exceed the NCO criteria.

9.3.7 It has not been possible at this stage to undertake detailed predictions of the impacts which may be caused by vibration from the operational railway, due to a lack of detailed information on the location and nature of existing foundations and other sub-surface structures along the proposed alignment. This aspect will need to be addressed at the detailed design stage, although experience with the similar systems in Hong Kong and elsewhere indicates that vibration from the operational railway can be controlled effectively by suitable viaduct and track form design.

Water Quality

9.3.8 It is considered that further water quality assessment work will be required to develop the necessary control and treatment systems to meet the wastewater discharge licence requirements.

Waste Management

9.3.9 Further refinement of the recommendations for waste management during construction and operation will be possible when more accurate information on waste arisings is available. The necessary construction phase information requirements are detailed above for air quality. It is envisaged that the operational requirements will be developed when better information will be available on the numbers of users.

Ecology

9.3.10 It is recommended that a survey of the works areas is undertaken to determine and map the distribution and abundance of vegetation types and to locate large trees and other vegetation which should be protected or replaced. This mapping will provide the basis for site restoration.

Landuse and Visual Impact

9.3.11 The options for the mitigation of landuse and visual impacts during the construction phase will need to be reassessed when the construction sites and methodologies have been confirmed. As noted above, it is recommended that a comprehensive tree survey should be include in the detailed design stage.

9.3.12 Operational impacts will be controlled by the appropriate design and planning of the stations, depot and associated infrastructure to become an integral part of the townscape along the alignment. The most important mitigation measures will be those incorporated into the design of the railway structures, particularly the viaducts and noise barriers. Public consultation will be carried out prior to the tendering process. Public views will be taken into account during the consultation process.

Mitigation Measures

9.3.13 Mitigation measures to control air quality, noise, water quality, waste, ecological, landuse and visual impacts have been identified and put forward in the EFS, based upon the RDS Phase II Feasibility Study Design. These will be subject to change, as the design details are refined during the subsequent stages of the Project and should be updated accordingly.

Environmental Monitoring and Audit

9.3.14 The basic requirements for the EM&A Manual have been set out in *Section 8.0*, these include:

- representative TSP and noise monitoring locations for all sensitive receivers;
- the types of monitoring equipment to be used; and
- the recommended EM&A procedures.

9.3.15 It is also recommended that auditing of waste streams should be planned to determine if wastes are being managed in accordance with approved procedures and the site waste management plan and if waste reduction targets are being achieved and could be improved. Audits should look at all aspects of waste management including waste generation, storage, recycling, treatment, transport, and disposal.

Annex A

MOS Rail Construction Noise Calculations

C1435 - MOS Rail Link Construction Noise Calculations

Section - At-grade, Formation Preparation

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Clearance	Excavator/Loader	CNP081	1	112	112	1.58E+11
	Lorry	CNP141	2	112	115	3.17E+11
					Total SWL	117

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2A Excavation for &	Excavator/Loader	CNP081	1	112	112	1.58E+11
Construction of	Lorry	CNP141	1	112	112	1.58E+11
Drainage	Compactor, vibratory	CNP050	1	105	105	3.16E+10
					Total SWL	115

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2B Excavation for	Excavator/Loader	CNP081	1	112	112	1.58E+11
Minor Retaining	Lorry	CNP141	1	112	112	1.58E+11
Wall	Concrete lorry mixer	CNP044	1	109	109	7.94E+10
	Poker Vibrator	CNP170	2	113	116	3.99E+11
					Total SWL	119

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Formation	Grader	CNP104	1	113	113	2.00E+11
Preparation	Roller, vibratory	CNP186	1	108	108	6.31E+10
					Total SWL	114

Section - Standard Viaduct Sections

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Clearance	Excavator/Loader	CNP081	1	112	112	1.58E+11
	Lorry	CNP141	2	112	115	3.17E+11
					Total SWL	117

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Piling	Piling, reverse circulation drill	CNP166	6	100	108	6.00E+10
	Concrete lorry mixer	CNP044	2	109	112	1.59E+11
	Poker Vibrator	CNP170	2	113	116	3.99E+11
					Total SWL	118

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Pilecap Construction	Excavator/Loader	CNP081	1	112	112	1.58E+11
	Lorry	CNP141	1	112	112	1.58E+11
	Poker Vibrator	CNP170	4	113	119	7.98E+11
	Concrete lorry mixer	CNP044	3	109	114	2.38E+11
					Total SWL	121

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Column Construction	Poker Vibrator	CNP170	3	113	118	5.99E+11
	Concrete lorry mixer	CNP044	2	109	112	1.59E+11
	Mobile crane	CNP048	1	112	112	1.58E+11
					Total SWL	120

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Beam Erection	Excavator/Loader	CNP081	1	112	112	1.58E+11
(may be undertaken in	Mobile crane	CNP048	1	112	112	1.58E+11
night time)	Stressing Rig*	-	1	110	110	1.00E+11
	Generator	CNP101	1	108	108	6.31E+10
					Total SWL	117

* Remark: - SWL is assumed based on TM ref. CNP261 (Winch, pneumatic powered)

Section - Special Long Span Viaducts (for 3 sites only)

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Clearance	Excavator/Loader	CNP081	1	112	112	1.58E+11
	Lorry	CNP141	2	112	115	3.17E+11
					Total SWL	117

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Piling	Drilling Rig*	-	2	114	117	5.02E+11
	Poker Vibrator	CNP170	2	113	116	3.99E+11
	Concrete lorry mixer	CNP044	2	109	112	1.59E+11
	Mobile crane	CNP048	1	112	112	1.58E+11
					Total SWL	121

* Remark :- measured SWL of Percussive Drilling Machine at MTRC construction site (Central Subway)

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Pilecap Construction	Excavator/Loader	CNP081	1	112	112	1.58E+11
	Lorry	CNP141	1	112	112	1.58E+11
	Poker Vibrator	CNP170	4	113	119	7.98E+11
	Concrete lorry mixer	CNP044	3	109	114	2.38E+11
					Total SWL	121

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Column Construction	Poker Vibrator	CNP170	3	113	118	5.99E+11
	Concrete lorry mixer	CNP044	2	109	112	1.59E+11
	Mobile crane	CNP048	1	112	112	1.58E+11
					Total SWL	120

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Span Construction	Concrete pump	CNP047	1	109	109	7.94E+10
(or same as Beam	Concrete lorry mixer	CNP044	3	109	114	2.38E+11
Erection, may be	Poker Vibrator	CNP170	4	113	119	7.98E+11
undertaken in night-time)					Total SWL	120

Section - Station/Development Construction

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Clearance	Excavator/Loader	CNP081	1	112	112	1.58E+11
	Lorry	CNP141	2	112	115	3.17E+11
					Total SWL	117

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2A Piling for Station	Drilling Rig*	-	2	114	117	5.02E+11
	Poker Vibrator	CNP170	2	113	116	3.99E+11
	Concrete lorry mixer	CNP044	2	109	112	1.59E+11
	Mobile crane	CNP048	1	112	112	1.58E+11
					Total SWL	121

* Remark :- measured SWL of Percussive Drilling Machine at MTRC construction site (Central Subway)

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2B Piling for Development	Drilling Rig*	-	6	114	122	1.51E+12
	Poker Vibrator	CNP170	2	113	116	3.99E+11
	Concrete lorry mixer	CNP044	2	109	112	1.59E+11
	Mobile crane	CNP048	1	112	112	1.58E+11
					Total SWL	123

* Remark :- measured SWL of Percussive Drilling Machine at MTRC construction site (Central Subway)

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Pilecap Construction	Excavator/Loader	CNP081	1	112	112	1.58E+11
	Lorry	CNP141	1	112	112	1.58E+11
	Poker Vibrator	CNP170	4	113	119	7.98E+11
	Concrete lorry mixer	CNP044	3	109	114	2.38E+11
					Total SWL	121

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Column Construction	Poker Vibrator	CNP170	3	113	118	5.99E+11
	Concrete lorry mixer	CNP044	2	109	112	1.59E+11
	Mobile crane	CNP048	1	112	112	1.58E+11
					Total SWL	120

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Station/Development Construction	Air Compressor	CNP001	1	100	100	1.00E+10
	Mobile crane	CNP048	1	112	112	1.58E+11
	Poker Vibrator	CNP170	4	113	119	7.98E+11
	Concrete pump	CNP047	1	109	109	7.94E+10
	Concrete lorry mixer	CNP044	2	109	112	1.59E+11
					Total SWL	121

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
6 Roof Erection	Air Compressor	CNP001	1	100	100	1.00E+10
	Mobile crane	CNP048	1	112	112	1.58E+11
	Generator	CNP101	1	108	108	6.31E+10
	Lorry	CNP141	1	112	112	1.58E+11
					Total SWL	116

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
7 Sheet Piling (for TAW section only)	Mobile crane	CNP048	1	112	112	1.58E+11
	Lorry	CNP141	2	112	115	3.17E+11
					Total SWL	117

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
7A Sheet Piling (for TAW section only)	Pile Driver (Drop Hammer)	-	1	129	129	7.94E+12
					Total SWL	129

C1435 - MOS Rail Link Construction Noise Calculations

Mitigation 1 - Use of Quiet Plant

Section - At-grade, Formation Preparation

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Clearance	Excavator/Loader	CNP081	1	105	105	3.16E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	110

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2A Excavation for &	Excavator/Loader	CNP081	1	105	105	3.16E+10
Construction of	Lorry	CNP141	1	105	105	3.16E+10
Drainage	Compactor, vibratory	CNP050	1	105	105	3.16E+10
					Total SWL	110

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2B Excavation for	Excavator/Loader	CNP081	1	105	105	3.16E+10
Minor Retaining	Lorry	CNP141	1	105	105	3.16E+10
Wall	Concrete lorry mixer	CNP044	1	109	109	7.94E+10
	Poker Vibrator	CNP170	2	110	113	2.00E+11
					Total SWL	115

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Formation	Grader	CNP104	1	113	113	2.00E+11
Preparation	Roller, vibratory	CNP186	1	108	108	6.31E+10
					Total SWL	114

Section - Standard Viaduct Sections

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Clearance	Excavator/Loader	CNP081	1	105	105	3.16E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	110

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Piling	Piling, reverse circulation drill	CNP166	6	100	108	6.00E+10
	Concrete lorry mixer	CNP044	2	109	112	1.59E+11
	Poker Vibrator	CNP170	2	110	113	2.00E+11
					Total SWL	116

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Pilecap Construction	Excavator/Loader	CNP081	1	105	105	3.16E+10
	Lorry	CNP141	1	105	105	3.16E+10
	Poker Vibrator	CNP170	4	110	116	4.00E+11
	Concrete lorry mixer	CNP044	3	109	114	2.38E+11
					Total SWL	118

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Column Construction	Poker Vibrator	CNP170	3	110	115	3.00E+11
	Concrete lorry mixer	CNP044	2	109	112	1.59E+11
	Mobile crane	CNP048	1	105	105	3.16E+10
					Total SWL	117

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Beam Erection	Excavator/Loader	CNP081	1	105	105	3.16E+10
(may be undertaken in	Mobile crane	CNP048	1	105	105	3.16E+10
night time)	Stressing Rig*	-	1	110	110	1.00E+11
	Generator	CNP101	1	100	100	1.00E+10
					Total SWL	112

* Remark: - SWL is assumed based on TM ref. CNP261 (Winch, pneumatic powered)

Section - Special Long Span Viaducts (for 3 sites only)

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Clearance	Excavator/Loader	CNP081	1	105	105	3.16E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	110

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Piling	Drilling Rig*	-	2	114	117	5.02E+11
	Poker Vibrator	CNP170	2	110	113	2.00E+11
	Concrete lorry mixer	CNP044	2	109	112	1.59E+11
	Mobile crane	CNP048	1	105	105	3.16E+10
					Total SWL	120

* Remark :- measured SWL of Percussive Drilling Machine at MTRC construction site (Central Subway)

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Pilecap Construction	Excavator/Loader	CNP081	1	105	105	3.16E+10
	Lorry	CNP141	1	105	105	3.16E+10
	Poker Vibrator	CNP170	4	110	116	4.00E+11
	Concrete lorry mixer	CNP044	3	109	114	2.38E+11
					Total SWL	118

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Column Construction	Poker Vibrator	CNP170	3	110	115	3.00E+11
	Concrete lorry mixer	CNP044	2	109	112	1.59E+11
	Mobile crane	CNP048	1	105	105	3.16E+10
					Total SWL	117

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Span Construction	Concrete pump	CNP047	1	105	105	3.16E+10
(or same as Beam	Concrete lorry mixer	CNP044	3	109	114	2.38E+11
Erection, may be	Poker Vibrator	CNP170	4	110	116	4.00E+11
undertaken in night-time)					Total SWL	118

Section - Station/Development Construction

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Clearance	Excavator/Loader	CNP081	1	105	105	3.16E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	110

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2A Piling for Station	Drilling Rig*	-	2	114	117	5.02E+11
	Poker Vibrator	CNP170	2	110	113	2.00E+11
	Concrete lorry mixer	CNP044	2	109	112	1.59E+11
	Mobile crane	CNP048	1	105	105	3.16E+10
					Total SWL	120

* Remark :- measured SWL of Percussive Drilling Machine at MTRC construction site (Central Subway)

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2B Piling for Development	Drilling Rig*	-	6	114	122	1.51E+12
	Poker Vibrator	CNP170	2	110	113	2.00E+11
	Concrete lorry mixer	CNP044	2	109	112	1.59E+11
	Mobile crane	CNP048	1	105	105	3.16E+10
					Total SWL	123

* Remark :- measured SWL of Percussive Drilling Machine at MTRC construction site (Central Subway)

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Pilecap Construction	Excavator/Loader	CNP081	1	105	105	3.16E+10
	Lorry	CNP141	1	105	105	3.16E+10
	Poker Vibrator	CNP170	4	110	116	4.00E+11
	Concrete lorry mixer	CNP044	3	109	114	2.38E+11
					Total SWL	118

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Column Construction	Poker Vibrator	CNP170	3	110	115	3.00E+11
	Concrete lorry mixer	CNP044	2	109	112	1.59E+11
	Mobile crane	CNP048	1	105	105	3.16E+10
					Total SWL	117

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Station/Development Construction	Air Compressor	CNP001	1	100	100	1.00E+10
	Mobile crane	CNP048	1	105	105	3.16E+10
	Poker Vibrator	CNP170	4	110	116	4.00E+11
	Concrete pump	CNP047	1	105	105	3.16E+10
	Concrete lorry mixer	CNP044	2	109	112	1.59E+11
					Total SWL	118

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
6 Roof Erection	Air Compressor	CNP001	1	100	100	1.00E+10
	Mobile crane	CNP048	1	105	105	3.16E+10
	Generator	CNP101	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	109

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
7 Sheet Piling (for TAW section only)	Mobile crane	CNP048	1	105	105	3.16E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	110

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
7A Sheet Piling (for TAW section only)	Pile Driver (Drop Hammer)	-	1	129	129	7.94E+12
					Total SWL	129

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Mitigation 2 - Use of Quiet Plant + Barrier

Section - At-grade, Formation Preparation						
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Clearance	Excavator/Loader	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	109
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2A Excavation for & Construction of Drainage	Excavator/Loader	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
	Compactor, vibratory	CNP050	1	95	95	3.16E+09
					Total SWL	107
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2B Excavation for Minor Retaining Wall	Excavator/Loader	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
	Concrete lorry mixer	CNP044	1	104	104	2.51E+10
	Poker Vibrator	CNP170	2	100	103	2.00E+10
					Total SWL	109
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Formation Preparation	Grader	CNP104	1	113	113	2.00E+11
	Roller, vibratory	CNP186	1	108	108	6.31E+10
					Total SWL	114

Section - Standard Viaduct Sections						
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Clearance	Excavator/Loader	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	109
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Piling	Piling, reverse circulation drill	CNP166	6	90	98	6.00E+09
	Concrete lorry mixer	CNP044	2	104	107	5.02E+10
	Poker Vibrator	CNP170	2	100	103	2.00E+10
					Total SWL	109
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Pilecap Construction	Excavator/Loader	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
	Poker Vibrator	CNP170	4	100	106	4.00E+10
	Concrete lorry mixer	CNP044	3	104	109	7.54E+10
					Total SWL	112
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Column Construction	Poker Vibrator	CNP170	3	100	105	3.00E+10
	Concrete lorry mixer	CNP044	2	104	107	5.02E+10
	Mobile crane	CNP048	1	105	105	3.16E+10
					Total SWL	110
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Beam Erection (may be undertaken in night time)	Excavator/Loader	CNP081	1	100	100	1.00E+10
	Mobile crane	CNP048	1	105	105	3.16E+10
	Stressing Rig*	-	1	110	110	1.00E+11
	Generator	CNP101	1	90	90	1.00E+09
					Total SWL	112

* Remark: - SWL is assumed based on TM ref. CNP261 (Winch, pneumatic powered)

Section - Special Long Span Viaducts (for 3 sites only)

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Clearance	Excavator/Loader	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	109

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Piling	Drilling Rig*	-	2	104	107	5.02E+10
	Poker Vibrator	CNP170	2	100	103	2.00E+10
	Concrete lorry mixer	CNP044	2	104	107	5.02E+10
	Mobile crane	CNP048	1	105	105	3.16E+10
					Total SWL	112

* Remark :- measured SWL of Percussive Drilling Machine at MTRC construction site (Central Subway)

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Pilecap Construction	Excavator/Loader	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
	Poker Vibrator	CNP170	4	100	106	4.00E+10
	Concrete lorry mixer	CNP044	3	104	109	7.54E+10
					Total SWL	112

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Column Construction	Poker Vibrator	CNP170	3	100	105	3.00E+10
	Concrete lorry mixer	CNP044	2	104	107	5.02E+10
	Mobile crane	CNP048	1	105	105	3.16E+10
					Total SWL	110

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Span Construction	Concrete pump	CNP047	1	95	95	3.16E+09
(or same as Beam	Concrete lorry mixer	CNP044	3	104	109	7.54E+10
Erection, may be	Poker Vibrator	CNP170	4	100	106	4.00E+10
undertaken in night-time)					Total SWL	111

Section - Station/Development Construction

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Clearance	Excavator/Loader	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	109

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2A Piling for Station	Drilling Rig*	-	2	104	107	5.02E+10
	Poker Vibrator	CNP170	2	100	103	2.00E+10
	Concrete lorry mixer	CNP044	2	104	107	5.02E+10
	Mobile crane	CNP048	1	105	105	3.16E+10
					Total SWL	112

* Remark :- measured SWL of Percussive Drilling Machine at MTRC construction site (Central Subway)

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2B Piling for Development	Drilling Rig*	-	6	104	112	1.51E+11
	Poker Vibrator	CNP170	2	100	103	2.00E+10
	Concrete lorry mixer	CNP044	2	104	107	5.02E+10
	Mobile crane	CNP048	1	105	105	3.16E+10
					Total SWL	114

* Remark :- measured SWL of Percussive Drilling Machine at MTRC construction site (Central Subway)

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Pilecap Construction	Excavator/Loader	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
	Poker Vibrator	CNP170	4	100	106	4.00E+10
	Concrete lorry mixer	CNP044	3	104	109	7.54E+10
					Total SWL	112

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Column Construction	Poker Vibrator	CNP170	3	100	105	3.00E+10
	Concrete lorry mixer	CNP044	2	104	107	5.02E+10
	Mobile crane	CNP048	1	105	105	3.16E+10
					Total SWL	110

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Station/Development Construction	Air Compressor	CNP001	1	90	90	1.00E+09
	Mobile crane	CNP048	1	105	105	3.16E+10
	Poker Vibrator	CNP170	4	100	106	4.00E+10
	Concrete pump	CNP047	1	95	95	3.16E+09
	Concrete lorry mixer	CNP044	2	104	107	5.02E+10
					Total SWL	111

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
6 Roof Erection	Air Compressor	CNP001	1	90	90	1.00E+09
	Mobile crane	CNP048	1	105	105	3.16E+10
	Generator	CNP101	1	90	90	1.00E+09
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	108

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
7 Sheet Piling	Mobile crane	CNP048	1	105	105	3.16E+10
(for TAW section only)	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	110

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
7A Sheet Piling	Pile Driver (Drop Hammer)	-	1	129	129	7.94E+12
(for TAW section only)					Total SWL	129

C1435 - MOS Rail Link Construction Noise Calculations

Mitigation 3 - Use of Quiet Plant + Barrier + Reduction in no. of plant

Section - At-grade, Formation Preparation

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Clearance	Excavator/Loader	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	106
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2A Excavation for &	Excavator/Loader	CNP081	1	100	100	1.00E+10
Construction of	Lorry	CNP141	1	105	105	3.16E+10
Drainage	Compactor, vibratory	CNP050	1	95	95	3.16E+09
					Total SWL	107
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2B Excavation for	Excavator/Loader	CNP081	1	100	100	1.00E+10
Minor Retaining	Lorry	CNP141	1	105	105	3.16E+10
Wall	Concrete lorry mixer	CNP044	1	104	104	2.51E+10
	Poker Vibrator	CNP170	1	100	100	1.00E+10
					Total SWL	109
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Formation	Grader	CNP104	1	113	113	2.00E+11
Preparation	Roller, vibratory	CNP186	1	108	108	6.31E+10
					Total SWL	114

Section - Standard Viaduct Sections

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Clearance	Excavator/Loader	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	106
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Piling	Piling, reverse circulation drill	CNP166	1	90	90	1.00E+09
	Concrete lorry mixer	CNP044	1	104	104	2.51E+10
	Poker Vibrator	CNP170	1	100	100	1.00E+10
					Total SWL	106
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Pilecap Construction	Excavator/Loader	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
	Poker Vibrator	CNP170	1	100	100	1.00E+10
	Concrete lorry mixer	CNP044	1	104	104	2.51E+10
					Total SWL	109
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Column Construction	Poker Vibrator	CNP170	1	100	100	1.00E+10
	Concrete lorry mixer	CNP044	1	104	104	2.51E+10
	Mobile crane	CNP048	1	105	105	3.16E+10
					Total SWL	108
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Beam Erection	Excavator/Loader	CNP081	1	100	100	1.00E+10
(may be undertaken in	Mobile crane	CNP048	1	105	105	3.16E+10
night time)	Stressing Rig*	-	1	110	110	1.00E+11
	Generator	CNP101	1	90	90	1.00E+09
					Total SWL	112

* Remark: - SWL is assumed based on TM ref. CNP261 (Winch, pneumatic powered)

Section - Special Long Span Viaducts (for 3 sites only)

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Clearance	Excavator/Loader	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	106

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Piling	Drilling Rig*	-	1	104	104	2.51E+10
	Poker Vibrator	CNP170	1	100	100	1.00E+10
	Concrete lorry mixer	CNP044	1	104	104	2.51E+10
	Mobile crane	CNP048	1	105	105	3.16E+10
					Total SWL	110

* Remark :- measured SWL of Percussive Drilling Machine at MTRC construction site (Central Subway)

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Pilecap Construction	Excavator/Loader	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
	Poker Vibrator	CNP170	1	100	100	1.00E+10
	Concrete lorry mixer	CNP044	1	104	104	2.51E+10
					Total SWL	109

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Column Construction	Poker Vibrator	CNP170	1	100	100	1.00E+10
	Concrete lorry mixer	CNP044	1	104	104	2.51E+10
	Mobile crane	CNP048	1	105	105	3.16E+10
					Total SWL	108

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Span Construction	Concrete pump	CNP047	1	95	95	3.16E+09
(or same as Beam	Concrete lorry mixer	CNP044	1	104	104	2.51E+10
Erection, may be	Poker Vibrator	CNP170	1	100	100	1.00E+10
undertaken in night-time)					Total SWL	106

Section - Station/Development Construction						
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Clearance	Excavator/Loader	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	106
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2A Piling for Station	Drilling Rig*	-	1	104	104	2.51E+10
	Poker Vibrator	CNP170	1	100	100	1.00E+10
	Concrete lorry mixer	CNP044	1	104	104	2.51E+10
	Mobile crane	CNP048	1	105	105	3.16E+10
					Total SWL	110
* Remark :- measured SWL of Percussive Drilling Machine at MTRC construction site (Central Subway)						
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2B Piling for Development	Drilling Rig*	-	1	104	104	2.51E+10
	Poker Vibrator	CNP170	1	100	100	1.00E+10
	Concrete lorry mixer	CNP044	1	104	104	2.51E+10
	Mobile crane	CNP048	1	105	105	3.16E+10
					Total SWL	110
* Remark :- measured SWL of Percussive Drilling Machine at MTRC construction site (Central Subway)						
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Pilecap Construction	Excavator/Loader	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
	Poker Vibrator	CNP170	1	100	100	1.00E+10
	Concrete lorry mixer	CNP044	1	104	104	2.51E+10
					Total SWL	109
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Column Construction	Poker Vibrator	CNP170	1	100	100	1.00E+10
	Concrete lorry mixer	CNP044	1	104	104	2.51E+10
	Mobile crane	CNP048	1	105	105	3.16E+10
					Total SWL	108
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Station/Development Construction	Air Compressor	CNP001	1	90	90	1.00E+09
	Mobile crane	CNP048	1	105	105	3.16E+10
	Poker Vibrator	CNP170	1	100	100	1.00E+10
	Concrete pump	CNP047	1	95	95	3.16E+09
	Concrete lorry mixer	CNP044	1	104	104	2.51E+10
					Total SWL	109
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
6 Roof Erection	Air Compressor	CNP001	1	90	90	1.00E+09
	Mobile crane	CNP048	1	105	105	3.16E+10
	Generator	CNP101	1	90	90	1.00E+09
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	108
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
7 Sheet Piling (for TAW section only)	Mobile crane	CNP048	1	105	105	3.16E+10
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	108
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
7A Sheet Piling (for TAW section only)	Pile Driver (Drop Hammer)	-	1	129	129	7.94E+12
					Total SWL	129

Annex B

MOS Town Centre Alignment Selection

B1 ALIGNMENT SELECTION MA ON SHAN TOWN CENTRE

B1.1 INTRODUCTION

B1.1.1 The layout of Ma On Shan Town Centre was planned on the basis that there would be an at-grade light rail system similar to the Tuen Mun LRT operating in the median of Sai Sha Road. With this in mind, the town centre has been built with major developments on either side of the road with pedestrian circulation at second floor level at about +15.0 mPD (around 8 m above road level) linked by four footbridges across Sai Sha Road. The footbridges were envisaged as having staircase or escalator connections down to LRT stops located in the highway median which is around 24 m wide at this location.

B1.1.2 However the RDS recommended that MOS Rail should be a conventional intermediate capacity urban railway with no at-grade highway crossings. Hence a fully segregated alignment is required for the railway through MOS Town Centre respecting as far as possible the constraints of the existing buildings and traffic and pedestrian circulation arrangements. This *Annex* describes the options that have been considered and the way in which the most suitable option was selected.

B1.2 ALIGNMENT ISSUES

B1.2.1 Following the *RDS Preliminary Review Study*, work on MOS Rail has progressed on the basis that while MOS Rail will be built as a stand alone railway operated by 4-car trains, the civil works should be designed to allow for the eventual operation of trains of up to 8-cars. Hence provision has to be made for platforms capable of being extended to 180 m length and for maximum gradients of 3%.

B1.2.2 For all of the options investigated the horizontal alignment of the railway remains within the existing Railway Reserve in the Sai Sha Road median through Ma On Shan Town Centre.

B1.2.3 In accordance with the design adopted for other MOS Rail stations, a side platform layout is proposed for Ma On Shan Station, though it would be possible to modify the options to accommodate an island platform station if required.

B1.2.4 Six main options were considered in detail for the vertical alignment of the railway through Ma On Shan in terms of the level at which it crosses the On Yuen Street and On Chiu Street junctions and its height in relation to the four footbridges, namely:

- Option 1: Over road junctions and over all four footbridges;
- Option 2: Over road junctions and under the two central footbridges;
- Option 3: Over road junctions and raise all four footbridges above the railway;
- Option 4: Under road junctions with an at-grade station in the median;
- Option 5: Under road junctions with an underground station in the median; and
- Option 6: Under all four footbridges, having lowered the roads at the junctions.

B1.2.5 Of the six main options considered for the vertical alignment through MOS Town Centre, only three appear feasible if provision has to be made for the eventual operation of 8-car trains. These are Option 1 (high level), Option 3 (medium level) and Option 6 (low level). All three of these options are feasible with 3% grades. The three discarded options (2, 4 and 5) are not feasible with 3% grades and were, therefore, given no further consideration.

B1.3 EVALUATION OF OPTIONS

B1.3.1 On the basis of a preliminary evaluation of the three feasible options it was apparent that Option 3 was by far the worst performer. In fact this Option was largely put forward on the premise that in order to keep down the height of the railway, the owners of the developments might be interested in reconfiguring the interiors of the developments to make more intensive use of the third floor areas, possibly in conjunction with the provision of additional retail space over the station. However, in meetings held with the owners in the early summer of 1996, at which the options then under consideration were discussed (these were the original options based on 4-car trains and 5% grade limits), it became apparent that they would not favour this concept. As Option 3 would require the full co-operation of the developers to implement and did not perform particularly well in other respects, it was recommended that it be given no further consideration.

B1.3.2 The remaining two options, Option 1 and Option 6 have been compared on the basis of a number of evaluation criteria. A summary of the comparison is shown in *Table B1.3a* and consideration of the visual elements are discussed further in *Section B1.4a*.

Table B1.3a Comparison between Option 1 and Option 6 Alignment through MOS Town Centre

Item	Option 1- Over Footbridges and Road Junctions	Option 6 - Under Footbridges and Lower Road Junctions	Preferred Option
Impact on existing footbridges	Minimal impact. Connections required to station from two central footbridges. Station concourse to be integrated with existing footbridges.	Minimal impact. Connections required to station from two central footbridges. Station concourse to be integrated with existing footbridges.	Option 1 or 6.
Need to reconfigure adjoining development	Not necessary. Only physical link is via existing footbridges.	Not necessary. Only physical link is via existing footbridges.	Option 1 or 6.
Passenger access - from 2nd floor	Direct access to station concourse.	Direct access to station concourse.	Option 1 or 6.
- from ground level	Need to ascend two levels to concourse.	Need to ascend two levels to concourse.	Option 1 or 6.
Noise impact	Noise impact will be the same for both options as the railway will be required to provide sufficient mitigation in the form of noise barriers to meet the same levels, set out in the Noise Control Ordinance, for either option.		Option 1 or 6.

Item	Option 1- Over Footbridges and Road Junctions	Option 6 - Under Footbridges and Lower Road Junctions	Preferred Option
Visual Impact - retail/ ground level	Higher as railway is higher than receivers, therefore obstructing the passage of daylight to the ground, with track silhouetted against sky.	Lower as railway is at the same level as receivers and does not block views of the sky. Its impact may also be lessened by screen planting and landscaping.	Option 6.
- residential block level	Higher as railway is at same level as receivers.	Lower as railway is below level of receivers.	Option 6.
Railway Operations	Ideal profile in terms of energy efficiency. Slopes on either side of station help to slow train on arrival and accelerate train on departure.	Increased energy demand due to low point of station in a dip.	Option 1.
Interface with existing road network (after construction	Minimal impact as railway is elevated over road junctions.	Major impact both during and after construction due to lowering of two major road junctions. Poor visibility and revised junctions prone to flooding. Could be even worse if structure gauge on railway is increased for overhead electrification. Tolo Place entrance needs regrading.	Option 1.
Interface with existing pedestrian network (after construction)	Minimal impact as railway is elevated. Access to station via existing footbridges.	Similar impacts at station and existing footbridges. Severance to existing accesses at road junctions and side streets. Loss of existing subways and at-grade crossings requiring new footbridges or more arduous crossings. Particularly bad for cycle tracks.	Option 1.
Interface with existing utilities	Minimal impact. No major diversions necessary.	Major disruption to at least 7 existing gas mains, 26 water mains, 8 CLP cables and 7 Telecom cables, probably more. Existing box culvert west of On Yuen Street may require reconstruction.	Option 1.
Construction	Construction not difficult and confined to highway median and is elevated. Minimal disruption due to traffic or pedestrian movements/access requirements.	Construction made difficult due to major road works at road junctions and side streets. Major disruption to existing developments due to impact on traffic and pedestrian movement and access requirements along Sai Sha Road. Lane closures and major utility diversions.	Option 1.
Cost	Lower	Approximately double the cost of Option 1 for the length of rail between road junctions. Estimated additional cost of HKD120 million (1.7% total capital cost of the whole railway) to lower road junctions.	Option 1.
Overall Construction Time	Comparable construction rates with rest of alignment.	Increased by major junction road works and utility diversions. Delay to MOS section of 6 to 9 months and to whole project of 3 to 6 months.	Option 1.

B1.4 VISUAL IMPACT

B1.4.1 It can be seen from the comparison of Options 1 and 6 in *Table B1.3a,* that Option 1 has considerable engineering advantages. The principal argument against Option 1 is that the visual impact of the elevated alignment may be unacceptable. The questions that remain are :

(a) is the visual impact of the Option 1 alignment unacceptable; and
(b) if not, what measures can be undertaken to mitigate the visual intrusion of the station and railway structures?

B1.4.2 It can be argued that, whilst the visual impact due to the Option 1 alignment is undoubtedly worse than that of the Option 6 alignment, there are a number of reasons that can be put forward in defence of the Option 1 visual impact.

- The Existing architectural context of the Ma On Shan Town Centre can be described as a series of horizontal podiums with vertical blocks of medium cost housing. The railway structures will still be essentially contained with the horizontal podium zone and therefore will not detract from the existing context. The roof of the station development will be low relative to the existing 90 m high towers on each side of it.

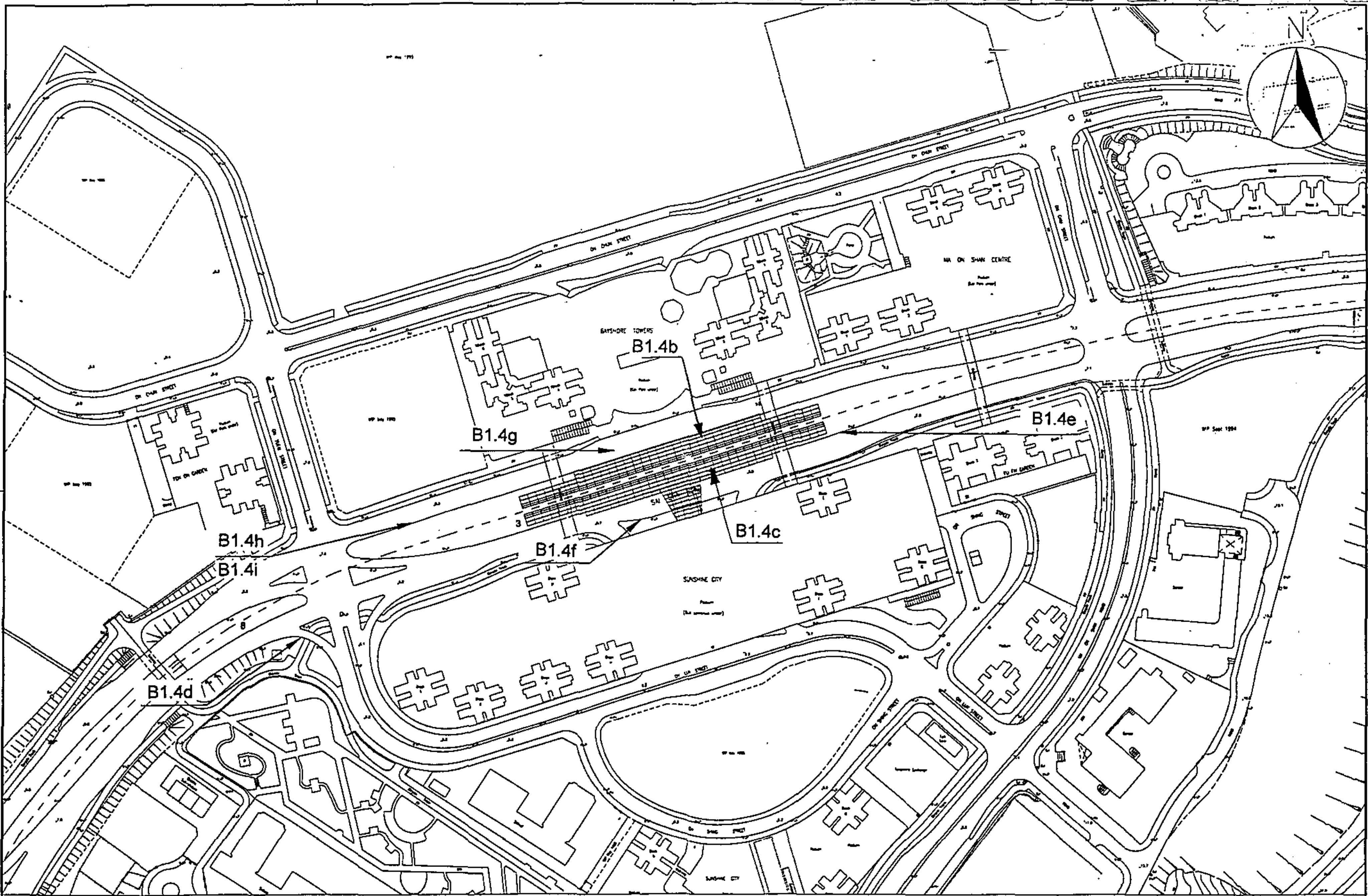
- The main station development will be adjacent to Ma On Shan Plaza on one side of Sai Sha Road and Sunshine City Plaza on the other side. For both these developments the first floor flats will be approximately 3 m above the station development (structure gauge +28.3 mPD) and their existing outlook will be largely uninterrupted.

- At each end of Ma On Shan Town Centre the Tolo Place, Ma On Shan Centre, and Fu Fai Garden developments are lower and will have direct line of sight onto the railway viaduct. The existing view from these flats is straight into the block on the opposite side of the street, some 50-60 m away. The elevated viaduct will be significantly closer although there will still be a corridor with a minimum width of 20 m separating the railway and the existing buildings. According to preliminary noise assessments this section of railway will need to be fully enclosed in order to adequately mitigate the predicted noise impact. There is an opportunity both to screen the trains visually and create an aesthetically pleasing canopy to minimize the visual impact.

- It is suggested that the 20 m wide corridor on each side of the railway should still be sufficient to allow light to filter through to the low level flats. This width is similar to the space between many existing developments in Central and is more than the gap provided between some of the existing tower blocks in Ma On Shan Town Centre.

- The high level view of the station from existing developments will be similar for both Option 1 and Option 6.

B1.4.3 A number of views have been prepared to demonstrate the visual impact of the new station and support the above discussion. *Figure B1.4a* shows the locations of the view points for the perspectives shown in Figures *B1.4b-i,* which are discussed



Highways Department
Railway Division

RAILWAY DEVELOPMENT STUDY
PHASE 2 (PART 1)

FEASIBILITY STUDY FOR THE TAI WAI TO MA ON SHAN RAIL LINK AND THE KCR EXTENSION TO TSIM SHA TSUI

TAI WAI TO MA ON SHAN RAIL LINK
MA ON SHAN TOWN CENTRE

DATE: MAR 97

SCALE: NTS

MVA ASIA
MAUNSELL CONSULTANTS ASIA
and associated consultants

CAD REF: C:/DRU/3379/MODEL/OPTION1.DWG

FIGURE No. B1.4a

below.

Figure B1.4b - Visual Context of Option 1 MOS Station

B1.4.4 This *Figure* illustrates how the new station would be contained within the existing central median strip. It shows that the station would not be much higher than the existing podium levels. An important feature of the Option 1 station layout is the visual link that would be available to sensitive receivers at ground level. This visual link is important to maintain the homogeneity of the existing development. The *Figure* also demonstrates that the corridors on each side of the station are sufficient to allow good penetration of light to the lower levels of the existing developments.

Figure B1.4c - Visual Context of Option 6 MOS Station

B1.4.5 This *Figure* demonstrates that the difference between Option 1 and Option 6 will not be particularly significant in terms of visual intrusion on the town centre. The main improvement will be the reduced impact to receivers near podium level. The main disadvantage of this option is that the visual link at ground level will be cut off by the at-grade station.

Figure B1.4d - Visual Impact for Option 1 Alignment (Sheet 1 of 5)

B1.4.6 This *Figure* shows a view of the Option 1 alignment from an elevated location west of the town centre. The view demonstrates the small size of the station relative to the existing structures. The figure also shows the worst case for visual impact with fully enclosed noise barriers along the whole rail alignment.

Figure B1.4e - Visual Impact for Option 1 Alignment (Sheet 2 of 5)

B1.4.7 The *Figure* shows a view from the 23rd floor of Fu Fai Gardens looking west. The view demonstrates that there is potential to actually improve the view down onto the town centre by building an architecturally sensitive structure.

Figure B1.4f - Visual Impact for Option 1 Alignment (Sheet 3 of 5)

B1.4.8 This *Figure* shows a view to the north looking from approximately 5 m above the Sunshine City podium level. The station structure appears small relative to the tower blocks in the background. The *Figure* also shows that the use of curved roof structures will help to mitigate visual impact of the station and viaduct.

Figure B1.4g - Visual Impact for Option 1 Alignment (Sheet 4 of 5)

B1.4.9 This Figure shows a podium view looking east from Tolo Place. Extensive use of glass would help to mitigate visual impact of the station structure.

Figure B1.4h - Visual Impact for Option 1 Alignment (Sheet 5 of 5)'

B1.4.10 This Figure shows the visual impact for a pedestrian at street level. The view is taken looking east from the intersection between Sai Sha Road and On Yuen Street. The visual link beneath the elevated structures is apparent from this view.

Figure B1.4i - Visual Impact for Option 6 Alignment

B1.4.11 This *Figure* is added for completeness to demonstrate the extent of road regrading that would be required for the Option 6 alignment. The view is taken looking east towards Ma On Shan centre. The *Figure* does not show the new pedestrian footbridge crossings that would also be required to bridge the lowered road junction.

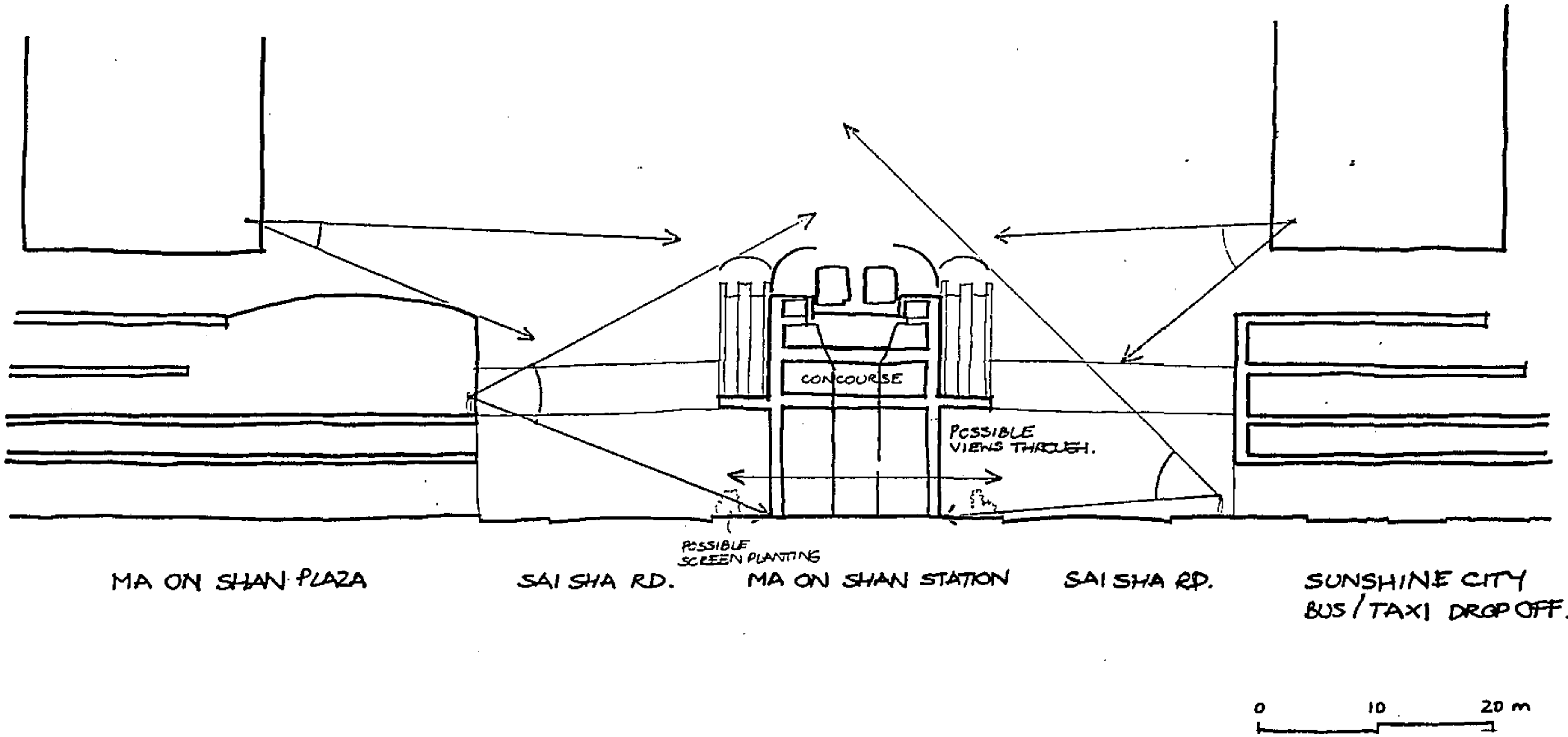
B1.4.12 It can be seen from the *Figures* presented that whilst the Option 1 alignment visual impact may be worse than Option 6 in some respects, it cannot be said that the visual impact of Option 1 will be unacceptable. Possible measures to help further mitigate visual impact would be :

- extensive use of curved roof structures to soften the visual impact;
- use of glass or similar materials to increase transparency and reduce the visual bulk of the station;
- use of structure planting and landscaping such as hanging vines to improve the appearance of the structures; and
- adoption of a colour scheme that is sympathetic to the existing environment.

B1.4.13 With respect to mitigation of visual impact it is suggested that Ma On Shan Station should be considered along with the whole railway with a view to developing a set of visual design criteria applicable to all new structures, including the elevated viaduct. In this way it should be possible to control and minimize the future visual intrusion due to the railway.

B1.5 CONCLUSION

B1.5.1 A preferred rail alignment option, Option 1, has been selected from six possible options for the length of rail passing through Ma On Shan town centre. A number of major disadvantages have been identified for the low level Option 6 railway alignment. These include major disruption to local residents during construction, additional cost, additional construction time, extensive reprovisioning of utilities, major disruption to the existing pedestrian network, and reduced flexibility for railway operations in the future. The major argument against the Option 1 high level alignment was that it may entail unacceptable visual impact to existing residents and receivers in the Ma On Shan town centre developments. A number of drawings have been produced to demonstrate that the visual impact due to the elevated rail alignment would not be unacceptable. The need for tight control on the visual appearance of future MOS Rail structures has been identified as being critical to the successful mitigation of visual impact in the future.



OPTION 1

TRACK ALIGNMENT AT 23.3 MPD.

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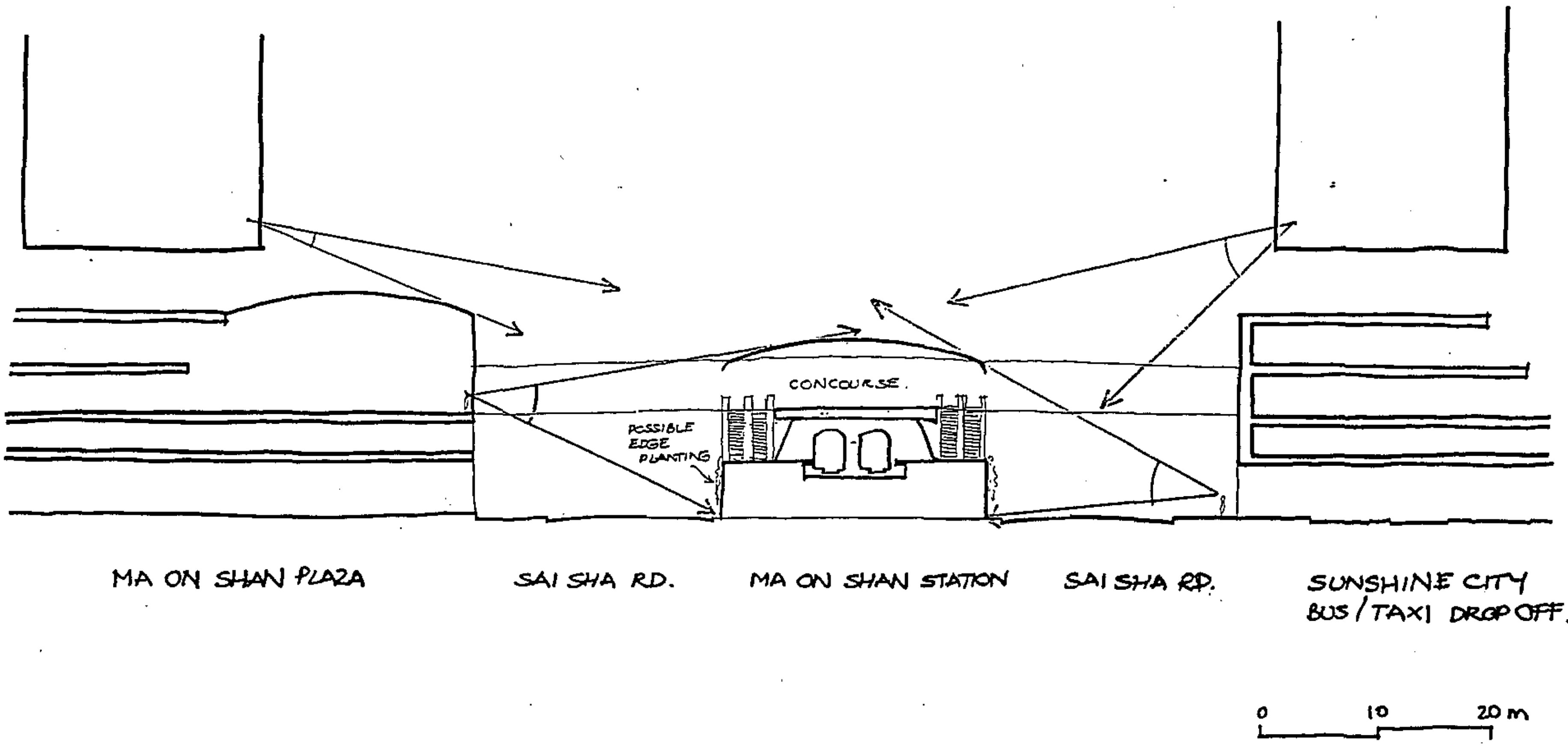
RAILWAY DEVELOPMENT STUDY PHASE 2 (PART 1)	TAI WAI TO MA ON SHAN RAIL LINK VISUAL CONTEXT OF OPTION 1 MOS STATION	SCALE:	FIGURE No. B1.4b



OPTION 6

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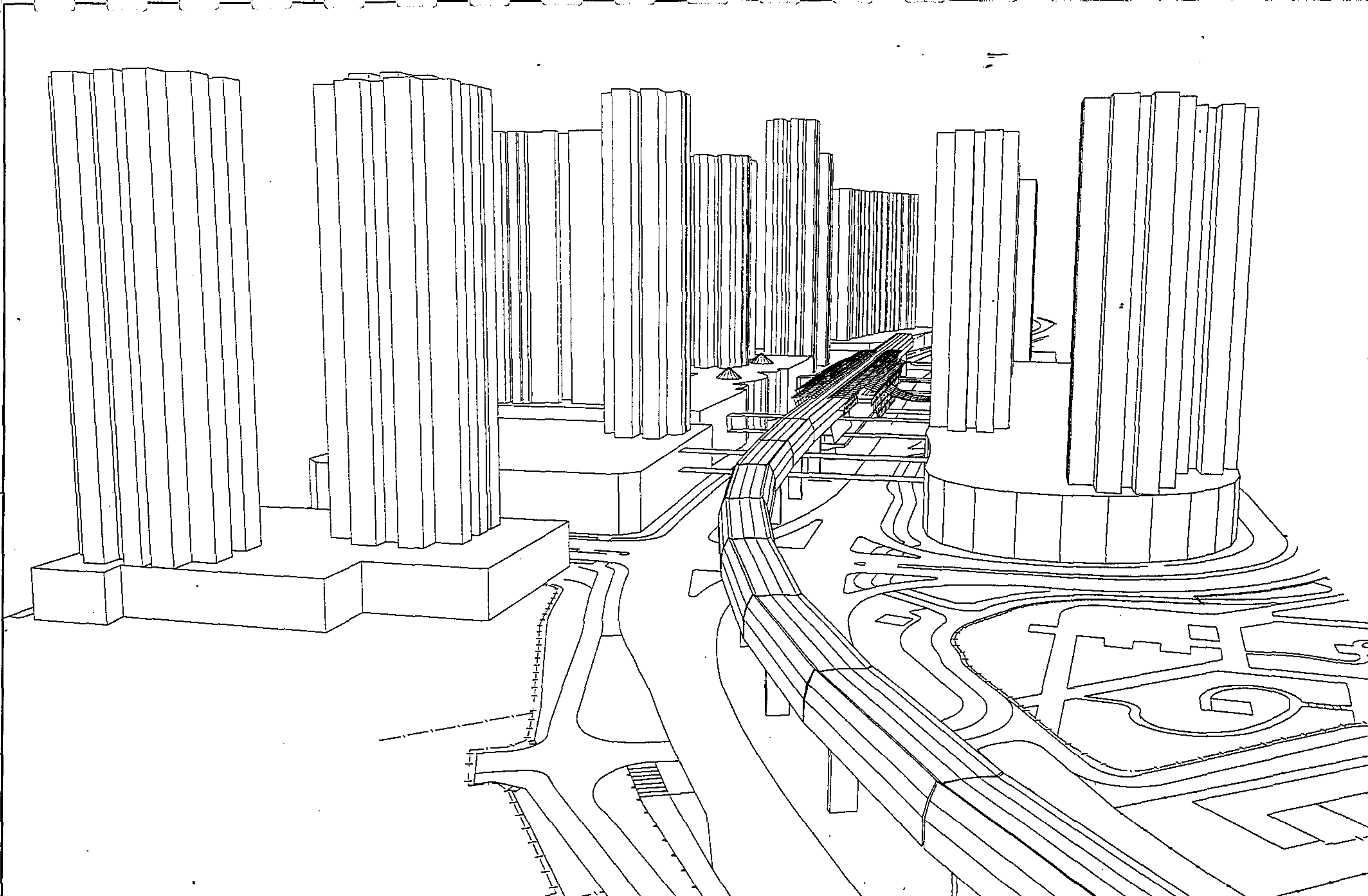
RAILWAY DEVELOPMENT STUDY PHASE 2 (PART 1)	TAI WAI TO MA ON SHAN RAIL LINK VISUAL CONTEXT OF OPTION 6 MOS STATION	DATE: SCALE:	FIGURE No. B1.4c



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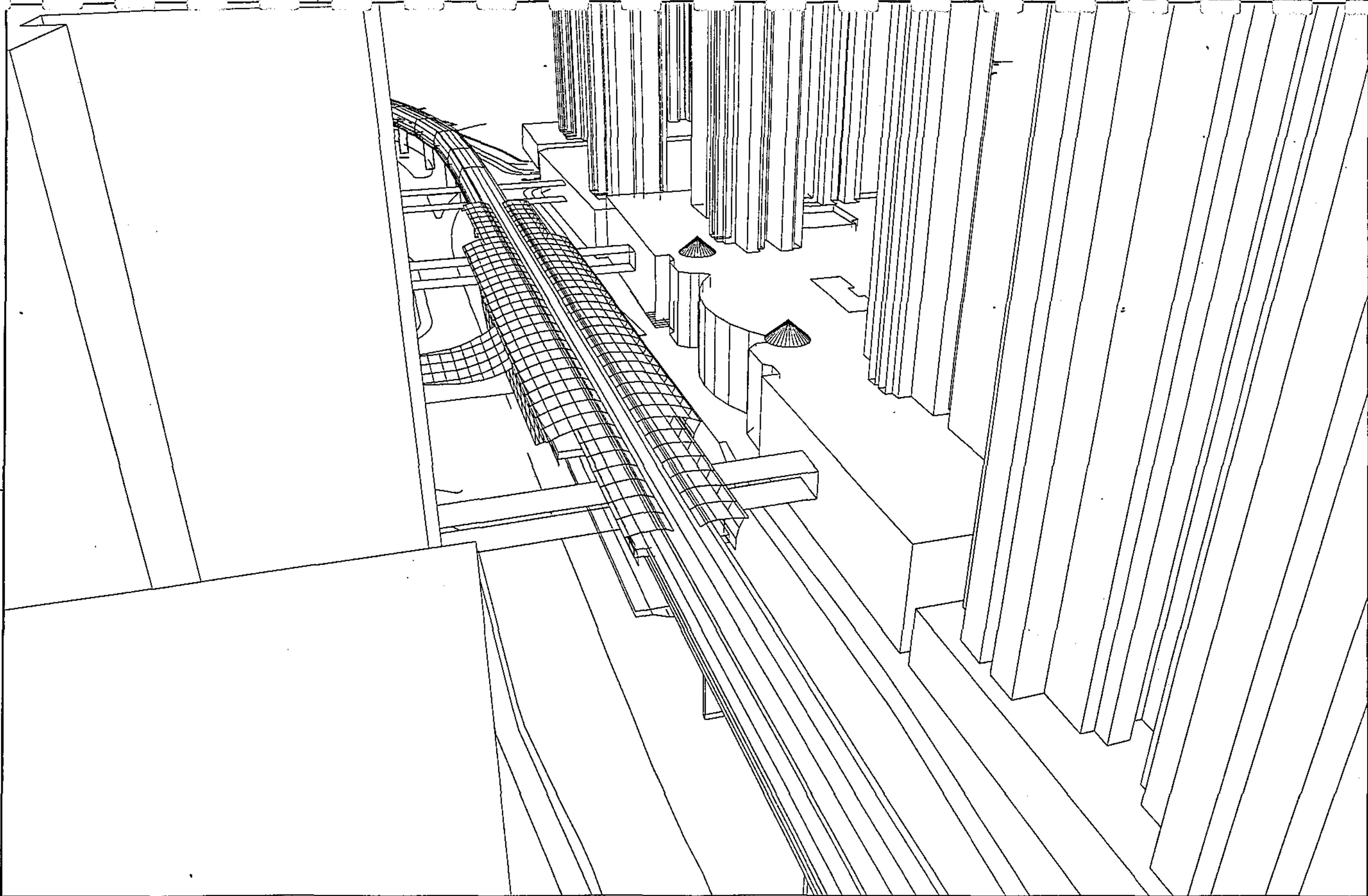
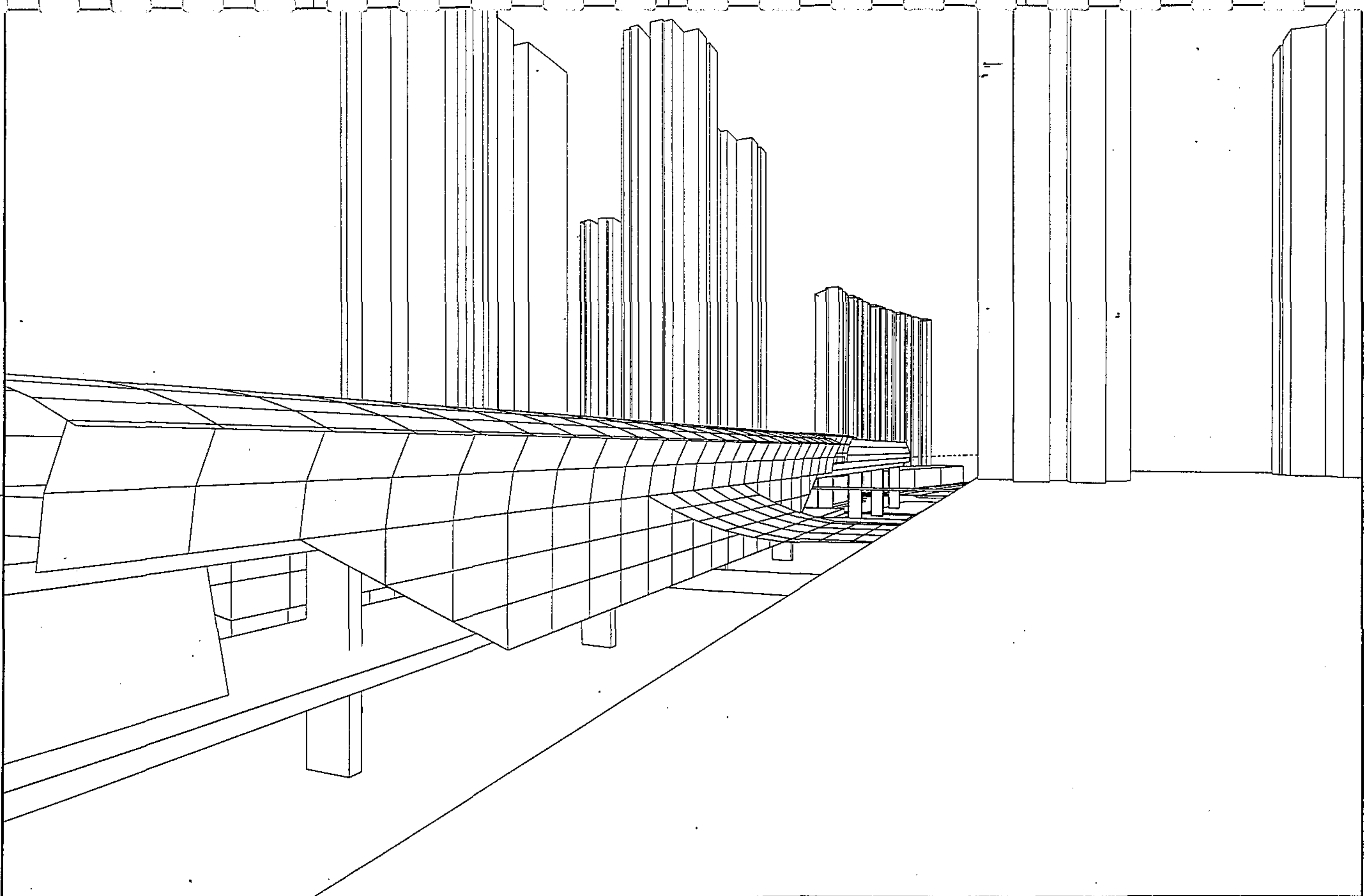
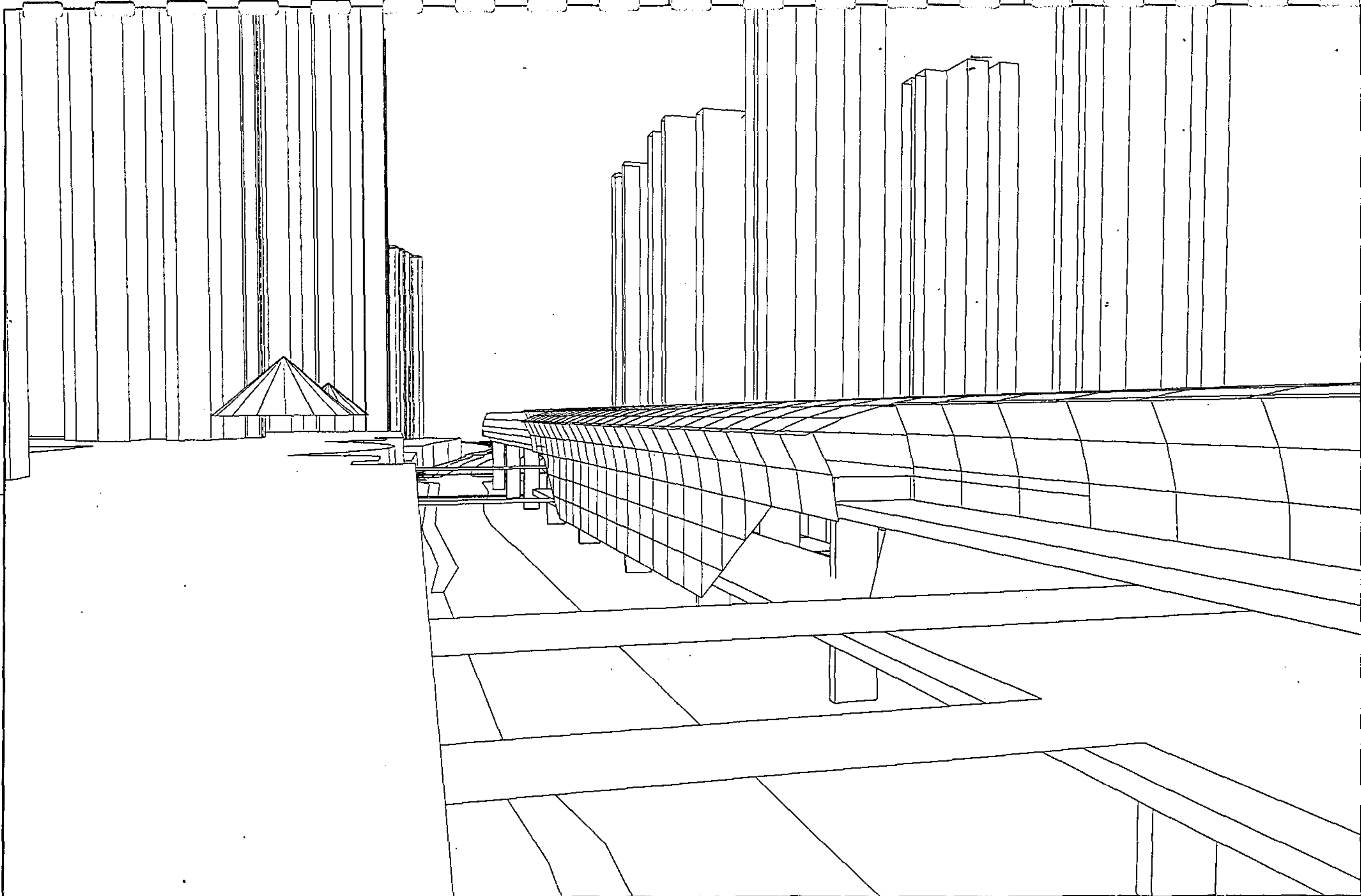
RAILWAY DEVELOPMENT STUDY PHASE 2 (PART 1)	MA ON SHAN TOWN CENTRE VISUAL IMPACT FOR OPTION 1 ALIGNMENT (SHEET 1 OF 5)	DATE: MAR 97	CAD REF : C:/DRU/3379/MODEL/OPTION1.DWG
		SCALE: NTS	FIGURE No. B1.4d



Highways Department Railway Division	FEASIBILITY STUDY FOR THE TAI WAI TO MA ON SHAN RAIL LINK AND THE KCR EXTENSION TO TSIM SHA TSUI MA ON SHAN TOWN CENTRE VISUAL IMPACT FOR OPTION 1 ALIGNMENT (SHEET 2 OF 5)		MVA ASIA MAUNSELL CONSULTANTS ASIA and associated consultants
RAILWAY DEVELOPMENT STUDY PHASE 2 (PART 1)		DATE: MAR 97	CAD REF : C:/DRU/3379/MODEL/OPTION1.DWG
		SCALE: NTS	FIGURE No. B1.4e



Highways Department Railway Division	FEASIBILITY STUDY FOR THE TAI WAI TO MA ON SHAN RAIL LINK AND THE KCR EXTENSION TO TSIM SHA TSUI		MVA ASIA MAUNSELL CONSULTANTS ASIA and associated consultants
	MA ON SHAN TOWN CENTRE	DATE: MAR 97	CAD REF : C:/DRU/3379/MODEL/OPTION1.DWG
RAILWAY DEVELOPMENT STUDY PHASE 2 (PART 1)	VISUAL IMPACT FOR OPTION 1 ALIGNMENT (SHEET 3 OF 5)	SCALE: NTS	FIGURE No. B1.4f



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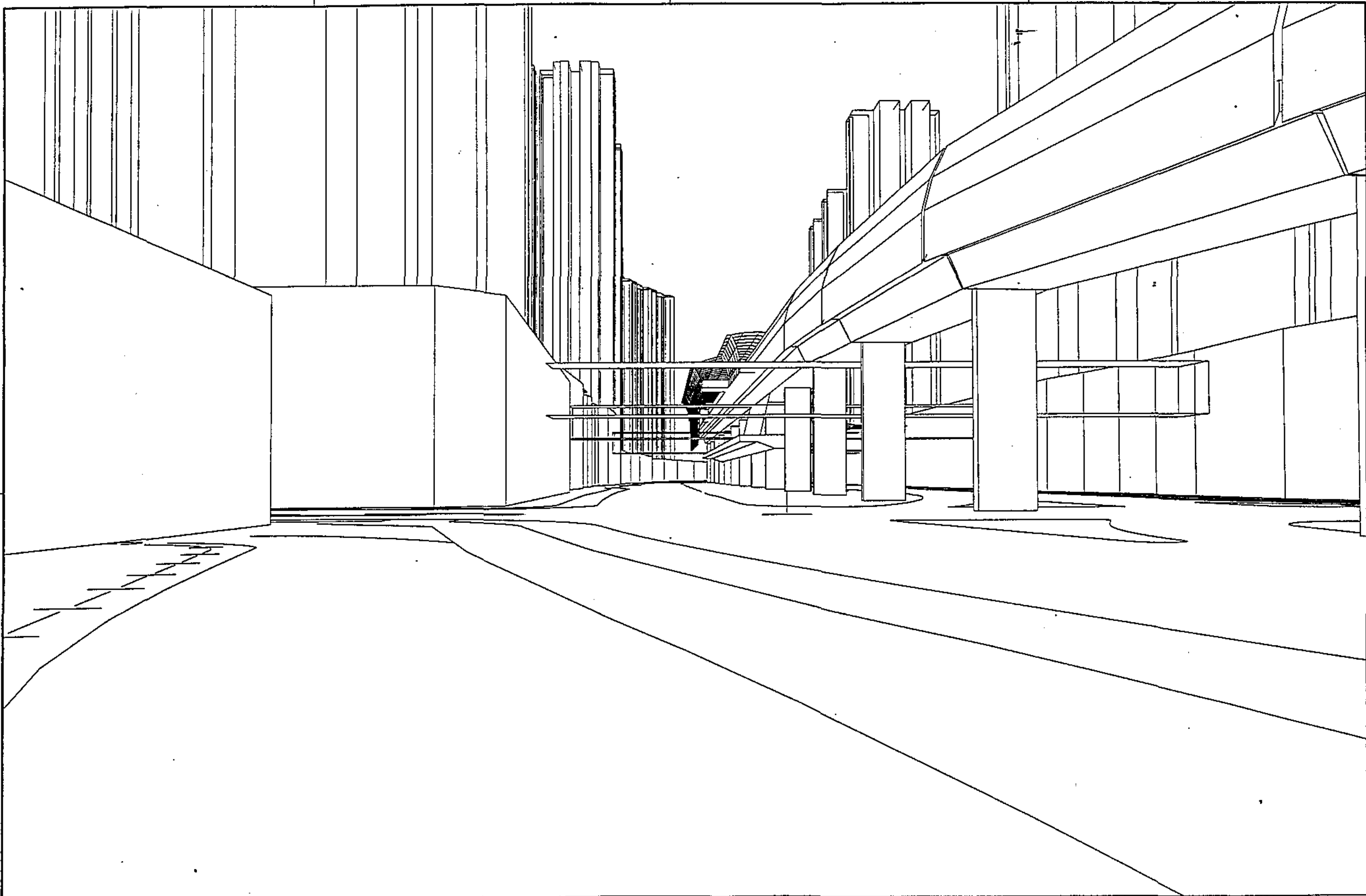
	MA ON SHAN TOWN CENTRE	DATE: MAR 97	CAD REF : C:/DRU/3379/MODEL/OPTION1.DWG
RAILWAY DEVELOPMENT STUDY PHASE 2 (PART 1)	VISUAL IMPACT FOR OPTION 1 ALIGNMENT (SHEET 4 OF 5)	SCALE: NTS	FIGURE No. B1.4g



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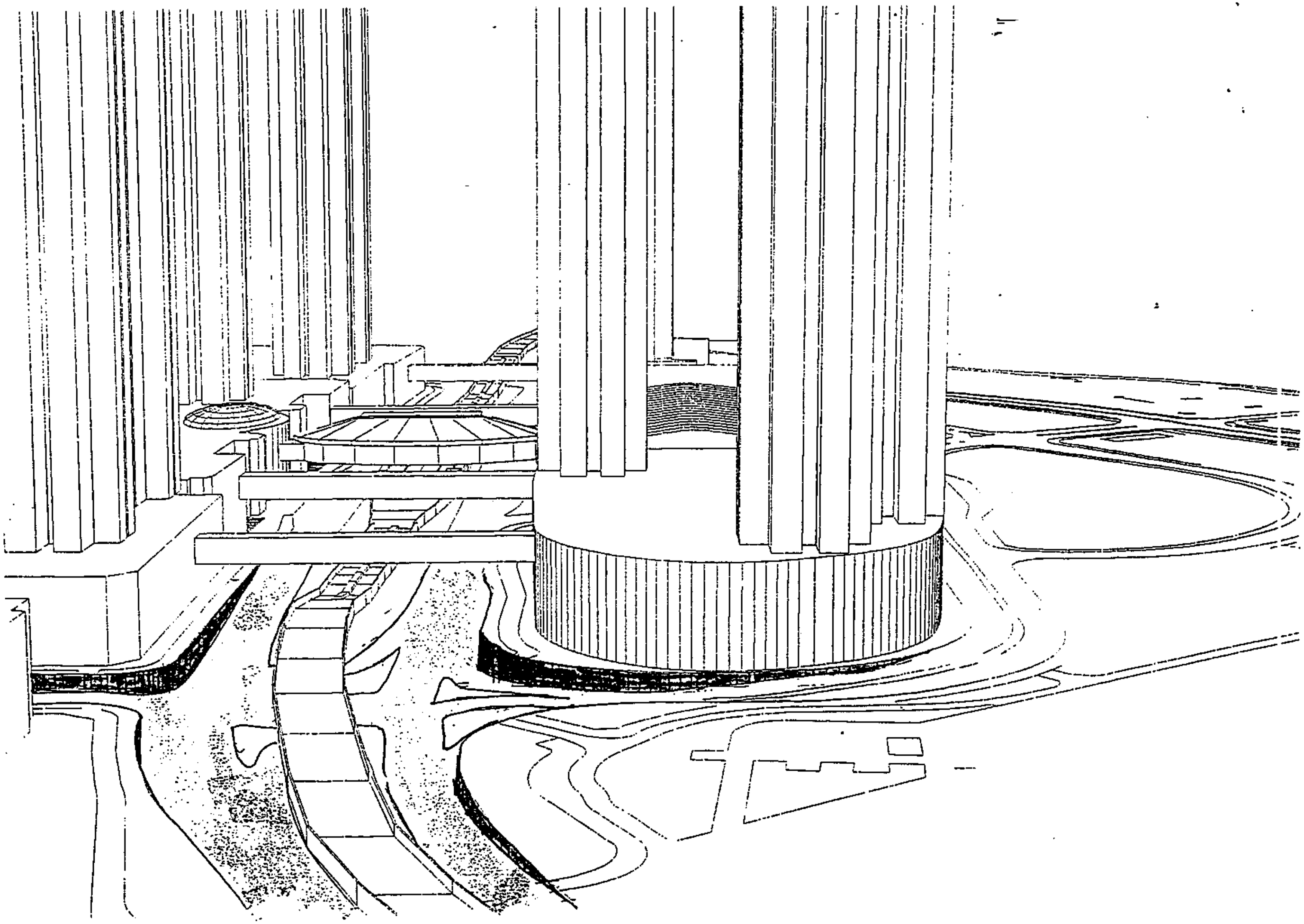
		SCALE: NTS	FIGURE No. B1.4h



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	TAI WAI TO MA ON SHAN RAIL LINK	DATE: APRIL 96	
RAILWAY DEVELOPMENT STUDY PHASE 2 (PART 1)	VISUAL IMPACT FOR OPTION 6 ALIGNMENT	SCALE: N.A.	FIGURE No. B1.4i

CONSULTING SERVICES BY ENVIRONMENTAL RESOURCES MANAGEMENT

FINAL REPORT

Maunsell/MVA

RDS Phase II KCR Extension to Tsim Sha Tsui : *KV4 Environmental Feasibility Study*

14 March 1997

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ERM

FINAL REPORT

Maunsell/MVA

RDS Phase II KCR Extension to Tsim Sha Tsui : *KV4 Environmental Feasibility Study*

14 March 1997

Reference C1435/45347

For and on behalf of ERM-Hong Kong, Ltd

Approved by: [signature]

Position: Deputy Managing Director

Date: 13th March 1997

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Annex A *KCR Extension Construction Noise Calculations*

GLOSSARY

ANL	Acceptable Noise Level
AP-42	Compilation of Air Pollutant Emission Factors, 5th Edition, US Environmental Protection Agency, 1996
APC(A)O	Air Pollution Control (Amendment) Ordinance No 13, 1993, Part IX, Sections 69 to 73
APCO	Air Pollution Control Ordinance (Cap 311)
AQO	Air Quality Objective
ASR	Air Sensitive Receiver (*Section* 2)/Area Sensitivity Rating (*Section* 3)
BNL	Basic Noise Levels
BOD	5 day biological oxygen demand
CED	Civil Engineering Department
CNL	Corrected Noise Level
CNP	Construction Noise Permit
DO	Dissolved Oxygen
EC	Environmental Checker
ECP	Event Contingency Plan
EFS	Environmental Feasibility Study
EIA	Environmental Impact Assessment
EM&A	Environmental Monitoring and Audit
EPD	Environmental Protection Department
ETS	East Tsim Sha Tsui Station
FDM	Fugitive Dust Model
HKPSG	Hong Kong Planning Standards and Guidelines
KCR	Kowloon - Canton Railway
MOS Rail	Ma On Shan Rail Link
NCO	Noise Control Ordinance
NSR	Noise Sensitive Receiver
RDS	Railway Development Strategy
RSP	Respirable Suspended Particulates
PCW	Prescribed Construction Work
PME	Powered Mechanical Equipment
SPME	Specified Powered Mechanical Equipment
SS	Suspended Solids
SSSI	Site of Special Scientific Interest
SWL	Sound Power Level
TKE	Tseung Kwan O Extension
TM	Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters
TM1	Technical Memorandum on Noise From Construction Work Other Than Percussive Piling
TM2	Technical Memorandum on Noise from Construction Work in Designated Areas
TM3	Technical Memorandum on Noise From Percussive Piling
TM4	Technical Memorandum on Noise from Places Other Than Domestic Premises, Public Places or Construction Sites
TSP	Total Suspended Particulates
WCR	Western Corridor Railway
WCZ	Water Control Zone
WDO	Waste Disposal Ordinance
WPCO	Water Pollution Control Ordinance
WQO	Water Quality Objective
WSD	Water Supplies Department
WSR	Water Sensitive Receiver

1 INTRODUCTION

1.1 Preamble

1.1.1 The Hong Kong Government announced in December 1994 its Railway Development Strategy which set out the framework for the expansion of the Territory's railway network into the next century. The strategy classified proposed new railways in terms of priority and accorded the highest priority to three packages:

- the Western Corridor Railway (WCR)
- the Tseung Kwan O Extension (TKE) of the MTR system and
- Ma On Shan Rail Link (MOS Rail) and Kowloon-Canton Railway (KCR) Extension to Tsim Sha Tsui.

1.1.2 The WCR and the TKE are being progressed by the KCRC and MTRC respectively. MOS Rail and the KCR Extension are envisaged by Government as being potentially suitable for private sector participation and as a next step the Railways Development Office of Highways Department has initiated the MOS and KCR Extension Study as Phase II (Part 1) of the Railway Development Study. This new study is a comprehensive Feasibility Study to put forward the preferred railway schemes and if appropriate to prepare technical documentation to form part of an invitation for tenders from interested parties. On 30th October 1995 the MVA-Maunsell Joint Venture was appointed to undertake the study.

1.1.3 The KCR Extension is formed by extending a pair of tracks from the existing KCRC Kowloon Station (at Hung Hom) southwards into an underground east-west alignment to a station at Tsim Sha Tsui giving an interchange connection the MTR Tsuen Wan Line and ultimately connecting through to WestRail via the Kowloon Point Reclamation. Two alternative routes, one via Middle Road and the other via Salisbury Road were put forward for investigation (see *Figure 1.1a*); the former has been recommended.

1.1.4 The KCR Extension will provide a direct KCRC link to the employment areas of the Kowloon peninsula and a second interchange at Tsim Sha Tsui with the MTRC, thereby relieving Kowloon Tong of cross harbour journey demands. This will improve accessibility for residents of the north-west New Territories and give the KCRC much better penetration into the area. Furthermore, the line could be extended to connect with the KCRC WestRail on the West Kowloon Reclamation via the possible Kowloon Point Reclamation. This will provide a cross Kowloon link and further improve rail accessibility in Kowloon and the Territory as a whole.

1.1.5 The Railway Development Strategy (RDS) (December 1994) accorded high priority to the Project and the Government, in seeking early implementation, is considering inviting tenders from interested parties on a build/operate basis. The next stage of work is to both detail the Project itself and to determine how best to package it for implementation and operation. Government is therefore pursuing this objective through appointing consultants to conduct this comprehensive Feasibility Study and also Financial Advisors to assess the financing aspects.

1.1.6 If the project is subsequently endorsed by Government, this process will lead to the preparation of tender documents, invitation to bid, bid appraisal and negotiations, and ultimately construction and operations. As this would be the first private sector involvement in a rail project in recent years it is vital that the Feasibility Study approach takes into account the ultimate means of implementation. The bid documents must not unduly constrain bidders so as to prevent innovative ideas, but they must set out a framework to enable assessments to be made. They must also ensuring that the implemented Project provides the required level of service.

1.1.7 ERM Hong Kong, as part of the Study Team, have carried out a feasibility stage environmental impact assessment (EIA), that is to say an Environmental Feasibility Study (EFS) to provide information on the type and magnitude of impacts which may be caused by the construction and operation of the railway extensions. The findings of the EFS will contribute to the overall Feasibility Study for the railway extensions, providing information on:

- environmental constraints that may affect railway design;
- selection of the preferred railway system;
- options for mitigation measures to control adverse impacts; and
- environmental protection requirements for inclusion at the detailed design stage.

1.1.8 The purpose of the EFS is to investigate the suitability of the proposed project in terms of its environmental acceptability and, where necessary, provide recommendations to control any identified adverse impacts. If the project is approved, the findings of the EFS will be used to determine the scope of work required for a full EIA to be carried out through the project design stages.

1.1.9 This draft EFS Report will become the final output from the EFS and sets out the findings of the EFS and recommendations for further work.

1.2 Objectives of the Environmental Feasibility Study

1.2.1 The Feasibility Study Brief sets out the objectives of the Study to be to determine:

- the most appropriate system type(s) and configuration for the MOS and an effective interchange with the KCRC line at Tai Wai;

- how best to extend the KCR to Tsim Sha Tsui and potentially to West Kowloon Reclamation and provide an effective interchange with the MTR; and

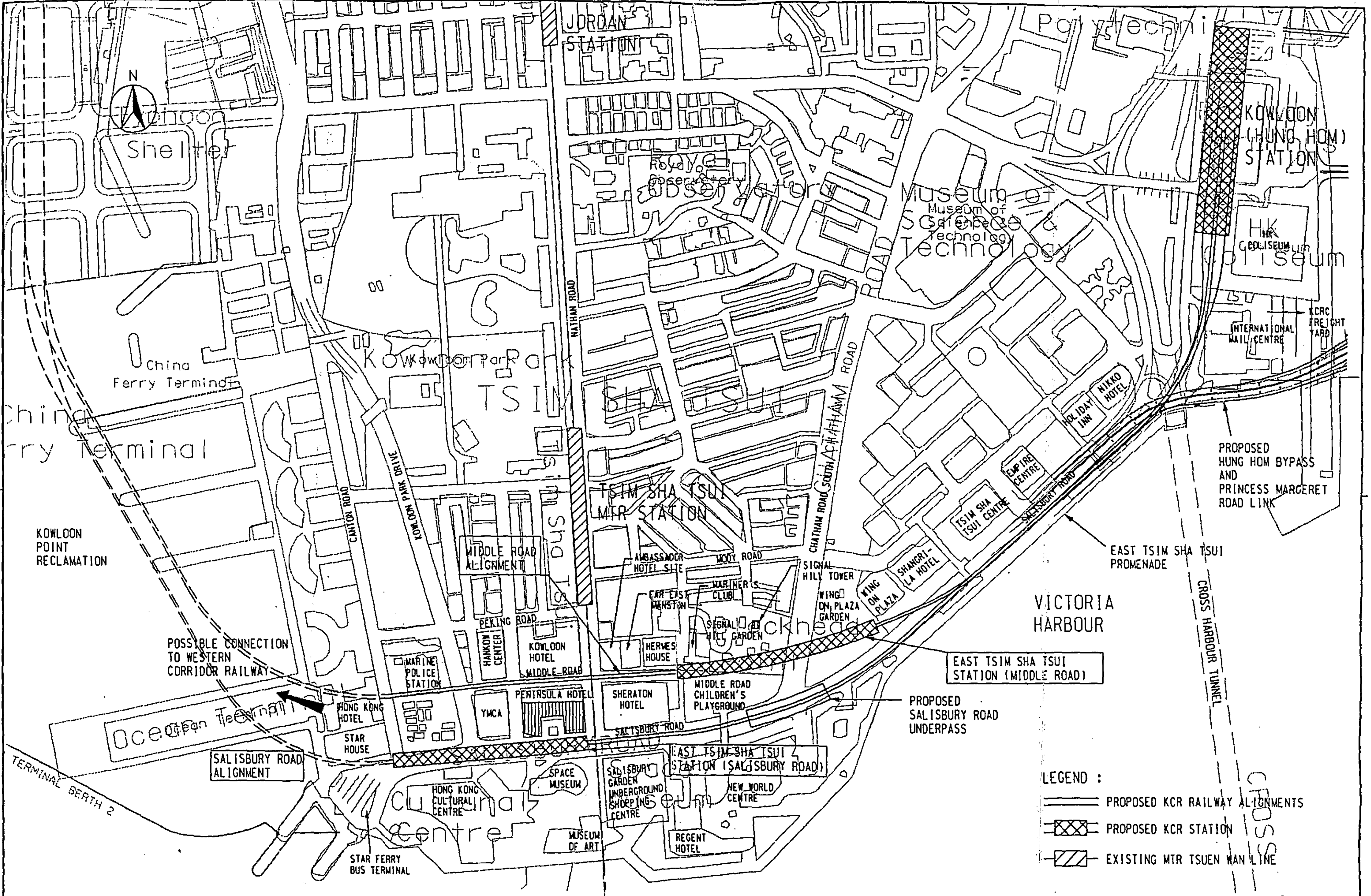
- how best to package and phase the lines for implementation.

1.2.2 The Study must also ensure that the Preferred Schemes support and enhance on-going planning and development and do not have any adverse environmental or drainage impacts. Furthermore they should be properly integrated into the Territory's transport system and their implications on other plans and proposals identified.

1.2.3 In addition, the EFS will fulfill the objectives of the Environmental Protection Department's (EPD) Study Brief which are:

i) to describe the proposed railway and associated facilities including railway stations and the requirements for their development;

ii) to identify and describe the elements of the existing and planned community and environment likely to be affected by the proposed railway;



Highways Department
Railway Division

RAILWAY DEVELOPMENT STUDY
PHASE 2 (PART 1)

FEASIBILITY STUDY FOR THE TAI WAI TO MA ON SHAN RAIL LINK AND THE KCR EXTENSION TO TSIM SHA TSUI

KCR EXTENSION TO TSIM SHA TSUI
ALIGNMENT OPTIONS

DATE: JAN 97

SCALE: 1 : 5000

MVA ASIA
MAUNSELL CONSULTANTS ASIA
and associated consultants

CAD REF : W:/PROJECTS/94595/MOS/MOSS117.DGN

FIGURE No. 1.1a

iii) to identity and quantify environmental polluting sources and determine the significance of impacts on sensitive receivers and potential affected uses;

iv) to minimize potential pollution and environmental disturbance arising from the development and its operation and during construction of the railway;

v) to identify, predict and evaluate the residual (ie. after practicable mitigation) environmental impacts and cumulative effects from other pollution emitters expected to arise during the construction, operation phases of the proposed railway in relation to the sensitive receivers and potential affected uses;

vi) to identify, assess and specify methods, measures and standards, to be included in the detailed design, construction and operation of the railway which are necessary to mitigate these impacts and reduce them to acceptable levels;

vii) to design and specify the environmental monitoring and audit requirements necessary to ensure the implementation and the effectiveness of the environmental protection and pollution control measures adopted;

viii) to investigate the extent of side-effects of proposed mitigation measures that may lead to other forms of impacts;

ix) to identify constraints associated with the mitigation measures recommended in the study; and

x) to identify any additional studies necessary to fulfill the objectives to the requirements of the Study Brief.

1.3 Structure of the Environmental Feasibility Study Report

1.3.1 After this introductory section, the remainder of the EFS is arranged as follows:

- *Section 2* identifies the air quality impacts arising from the construction and operation of the KCR Extension, assesses their magnitude and puts forward recommendations for appropriate mitigation measures;

- *Section 3* identifies the noise and vibration impacts arising from the construction and operation of the KCR Extension, their magnitude and suitable mitigation;

- *Section 4* identifies and reviews the water quality impacts arising from the construction and operation of the KCR Extension and puts forward effective mitigation measures;

- *Section 5* addresses the solid waste management implications arising from the construction and operation of the KCR Extension, considers waste reduction and disposal options and identifies control and mitigation measures;

- *Section 6* identifies the ecological impacts arising from the construction and operation of the KCR Extension and provides recommendations for suitable mitigation measures;

- *Section 7* reviews the landscape and visual impacts arising from the construction and operation of the KCR Extension and puts forward proposals for necessary mitigation;

- *Section 8* identifies the EM&A requirements arising from the assessment of construction and operational impacts from the KCR Extension and provides recommendations for their application; and

- *Section 9* discusses the overall conclusions and recommendations arising from the KCR Extension EFS and makes recommendations for further studies.

- *Annex A* contains the construction plant lists and their sound power levels.

- *Annex B* contains the responses to Government departmetn comments on the draft Environmental Feasibility Studies and the draft Executive Summaries .

2 AIR QUALITY

2.1 Introduction

2.1.1 This Section addresses the air quality impacts associated with the construction and operational activities of the proposed KCR Extension through Tsim Sha Tsui. Potential air quality impacts have been identified, particularly during the construction phase of the proposed railway extension, station and tunnels.

2.1.2 During the construction phase, there will be dust impacts from site preparation activities, earthworks and excavations. Exhaust emissions from trucks and powered mechanical equipment may affect the surrounding sensitive uses of the study area. The extent of impact depends on the distances between the work sites and sensitive receivers, construction methodologies and the number of mechanical plant and vehicles employed on site.

2.1.3 It is expected that the impacts from exhaust emissions should be limited as relatively small numbers of mechanical plant would be employed on site, these are not considered further in this Study.

2.1.4 In the operational phase, electrical-powered trains will be used and there will be no adverse air quality impacts although there might be some dust generation from abrasion and gaseous and particulate emissions from maintenance operations. However, these pollutant sources are expected to have little or no impact on surrounding sensitive uses because the entire alignment is enclosed within tunnels.

2.2 Government Legislation and Standards

2.2.1 The principal legislation for the management of air quality is the *Air Pollution Control Ordinance* (APCO) *(Cap 311)*. The whole of the Hong Kong Territory is covered by the *Air Quality Objectives* (AQOs) which stipulate the statutory limits of seven air pollutants and the maximum allowable numbers of exceedance over specific periods. The AQOs are shown in *Table 2.2a*.

2.2.2 In addition, the EPD recommends a maximum hourly TSP level of 500 $\mu g\ m^{-3}$ at the affected sensitive receivers.

2.3 Sensitive Receivers and Baseline Conditions

2.3.1 According to the *Hong Kong Planning Standards and Guidelines* (HKPSG), sensitive receivers include residential uses, schools and academic institutions, and active and recreational uses. Potential Air Sensitive Receivers (ASRs) in the vicinity of the proposed KCR Extension work sites are summarised in *Tables 2.3a-c* and their locations are shown in *Figures 2.3a* and *2.3b*.

Table 2.2a Hong Kong Air Quality Objectives ($\mu g\ m^{-3}$)(i)

Pollutant	Averaging Time				
	1 Hour(ii)	8 Hours(iii)	24 Hours(iii)	3 Months(iv)	1 Year(iv)
Total Suspended Particulates (TSP)	-	-	260	-	80
Respirable Suspended Particulates(v) (RSP)	-	-	180	-	55
Sulphur Dioxide (SO_2)	800	-	350	-	80
Nitrogen Dioxide (NO_2)	300	-	150	-	80
Ozone (O_3)	240	-	-	-	-
Lead (Pb)	-	-	-	1.5	-
Carbon Monoxide (CO)	30,000	10,000	-	-	-

Note: (i) Measured at 298°K (25°C) and 101.325 kPa (one atmosphere).
(ii) Not to be exceeded more than three times per year.
(iii) Not to be exceeded more than once per year.
(iv) Arithmetic means.
(v) Respirable suspended particulates means suspended particles in air with a nominal aerodynamic diameter of 10 micrometres and smaller.

2.3.2 The study area is classified as urban and the majority of land uses close to the KCR Extension are commercial and residential uses. Potentially affected sensitive uses in the study area include hotels, recreational areas and commercial/residential buildings. As there are no existing EPD air quality monitoring stations in the Tsim Sha Tsui area, baseline air quality has been established through the monitoring station in Central/Western district run by the EPD. The annual averaged Total Suspended Particulates (TSP) level measured at Central/Western district in 1995 was 93 $\mu g\ m^{-3}$.

2.3.3 In the study area, the main source of pollutant is from the traffic on existing roadways including Salisbury Road, Mody Road, Chatham Road South and Nathan Road. With reference to *The Annual Traffic Census 1995, Traffic and Transport Survey Division, June 1996*, the averaged daily traffic on Salisbury Road (from Nathan Road to Chatham Road South) was over 40,000 vehicles. Chatham Road South and Nathan Road had a daily traffic of over 20,000 vehicles in 1995.

2.3.4 Ventilation exhaust from the portal of the existing Cross Harbour Tunnel is another source of pollutants which contributes to the background NO_2 and Respirable Suspended Particulate (RSP) levels. In 1995, the annual averaged daily traffic flow through the Cross Harbour Tunnel was over 120,000. Heavy traffic on the existing road network in Tsim Sha Tsui, together with the portal exhaust of Cross Harbour Tunnel, are the main NO_2 and RSP emission sources in this area.

Hung Hom to Signal Hill

2.3.5 The alignment will follow the Tsim Sha Tsui East Promenade for most of this section and the nearest ASRs will be separated from the work site by Salisbury Road. The alignment then runs under Wing On Garden to the proposed East Tsim Sha Tsui Station (ETS). The buildings on the northern side of Salisbury Road are hotels, offices and shops, all of which are likely to be centrally air conditioned, sensitivity to construction dust will be largely limited to the fresh air intakes of the ventilation systems.

2.3.6 Ground floor shops with entrances on Salisbury Road may be affected by dust during the construction phase. Identified ASRs within this section are listed in *Table 2.3a* and shown in *Figure 2.3a*.

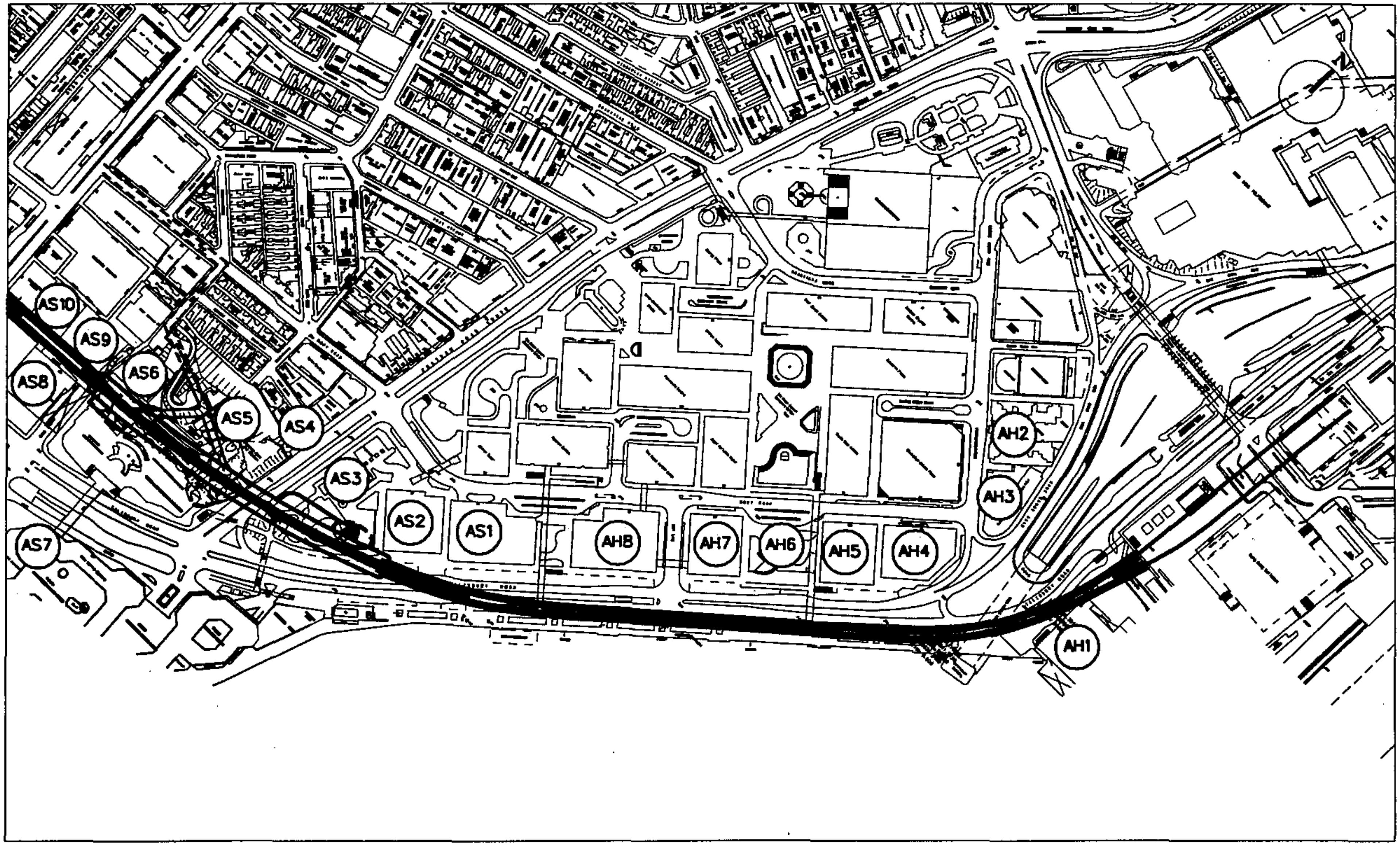


FIGURE 2.3a - Air Sensitive Receiver -

Hung Hom to Signal Hill

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_12
Sources :	

Prepared by ERM's GIS & MAPPING Group

KEY

	Alignment
	Station Site
AH1	Air Sensitive Receiver

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

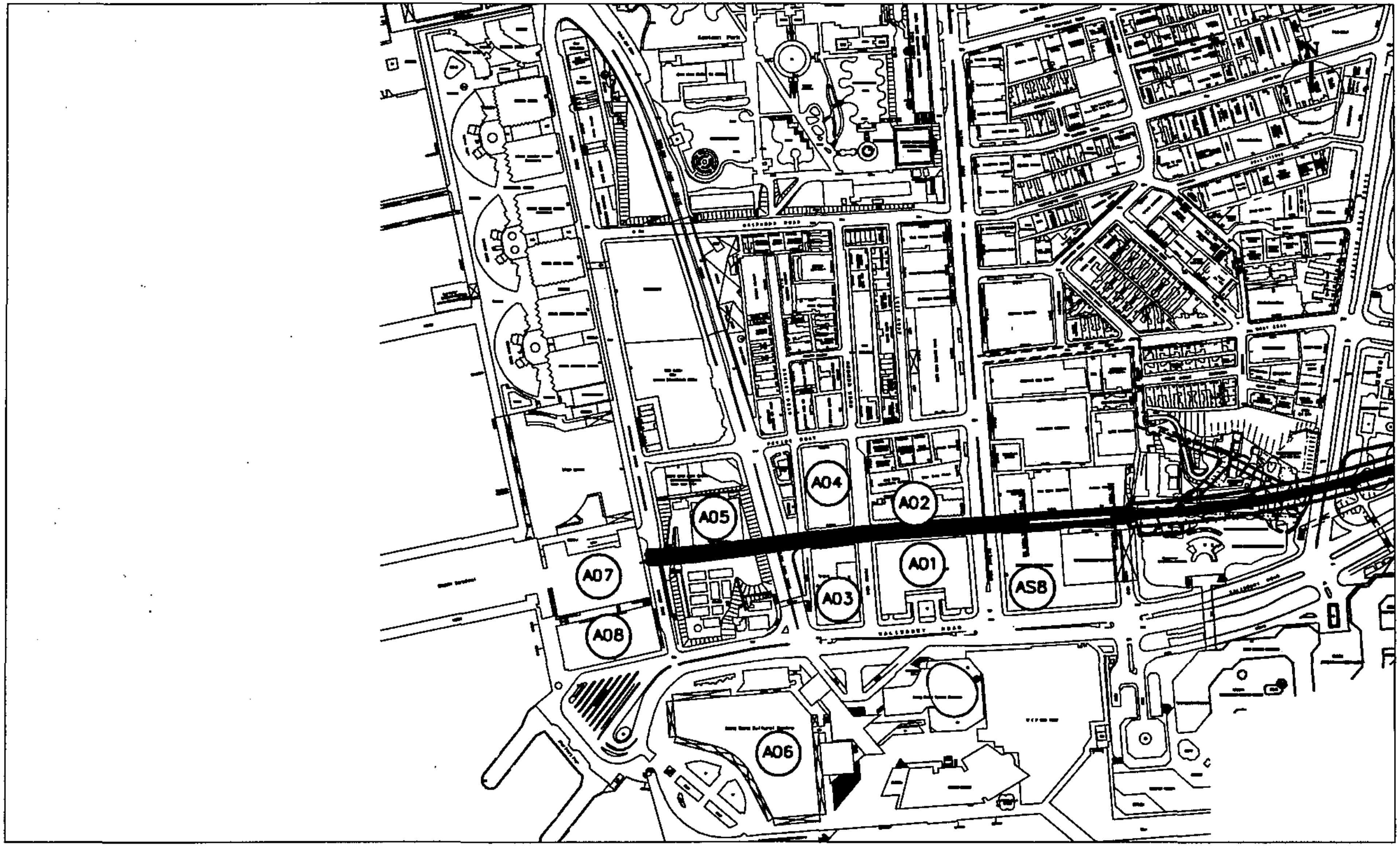


FIGURE 2.3b - Air Sensitive Receiver - Signal Hill and Over run Tunnel

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_11
Sources :	

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- Station Site
- A01 Air Sensitive Receiver

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

Table 2.3a Identified ASR - Hung Hom to Signal Hill

Air Sensitive Receiver		Distance from Work Site (m)
		Alignment
AH1	International Mail Centre	5
AH2	Pak Sui Yuen	71
AH3	Fire Services Headquarter's Building	26
AH4	Hotel Nikko HK	27
AH5	Grand Stanford Harbour View	36
AH6	The Urban Council Centenary Garden	43
AH7	Empire Centre	35
AH8	Tsim Sha Tsui Centre	32

East Tsim Sha Tsui Station

2.3.7 The proposed station is below Wing On Garden and Signal Hill and is approximately 300 m long. In the construction phase, Wing On Garden will be subject to major excavation works and the residential and commercial buildings along Chatham Road South are the nearest ASRs likely to be impacted. The Children's Playground and a section of Signal Hill will need to be removed to provide access for the construction of the station box and there will be potential dust impacts on the Mariners Club. Air quality impacts are also likely on other buildings along Middle Road.

2.3.8 During the operational phase, Wing On Garden will contain a station entrance and vent building. In addition, station and tunnel vents will also be located further west along the alignment, which may lead to adverse impacts on the surroundings. Identified ASRs within this section are listed in *Table 2.3b* and shown in *Figures 2.3a* and *2.3b*.

Overrun Tunnel

2.3.9 The overrun tunnel for the railway extension will run under Middle Road and end at Canton Road. There will be a bored tunnel section under the Marine Police Headquarters. Major sensitive uses in the vicinity of the work site are commercial buildings, hotels and some residential uses along Middle Road. Identified ASRs are listed in *Table 2.3c* and shown in *Figure 2.3b*.

Table 2.3b Identified ASR - East Tsim Sha Tsui Station

Air Sensitive Receiver		Distance from Work Site (m)	
		Alignment	Station
AS1	Shangri-La Hotel	20	60
AS2	Wing On Plaza	5	5
AS3	Wing On Plaza Garden	-	10
AS4	Wang Fu Building	125	32
AS5	Signal Hill Garden	-	10
AS6	Mariner's Club	32	10
AS7	New World Centre	120	54
AS8	Sheraton Hong Kong Hotel	10	51
AS9	Hermes House	10	5
AS10	Far East Mansion	10	50

Table 2.3c Identified ASR - Overrun Tunnel

Air Sensitive Receiver		Distance from Work Site (m)	
		Alignment	Station
AO1	The Peninsula Hotel	10	150
AO2	Kowloon Hotel	10	145
AO3	YMCA Building	10	-
AO4	Hankow Centre	10	-
AO5	Marine Police Headquarters	10	-
AO6	Hong Kong Cultural Centre	81	-
AO7	Hong Kong Hotel	20	-
AO8	Star House	35	-

2.4 Construction Impacts

Potential Sources of Impact

2.4.1 The principal source of potential air quality impacts during the construction of the KCR Extension will be dust. Gaseous emissions from site vehicles and powered mechanical plant will have minimal impacts on the surrounding area owing to the limited number of potential sources. No batching plant is required as it is envisaged that ready mixed concrete will be delivered by truck. It is likely that access roads to the work sites will all be paved and therefore, dust will mainly arise within the construction sites themselves.

2.4.2 The main construction activities which would generate dust impacts to the surrounding sensitive uses include demolition and site clearance, ground excavation, cut and cover tunnelling, diaphragm wall construction, material handling and transfer off-site, vehicle movements within work sites and stockpiling of excavated material for station and alignment construction. In addition, the construction of ventilation shafts and above ground structures will generate dust impacts at the nearby sensitive receivers.

Hung Hom to Signal Hill

2.4.3 The construction of the proposed alignment from Hung Hom Station to Signal Hill will mainly be by cut and cover method together with chemical or hydraulic method for rock breaking. Excavators, crawler-mounted breakers and dump trucks will be used for such construction activities. There will be approximately 125,000 m^3 of fill material generated during the construction phase. Fugitive emissions are likely through handling of spoil. There are also potential dust impacts to the surrounding sensitive uses during the construction of the box sub-structure for the proposed alignment.

2.4.4 The work site access will be along the proposed route at locations adjacent to the stage of work in progress. No stockpiling on-site is expected and excavated spoil will be transported off-site promptly. The site area will be approximately 20,000 m^2 for the first 300 m from Hung Hom Station, and the remainder will be constructed in 100×15 m^2 segments.

East Tsim Sha Tsui Station

2.4.5 Cut and cover methods will be employed for the construction of the station structure. Wing On Garden will be subject to major excavation works and fugitive dust emission would be a potential source of impact to the surrounding area. Excavators, crawler-mounted breakers and dump trucks will be used during the excavation stage. There will be a total of approximately 190,000 m^3 of spoil to be generated from the excavations, mainly decomposed granite. Fugitive emissions are likely to be generated through spoil handling although stockpiling of spoil is not anticipated. The construction site will cover an area of 15,000 m^2, dump trucks will be employed for the transport of spoil material and dust emissions are likely from truck movements on the site's unpaved haul roads. Air quality impacts would be likely during the construction of ventilation shaft, above ground structures and the station.

Overrun Tunnel

2.4.6 The overrun tunnel section will be constructed by cut and cover method except for the section under Marine Police Headquarters. Bored tunnelling will be employed for this tunnel segment and the potential of dust impacts on the surroundings will be limited. Dust impacts will be likely during the diaphragm wall construction and the excavation of the tunnel. Excavators, crawler-mounted breakers and dump trucks will be used during the excavation stage. There will be a total of approximately 80,000 m^3 of spoil to be generated from the construction of the overrun tunnel, mainly composed of marine deposits with high moisture content. Stockpiling of spoil is not expected on site and the construction will be divided into 100 m x 15 m segments over the cut and cover section.

Assessment Methodology

2.4.7 The assessment has focused on the potential dust impacts from the construction of the station, tunnels and the proposed alignment. Excavation, handling of spoil and construction material, and vehicular movements on unpaved haul roads will be the major dusty activities.

2.4.8 Cumulative impacts were also assessed during the construction phase of the development. Background air quality was referenced to EPD's monitoring station at Central/Western district, which was the nearest existing EPD air quality monitoring station in the study area. The annual averaged background TSP level in Central/ Western in 1995 of 93 $\mu g\ m^{-3}$ district was added to the predicted results.

Dispersion Model

2.4.9 The *Fugitive Dust Model* (FDM) was used to model the extent of impacts from the construction sites on identified ASRs. Six categories of particle size (100 µm, 30 µm, 15 µm, 10 µm, 5 µm and 2.5 µm) were assumed in the model. The mass fraction of each size range for different dust sources were based on the emission rates as listed in the US EPA publication, *Compilation of Air Pollutant Emission Factors, Volume I : Stationary Point and Area Sources, 5th Edition* (AP-42). Gravitational settling velocities were calculated by the model.

2.4.10 The 1-hour levels shown in *Table 2.4b-d* represent the worst case impact, assuming that the wind is blowing from the worksite directly towards the receiver for the entire hour at the wind speed most effective for TSP transport. 24-hour level calculations are based on the 1-hour predictions, factored to account for the construction works taking place for not more than 12 hours out of the 24 hour period (ie 50%). Unless the background level is already very high, the predicted levels will have a similar relationship to the 24-hour AQO (260 $\mu g\ m^{-3}$) as to the 1-hour limit (500 $\mu g\ m^{-3}$). However, during the whole day, the wind speed and direction will vary considerably and the actual 24-hour level will be noticeably lower than the corresponding 1-hour value. Therefore, the recommended mitigation measures to reduce the predicted 1-hour levels to within the recommended limit will also control the 24-hour levels to within the AQO. Daily and annual TSP levels at nearby ASRs would be addressed in the detail assessment stage using historical meteorological data.

Meteorological Input

2.4.11 At this feasibility stage, the likely impacts at downwind distances were assessed with stability class D, which is the typical daytime atmospheric condition in Hong Kong and with wind speeds of 1-5 m s^{-1}. Under these meteorological conditions, the worst hourly dust levels were predicted at the ASRs and the results are presented in this study. The worst case wind speed was identified to be 5 m s^{-1}. Detailed dust impact assessment should be undertaken at a later stage of the Study using true meteorological data when detailed information on construction activities are available.

Emission Rates

2.4.12 Dust emission rates from construction works are dependent on the extent of the site area where construction activities are taking place, the levels of construction activities and the daily and weekly construction period. It has been assumed that the effective working area within which dusty operations are undertaken, will be 30% of the total site area. There will be 25 working days in any one month and it is expected that the daily working period will be 12 hours (07.00-19.00).

2.4.13 Estimations of emission factors employed in the dispersion modelling have been made in accordance with AP-42 and are shown in *Table 2.4a.* The dust density used in the model was assumed to vary from 1700-2550 kg m^{-3}. Properties of the excavated spoil such as moisture content and silt content were provided by the Study Team. Dusty activities such as excavation and handling of materials and vehicular flows on unpaved haul roads were considered in the modelling study.

Table 2.4a Emission Factors of Dusty Construction Activities

Activity/Section	Emission Factor	Remark
Handling of Excavated Material		
• Hung Hom to Signal Hill	2.06×10^{-6} g s^{-2} m^{-2}	the emission rates are dependent on wind speed
• East Tsim Sha Tsui Station	1.08×10^{-5} g s^{-2} m^{-2}	
• Overrun Tunnel	1.77×10^{-6} g s^{-2} m^{-2}	
Truck Movements on Unpaved Haul Road		
• East Tsim Sha Tsui Station	0.0034 g s^{-1} m^{-1}	assumed peak hour traffic flow of 6 vehicles

2.4.14 No unpaved haul roads are expected during the construction phase of the proposed alignment for the section between Hung Hom and Signal Hill, and the overrun tunnel. Since the main access roads would be the adjacent paved roadways and there would be limited potential for dust emissions.

Prediction of Impacts

2.4.15 The dust impacts arising from the construction of the KCR Extension at the identified ASRs, including the cumulative impact of background dust, are shown in *Tables 2.4b-d.* Dust impacts from station construction and alignment construction are shown individually and, where applicable, cumulatively. The nearest ASR to each construction site, including station and alignment sites, for each section, are identified for the worst case assessment. The maximum dust impact at the ASR is then evaluated by summation of the individual dust impact and the background TSP concentration of 93 µg m^{-3}.

Hung Hom to Signal Hill

2.4.16 The predicted 1-hour TSP levels at identified ASRs from alignment construction are shown in *Table 2.4b* below.

Table 2.4b Predicted Ground Level 1-hour TSP Concentrations (µg m^{-3})(1)

Air Sensitive Receiver		Alignment Construction
AH1	International Mail Centre	114
AH2	Pak Sui Yuen	95
AH3	Fire Services Headquarter's Building	99
AH4	Hotel Nikko HK	99
AH5	Grand Stanford Harbour View	97
AH6	The Urban Council Centenary Garden	96
AH7	Empire Centre	97
AH8	Tsim Sha Tsui Centre	98

Note : (1) Background level of 93 µg m^{-3} is included.

East Tsim Sha Tsui Station

2.4.17 The predicted 1-hour TSP levels at identified ASRs from alignment and station construction are shown in *Table 2.4c* below.

Table 2.4c Predicted Ground Level 1-hour TSP Concentrations (µg m^{-3})(1)

Air Sensitive Receiver		Alignment Construction	Station Construction	Cumulative Level
AS1	Shangri-La Hotel	101	330	338
AS2	Wing On Plaza	114	1161	1182
AS3	Wing On Plaza Garden	-	872	-
AS4	Wang Fu Building	94	478	479
AS5	Signal Hill Garden	-	872	-
AS6	Mariner's Club	97	872	876
AS7	New World Centre	94	352	353
AS8	Sheraton Hong Kong Hotel	105	364	376
AS9	Hermes House	105	1161	1173
AS10	Far East Mansion	105	368	380

Note : (1) Background level of 93 µg m^{-3} is included.

Overrun Tunnel

2.4.18 The predicted 1-hour TSP levels at identified ASRs from alignment construction are shown in *Table 2.4d* below.

Table 2.4d Predicted Ground Level 1-hour TSP Concentrations (µg m^{-3})

Air Sensitive Receiver		1-hour TSP [1]
AO1	The Peninsula Hotel	105
AO2	Kowloon Hotel	105
AO3	YMCA Building	105
AO4	Hankow Centre	105
AO5	Marine Police Headquarters	105
AO6	Hong Kong Cultural Centre	94
AO7	Hong Kong Hotel	100
AO8	Star House	97

Note : [1] Background level of 93 µg m^{-3} is included.

Evaluations of Impacts

Hung Hom to Signal Hill

2.4.19 There is no AQO for hourly TSP but it is generally accepted that an hourly averaged TSP concentration of 500 µg m^{-3} should not be exceeded at identified ASRs. Dust impact from this section of proposed alignment would arise mainly from excavation works and handling of spoil. The modelled results showed that all the hourly dust levels at the ASRs were below the guideline value and that unmitigated alignment construction for this section of railway extension would cause minimal impacts.

2.4.20 The maximum predicted 1-hour TSP level was 114 µg m^{-3} at the International Mail Centre, this is due to the larger area of this work site compared to the rest of the alignment. Other predicted dust levels at the identified ASRs were less than 100 µg m^{-3} which, allowing for an included background level of 93 µg m^{-3}, showed that the construction activities would impose minimal impacts on these ASRs.

East Tsim Sha Tsui Station

2.4.21 The construction of ETS would involve extensive earthworks and excavation works, handling of excavated material and vehicle movements on unpaved haul roads would be the dominant sources of dust. As shown in *Table 2.4c*, Hermes House and Wing On Plaza would receive high dust levels (1161 µg m^{-3}) during the construction phase of ETS. The predicted dust levels at other ASRs close to the proposed construction site such as Wing On Garden Plaza, Signal Hill Garden and Mariner's Club, also exceeded the guideline value. The close proximity of the ASRs to the work site, high material handling rate and extensive excavations during the course of construction are the causes of these high dust levels. Therefore, effective mitigation measures should be implemented to control dust emissions and protect the ASRs to an appropriate extent.

2.4.22 The modelled dust levels at all the ASRs during alignment construction were within the 500 µg m^{-3} limit, indicating that there would be limited impacts on the ASRs because of the greater distance and lesser extent of works than for the station construction.

Overrun Tunnel

2.4.23 Referring to *Table 2.4d*, all the predicted 1-hour TSP levels at the identified ASRs were below the 500 µg m^{-3} value. It is predicted that dust impacts on the surrounding sensitive uses during the construction of the overrun tunnel would be minimal due to the limited extent of work. The highest predicted dust level was 105 µg m^{-3}, predicted at the receivers along Middle Road and close to the proposed work sites.

Mitigation Measures

2.4.24 Standard dust suppression measures should be incorporated into contract documents and adopted as part of good site practices to minimize potential dust impacts on the identified ASRs. The following measures should be implemented in order to reduce dust generation:

Earthworks and Excavation Activities

- surface compaction over completed earthworks where practicable to minimize the extent of exposed soil;
- frequent watering of the work site, an effective watering programme (ie. twice daily with complete coverage) may reduce dust emissions by up to 50 percent;

Materials Stockpiling and Handling

- all stockpiles of aggregate or spoil greater than 50 m^3 should be enclosed or covered and watered regularly in dry or windy conditions;
- dropping heights for excavated materials should be controlled to a practical height to minimize the fugitive dust arising from loading and unloading;

Vehicle Movements within the Works Site

- avoidance of truck exhaust pipes stirring up dust by directing the outlets upward;
- provision of wheel washing facilities at the exit of the site;
- effective water sprays should be used on the site at potential dust emission sources such as unpaved areas and active construction areas;
- the travelling speed should be controlled in order to reduce the traffic induced dust dispersion and re-suspension within the work site from the operating haul trucks; and
- during transportation by truck, materials should not be loaded to a level higher than the side and tail boards, and should be dampened or covered before transport off-site.

2.4.25 For all the assessed sites, the most effective dust control measures should be incorporated into the detailed construction programme to ensure impacts are minimised. The mitigated dust levels are shown in *Tables 2.4e-g*, with the incorporation of the suggested control measures. Dust emissions can be reduced by 50% with the implementation of a regular watering programme on active or inactive work sites.

Table 2.4e Mitigated 1-hour TSP Concentrations ($\mu g\ m^{-3}$) - Hung Hom to Signal Hill

Air Sensitive Receiver		Mitigated 1-hour TSP [1]
AH1	International Mail Centre	103
AH2	Pak Sui Yuen	94
AH3	Fire Services Headquarter's Building	96
AH4	Hotel Nikko HK	96
AH5	Grand Stanford Harbour View	95
AH6	The Urban Council Centenary Garden	95
AH7	Empire Centre	95
AH8	Tsim Sha Tsui Centre	95

[1] Included background level of 93 $\mu g\ m^{-3}$

Table 2.4f Mitigated 1-hour TSP Concentrations ($\mu g\ m^{-3}$)[1] - East Tsim Sha Tsui Station

Air Sensitive Receiver		Alignment Construction	Station Construction	Cumulative Level
AS1	Shangri-La Hotel	97	167	171
AS2	Wing On Plaza	103	437	447
AS3	Wing On Plaza Garden	-	339	-
AS4	Wang Fu Building	93	214	214
AS5	Signal Hill Garden	-	339	-
AS6	Mariner's Club	95	339	341
AS7	New World Centre	93	174	174
AS8	Sheraton Hong Kong Hotel	99	178	184
AS9	Hermes House	99	437	443
AS10	Far East Mansion	99	179	185

[1] Included background level of 93 $\mu g\ m^{-3}$

Table 2.4g Mitigated 1-hour TSP Concentrations ($\mu g\ m^{-3}$) - Overrun Tunnel

Air Sensitive Receiver		Mitigated 1-hour TSP [1]
AO1	The Peninsula Hotel	99
AO2	Kowloon Hotel	99
AO3	YMCA Building	99
AO4	Hankow Centre	99
AO5	Marine Police Headquarters	99
AO6	Hong Kong Cultural Centre	94
AO7	Hong Kong Hotel	97
AO8	Star House	95

[1] Included background level of 93 $\mu g\ m^{-3}$

2.4.26 As shown above, all the mitigated dust levels are within the 500 μg m^{-3} target, the predicted dust levels for alignment construction are dominated by the ambient TSP level.

2.4.27 For those ASRs close to the proposed ETS where high dust impacts are predicted, the maximum mitigated 1-hour TSP level is 447 μg m^{-3} at Wing On Plaza (alignment 10 μg m^{-3}, station 344 μg m^{-3} and background of 93 μg m^{-3}), indicating that the control measures were effective in fugitive dust suppression. Further control measures such as installation of wind breaks or increasing the height of hoarding to prevent the wind-induced fugitive emissions, or maintaining best engineering practices on site to reduce the likely dust generation could further reduce impacts .

2.4.28 Detailed assessment of 1-hour and 24-hour TSP levels should be undertaken, especially at the air intake locations of the hotel buildings, at the detailed design stage.

2.5 Operational Phase

2.5.1 No potential air quality impacts during the normal operation of the KCR Extension have been identified since electric trains will be used. However, low levels of dust may be created by the abrasion and wear of track, electrical pick-up gear and rolling stock and from maintenance activities. These emission sources are anticipated to be limited and no air quality impacts from these sources are expected. Railway impacts will be limited to the station and tunnel ventilation systems.

Ventilation Shafts

2.5.2 Ventilation shafts will provide air exchange and air-conditioning for the proposed tunnels and station and no major air pollutants are expected during normal operations. Nevertheless, the locations and directions of ventilation exhausts should not face directly toward any ASR. Where possible, inlet and exhaust vents should be directed away from any sensitive uses. This is particularly important as the general air conditioning system within the proposed tunnels and station would be used for emergency smoke extraction in the event of fire.

2.6 Conclusions

2.6.1 Dust has been identified as the main air quality impact arising from the proposed KCR Extension during the construction phase. Handling of excavated material and vehicle movements on unpaved haul roads are the potential sources of dust. The proposed construction works will be undertaken in urban area and the majority of land uses close to the potential sites are identified as ASRs. High dust impacts are predicted close to the proposed ETS, since extensive earthworks would be required with limited buffering distance between the work site and ASRs.

2.6.2 Sufficient mitigation measures have been identified in this Study and should be incorporated in the planning and design stage to reduce the likely impacts of the ASRs to within the identified criteria. Construction methods should be selected to minimize potential impacts and mitigation measures such as regular watering on active and inactive work sites and, if necessary, a reduction in the travelling speed of trucks should be implemented to control the dust impacts to acceptable levels. Further mitigation measures should be implemented, where appropriate, to reduce the likely impacts at the identified ASRs in the vicinity of the station sites. A more detailed assessment should be undertaken at the detailed design stage to evaluate the hourly and daily dust levels with true meteorological data, especially at the air intake locations of the ASRs.

2.6.3 Air quality impacts during the operational phase of the KCR Extension are not considered to be of concern as limited potential sources have been identified. However, consideration must be given to the design and orientation of the ventilation shafts in order to reduce the likely impacts on the surrounding area. Ventilation exhaust should be directed away from ASRs to avoid any potential air quality nuisance.

3 NOISE AND VIBRATION

3.1 Introduction

3.1.1 This Section outlines the likely noise and vibration impacts arising from the construction and operational phases of the proposed KCR Extension in Tsim Sha Tsui. Potential noise and vibration impacts are identified and appropriate mitigation measures are recommended in order to mitigate any adverse impacts. The proposed alignment and station for the KCR Extension will be underground, therefore train noise in the operational phase of the railway extension will not cause adverse impacts. Potential noise impacts from ventilation systems are, however, addressed in this study.

3.2 Government Legislation and Standards

Construction Noise

3.2.1 In Hong Kong, the control of construction noise at any time outside normal daytime, weekday working hours (07.00-19.00, Monday through Saturday excluding Public Holidays) is governed by the Noise Control Ordinance (NCO) and the subsidiary technical memoranda namely the *Technical Memorandum on Noise From Construction Work Other Than Percussive Piling* (TM1), *Technical Memorandum on Noise From Construction Work in Designated Areas* (TM2) and *Technical Memorandum on Noise From Percussive Piling* (TM3). These technical memoranda prescribe the permitted noise levels for construction work depending upon working hours and the existing noise climate.

3.2.2 The NCO criteria for the control of noise from powered mechanical equipment (PME) are dependant on the type of area containing the noise sensitive receivers (NSRs) rather than the measured background noise level. The NCO requires that noise levels from construction at affected NSRs be less than a specified Acceptable Noise Level (ANL) which depends on the Area Sensitivity Rating (ASR).

3.2.3 The ANL is derived from the Basic Noise Levels (BNL) determined in TM1 by applying corrections for the duration of the works and the effect of any other nearby construction sites operating under a Construction Noise Permit (CNP). No information on any such sites is currently available and therefore these corrections have been set to zero.

3.2.4 It is intended that the construction activities of the proposed works should be planned and controlled in accordance with the NCO. Works requiring the use of PME during restricted hours (all times other than 07.00-19.00 Monday through Saturday, excluding Public Holidays) will require a CNP and will need to achieve the applicable ANL.

3.2.5 The use of specified powered mechanical equipment (SPME), other than percussive piling, and the undertaking of Prescribed Construction Work (PCW) during restricted hours are controlled by TM2. Construction plant or equipment classified as SPME under TM2 are hand-held breaker, bulldozer, concrete mixer lorry, dump truck and poker vibrator. Prescribed construction work includes the: erection or dismantling of formwork or scaffolding; handling of rubble, wooden boards, steel bars, or scaffolding material; hammering; and the disposal of rubble through plastic chutes. More stringent noise limits are stipulated in TM2 to control construction noise generated from SPME and PCW.

3.2.6 Percussive piling is only permitted during normal working hours, within the constraints of a CNP. TM3 sets the requirements for working under a CNP and determination of the permitted hours of operations and other condition where appropriate. Percussive piling is prohibited during restricted hours unless specifically exempted. ANLs for percussive piling are outlined in TM3 and are dependent on the type of NSR. The ANLs for daytime percussive piling are presented in *Table 3.2a*.

Table 3.2a Acceptable Noise Levels for Daytime Percussive Piling

Type of Receptor	Acceptable Noise Level (dB(A))
Noise Sensitive Receiver (NSR) with no windows or other openings	100
NSR with central air conditioning systems	90
NSR with windows or other openings but without central air conditioning system	85

3.2.7 It should be noted that for hospitals, clinics, schools, courts of law or other particularly sensitive receivers, the ANL is 10 dB(A) below that quoted in *Table 3.2a*. The permitted hours of operations are determined by comparing the Corrected Noise Level (CNL) and the ANL at the NSR. *Table 3.2b* presents the permitted hours of operation for percussive piling.

Table 3.2b Permitted Hours of Operation for Percussive Piling

Amount by which CNL exceeds ANL	Permitted hours of operation on any day note being a holiday
more than 10 dB(A)	08.00 - 09.00 AND 12.30 - 13.30 AND 17.00 - 18.00
between 1 dB(A) and 10 dB(A)	08.00 - 0930 AND 12.00 - 14.00 AND 16.30 - 18.00
no exceedance	07.00 to 19.00

3.2.8 Although the NCO does not provide for the control of construction activities during normal working hours, a limit of $L_{Aeq, 30\,min}$ 75 dB is proposed in the *Practice Note for Professional Persons - Noise from Construction Activities - Non-statutory Controls, Environmental Protection Department, June 1993* (ProPECC PN2/93). This limit has been applied on major construction projects, and is now generally accepted in Hong Kong, and will, therefore, be adopted in this study in order to protect NSRs to an appropriate extent.

Fixed Plant Noise

3.2.9 Noise from fixed sources will be evaluated in accordance with HKPSG. All fixed noise sources should be so located and designed so that the noise level at the façade of the nearest NSRs should be at least 5 dB(A) lower than the appropriate ANL as stated in the *Technical Memorandum for the Assessment of Noise From Places other than Domestic Premises, Public Places or Construction Sites* (TM4).

3.3 Sensitive Receivers and Baseline Conditions

3.3.1 Noise Sensitive Receivers were identified in accordance with the HKPSG and NCO in this study. The worst affected and representative NSRs to be impacted during the construction and operational phases of the proposed development have been considered.

Construction Phase

Hung Hom to Signal Hill

3.3.2 Major land uses close to the proposed alignment are commercial and residential. Pak Sui Yuen is the main residential development likely to be impacted during the construction phase. Hotels and the commercial buildings along the northern side of Salisbury Road could be affected, but these are centrally air-conditioned with sealed windows or curtain wall and, therefore, have a lower sensitivity to noise.

3.3.3 The existing noise climate around the proposed work sites is dominated by road traffic noise and the Cross Harbour Tunnel toll plaza. Identified NSRs within this section are listed in *Table 3.3a* and shown in *Figure 3.3a*.

Table 3.3a Noise Sensitive Receivers - Hung Hom Station to Signal Hill

Noise Sensitive Receiver		Type of Use	Distance from Work Site (m)
			Alignment
N1	International Mail Centre(1)	Government Office	8
N2	Pak Sui Yuen	Residential	92
N3	Fire Services Headquarter's Building(1)	Government Office	45
N4	Hotel Nikko HK(1)	Hotel	47
N5	Grand Stanford Harbour View(1)	Hotel	40
N6	Shangri-La Hotel(1)	Hotel	25

Note : (1)NSR with central air-conditioning and sealed windows.

East Tsim Sha Tsui Station

3.3.4 The region surrounding the proposed station work sites currently consists of commercial buildings and hotels, and residential dwellings in Wang Fu Building and Far East Mansion. Existing noise sources are traffic on Salisbury Road and Chatham Road South. The nearest NSR with openable windows is Wang Fu Building, Far East Mansion will be more distant from the works. The Mariner's Club has openable windows, however, the building is centrally air-conditioned and the windows need not be opened for ventilation. All other NSRs are provided with central air-conditioning and sealed windows, which will reduce their sensitivity to construction noise.

3.3.5 The NSRs identified within this section are listed in *Table 3.3b* and shown in *Figures 3.3a* and *3.3b*.

Overrun Tunnel

3.3.6 The land uses in the vicinity of the overrun tunnel are commercial. Existing noise sources are from the traffic on Middle Road, Hankow Road, Kowloon Park Drive and Canton Road. The existing noise climate in this area is dominated by traffic noise which is exacerbated by the street canyon effect caused by the high-rise buildings along both sides of Middle Road. As most of the hotels and commercial buildings are equipped with central air-conditioning and sealed windows, sensitivity to construction noise is reduced. However, due to the close proximity of the NSRs to the work sites, construction noise impacts are likely. Identified NSRs within this section are listed in *Table 3.3c* and shown in *Figure 3.3b*.

Table 3.3b Noise Sensitive Receivers - East Tsim Sha Tsui Station

Noise Sensitive Receiver		Type of Use	Distance from Work Site (m)	
			Alignment	Station
N6	Shangri-La Hotel[1]	Hotel	25	101
N7	Wang Fu Building	Res./Comm.	140	38
N8	Mariner's Club[2]	Hotel	45	10
N9	New World Centre[1]	Hotel	156	90
N10	Sheraton Hong Kong Hotel[1]	Hotel	10	70
N11	Hermes House[1]	Office	5	46
N12	Far East Mansion	Res./Comm.	5	90
N13	The Peninsula Hotel[1]	Hotel	5	184
N14	Kowloon Hotel[1]	Hotel	5	186

Note : [1]NSR with central air-conditioning and sealed windows.
[2]Non-residential NSR with air-conditioning and openable windows.

Table 3.3c Noise Sensitive Receivers - Overrun Tunnel

Noise Sensitive Receiver		Type of Use	Distance from Work Site (m)
			Alignment
N12	Far East Mansion	Res./Comm.	5
N13	The Peninsula Hotel[1]	Hotel	5
N14	Kowloon Hotel[1]	Hotel	5
N15	YMCA Building	Hotel	5
N16	Marine Police Headquarters	Government Office	20

Note : [1]NSR with central air-conditioning and sealed windows

Operational Phase

3.3.7 Traffic noise is the dominant existing noise source in the study area. Potential noise impacts during the operational phase will be exhaust noise from station and tunnel ventilation shafts. NSRs in the vicinity of the proposed ventilation shafts are shown in *Table 3.3b*.

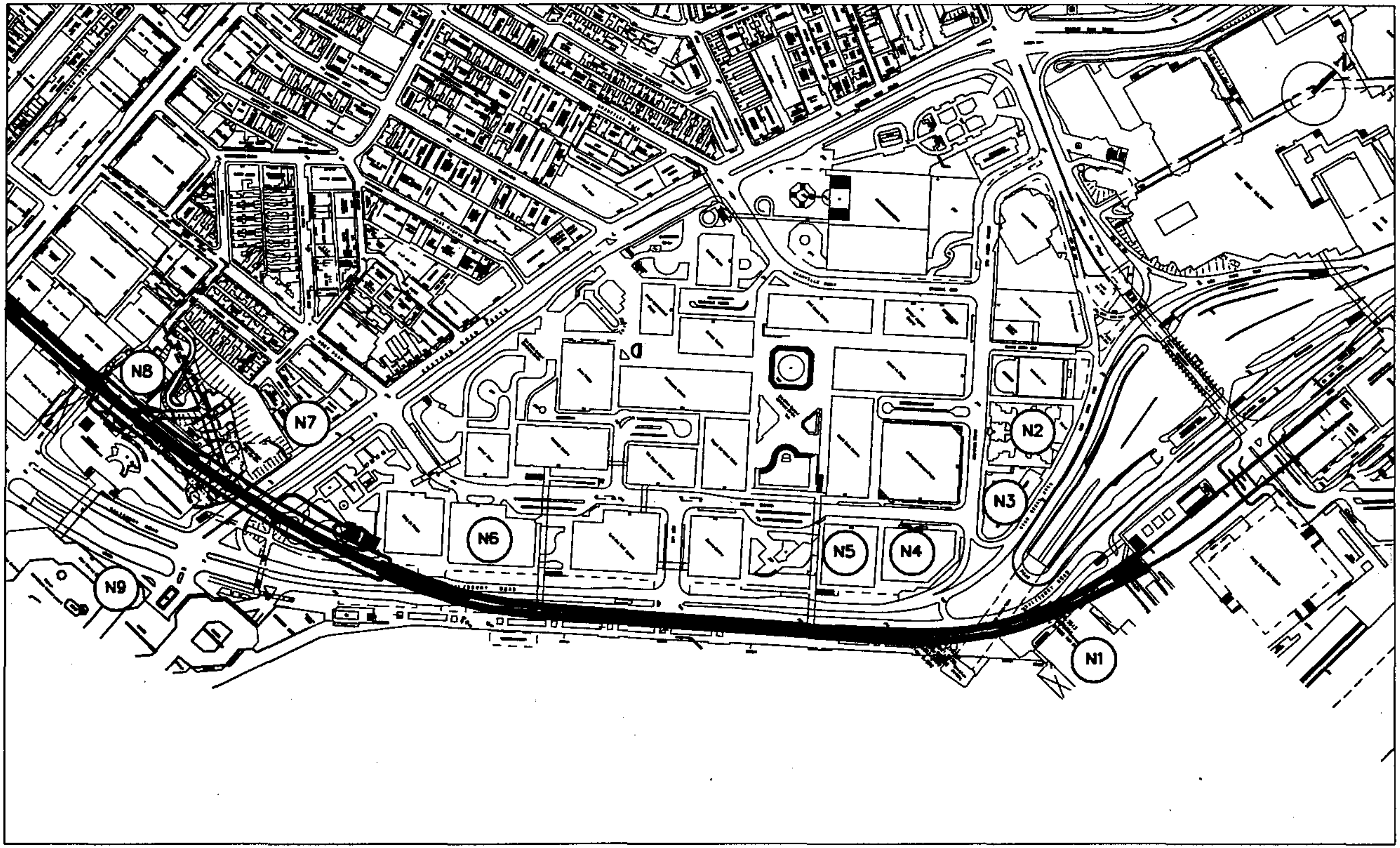


FIGURE 3.3a - Noise Sensitive Receiver - Hung Hom to Signal Hill	
Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_13
Sources :	
	Prepared by ERM's GIS & MAPPING Group

KEY

	Alignment
	Vent
	Station Site
N1	Noise Sensitive Receiver

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

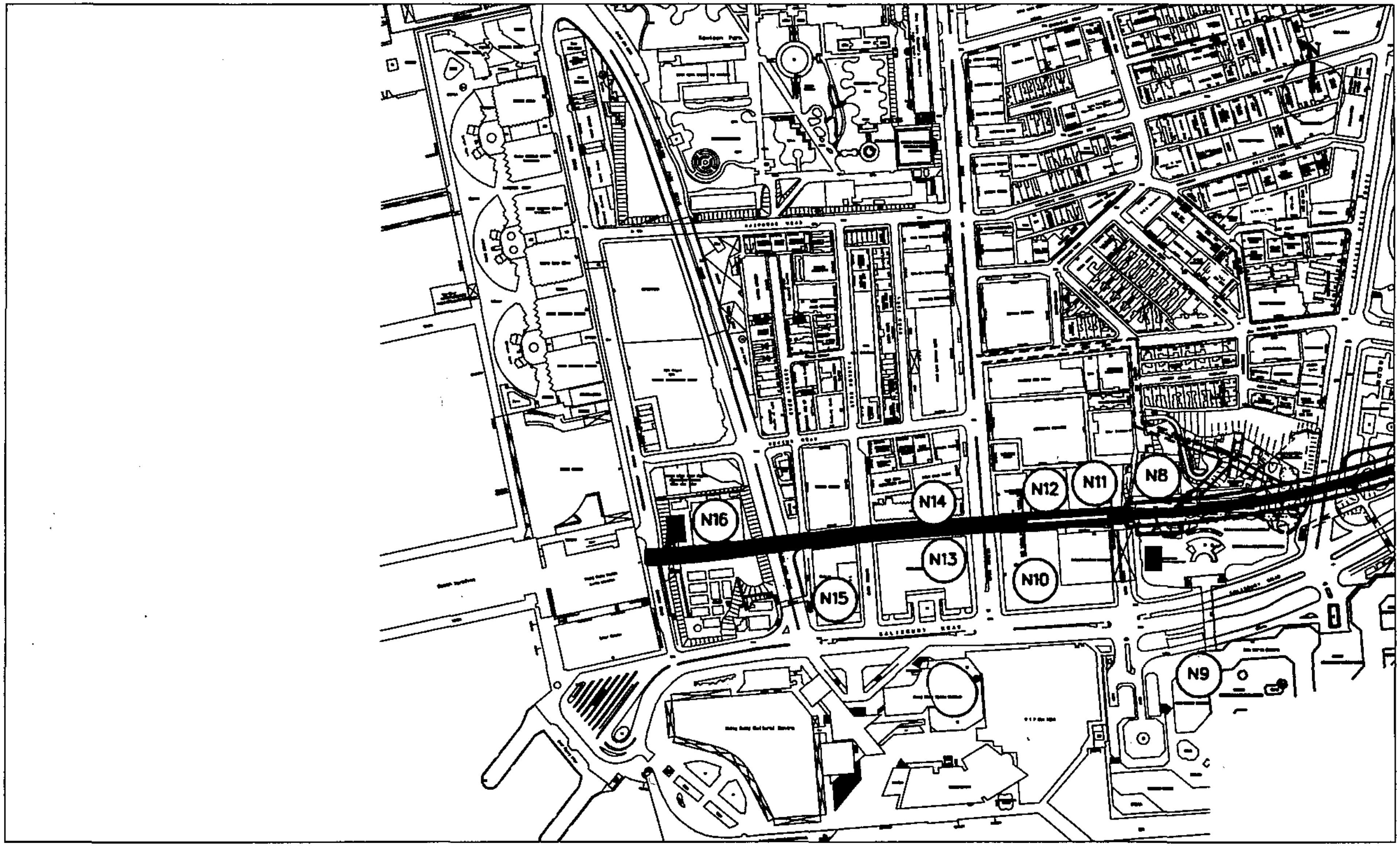


FIGURE 3.3b - Noise Sensitive Receiver -

Signal Hill to Over run Tunnel

Date : 15 Oct 1996	Drawing No.: /Contract/C1435/C1435_14
Sources :	

Prepared by ERM's GIS & MAPPING Group

KEY

- Alignment
- Vent
- Station Site
- N1 Noise Sensitive Receiver

ERM Hong Kong
6th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong

ERM

3.3.8 The NSRs identified for the construction stage assessment could also be impacted by operational train vibration. However, this can be controlled through the detailed design of the track form and potential impacts have not been quantitatively assessed at this preliminary stage.

Table 3.3d Noise Sensitive Receivers - Ventilation Shaft

Noise Sensitive Receiver	Distance from Vent Shaft (m)
N2 Pak Sui Yuen	104
N7 Wang Fu Building	104
N8 Mariner's Club	53
N12 Far East Mansion	82
N 15 YMCA Building	60

3.4 Construction Impacts

Potential Sources of Impacts

3.4.1 Potential impacts on nearby NSRs during the construction phase of the project will mainly be from PME operated in the construction work sites. The alignment and station will be underground except for the section between the existing Hung Hom Station and the Grand Stanford Harbour View which is to be constructed in a covered tunnel box. The cut and cover method will be employed for the construction of tunnels and underground station structure. Above ground construction will also be carried out for site clearance, diaphragm wall construction, road reinstatement works and the covered tunnel box.

3.4.2 Particularly noisy activities during the construction phase of KCR Extension are predicted to be:

- Site Preparation - use of breaking and earthmoving machine and vehicles;
- Excavation - use of excavators and mobile cranes for tunnel and station construction;
- Piling - use of bored piling equipment for the construction of subsurface retaining structures, and the use of percussive piling method for driving sheet piles;
- Station Structure and Tunnel Construction - use of general construction plant and equipment;
- Reinstatement of Roads - use of general construction plant and equipment; and
- Site Traffic - use of heavy vehicles for material delivery and spoil removal, vehicles used by site staff and workers.

Assessment Methodology

3.4.3 The assessment of noise impacts from the construction of the KCR Extension has been undertaken based on the procedure outlined in TM1. In general, the methodology is as follows:

- locate NSRs that may be affected by construction work sites;
- determine plant items for corresponding construction activities;
- assign sound power levels (SWLs) to plant based on the information in TM1;
- calculate the correction factors based on the distance between the NSRs and the

notional noise source point at the work sites; and

- calculate the predicted noise levels at NSRs in the absence of any mitigation measures.

3.4.4 The NCO criteria for the control of noise from PME are dependent on the type of area containing the individual NSR rather than the measured background noise level. The study area is classified as an urban area and the annual averaged daily traffic flow on Salisbury Road (between from Nathan Road and Chatham Road South) was over 40,000 in 1995. The noise climate in the study area is dominated by traffic noise and all the NSRs are either directly or indirectly affected by this influencing factor. In this case, all NSRs have an ASR of C, according to TM1. *Table 3.4a* shows the ANL under an ASR of C during restricted hours.

Table 3.4a Acceptable Noise Levels ($L_{Aeq, 30min}$ (dB))

Time Period	ANL
All days during the evening (19.00-23.00) and general holidays (including Sunday) during the day and evening (07.00-23.00)	70
All days during the night-time (23.00-07.00)	55

3.4.5 The correction factor for distance attenuation for each NSR with respect to each construction activity, is calculated from the distance of the NSR from the work site notional noise source point in accordance with TM1. The construction of the KCR Extension will involve different construction activities, and therefore the type of construction plant and equipment used in each stage of construction will vary.

3.4.6 A -10 dB(A) correction has been allowed in the predicted noise levels at those NSRs provided with central air-conditioning and sealed windows (or in the case of the Mariners Club, window type air conditioners and closeable windows) to account for the potential noise insulation capacity at these NSRs

3.4.7 The methodology for assessing percussive piling has been based on TM3, the CNL at the NSRs is calculated and the permitted hours of operation are determined by the amount by which the CNL exceeds the ANL.

Hung Hom to Signal Hill

3.4.8 This section of the proposed alignment will be underground and constructed using cut and cover tunnelling. Construction activities and the total SWL of specific operations for this section are listed in *Table 3.4b.* The plant inventories for the construction activities are described in detail in *Annex A.*

Table 3.4b Total SWLs for Construction Activities - Hung Hom to Signal Hill

Construction Activities	Total SWL (dB(A))
Site Preparation	123
Service Diversions	123
Tunnel Construction	115
Percussive Sheet Piling	129
Excavation for Tunnel	124
Form and Construct Tunnel Structure	121
Backfill/Reinstate Roads	120

East Tsim Sha Tsui Station

3.4.9 Cut and cover tunnelling will be used for the construction of both tunnel and station structure. The construction activities involved are shown in *Table 3.4c*, together with the total SWL of specific operations at the notional noise source of the site. The plant inventories for the construction activities are described in detail in *Annex A*.

Table 3.4c Total SWLs for Construction Activities - East Tsim Sha Tsui Station

Construction Activities	Total SWL (dB(A))
Site Preparation	123
Service Diversions	123
Excavation for Station	126
Percussive Sheet Piling	129
Form and Construct Tunnel Structure	121
Backfill/Reinstate Roads & Signal Hill	120

Overrun Tunnel

3.4.10 This section will be underground and mainly employ the cut and cover tunnelling method, for the tunnel section below the Marine Police Headquarters, bored tunnelling will be used. Construction activities and the total SWL of specific operations for the overrun tunnel are listed in *Table 3.4d*. The plant inventories for the construction activities are described in detail in *Annex A*.

Table 3.4d Total SWLs for Construction Activities - Overrun Tunnel

Construction Activities	Total SWL (dB(A))
Site Preparation	123
Service Diversions	123
Diaphragm Wall for Tunnel Construction	118
Bored Tunnel	127
Excavation for Tunnel	124
Form and Construct Tunnel Structure	121
Backfill/Reinstate Roads	120

Prediction of Construction Noise Impacts

3.4.11 The predicted noise levels at the identified NSRs during the construction of the KCR Extension are shown in *Tables 3.4e-g*. Façade noise levels at the NSRs were calculated based on the SWLs and corrections for distance attenuation given in TM1 & TM3.

Table 3.4e Predicted Noise Levels (dB(A)) - Hung Hom to Signal Hill

Activity	NSR Number					
	N1	N2	N3	N4	N5	N6
Site Preparation	-	79	-	75	76	80
Service Diversions	-	79	-	75	76	80
Tunnel Construction	-	71	-	67	68	72
Percussive Sheet Piling	105	85	91	91	92	96
Excavation for Tunnel	-	80	-	76	77	81
Form and Construct Tunnel Structure	-	77	-	73	74	78
Backfill/Reinstate Roads	-	76	-	72	73	77

Table 3.4f Predicted Noise Levels (dB(A)) - East Tsim Sha Tsui Station

Activity	NSR Number								
	N6	N7	N8	N9	N10	N11	N12	N13	N14
Site Preparation	68	86	87	69	71	-	79	63	63
Service Diversions	68	86	87	69	71	-	79	63	63
Excavation for Station	71	89	90	72	74	-	82	66	66
Percussive Sheet Piling	84	92	103	85	87	91	85	79	79
Form and Construct Tunnel & Station Structure	66	84	85	67	69	-	77	61	61
Backfill/Reinstate Roads & Signal Hill	65	83	84	66	68	-	76	60	60

Table 3.4g Predicted Noise Levels (dB(A)) - Overrun Tunnel

Activity	NSR Number				
	N12	N13	N14	N15	N16
Site Preparation	101	91	91	101	92
Service Diversions	101	91	91	101	92
Diaphragm Wall for Tunnel Construction	96	86	86	96	87
Bored Tunnel	-	95	95	105	96
Excavation for Tunnel	102	92	92	102	93
Form and Construct Tunnel Structure	99	89	89	99	90
Backfill/Reinstate Roads	98	88	88	98	89

Evaluation of Impacts

3.4.12 Cumulative impacts from the construction works are predicted based on the assumption that the noisiest construction activity could be undertaken simultaneously at any two adjacent cut and cover construction sites with maximum impact at any one

NSR. Thus the predicted noise levels shown in *Tables 3.4e* and *3.4g* have been increased by 3 dB(A) to assess the worst case cumulative impact at the NSR. No cumulative impacts from the station site and any of the cut and cover sites will occur as the difference in predicted noise levels from these sites is more than 10 dB(A)

Hung Hom to Signal Hill

3.4.13 Construction noise impacts are expected at all NSRs from unmitigated construction operations during the daytime. The noisiest phases of construction were considered to be sheet piling for tunnel construction and excavations for tunnels. Adverse cumulative noise impacts of up to 9 dB(A) above the recommended daytime criteria were predicted at the NSRs from construction activities. A maximum of 81 dB(A) was predicted at the Shangri-La Hotel (N6) during the tunnel excavation stage and effective mitigation measures are necessary in order to ameliorate the noise levels.

3.4.14 If restricted hours working is required, the Contractor will be required to comply with the NCO criteria in order to obtain a CNP before commencing the works.

3.4.15 Noise impacts would also be likely from percussive sheet piling; a noise level of 105 dB(A) was predicted at the International Mail Centre (N1) which would exceed the ANL by 15 dB(A) as stated in TM3. Based on TM3, sheet piling operations should be permitted from 08.00-09.00, 12.30-13.30 and 17.00-18.00 on any normal working day, as stated in TM3.

East Tsim Sha Tsui Station

3.4.16 Owing to the limited distance from the works, all identified NSRs would experience high noise levels during the construction phase. Cumulative construction noise impacts of up to 15 dB(A) above the daytime criterion have been predicted. The Mariner's Club (N8) would be adversely impacted and is predicted to receive a maximum noise level of 90 dB(A) during the excavation stage. Site preparation and service diversions will also cause impacts. Mitigation measures should therefore be implemented. Other NSRs with sealed windows and central air-conditioning, would be less exposed to construction noise as they are more distant from the works.

3.4.17 If restricted hours working is required, the Contractor will be required to comply with the NCO criteria in order to obtain a CNP before commencing the works.

3.4.18 Percussive piling would lead to adverse noise impacts on the surrounding NSRs. The highest noise level predicted is 103 dB(A) at Mariner's Club, and therefore according to TM3 the piling works should be restricted to 08.00-09.00, 12.30-13.30 and 17.00-18.00 on any normal working day.

Overrun Tunnel

3.4.19 Adverse impacts from the construction of the proposed alignment are expected and the worst predicted cumulative noise levels at all NSRs would exceed the daytime criterion. A maximum noise level of 105 dB(A) was predicted at the YMCA Building (N15) during the bored tunnelling stage. Excavation works, site preparation and service diversions would also create noise impacts. Mitigation measures are therefore considered necessary to reduce the noise levels to within the established criterion.

3.4.20 If restricted hours working is required, the Contractor will be required to comply with the NCO criteria in order to obtain a CNP before commencing the works.

3.4.21 No percussive piling will be required for this section of the works.

Mitigation Measures

3.4.22 The predicted noise levels in the preceding section indicate construction activities could give rise to significant daytime noise impacts at most NSRs with a predicted cumulative noise level of up to 108 dB(A) at the YMCA Building. Substantial mitigation measures are therefore required and the following forms of mitigation have been considered :

- Use of good site practice to limit noise emissions at source and constructing temporary noise barriers.
- Use of "quiet" PME and working methods (M1).
- Use of movable noise barriers (M2).
- Reduction in the number of plant operating in critical areas close to NSRs (M3).

Good Site Practices and Constructing Temporary Noise Barriers

3.4.23 Good site practices and noise management can considerably reduce the impact of construction activities on nearby NSRs. The following measures should be followed during each phase of construction:

- only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme;

- machines and plant (such as trucks) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;

- plant known to emit noise strongly in one direction, should, where possible, be orientated so that the noise is directed away from nearby NSRs;

- silencers or mufflers on construction equipment should be properly fitted and maintained;

- 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.

3.4.24 The noise benefits of these techniques can vary according to specific site conditions and operations, and while they would provide some attenuation, they cannot be assumed to guarantee a precise level of noise mitigation.

3.4.25 Noise barriers of 3-5 m high, located on the site boundaries between noisy construction activities and NSRs could reduce impacts by 5 dB(A). It should be possible for the Contractor to provide these in the form of site hoardings to achieve this attenuation effect, provided that the barriers have no openings or gaps and have a superficial surface density of at least 15 kg m^{-2}. However, as the geometry between the NSRs and the sources have not been defined and the design of the site boundary hoardings are not yet available, the potential benefit cannot be assessed at this stage.

Use of "Quiet" Equipment and Working Methods

3.4.26 The Contractor will be able to obtain particular models of plant that are quieter than the noise levels given in TM1 which have been used in this assessment to predict noise impact. The benefits achievable in this way will depend on the Contractor's chosen construction methods, and it is considered too restrictive to specify that the Contractor has to use specific models or items of plant for the construction operations. It is reasonable and practical to set plant noise performance specifications of specific PME. In this way, plant teams can be chosen by the contractor to suit his adopted working methodologies.

3.4.27 Quiet PME is defined as PME whose actual SWL is less than the value specified in TM1 for the same item of plant, examples which are known to be available and are given below:

Breaker (Excavator-mounted):	115 dB(A) max;
Bored Piling Rig:	110 dB(A) max;
Bulldozer:	110 dB(A) max;
Dump Truck:	110 dB(A) max;
Breaker (Hand-held):	110 dB(A) max;
Poker vibrator:	110 dB(A) max;
Excavator:	105 dB(A) max;
Concrete Pumps:	105 dB(A) max;
Loader:	105 dB(A) max;
Lorry:	105 dB(A) max;
Mobile Crane:	105 dB(A) max;
Compressors:	100 dB(A) max;
Generators:	100 dB(A) max; and
Water pumps:	88 dB(A) max.

3.4.28 Various types of silenced equipment can be found in Hong Kong, however, the EPD when processing a CNP application, will apply the noise levels contained in the relevant statutory TM unless the noise emission of a particular piece of equipment can be validated by certificate or demonstration.

3.4.29 As it is considered too restrictive to insist that the Contractor uses specific items of plant not exceeding the SWL given above, recommendations for mitigation to achieve the applicable noise criterion have been specified as a combination of noise barriers and plant noise performance specifications.

Movable Noise Barriers

3.4.30 Movable barriers that can be located close to noisy plant can be very effective at screening NSRs, 3 m high movable barriers with skid footing and a small cantilevered upper portion can be located within a few metres of static plant. Barriers of similar type can be placed within about 5 m of more mobile plant such as excavators, mobile cranes etc.

3.4.31 Based on the NSR heights and site geometry, it is estimated that mobile noise barriers of this type can give 10 dB(A) of screening for static plant and 5 dB(A) of screening for mobile plant if they are properly located before any noisy operations proceed. Where these screening effects can be achieved at upper floors of NSRs, greater benefits would result at lower floors. The noise screening benefit for each plant considered in this study is listed as follows:

- stationary plant - 10 dB screening for PME such as air compressor, drilling rig, water pump, generator, concrete pump and poker vibrator; and
- mobile plant - 5 dB screening for PME such as excavator, bulldozer, loader, truck mixer, bar bender, roller and crane.

Reducing the Numbers of Plant Operating in Critical Areas Close to NSRs

3.4.32 In general the numbers of plant should be left to the choice of the Contractor. However, further reduction in the total SWL, can be achieved by management of the number of plant in operation. This method would be effective for activities associated with foundation work, station box and ventilation building construction and excavation activities in which the presence of a large numbers of PME are anticipated.

Assessment of Mitigation Measures

3.4.33 The assessment of mitigated noise predictions for each work area are described below and the results are shown in *Tables 3.4h-j*. It should be noted that the figures in the following *Tables* include a +3 dB(A) correction to allow for the worst case cumulative impacts at the NSRs.

Table 3.4h Mitigated Cumulative Noise Levels (dB(A)) - Hung Hom to Signal Hill

Activity	NSR			
	N2	N4	N5	N6
Site Preparation	75(1)/ -/ -	71/ -/ -	72/ -/ -	76/76(2)/76(3)
Service Diversions	75/ -/ -	71/ -/ -	72/ -/ -	76/76/76
Tunnel Construction	67/ -/ -	63/ -/ -	64/ -/ -	68/ -/ -
Excavation for Tunnel	76/75/ -	72/ -/ -	73/ -/ -	77/ 76/76
Form and Construct Tunnel Structure	77/71/ -	73/ -/ -	74/ -/ -	78/72/ -
Backfill Reinstate Roads	76/72/ -	72/ -/ -	73/ -/ -	77/73/ -

Notes : (1) - Predicted Noise Level with Mitigation M1
(2) - Predicted Noise Level with Mitigation M1 and M2
(3) - Predicted Noise Level with Mitigation M1, M2 and M3

3.4.34 As shown in *Table 3.4h*, a maximum of 4 dB(A) reduction could be achieved from the use of silenced type PME. Quiet PME and the use of movable barriers together could offer a maximum noise reduction of 9 dB(A), especially for stationary PME. A further reduction of up to 5 dB(A) could also be achieved if the number of PME used on site is reduced, as estimated from the predicted values.

3.4.35 With the use of all the suggested mitigation measures, construction works for the Hung Hom to Signal Hill section are not predicted to exceed the daytime criterion at any NSR during the tunnel construction stage, tunnel structure construction and reinstatement of roads. The use of silenced type PME and movable barriers would be sufficient to protect NSR N2, N4 and N5. However, exceedance of 1 dB(A) over the daytime noise limit was predicted from the worst cumulative noise level at Shangri-La Hotel (N6) during the site preparation stage, service diversions works and tunnel excavation.

3.4.36 Implementation of all the recommended mitigation measures would be sufficient to protect NSR N6, N9, N10, N12, N13 ,N14. However, residual daytime impacts have been identified at Wong Fu Building (N7) and the Mariner's Club (N8) from station works and at all the identified NSRs exposed to the overrun tunnel works. Since the distance separation between the NSRs and the proposed work sites are small and a considerable number of PME would be used for the construction works, additional mitigation measures are necessary.

Table 3.4i Mitigated Cumulative Noise Levels (dB(A)) - East Tsim Sha Tsui Station

Activity	NSR		
	N7	N8	N12
Site Preparation	82(1)/82(2)/82(3)	83/83/83	75/ -/ -
Service Diversions	82/82/82	83/83/83	75/ -/ -
Excavation for Station	85/85/82	86/86/83	78/78/75
Form and Construct Tunnel Structure	84/78/75	85/79/76	77/71/ -
Backfill Reinstate Roads/Signal Hill	83/79/76	84/80/77	76/72/ -

Notes : (1) - Predicted Noise Level with Mitigation M1
(2) - Predicted Noise Level with Mitigation M1 and M2
(3) - Predicted Noise Level with Mitigation M1, M2 and M3

3.4.37 During the ETS works, Wong Fu Building is predicted to receive noise impacts up to 7 dB(A) above the criterion and the Mariner's Club would be impacted by a maximum exceedance of 8 dB(A). Noisy operations are identified to be site preparation works, service diversions and excavation activities. Wong Fu Building is effectively screened from much of the works by Signal Hill and it is considered that cantilever barriers would be sufficient to control the worst exceedances. Whilst cantilever barriers will also help to control impacts at the Mariners Club, further restrictions to on site activities to minimise cumulative impacts will also be necessary.

Table 3.4j Mitigated Cumulative Noise Levels (dB(A)) - Overrun Tunnel

Activity	NSR				
	N12	N13	N14	N15	N16
Site Preparation	97(1)/97(2)/97(3)	87/87/87	87/87/87	97/97/97	88/88/88
Service Diversions	97/97/97	87/87/87	87/87/87	97/97/97	88/88/88
Diaphragm Wall for Tunnel Construction	97/90/87	87/80/77	87/80/77	97/90/87	88/81/78
Bored Tunnel	-	97/88/83	97/88/83	107/98/93	98/89/84
Excavation for Tunnel	98/97/97	88/87/87	88/87/87	98/97/97	89/88/88
Form and Construct Tunnel Structure	99/93/89	89/83/79	89/83/79	99/93/89	90/84/80
Backfill Reinstate Roads	98/94/91	88/84/81	88/84/81	98/94/91	89/85/82

Notes : (1) - Predicted Noise Level with Mitigation M1
(2) - Predicted Noise Level with Mitigation M1 and M2
(3) - Predicted Noise Level with Mitigation M1, M2 and M3

3.4.38 The predicted noise levels at most of the NSRs such as Far East Mansion (N12) and the YMCA Building (N15), after the implementation of all the mitigation measures still exceeded the daytime limit by up to 22 dB(A). The use of quieter construction methods is recommended since cut and cover tunnelling would involve extensive noisy operations.

3.4.39 The following additional measures should be considered to reduce the likely impacts on the NSRs.

- During the site preparation and service diversions stage, a hand-held breaker should be used instead of a crawler-mounted breaker, in which case a 7 dB(A) reduction could be achieved. The operational period of all PME should be limited and they should be turned off when not in use. It is suggested that if the PME could be operated for 5-10 minutes out of any 30 minutes, a further reduction of 5-8 dB(A) could be achieved.

- For backfilling or reinstating roads, a noise reduction of 5-8 dB(A) could also be achieved by limiting the operating time of the PME to 5-10 minutes out of any 30 minute period.

- Screening structures such as site hoardings or cantilever-type barriers should be employed on the sites close to the YMCA Building (N15) and Far East Mansion (N12). A noise reduction of up to 5 dB(A) could be achieved if the line of sight to the NSRs is blocked in this way. It may be possible to erect a mobile noise enclosure which could be used to control the noisiest elements of the construction works until a temporary road surface can be put in place over the cut and cover sections.

- A noise enclosure should be erected around the tunnel portal near Kowloon Park Drive where the bored tunnelling portal is located, which will give a reduction of up to 20 dB(A).

- Top down construction as an alternative construction method can reduce the likely noise impacts, especially prior to tunnel excavation works, by covering the entire work site after ground opening. A reduction of 4 dB(A) of the total SWL could be gained and a further 5-10 dB(A) could be achieved when the work sites are covered. Furthermore, noisy diaphragm wall construction could be avoided.

3.4.40 The additional mitigation measures listed above will be sufficient to reduce most impacts to below the recommended voluntary daytime noise limit. Residual exceedances of 2-3 dB(A) above the recommended voluntary daytime limit are predicted at Far East Mansion (N12) and the YMCA Building (N15). The information available at this Feasibility Study stage, concerning the details of construction methodologies and, therefore, their impacts, is bound to be limited. Whilst the information and assumptions on which the noise assessment has been based are considered sufficiently robust for this EFS, it is considered that when a more accurate assessment of the opportunities to control the noisiest elements of the works can be achieved, at a later stage of the study when more detailed information is available, the construction methodology and programme can be refined further to meet the noise target.

3.5 Operational Impacts

Potential Sources of Impacts

3.5.1 The railway will be covered for its entire length and the only potential for adverse impacts during the operational phase could arise from fixed plant noise, exhaust noise from ventilation systems and ground borne vibration from rolling stock. Noise from fixed plant and ventilation systems can be readily controlled by effective screening and silencing equipment to be specified at the detailed design stage.

3.5.2 As sufficient detailed information on, *inter alia*, track form and lithology is not available at this stage, the ground-borne noise from underground trains is not assessed in this study. The effects of ground borne vibration will be assessed at the detailed design stage. The impacts from ground borne vibration can be controlled by means of a suitably designed resilient track form and all vibration related impacts can be mitigated. The requirements for vibration measures will be determined in the detailed engineering design of the project.

3.5.3 At this early stage, no information regarding the design of fixed plant is available and, therefore, a full quantitative assessment on this aspect cannot be undertaken. However, a brief review of noise from ventilation shafts has been undertaken based on the likely locations and the source noise level limits usually adopted at louvre outlets.

3.5.4 Tunnel ventilation will normally occur through the piston effect of the moving train pushing stale air out in front of the train and drawing fresh air in behind. It is expected that fans will be fitted into the ventilation shafts for use in congested or emergency situations where trains are stationary or when it is necessary to exhaust smoke in the event of fire. Effective noise control equipment is expected to be included in the ventilation system design to ensure no adverse impacts from these potential sources.

Assessment Methodology

3.5.5 For the proposed ventilation louvre locations, the $L_{Aeq, 30 min.}$ levels at the NSRs have been predicted by assuming that a limiting noise criterion of $L_{Aeq, 30 min.}$ 70 dB at 1 m from the louvre has been adopted to ensure the public will not be unduly affected by high noise levels when in the vicinity of the ventilation buildings. The size of the louvre was assumed to be 3×3 m.

3.5.6 The location of the ventilation shafts for the station and tunnels are shown in *Figures 3.3a* and *3.3b*. The criterion noise level at NSRs is the night-time ANL (60 dB(A)) minus 5 (in line with the HKPSG) i.e. $L_{Aeq, period}$ 55 dB, since an ASR of 'C' has been derived for NSRs in the study areas.

Predictions of Impacts

3.5.7 Assuming maximum noise levels of $L_{Aeq, period}$ 70 dB at 1 m could be achieved at the louvres, the 1 m façade noise levels of each of the NSRs are given in *Table 3.5a*. The noise levels predicted at the NSRs are a 'worst case' estimate as directivity and screening corrections have been ignored in the assessment. The calculated noise levels are based on the distance between the louvres and the NSRs which are given in *Table 3.3d* in *Section 3.3.2*.

Table 3.5a Predicted Operational Noise Levels (dB(A))

Noise Sensitive Receiver	Distance from Vent Shaft (m)	$L_{Aeq, period}$ (dB)
Pak Sui Yuen	104	35
Wang Fu Building	104	35
Mariner's Club	53	41
Far East Mansion	82	37
YMCA Building	60	39

Evaluation of Impacts

3.5.8 The results shown in *Table 3.5a* indicate that all the predicted noise levels are in compliance with the NCO noise limits provided that the recommended 1 m $L_{Aeq, 30 min.}$ levels at the face of the louvres can be achieved. No noise impacts are therefore, expected during the night-time. It is anticipated that sizeable fan silencers will be needed to achieve the recommended 70 dB(A) at 1 m specification and appropriate space requirements should be identified by the E&M consultants and allowed for in the ventilation shaft design. It is also recommended that the louvres should not face directly towards the NSRs.

3.6 Conclusion

3.6.1 This assessment has predicted that unmitigated construction noise associated with the KCR Extension would cause adverse noise impacts at the nearby NSRs. Standard mitigation measures have been identified which could reduce the noise levels at identified NSRs. Measures include the use of silenced PME, installation of movable barriers and restrictions on the number of PME in use.

3.6.2 However, additional measures are necessary in order to control the noise levels to below the recommended voluntary daytime criteria at a number of NSRs. PME with lower SWL could be used in the work sites potentially affecting the nearby NSRs (for instance substituting a hand-held breaker for a crawler-mounted model). For the overrun tunnel section, an alternative tunnel construction method is recommended in order to reduce potential noise emission during any noisy operations.

3.6.3 As sufficient detailed information on track form and lithology is not available at this stage, the ground-borne noise from underground trains has not been assessed in this study. The impacts from ground borne vibration can be controlled by means of a suitably designed resilient track form and all vibration related impacts can be mitigated. The requirements for vibration measures will be determined in the detailed engineering design of the project.

3.6.4 Operational noise from the ventilation shafts of KCR Extension would not exceed the criterion noise levels provided that the noise is controlled at source and adequate silencers are incorporated within the ventilation buildings. The construction and operational impact should be reviewed at the detailed design stage when more accurate details of construction methods and operational conditions are available.

4 WATER QUALITY

4.1 Introduction

4.1.1 Construction and operation of the KCR Extension could generate wastewater which may cause adverse water quality impacts if not properly controlled. This section presents the results of a study of potential water quality impacts arising from both the construction and operational phases of the KCR Extension from the Hung Hom KCR Terminus to Tsim Sha Tsui. This section also identifies requirements for further water quality impact studies and outlines potential mitigation measures.

4.2 Legislation and Non-Statutory Guidelines

4.2.1 Under the Water Pollution Control Ordinance (WPCO), Hong Kong waters are subdivided into 10 Water Control Zones (WCZs). Each WCZ has a designated set of statutory Water Quality Objectives (WQO). For this study, the marine water of Victoria Harbour could be affected by wastewater discharges from the KCR Extension.

4.2.2 The WQOs for the Victoria Harbour Phase II WCZ will be applicable as evaluation criteria for assessing compliance of the Project. The parameters of most concern during the construction phase will be suspended solids (SS) and dissolved oxygen (DO) levels. The associated WQOs against which impacts will be assessed are as follows:

- SS levels: Activities during the construction phase must not cause the natural ambient SS level to be raised by more than 30% nor give rise to accumulation of SS in Victoria Harbour which may adversely affect aquatic communities.
- DO levels: DO levels should not be less than 2 mg l^{-1} within 2 m of the seabed and above 4 mg l^{-1} at an average of three water depths (1 m below the water surface; mid-depth; and 1 m above sea bed) for Victoria Harbour.

4.2.3 All discharges during both the construction and operational phases of the KCR Extension are required to comply with the *Technical Memorandum for Effluents discharged into Drainage and Sewerage Systems, Inland and Coastal Waters* (TM) issued under Section 21 of the WPCO, which defines the acceptable discharge limits to different types of receiving waters. Under the TM, effluents discharged into the drainage and sewerage systems, inshore and coastal waters of the WCZs are subject to pollutant concentration standards for particular volumes of discharge. These are defined by the EPD and specified in licence conditions for any new discharge within a WCZ. The pertinent discharge limits for Victoria Harbour WCZ are listed in *Table 4.2a.*

4.2.4 In addition, there are non-statutory guidelines for the seawater pumping stations to control the water quality of cooling and flushing water. As reported in the *Central Reclamation, Phase III Studies, Draft Environmental Impact Assessment, Atkins Haswell, September 1996* the criteria specified by operators of several cooling water intakes in Victoria Harbour is 140 mg l^{-1}. This limit has been determined to be the upper tolerance threshold for solids in cooling water. Water Supplies Department (WSD) has specified the WQOs at intake points of sea water pumping stations for toilet flushing. The WSD Standards of seawater for SS and DO are < 10 mg l^{-1} and > 2 mg l^{-1} respectively.

Table 4.2a Standards for Effluents Discharged into the Marine Waters of Victoria Harbour Water Control Zone

Flow rate (m^3/day)	≤10	>10 & ≤200	>200 & ≤400	>400 & ≤600	>600 & ≤800	>800 & ≤1000	>1000 & ≤1500	>1500 & ≤2000	>2000 & ≤3000	>3000 & ≤4000	>4000 & ≤5000	>5000 & ≤6000
Determinant												
pH (pH units)	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10	6-10
Temperature (°C)	45	45	45	45	45	45	45	45	45	45	45	45
Colour	4	1	1	1	1	1	1	1	1	1	1	1
Suspended solids	700	600	600	500	375	300	200	150	100	75	60	40
BOD	700	600	600	500	375	300	200	150	100	75	60	40
COD	1500	1200	1200	1000	700	600	400	300	200	100	100	85
Oil & Grease	50	50	50	30	25	20	20	20	20	20	20	20
Iron	20	15	13	10	7.5	6	4	3	2	1.5	1.2	1
Boron	6	5	4	3.5	2.5	2	1.5	1	0.7	0.5	0.4	0.3
Barium	6	5	4	3.5	2.5	2	1.5	1	0.7	0.5	0.4	0.3
Mercury	0.1	0.1	0.05	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.1	0.1	0.05	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Other toxic metals	2	1.5	1	0.8	0.6	0.5	0.32	0.24	0.16	0.12	0.1	0.1
Total toxic metals	4	3	2	1.6	1.2	1	0.64	0.48	0.32	0.24	0.2	0.14
Cyanide	1	0.5	0.5	0.5	0.4	0.3	0.2	0.1	0.1	0.08	0.06	0.04
Phenols	0.5	0.5	0.5	0.3	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1
Sulphide	5	5	5	5	5	5	2.5	2.5	1.5	1	1	0.5
Total residual	1	1	1	1	1	1	1	1	1	1	1	1
Total nitrogen	100	100	100	100	100	100	100	100	100	100	100	50
Total phosphorus	10	10	10	10	10	10	10	10	10	10	10	5
Surfactants (total)	30	20	20	20	15	15	15	15	15	15	15	15
E. coli (count/100 ml)	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000

(All units in mgl^{-1}unless otherwise stated; all figures are upper limits unless otherwise indicated)

4.3 Water Sensitive Receivers

4.3.1 In order to evaluate the water quality impacts resulting from the KCR Extension, the proximity of Water Sensitive Receivers (WSRs) to the Study Area must be considered. WSRs have been identified in accordance with the HKPSG, which provide criteria for identifying environmental factors influencing development planning.

4.3.2 The receiving water body during the construction and operation of the works will be Victoria Harbour. Due to the highly urbanized nature of the Kowloon peninsula there are no natural streams located within the KCR Extension construction area. There are, however, a number of seawater pumping stations and associated cooling water intakes along the Kowloon coast line for either the cooling systems of commercial buildings or toilet flushing throughout the area. These WSRs could be impacted by increases in suspended solids and associated siltation problems.

4.3.3 There are no marine biological sensitive receivers such as mariculture zones, commercial fisheries or shell fisheries in the vicinity of the KCR Extension. Victoria Harbour is considered to be of low relative sensitivity as a result of the existing poor water quality. However, it will be important to prevent any further deterioration resulting from construction or operation of the KCR Extension.

4.4 Construction Phase Impacts

4.4.1 The extent of water quality impacts associated with the works will depend upon the construction methods chosen, the type of land use that the alignment passes through, and the distance from the sensitive receivers. It is considered that the more remote the construction site is from the receiving water body, in this case Victoria Harbour, the lower the likelihood of the Project having a direct impact on receiving water quality.

4.4.2 Water quality impacts arising from the construction of KCR Extension will be similar to those of other land-based construction activities that include:

- construction runoff and drainage;
- tunnelling;
- excavation and demolition materials;
- sewage effluent; and
- general construction activities.

Construction Runoff and Drainage

Construction Runoff

4.4.3 Runoff from construction sites may contain increased sediment loads, other suspended solids and various contaminants. Potential sources of water pollution from the KCR Extension runoff include:

- runoff and erosion from site surfaces, drainage channels and earth working areas;
- bentonite slurries and other grouting materials;
- wash water from dust suppression sprays and wheel washing facilities; and
- fuel, oil and lubricants from construction vehicles and equipment.

4.4.4 Construction runoff may cause physical, chemical and biological effects. Any increase in SS from the site could accumulate, leading to blocked channels, and associated local flooding when heavy rainfall occurs, as well as affecting the water quality in Victoria Harbour.

4.4.5 Chemical and biological effects could also arise as a result of construction runoff, depending upon the chemical and nutrient content. Primary chemical effects may result from liquors containing significant quantities of concrete and cement derived materials. These may include localised increases in turbidity and discolouration, localised elevations in pH, and accretion of pH solids. Bentonite slurry and other grouting material within runoff could also contribute to these chemical effects within the water column. A number of secondary effects may also result in toxic effects to marine biota due to elevated pH values, reduced decay rates of faecal micro-organisms due to decreased light penetration, and a localised increase in the proportion of un-ionised ammonia.

Drainage

4.4.6 Drainage along the alignment of the KCR Extension comprises stormwater pipes, local highway drainage and sewers. The stormwater drainge system along Salisbury Road discharges to Victoria Harbour via three main drainage outfalls, while the sewers connect to a Screening Plant in Tsim Sha Tsui East. The drainage along Hankow Road and Kowloon Park Drive connects into the Middle Road drainage system which connects into the main drainage system in Nathan Road and eventually discharges to Victoria Harbour.

4.4.7 The drainage system is located to the north side of Middle Road and extends between the Mariners' Club and Nathan Road. These drains finally connect into the main drainage system in Nathan Road and eventually discharge to Victoria Harbour.

4.4.8 The need for temporary construction stage diversions of stormwater drains and the re-alignment of sewers have been identified in *Draft Drainage Impact Assessment, KCR Extension to Tsim Sha Tsui, Phase II (Part 1), Report KD2, Highways Department, 1996.* These include:

- the diversion of the Tsim Sha Tsui East box culvert 100 m westward along Salisbury Road, a 1350 mm diameter stormwater pipe which is currently proposed to be diverted under the Hung Hom Bypass project and a 1050 mm diameter stormwater drain at the Salisbury Road;

- the realignment of the cooling water intake pipes under Salisbury Road and the stormwater outfall close to the existing cooling water pumping station; and

- the temporary support of the existing sewers will be required during station construction and ETS will be designed to avoid the new sewerage works.

4.4.9 The potential water quality impact of the diversion and re-alignment of drainage pipes and culverts should be assessed in the subsequent EIA to ensure that the existing flows in the drainage systems will be maintained and the construction activities will not result in local flooding nor deterioration of water quality in Victoria Harbour. Any practical options for the diversion and re-alignment of drainage should comply with both engineering and environmental requirements.

Tunnelling

4.4.10 Tunnelling will comprise two construction methods, cut and cover tunnelling and bored tunnelling.

Cut and Cover Tunnelling

4.4.11 Cut and cover tunnelling is presently proposed for the alignment and station between Hung Hom KCR Terminus and the Marine Police Headquarters at Tsim Sha Tsui. During wet periods, rainfall and surface runoff entering exposed cut and cover tunnel sections could lead to construction runoff with high SS content and thus mitigation should be designed to reduce the influx of rainwater into the exposed cut and cover works areas.

4.4.12 Bentonite will be required during cut and cover tunnelling for diaphragm walls, and as a result runoff may be contaminated with bentonite or other grouting materials.

4.4.13 There is also some potential for contamination of the ground water depending on the vertical profile of tunnel sections, the relationship with the water table height, and the geological features along the tunnel route.

Bored Tunnelling (Below Marine Police Headquarters)

4.4.14 This portion of the KCR Extension would be entirely confined and isolated underground, and would have limited potential to cause water quality impacts. However, runoff could result from the few areas that are accessible to rainwater including the plant access portals. At these locations silt traps will be required to prevent discharge of silty site runoff from the construction areas.

4.4.15 Grouting materials would also be required during construction of the tunnels and could lead to contamination of runoff and would, therefore, require appropriate collection and disposal practices to ensure that no unacceptable water quality impacts arise as a result of the works.

4.4.16 There is also some potential for contamination of the ground water depending on the final vertical profile of tunnel sections, the relationship with the water table height, and the geological features along the tunnel route.

Excavated and Demolition Materials

4.4.17 Tunnelling will generate materials requiring handling and disposal, and this will be common to both tunnelling construction methods. However, cut and cover tunnelling may result in a greater degree of impact as the material will require storage and double handling. Excavated material being used as backfill for the cut and cover tunnel, will require temporary storage on site. The potential water quality impact of runoff from the temporary storage area will be similar to those discussed above.

4.4.18 Water quality impacts associated with the disposal of material excavated during tunnel formation will be minimal. The excavated materials will mainly comprise rock, sand and rubble that may be disposal at a public dump. No insurmountable water quality impacts are expected to arise from this material. Solid waste management is discussed in *Section 6*.

Sewage Effluent

4.4.19 Sewage is characterized by high levels of biochemical oxygen demand (BOD), ammonia and *E. coli.* Sewage effluents arising from the on-site construction workforce also have the potential to cause water pollution.

General Construction Activities

4.4.20 Construction activities have the potential to cause water pollution from debris and rubbish, such as packaging and used construction materials, entering the water column and resulting in floating refuse in the vicinity of the site that reduces the aesthetic quality of the water body.

4.5 Mitigation Measures

General

4.5.1 Stormwater best mangement practices, detailed as follows, should be implemented to ensure that runoff from construction areas and any stored excavated material comply with the WPCO and no unacceptable impact on the WSRs arises due to the KCR Extension construction.

Construction Runoff and Drainage

4.5.2 Construction runoff related impacts associated with tunnelling and above ground construction activities can be readily controlled through the use of appropriate mitigation measures which include:

- the use of sediment traps; and
- the adequate maintenance of drainage systems to prevent flooding and overflow.

4.5.3 All temporary and permanent drainage pipes and culverts provided to facilitate runoff discharge should be adequately designed for the controlled release of storm flows. All sediment traps should be regularly cleaned and maintained. The temporarily diverted drainage should be reinstated to its original condition when the construction work has finished or the temporary diversion is no longer required.

4.5.4 Sand and silt in the wash water from the wheel washing facilities, which ensure no earth, mud and debris is deposited on roads, should be settled out and removed before discharging into storm drains. A section of the road between the wheel washing bay and the public road should be paved with backfall to prevent wash water or other site runoff from entering public road drains.

4.5.5 Oil interceptors should be provided in the drainage system and regularly emptied to prevent the release of oils and grease into the storm water drainage system after accidental spillages. The interceptor should have a bypass to prevent flushing during periods of heavy rain.

Tunnelling

4.5.6 The cut and cover tunnelling work will be conducted segment by segment with a maximum open cut and cover area of 100x15 m to limit the amount of construction runoff generated in the areas during the wet season (April to September).

4.5.7 Ground water pumped out of tunnels should be discharged into the drainage channels which incorporate sediment traps to enhance deposition rates and to remove silt.

4.5.8 Bentonite slurries used in diaphragm wall construction should be reconditioned and reused wherever practicable. Used bentonite slurry disposal will only be permitted if it is treated to the TM standards as set out in *Table 4.2a* before discharge to the storm drains.

4.5.9 Water used in bored tunnelling should as far as practicable be recirculated after sedimentation. When final disposal is required, the waste water should be discharged into storm drains via silt traps.

Excavated and Demolition Materials

4.5.10 Temporary open storage of excavated materials used for backfill on site should be covered with tarpaulin or similar fabric during rainstorms. Any washout of construction or excavated materials should be diverted to the drainage system via appropriate sediment traps.

Sewage Effluent

4.5.11 The KCR Extension site is expected to have a maximum of approximately 250 workers on site full time. Appropriate and adequate disposal facilities, such as portable chemical toilets, should be provided.

General Construction Activities

4.5.12 Debris and rubbish on site should be collected, handled and disposed of properly to avoid entering the water column and cause water quality impacts. The waste management requirement on site to prevent such impact is detailed in *Section 6*.

4.6 Operational Phase Impacts

4.6.1 This section assesses potential impacts against the relevant environmental legislation with regard to identified sensitive receivers in accordance with the HKPSG. Legislation and WSRs have been defined and detailed in *Sections* 3.2 and 3.3 respectively.

4.6.2 No detrimental operational water quality impacts are expected if appropriate drainage systems, including silt traps and oil interceptors prior to discharge to sewer, are installed. It is considered that provided these drainage facilities are implemented, with regularly cleaning and maintenance practices, operational water quality will be compliant with the WPCO standards.

4.6.3 Where staff toilets are provided, appropriate sewerage to transfer effluent to the treatment facilities should be built to ensure that all effluents from ETS meet the standards defined in the TM prior to discharge.

4.7 Conclusions

4.7.1 This preliminary qualitative water quality assessment has determined that no insurmountable water quality impacts should result from the construction and operation of the KCR Extension providing that the mitigation measures outlined are implemented. Further assessment will be required to develop and recommend appropriate site specific mitigation measures to minimise impacts of concern. Key water quality issues are summarized below:

- general construction activities associated with tunnelling and station construction could lead to site runoff containing elevated concentrations of SS and associated contaminants;
- any diversion of drainage pipes or channels should be constructed to allow the water flow to the discharge point or outfall without overflow or washout, all temporary drainage diversions should be reinstated to the original condition after the construction works are completed; and
- no unacceptable water quality impacts are anticipated from the operation of the KCR Extension, provided appropriate drainage collection facilities are incorporated into the tunnel and station design such that the wastewater is in full compliance with the WPCO effluent discharge standards.

5 WASTE

5.1 Introduction

5.1.1 This Section identifies the potential waste arisings from the construction and operation of the KCR Extension and assesses the environmental impacts that may occur.

5.1.2 The options for waste minimisation, recycling, treatment, storage, collection, transport and disposal for waste arisings from the KCR Extension have been examined. Procedures for waste reduction and management are considered and mitigation measures for minimising the impacts of the wastes are recommended.

5.2 Legislation

General

5.2.1 The following legislation covers, or has some bearing upon, the handling, treatment and disposal of wastes in Hong Kong:

- *Waste Disposal Ordinance (Cap 354);*
- *Waste Disposal (Chemical Waste) (General) Regulation (Cap 354);*
- *Crown Land Ordinance (Cap 28); and*
- *Public Health and Municipal Services Ordinance (Cap 132) - Public Cleansing and Prevention of Nuisances (Urban Council) and (Regional Council) By-laws.*

Waste Disposal Ordinance

5.2.2 The *Waste Disposal Ordinance* (WDO) prohibits the unauthorised disposal of wastes, with waste defined as any substance or article which is abandoned. Construction waste is not directly defined in the WDO but is considered to fall within the category of "trade waste". Trade waste is defined as waste from any trade, manufacturer or business, or any waste building, or civil engineering materials, but does not include animal waste.

5.2.3 Under the WDO, wastes can only be disposed of at a licensed site. A breach of these regulations can lead to the imposition of a fine and/or a prison sentence. The WDO also provides for the issuing of licences for the collection and transport of wastes. Licences are not, however, currently issued for the collection and transport of construction and/or trade wastes.

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

5.2.4 Chemical waste as defined under the *Waste Disposal (Chemical Waste) (General) Regulation* includes any substance being scrap material, or unwanted substances specified under *Schedule 1* of the *Regulation*, if such a substance or chemical occurs in such a form, quantity or concentration so as to cause pollution or constitute a danger to health or risk of pollution to the environment.

5.2.5 A person should not produce, or cause to be produced, chemical wastes unless he is registered with the EPD. Any person who contravenes this requirement commits an offence and is liable, upon conviction for a first offence, to a fine of up to HK$200,000 and to imprisonment for up to 6 months. The current fee for registration is HK$240.

5.2.6 Producers of chemical wastes must treat their wastes utilising on-site plant licensed by EPD or have a licensed collector take the wastes to a licensed facility. For each consignment of waste, the producer, collector and disposer must sign all relevant parts of a computerised trip ticket. The transfer of wastes can, therefore, be traced from cradle to grave .

5.2.7 The *Regulation* prescribes the storage facilities to be provided on site including labelling and warning signs. To minimise the risks of pollution and danger to human health or life, the waste producer is required to prepare and make available written procedures to be observed in the case of emergencies due to spillage, leakage or accidents arising from the storage of chemical wastes. He must also provide employees with training in such procedures.

Crown Land Ordinance

5.2.8 Construction wastes which are wholly inert may be taken to public dumps. Public dumps usually form part of land reclamation schemes and are operated by the Civil Engineering Department (CED). The *Crown Land Ordinance* requires that dumping licences are obtained by individuals or companies who deliver suitable construction wastes to public dumps. The licences are issued by the CED under delegated authority from the Director of Lands.

5.2.9 Individual licences and windscreen stickers are issued for each vehicle involved. Under the licence conditions public dumps will accept only inert building debris, soil, rock and broken concrete. There is no size limitation on the rock and broken concrete, and a small amount of timber mixed with inert material is permissible. The material should, however, be free from marine mud, household refuse, plastic, metal, industrial and chemical waste, animal and vegetable matter and other material considered unsuitable by the dump supervisor.

Public Cleansing and Prevention of Nuisances By-laws

5.2.10 These *By-laws* provide a further control on the illegal tipping of wastes on unauthorised (unlicensed) sites. The illegal dumping of wastes can lead to fines of up to HK$ 10,000 and imprisonment for up to 6 months.

Additional Guidelines

5.2.11 Other 'guideline' documents which detail how the Contractor should comply with the regulations are as follows:

- *Waste Disposal Plan for Hong Kong (December 1989), Planning, Environment and Lands Branch Government Secretariat.*
- *Environmental Guidelines for Planning In Hong Kong (1990), Hong Kong Planning and Standards Guidelines, Hong Kong Government.*
- *New Disposal Arrangements for Construction Waste (1992), Environmental Protection Department & Civil Engineering Department.*
- *Code of Practice on the Packaging , Labelling and Storage of Chemical Wastes (1992), Environmental Protection Department.*

5.3 Sensitive Receivers and Baseline Conditions

5.3.1 The sensitive receivers for the KCR Extension with respect to waste management, have been identified in *Sections 2, 3 and 4* which relate to air, noise and water impacts respectively. These receivers may be affected by the storage, handling, collection of waste generated by the construction and operation of the KCR Extension. Baseline conditions have also been described in the previous sections.

5.3.2 The sensitive receivers with respect to the transport and disposal of wastes have not been identified within this report. At this Feasibility Study Stage it is not possible to define transport routes and disposal points. However, the disposal points will themselves have been the subject of environmental assessments and appropriate mitigation measures should be in place. In addition, the recommended mitigation measures applied to the collection of waste will assist in minimising potential impacts.

5.4 Construction Impacts

General

5.4.1 The construction of the KCR Extension will involve the following construction works:

- Hung Hom to Signal Hill tunnel;
- overrun tunnel beyond ETS; and
- ETS and associated development.

Potential Sources of Impacts

General

5.4.2 Construction activities will result in the generation of a variety of wastes which can be divided into distinct categories based on their composition, as follows:

- excavated inert material,
- construction and demolition waste;
- chemical waste; and
- general refuse.

5.4.3 The volumes and nature of each of these waste types arising from the construction of the KCR Extension are identified below.

Excavated Materials

5.4.4 Excavated material is defined as inert virgin or reclamation fill material removed from the ground and sub-surface. The materials arising from the KCR Extension works will comprise rock, sand, clay and mud excavated from the construction of the main Hung Hom to signal hill tunnels, ETS and the associated overrun tunnel beyond Signal Hill. The volumes and nature of the excavated materials which will be generated from each of the site working areas are detailed in *Table 5.4a*. The estimated total volume of excavated material arising from the construction of the KCR Extension is 400,000 m^3 of which up to 70,000 m^3 will be reused on-site. The remaining materials will have to be disposed of off-site.

Table 5.4a Waste Management During Construction

Site Location	Activity No.	Site Working Area	Staff On Site	Excavated Material (m^3)	Nature of Material	Reuse on Site	Construction Waste (m^3)	Demolition Waste (m^3)	Chemical Waste	Construction Period (Months)
Hung	1	100 m x 15 m(1)	10	nil	rubble	nil	36 (2)	5,000	Small Qty Oil	12
Hom to	2	100 m x 15 m	10	2,000	rock & sand	nil	36	-	Small Qty Oil	12
Signal	3	100 m x 15 m	6	-	-	-	36	-	Small Qty Oil	12
Hill	4	100 m x 15 m	10	125,000	rock & sand	20,000	36	-	Small Qty Oil	12
	5	100 m x 15 m	18	-	-	-	36	-	Small Qty Oil	12
	6	100 m x 15 m	10	-	-	-	36	-	Small Qty Oil	12
	7	Inside Tunnel	10	-	-	-	36	-	-	12
East	1	≈ 15,000 m^2	10	-	rubble & vegetation	nil	27	5,000	Small Qty Oil	9
Tsim	2	Ditto	10	1,500	rock & sand	nil	18	-	Small Qty Oil	6
Shs	3	Ditto	16	190,000	rock & sand	20,000	27	-	Small Qty Oil	9
Tsui	4	Ditto	up to 30(3)	-	-	-	54	-	Small Qty Oil	18
Station	5	Ditto	20	-	-	-	18	-	Small Qty Oil	6
	6	(4)	up to 30	-	-	-	54	-	Small Qty Oil	18
Overrun	1	100 m x 15 m	10	-	rubble	nil	24	2,500	Small Qty Oil	8
Tunnels	2	100 m x 15 m	10	2,000	rock & sand	nil	36	-	Small Qty Oil	12
	3A	100 m x 15 m	15	-	soft mud	nil	27	12,200	Small Qty Oil	9
	3B	2 x 15 m x 30 m	12	15,000	rock & sand	15,000	27	-	Small Qty Oil	9
	4	100 m x 15 m	10	63,000	rock, sand & clay	16,500	27	-	Small Qty Oil	9
	5	100 m x 15 m	18	-	-	-	45	-	Small Qty Oil	15
	6	100 m x 15 m	10	-	-	-	18	-	Small Qty Oil	6
	7	Inside Tunnel	10	-	-	-	18	-	Small Qty Oil	6
	TOTAL	-	285	398,500	-	71,500	672	24,700	-	-

Note: (1) First 300 m at Hung Hom Site Area approx. 20,000 m^2. Remainder would be constructed in 100 m sections as shown here.
(2) Estimated that 3 m^3 per month per site will be generated.
(3) Will vary during various construction stages.
(4) Storage inside station and in Middle Road Playground

Construction and Demolition Waste

5.4.5 Construction waste comprises unwanted materials generated during construction, including rejected structures and materials, materials which have been over ordered or are surplus to requirements and materials used and discarded. Construction waste will arise from a number of different activities carried out by the KCR Extension contractor during construction and maintenance activities, and may include:

- wood from formwork and falsework;
- equipment and vehicle maintenance parts, including materials used in tunnel boring;
- materials and equipment wrappings;
- unusable/surplus concrete/grouting mixes;
- bentonite slurries; and
- damaged/contaminated/surplus construction materials.

5.4.6 The estimated construction waste arisings from each of the working areas are provided in *Table 5.4a*. The total amount of construction wastes generated in the 9-18 month construction period, will be in the order of 700 m^3.

5.4.7 At the completion of the construction works any noise enclosures erected to reduce noise emanating from construction activities will be dismantled, producing a small amount of additional construction waste.

5.4.8 Demolition wastes are generated as a result of the clearance of sites which are currently occupied by man-made structures. Demolition wastes may include:

- brick, concrete, reinforcing bars, pipework and other rubble;
- derelict equipment and plant;
- wood, furniture and general refuse; and
- asbestos bearing materials.

5.4.9 Depending upon the nature of such structures and the nature of the activities which have been undertaken in them, demolition wastes may be inert, mixed with putrescibles, or contaminated.

5.4.10 The structures to be demolished during the construction of the KCR Extension include:

- manholes;
- pipework;
- retaining walls;
- a footbridge;
- foundations;
- columns; and
- part of the podium at the Hung Hom KCR Station.

5.4.11 The water pipework structures may contain some asbestos bearing materials.

5.4.12 The amount of demolition activity for the construction of the KCR Extension will be limited because of the carefully selected routing and most of the works will take place underground. The estimated total volume of demolition waste arisings is approximately 25,000 m^3.

Chemical Waste

5.4.13 Chemical Waste, as defined under the *Waste Disposal (Chemical Waste) (General) Regulation*, includes any substance being scrap material, or unwanted substances specified under *Schedule 1* of the *Regulation*. A complete list of such substances is provided under the *Regulation*, however substances likely to be generated by construction activities will for the most part arise from the maintenance of equipment. These may include, but need not be limited to the following:

- scrap batteries or spent acid/alkali from their maintenance;
- used engine oil from oil changing;
- hydraulic fluids;
- used air, oil and fuel filters from machinery;
- spent mineral oils/cleaning fluids from machinery, including materials used in tunnel boring; and
- spent solvents/solutions, which may be halogenated, from equipment cleaning activities.

5.4.14 Chemical waste will arise primarily from vehicle maintenance. Estimates suggest that monthly arisings at the KCR Extension site will be in the order of a few litres of used lubricating oils, a few batteries, and small amounts of all other chemical wastes. In addition, small quantities of asbestos waste may arise from the demolition of pipework structures. The potential impacts and recommended mitigation measures for asbestos waste are described under the *Construction and Demolition Waste* headings of this *Section*.

General Refuse

5.4.15 The presence of a construction site with large numbers of workers and site offices and canteens will result in the generation of a variety of general refuse materials requiring disposal. General refuse may include food wastes and packaging, waste paper, and packaging from construction materials.

5.4.16 The KCR Extension site is expected to have a maximum of approximately 250 workers on site full time. Estimates based on these figures suggest that the amount of general refuse produced by KCR Extension construction will be in the order of one hundred and fifty kilograms (15 m^3) per day.

Assessment Methodology

5.4.17 The assessment of environmental impacts from waste generation is based on three factors:

- the type of waste generated;
- the amount of principal waste types generated; and
- the proposed recycling, storage, transport, treatment and disposal methods, and the impacts of these methods.

Prediction and Evaluation of Impacts

General

5.4.18 The nature and amount of the waste arisings from the construction of the KCR Extension and the potential environmental impacts from waste handling, storage, transport and disposal are discussed in detail below under the headings of each waste type.

Excavated Materials

5.4.19 A total quantity of 400,000 m^3 of excavated materials will be generated of which approximately 330,000 m^3 will require disposal off-site. An estimated 70,000 m^3 will be reused on site in abutments and miscellaneous works such as landscaping while the excess materials will be taken to reclamation sites. Given the inert nature of this material, reuse on-site or in reclamation works is unlikely to have any unacceptable impacts relating to its disposal. The potential air, noise and water impacts from the excavation works are covered in *Section* 2, 3 *and* 4 respectively.

Construction and Demolition Waste

5.4.20 The storage, handling, transport and disposal of construction wastes have the potential to create similar visual, water, dust and noise impacts as the storage and disposal of excavated materials.

5.4.21 It should be determined, prior to demolition, whether any of the materials comprising the demolition wastes are asbestos bearing materials. If this is the case, specific mitigation measures relating to asbestos must be taken because there is the potential for adverse health effects on workers.

5.4.22 The disposal of construction and demolition wastes is unlikely to raise any long term concerns because of the inert nature of most construction wastes. To conserve void space at landfill sites, construction waste must not be disposed of at a landfill site if it contains more than 20% inert material by volume. It is therefore good practice to segregate wastes at construction sites before disposing of inert materials at public dumps for reclamation works and putrescible materials at a controlled landfill site. The amount of construction waste which is generated should be minimised by the careful control of ordering procedures to avoid the purchase of surplus materials.

5.4.23 Construction and demolition wastes currently form approximately 35% of the annual take-up of the landfill void in Hong Kong, (although this proportion has varied widely over recent years). Therefore, given the very limited total landfill void which is available, it is important to minimise, wherever possible, the wastes being delivered to landfill.

5.4.24 The avoidance of over ordering and the segregation of materials will minimise waste arisings requiring landfill disposal which will also assist in minimising costs if landfill charges are introduced.

Chemical Waste

5.4.25 Chemical wastes may pose serious environmental and health and safety hazards if not stored and disposed of in an appropriate manner as outlined in the *Waste Disposal (Chemical Waste) (General) Regulation* and the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes*. These hazards include:

- toxic effects on workers;
- adverse effects on air, water and land from spills or leakage;
- fire hazards; and
- disruption of sewage treatment works if waste enters the sewage system.

5.4.26 Chemical wastes will arise principally as a result of maintenance activities. It is difficult to quantify the amount of chemical waste which will arise from the construction activities since it will be highly dependent on the KCR Extension contractor's on-site maintenance intentions and the numbers of plant and vehicles utilised. However, it is anticipated that volumes will be relatively small.

General Refuse

5.4.27 The storage of general refuse has the potential to give rise to a variety of adverse environmental impacts. These include odour if waste is not collected frequently (eg. daily), windblown litter, water quality impacts if waste enters water bodies, and visual impact. The waste may also attract insects, vermin and other animals if the storage areas are not well maintained and cleaned regularly. In addition, disposal of wastes, at sites other than approved landfills, can also lead to similar adverse impacts at those sites.

Mitigation Measures

Introduction

5.4.28 This section sets out recycling storage, transportation and disposal measures which are recommended to avoid or minimise potential adverse impacts associated with waste arisings from the construction of the KCR Extension under the headings of each waste type.

Waste Management Hierarchy

5.4.29 Various options within waste management can be categorised in terms of preference from an environmental viewpoint. The options considered to be preferable have the least impacts and are more sustainable in the long term, hence, the hierarchy is as follows:

- avoidance and minimisation;
- reuse of materials;
- recovery and recycling; and
- treatment and disposal, as the last option to be considered.

5.4.30 The Waste Disposal Authority, which is the Environmental Protection Department, should be consulted by the Contractor on the final disposal of wastes.

5.4.31 This hierarchy should be used to evaluate and select waste management options. The aim should be to minimise the amount of waste which is generated which will usually reduce costs. For example, by reducing or eliminating over-ordering of construction materials, waste is avoided and costs are reduced both in terms of purchasing materials and in disposing of wastes.

Excavated Materials

5.4.32 Any uncontaminated inert materials which cannot be reused on site may be delivered to public dumps and fill sites. Excavated materials should be segregated from other wastes to avoid contamination thereby ensuring acceptability at fill sites or public dumps and avoiding the need for disposal at landfill.

Construction and Demolition Wastes

5.4.33 Careful planning and good site management can minimise over ordering and waste of materials such as concrete, mortars and cement grouts. The design of formwork should maximise the use of standard wooden panels so that high reuse levels can be achieved. More durable alternatives such as steel formwork or plastic facing should be considered to increase the potential for reuse.

5.4.34 The requirements for the handling and disposal of bentonite slurries should follow the *Practice Note For Professional Persons, Construction Site Drainage Professional Persons Consultative Committee, EPD, 1994* (ProPECC PN 1/94).

5.4.35 Asbestos containing materials should be removed, handled and disposed of in accordance with the *Air Pollution.Control (Amendment) Ordnance No. 13 of 1993 (APC (A) O), Part IX, Section 69 to 73*, and the *Code of Practice on the Handling, Transportation and Disposal of Asbestos.*

5.4.36 The Contractor should recycle as much as possible of the construction waste on-site. Proper segregation of wastes on site will increase the feasibility of recycling certain components of the waste stream by recycling contractors. Concrete and masonry, for example, can be ground up and used as fill and steel reinforcing bar can be used by scrap steel mills. Different areas can be designated for the storage and processing of the various materials which may be recycled depending on site specific conditions.

5.4.37 In accordance with the *New Disposal Arrangements for Construction Waste, Environmental Protection Department and Civil Engineering Department, 1992*, disposal of construction waste can either be at a specified landfill, or at a public dumps, with the latter being the preferred option. Construction wastes should be segregated from other wastes to avoid contamination thereby ensuring acceptability at public dumps and avoiding the need for disposal at landfill.

5.4.38 If landfill disposal has to be used, the wastes will most likely be delivered to the SENT Landfill.

Chemical Waste

5.4.39 Chemical waste that is produced, as defined by *Schedule 1* of the *Waste Disposal (Chemical Waste) (General) Regulation 1992*, should be handled in accordance with the *Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.*

General Refuse

5.4.40 General refuse generated on-site should be stored in enclosed bins or compaction units separate from construction and chemical wastes. A reputable waste collector should be employed by the Contractor to remove general refuse from the site, separately from construction and chemical wastes, on a daily or every second day basis to minimise odour, pest and litter impacts. The burning of refuse on construction sites is prohibited by law.

5.4.41 General refuse is generated largely by food service activities on site, so reusable rather than disposable dishware should be used if feasible. Aluminium cans are often recovered from the waste stream by individual collectors if they are segregated or easily accessible, so separate, labelled bins should be provided if feasible.

5.4.42 Office wastes can be reduced through recycling of paper if volumes are large enough to warrant collection. Participation in a local collection scheme should be considered if one is available.

Summary

5.4.43 This section describes waste management requirements and provides practical actions which can be taken to minimise the impacts arising as a result of the generation, storage, handling, transport and disposal of wastes.

5.4.44 Specifically, it is recommended that:

- wastes should be handled and stored in a manner which ensures that they are held securely without loss or leakage thereby minimising the potential for pollution;
- only reputable waste collectors authorised to collect the specific category of waste concerned should be employed;
- removal of demolition wastes should be carefully timed to coincide with the demolition work;
- appropriate measures should be employed to minimise windblown litter and dust during transportation by either covering trucks or transporting wastes in enclosed containers;
- the necessary waste disposal permits should be obtained from the appropriate authorities, if they are required, in accordance with the *Waste Disposal Ordinance (Cap 354), Waste Disposal (Chemical Waste) (General) Regulation (Cap 354)* and the *Crown Land Ordinance (Cap 28)*;
- collection of general refuse should be carried out frequently, preferably daily;
- waste should only be disposed of at licensed sites and site staff and the civil engineering Contractor should develop checking procedures to ensure that illegal disposal of wastes does not occur;
- waste storage areas should be well maintained and cleaned regularly; and
- records should be maintained of the quantities of wastes generated, recycled and

disposed, determined by weighing each load or by another method.

5.4.45 Training and instruction of construction staff should be given at the site to increase awareness and draw attention to waste management issues and the need to minimise waste generation. The training requirements should be included in the site waste management plan.

5.5 Operational Impacts

General

5.5.1 This Section describes the likely waste streams arising from the operation of the KCR Extension, the potential impacts and the waste management mitigation measures which are recommended.

Potential Sources of Impact

General

5.5.2 The sources, including facilities and activities, which may generate wastes during operation of the KCR Extension include:

- the public;
- KCRC offices, canteen and staff;
- commercial retailers within ETS;
- maintenance of building services at ETS or within the tunnels, such as ventilation fans and lifts; and
- any renovation or modification to ETS or tunnels.

5.5.3 Waste arisings will typically consist of general refuse, industrial waste and chemical waste, although some construction wastes may arise from renovation or modification works.

General Refuse

5.5.4 General refuse will be generated by the public and commercial retailers within ETS and the KCRC offices, canteen and staff. Based on similar operations, the general refuse is likely to be composed of food waste, wood, plastic, office wastes, paper, old tins/containers, cleaning materials and miscellaneous other wastes produced during daily activities. It has been estimated that ETS may generate up to 5 m^3 per day of such waste.

Industrial Waste

5.5.5 It is anticipated that the waste arisings from the maintenance and upkeep of the building services of ETS would be minimal. It is likely that these wastes would be handled in the same way as the general refuse without significantly adding to the quantities of the daily arisings of general refuse.

Chemical Waste

5.5.6 Chemical wastes may be generated from the maintenance of building services within ETS. These may include, but need not be limited to the following:

- waste oils and solvents; and
- spent solvents/solutions, which may be halogenated, from equipment cleaning activities.

5.5.7 It is considered that only minimal quantities of chemical wastes, if any, will arise during the operation of ETS.

Assessment Methodology

5.5.8 The assessment of environmental impacts from waste generation is based on three factors:

- the type of waste generated;
- the amount of principal waste types generated; and
- the proposed recycling, storage, transport, treatment and disposal methods, and the impacts of these methods.

Prediction and Evaluation of Impacts

General Refuse

5.5.9 The KCR Extension may generate approximately 5 m^3 of general refuse per day from the public and commercial retailers within ETS and the KCRC offices, canteen and staff of which a significant proportion will be paper and packaging from the offices and commercial retailers respectively.

5.5.10 There are a variety of impacts associated with the storage and handling of waste which can largely be controlled by good practice. Litter may accumulate on or near to ETS if waste is not properly collected, stored, handled, transported and disposed of in accordance with good management practice.

5.5.11 Contaminated water or leachate may arise if the waste is not properly stored in enclosed bins or the refuse collection point or if it is not entirely emptied during collections.

5.5.12 Pests and vermin may be attracted to the waste if it is not properly contained, and if the storage area is not regularly cleaned and well maintained. Odour problems may be caused if the refuse collection point is not properly cleaned and emptied frequently. Other impacts may occur if wastes other than the approved types are allowed to be deposited at the refuse collection point (such as chemical or hazardous wastes).

Industrial waste

5.5.13 It is anticipated that the maintenance activities will generate only minimal amounts of waste which will usually be limited to cleaning wastes, such as rags and empty detergent containers.

5.5.14 Maintenance of the KCR Extension or renovation work may generate larger amounts of waste, on an irregular basis, depending on particular needs and projects.

5.5.15 Industrial wastes have the potential to create similar environmental impacts to general refuse as described above.

Chemical waste

5.5.16 Chemical waste may be generated from building service maintenance and equipment cleaning, although the volumes would be minimal.

5.5.17 It is considered that no unacceptable environmental impacts will occur provided that chemical wastes are handled in accordance with the *Waste Disposal (Chemical Waste) (General) Regulation* and delivered to a facility licensed to receive chemical wastes.

Mitigation Measures

General

5.5.18 This Section sets out the recycling, treatment, storage, transportation and disposal options which may be implemented to avoid or minimise potential adverse impacts associated with waste arisings from the operation of the KCR Extension under the headings of each waste type.

Waste Management Hierarchy

5.5.19 The waste management strategy for the KCR Extension operation should follow the waste management hierarchy described in *Section 5.5.4*.

5.5.20 Based on the above principles of the waste management hierarchy, mitigation measures for the three operational waste types are given below.

General Refuse

5.5.21 Considerable scope exists to take waste reduction and management into account at the detailed design stage of the KCR Extension, particularly within the waste management area, by providing spaces or facilities for the segregation and storage of recyclable materials.

5.5.22 Waste collection bins should be strategically located around ETS for the collection of wastes. The bins should be emptied frequently throughout the day and the waste taken to a central refuse collection point. Guidelines for the design of refuse collection points are given in the HKPSG. Waste should be collected daily for disposal by a reputable waste collector.

5.5.23 The arisings of general refuse at the KCR Extension may contain recyclable elements. Aluminium, paper and paperboard may be present in quantities large enough to warrant the provision of separate bins for their collection, the contents of which could be collected by or sold to recycling contractors.

5.5.24 General refuse from the KCR Extension would most likely be taken directly to the SENT Landfill by private contractors.

Industrial Waste

5.5.25 Industrial wastes should be handled, transported, collected and disposed in the same way as that for general refuse described above.

Chemical Waste

5.5.26 Under the *Waste Disposal (Chemical Waste) (General) Regulation*, chemical waste producers should register with EPD. Chemical wastes should be transported by a registered chemical wastes collector to a facility licensed to receive chemical wastes.

5.5.27 Chemical waste should be stored in safe and suitably resistant containers, labelled, and in an appropriate store area, in accordance with the *Waste Disposal (Chemical Waste)(General) Regulation*, as discussed in *Section 6.4.5*. Enviropace, the operator of the Chemical Waste Treatment Facility on Tsing Yi, supplies approved containers for chemical waste which can be replaced with each collection.

5.6 Conclusions

5.6.1 It is likely that large quantities of excavated materials will arise from the development of the tunnels and ETS. A total volume of approximately 25,000 m^3 of demolition wastes will also be generated. It is therefore important that the mitigation measures relating to good practice which have been recommended are followed to ensure that adverse impacts are prevented and that the opportunities for waste minimisation and recycling are taken. The recommendations made in *Sections 2, 3 and 4* covering the handling, storage and transport of construction wastes are also applicable.

5.6.2 The level of general refuse produced by the KCR Extension operation is not expected to be unduly high, but all feasible measures should be taken to avoid, minimise and recycle wastes. Industrial and chemical waste arisings from maintenance activities will be very low and limited to plant and equipment maintenance.

5.6.3 Provided that the recommendations put forward in this report are conscientiously acted upon, no waste related regulatory non-compliances should occur as a result of the storage, handling, collection, transport, and disposal of wastes arising from the construction and operation of the KCR Extension.

6 ECOLOGY

6.1 Introduction

6.1.1 This section assesses and evaluates potential impacts to ecological resources arising from the proposed KCR Extension.

6.2 Legislation

6.2.1 The relevant regulations, legislation and guidelines which provide the framework for the protection of species and habitats of ecological importance in Hong Kong are described in detail below.

6.2.2 Hong Kong legislation provides for the protection of animals and plants and special areas through the following relevant ordinances and guidelines:

- Forests and Countryside Ordinance (Cap 96) of the Revised Edition 1994;
- Wild Animals Protection Ordinance (Cap 170);
- Animals and Plants (Protection of Endangered Species) Ordinance (Cap 187) of the Revised Edition 1994;
- Town Planning Ordinance (Cap 131); and
- Hong Kong Planning Standards and Guidelines.

6.2.3 The Forests and Countryside Ordinance (Cap 96) prohibits felling, cutting, burning or destroying of trees and growing plants in forests and plantations on government land. Its subsidiary Regulations prohibit the picking, felling or possession of listed rare and protected plant species. The list of protected species in Hong Kong was last amended in 1994 under the Forestry (Amendment) Regulation 1994 made under section 3 of the Forests and Countryside Ordinance (Cap 96).

6.2.4 Under the Wild Animals Protection Ordinance (Cap 170), designated wild animals are protected from hunting, whilst their nests and eggs are protected from injury, destruction and removal. All birds and most mammals are protected under this Ordinance. Prior approval from the Director of Agriculture and Fisheries is required for permission to destroy any of the protected wild animals listed in the Ordinance. The Second Schedule of the Ordinance which lists all the animals protected was last revised in 1994.

6.2.5 The Animals and Plants (Protection of Endangered Species) Ordinance controls the local possession of any endangered species of animals and plants listed in its schedules. It is designed to control trade in endangered species and restrict their local possession. In addition, there are measures which cover the retention, removal and replacement of trees on development sites, and is therefore relevant to this Study.

6.2.6 The recently amended Town Planning Ordinance provides for the designation of coastal protection areas, Sites of Special Scientific Interest (SSSIs), green belt or other specified uses that promote conservation or protection of the environment, eg Conservation Areas. Where SSSIs are covered by statutory town plans, the land uses therein are controlled by the provision of the Town Planning Ordinance. The authority responsible for administering the Town Planning Ordinance is the Town Planning Board (Planning Department).

6.2.7 The new revised Chapter 10 of the Hong Kong Planning Standards and Guidelines (HKPSG) covers "Landscape and Conservation". This chapter details the principles of conservation, the conservation of natural landscape and habitats, historic buildings, archaeological sites and other antiquities. It also addresses the issue of enforcement. The Appendices list the legislation and administrative controls for conservation, other conservation related measures in Hong Kong and Government Departments involved in Conservation.

6.3 Baseline Conditions and Sensitive Receivers

6.3.1 The proposed alignment for the KCR Extension lies in a highly urbanised area and no sites of particular ecological interest has been identified. Hence, no adverse ecological impacts arising from the proposed project are anticipated.

6.4 Mitigation Measures

6.4.1 Whilst no adverse ecological impacts have been predicted, the following mitigation measures should be implemented during the construction, as good practice, to minimize disturbance to the amenity planting in the vicinity of the station and alignment sites:

- erect fences along the boundary of construction sites before the commencement of works to prevent tipping, vehicle movements, and encroachment of personnel into undisturbed amenity areas;
- check regularly to ensure that the work site boundaries are not exceeded and that no damage is being caused to the surrounding areas;
- employ dust and noise control measures to minimize disturbance; and
- where the areas around the station and alignment remain the responsibility of the proponent, maintain planted areas and ensure the survival of trees for at least the first two years after the completion of the construction works.

7 LANDSCAPE AND VISUAL IMPACTS

7.1 Introduction

7.1.1 This *Section* of the report outlines the landscape and visual impacts associated with the development of the preferred KCR Extension track alignment and station.

7.1.2 The assessment initially identifies the existing landscape features of the station and alignment. The locations from where the development would be visible are then described. People in the surrounding areas who would potentially be able to see the proposed development are identified and categorised according to their predicted sensitivity to the visual intrusion that would be generated by the proposed development.

7.1.3 The potential landscape and visual impacts that would result from the development are then identified and the level of the potential impacts are assessed according to whether they are high, medium or low. Measures are identified that would help reduce the level of these potential impacts on the landscape and on the identified visual receivers.

7.2 Legislation

7.2.1 There is no legislation in Hong Kong that relates directly to the assessment of the landscape or visual impacts of new developments or construction sites. A degree of control is achieved through the requirement to address visual issues as part of an environmental review and assessment process. The advice note relating to the *Application of the EIA Process to Major Private Sector Projects, EPD, 1990*, identifies visual impact as being an issue of concern to be addressed. In addition, HKPSG (Chapter 10 - Landscape and Conservation), outlines those criteria which should be considered when planning in an urban environment. Government restrictions on the preservation and felling of trees in Hong Kong are detailed in Government General Regulation 740.

7.3 Sensitive Receivers and Baseline Conditions

Hung Hom Station to Wing On Garden

7.3.1 The alignment along this section of route runs from the southern edge of the existing Hung Hom Station complex. It passes underneath the Hong Kong Coliseum, between the Cross Harbour Tunnel portal and the International Mail Centre and then south-west along Salisbury Road. The International Mail Centre is located at the junction of Salisbury Road and Hong Chong Road. Large areas of amenity planting are located between these roads and their associated slip-road. This vegetation is largely grass but also includes small groups of trees and shrubs.

7.3.2 The urban area through which the proposed alignment is located comprises a narrow belt of land on either side of Salisbury Road. The central median of Salisbury Road is planted predominantly with shrubs along its eastern section and with an avenue of trees in its western section. A large planting strip, approximately 10 m wide, is located between Salisbury Road and the commercial and hotel buildings located to the north-west. This planting strip comprises almost entirely grass but has an avenue of immature trees growing within the area.

7.3.3 The Tsim Sha Tsui East Promenade is located immediately to the south-east of Salisbury Road and serves as an important recreational facility for the area. The promenade within this section of the alignment is approximately 20 m wide and 600 m long. A planting strip, approximately 1.8 m wide, is located adjacent to Salisbury Road along the inner edge of the promenade. This planting strip includes a narrow belt of shrubs, large areas of grass and approximately 30 semi-mature trees. The remainder of the promenade is predominantly hard paved but includes seven large planting beds that are spaced regularly along the promenade. These planting beds are approximately 40 m long and 5 m wide. They are planted mostly with grass but each bed has several semi-mature trees growing within it. Two large footbridges cross over Salisbury Road and serve to connect the promenade with Mody Road.

7.3.4 A large number of waterfront buildings (hotels and commercial blocks) are located to the north-west of the proposed alignment. The hotels include the Nikko, the Grand Stanford Harbour View, and the Kowloon Shangri-La. The commercial blocks include the Empire Centre, the Tsim Sha Tsui Centre and the Wing On Plaza. Visually sensitive receivers in this area include not only users of the above hotels and commercial buildings but also users of watercraft in the harbour and users of both the promenade and the adjacent road and pedestrian systems.

Wing On Garden and East Tsim Sha Tsui Station

7.3.5 The footprint for the proposed ETS extends from Middle Road to Salisbury Road and occupies part of Signal Hill, Middle Road Children's Playground, Wing On Garden and Chatham Road South.

7.3.6 Middle Road Children's Playground and Wing On Garden are formal gardens that contain a network of footpaths and activity spaces, including tai chi spaces, seating areas and a children's play area. A subway entrance structure is located within Wing On Garden. A large footbridge connects Middle Road Children's Playground with the New World Hotel and one access point to this footbridge is located within Middle Road Children's Playground. Wide belts of tree and shrub planting are located on the boundary of these open spaces and also amongst the various activity spaces. The trees within these areas are densely planted, are of mature size and provide a valuable contribution to the landscape of Tsim Sha Tsui.

7.3.7 Signal Hill is a large hillock located to the north of Middle Road Children's Playground. It is densely covered with mature tree growth and is a visually prominent landscape feature in the local area. A Grade 2 listed historic structure, a tower built for meteorological purposes, is located on the hill together with a rest garden. Access to the top of the hill is via a long winding road that starts at the north-west corner of the site.

7.3.8 The New World Hotel overlooks the station site from the south, Wing On Plaza overlooks the site from the east, the Sheraton Hotel and Hermes House overlook the site from the west and the Mariner's Club overlooks the site from the north-west. Visually sensitive receivers in this area include not only users of the hotels and commercial buildings but also users of the parks and the adjacent road and pedestrian systems.

East Tsim Sha Tsui Station to Canton Road

7.3.9 The alignment passes along Middle Road which links the Middle Road Children's Playground with Canton Road located further to the west. This road is approximately 12 m wide and has narrow footpaths on either side. There are no trees located along this section of road. The proposed alignment along this section of Middle Road crosses a number of other roads at right angles to the route. These other roads include Nathan Road, Hankow Road, Ashley Road, and Kowloon Park Drive. The section of alignment between Middle Road Children's Playground and Kowloon Park Drive is enclosed on both sides by densely packed buildings. These include Hermes House, the Far East Mansion, the Hankow Centre, the Kowloon Hotel, the Brunswick Bowling Centre, the historic Peninsula Hotel and the YMCA.

7.3.10 The alignment between Kowloon Park Drive and Canton Road passes underneath the site of the Marine Police Headquarters. This police station is an historic building protected by the Antiquities and Monuments Ordinance and is located in the centre of a vegetated mound. This mound is well-vegetated with mature trees on its southern, western and north-western sides. Another 12 smaller buildings are located on the southern portion of this mound and are set amongst groups of trees. The eastern edge of the mound, adjoining Kowloon Park Drive, has unsightly chunam covered slopes.

7.3.11 This western section of the proposed alignment along Middle Road is overlooked by the YMCA and the Hankow Centre from the east, the Pacific Star Building and the Ramada Renaissance Hotel from the north, and Star House and the Omni Hong Kong Hotel from the west. The proposed alignment would not be visible from either the Ex-Terminus Station structure (a Grade 3 protected building) or from the historic Kowloon Market building on Peking Road (a Grade 3 protected building). Visually sensitive receivers in this area include not only users of the above hotels and commercial buildings and the adjacent road and pedestrian systems, but also users of the pedestrian precinct around the Cultural Centre that is located to the south of the alignment.

7.4 Construction Impacts

Potential Sources of Impact

7.4.1 The KCR Extension will involve the construction of an underground station and railway track through the heavily developed east Tsim Sha Tsui area. The elements of the proposed development would create varying levels of impact on the physical landscape and on the visual amenity of the surrounding areas during the construction stage. Potential impacts on the physical landscape would result from general site preparation and excavation works for the construction of foundations. Visual impacts would result from the above site preparation works together with the implementation of piling works. Visual impacts would also be generated at construction stage by the presence of construction equipment and the presence of new structures under construction. There would, in addition, be visual impacts at all of the proposed construction sites during the night as a result of the presence of security lighting.

Assessment Methodology

7.4.2 The method for identifying potential landscape and visual impacts has initially involved identification of the sources of impact that would be generated by the scheme i.e. the elements of the construction works and operational procedures that would generate landscape and visual impacts. Site visits were initially conducted to gain an overview of the existing landscape (topography, vegetation cover, as well as landscape features) through which the proposed alignment and stations would be located. Baseline conditions and visually sensitive receivers have been established not only through these site visits to the study area but also by inspection of topographical maps and aerial photographs. Potential impacts on the landscape and on the identified visual receiver groups were identified for both the construction and operational stages of the scheme. These identified landscape and visual impacts are detailed and assessed below.

Prediction of Impacts

7.4.3 The site preparation and excavation works associated with the proposed development would result in disturbance to existing vegetation, structures and other landscape features. Areas of disturbed land, the construction operations, as well as the presence of the station and alignment at their various stages of construction, would all have a visual impact on the surrounding areas and their populations during the construction phase.

Hung Hom Station to Wing On Garden

7.4.4 Development of the proposed railway along this section of alignment would involve the closure of the access road to the International Mail Centre and the rail marshalling yards. This would represent a low-level landscape impact. Potential landscape impacts that would be generated by the proposed development include the excavation of deep trench along the Tsim Sha East Promenade. This would involve the loss of a high proportion of the amenity planting along this promenade. Public access to this area would probably be severely restricted during the construction works. These works would represent a high impact both on the physical landscape and the amenity of the area. One or both of the public footbridges that connect the promenade to Mody Road would have to be relocated. In addition, the footbridge across the access road to the International Mail Centre would probably be closed during this period.

7.4.5 There would, in addition, be the loss of approximately 500 m of the planting strips both along the centre and northern edge of Salisbury Road as a result of excavations and the use of the areas for contractor's works areas. There would be a loss of the vegetated character along Salisbury Road as a result of the above vegetation losses. A short section of Salisbury Road itself, would have to be excavated for the proposed alignment to cross from the promenade to Wing On Garden.

7.4.6 Adverse visual impact would result from the presence of construction machinery, deep excavations, the track structures that would be required for the above-grade section adjacent to Hung Hom Station and the presence of the remaining sections of the below-grade railtrack whilst under construction. There would, in addition, be temporary severance of existing views of the harbour by any site hoardings that may be used during the construction stage.

7.4.7 High levels of visual impact are predicted on users of the large number of waterfront buildings (hotels and commercial blocks) that are located to the north-west of the proposed alignment. These hotels include the Nikko, the Grand Stanford Harbour View, and the Kowloon Shangri-La. The commercial blocks include the Empire Centre, the Tsim Sha Tsui Centre and the Wing On Plaza. Visually sensitive receivers in this area include not only users of the above hotels and commercial buildings but also users of the above parks and the adjacent road and pedestrian systems.

7.4.8 The level of visual impact on people that use the lower floors of these buildings would be particularly high. Other visually sensitive receivers in this section of alignment (i.e. pedestrians, cyclists and users of the parts of the recreation facilities that would remain during the construction stage) would experience high levels of visual impact. Users of the surrounding road system and users of watercraft on the harbour would, by virtue of their transient nature, experience low to medium levels of visual impact.

Wing On Garden and East Tsim Sha Tsui Station

7.4.9 Development of the proposed railway along this section of alignment would involve the excavation of a deep pit for the station box. These works would involve the severance of Wing On Garden and loss of mature trees and seating areas within this garden. There would also be the loss of the north-east section of Middle Road Playground, including the tree-growth along its northern edge. The entrance to the open space from the Middle Road side would also be severed. The potential loss of these mature trees would represent a severe loss to the landscape of the local area.

7.4.10 Potential disturbance to Signal Hill Garden includes a major loss of mature tree growth on the southern, eastern and western sides of the hillock as a result of landcuts that would be required in this area. There would, in addition, be a loss of flat platforms on the hill which are used for recreational facilities and these platforms support seating areas and a pavilion, Signal Hill Tower would not be affected. The above landscape losses would represent a severe impact to the landscape of the area. If the landscape of Signal Hill is reinstated and the existing vegetation completely replaced, the proposed development would still have high residual impacts on the landscape of the area as any replacement trees would take several decades to reach the state of maturity of the existing vegetation. Any reinstatement at Signal Hill should also allow for greater pedestrian access to the Signal Tower and its associated open space. There would be a potential loss of the vegetated character of the surrounding area as a result of the vegetation losses in both Wing On Garden and Signal Hill Garden.

7.4.11 Excavation works for the station box would require severance of Chatham Road South and adjacent footpaths including those to the south of Wing On Garden and the one that connects Middle Road and Minden Road. The proposed removal of the Mariner's Club multi-storey building would represent a high level landscape impact.

7.4.12 High levels of visual impact are predicted on users of the large number of buildings (hotels and commercial blocks) that surround this section of the proposed railway. These buildings include the New World Hotel that overlooks the station site from the south, the Wing On Plaza that overlooks the site from the east, the Sheraton Hotel and Hermes House that overlook the site from the west and the Mariner's Club that overlooks the site from the north-west. The level of visual impact on people that use the lower floors of these buildings would be particularly high. Other visually sensitive receivers in this section of alignment (i.e. pedestrians, cyclists and users of the parts of the recreation facilities that would remain during the construction stage) would experience high levels of visual impact. Users of the surrounding road system would, by virtue of their transient nature, experience low to medium levels of visual impact.

East Tsim Sha Tsui Station to Canton Road

7.4.13 Development of the proposed railway along this section of alignment would involve the excavation of a deep pit along most of the route alignment and tunnelling underneath the hillock located between Kowloon Park Drive and Canton Road. The works would involve the severance of Middle Road, a short section of Nathan Road, a short section of Hankow Road, the Ashley Road and Middle Road junction and Kowloon Park Drive. The excavation works would also involve potential severance of the access to the Middle Road multi-storey carpark and also restrict the access to Hermes House, Far East Mansion, the Sheraton Hong Kong Hotel, the Peninsula Hotel, the YMCA and the Kowloon Hotel. No vegetation losses are predicted along this section of the route as it is assumed that there will be tunnelling under the hill that supports the Marine Police Headquarters building which would not be affected.

7.4.14 High levels of visual impact are predicted on users of the large number of buildings (hotels and commercial blocks) that surround this section of the proposed railway. These buildings include Hermes House, the Far East Mansion, the Hankow Centre, the Kowloon Hotel, the Brunswick Bowling Centre, the Penninsula Hotel, the YMCA, the Pacific Star Building, the Ramada Renaissance Hotel, Star House and the Omni Hong Kong Hotel.

7.4.15 The level of visual impact on people that use the lower floors of these buildings would be particularly high. Other visually sensitive receivers in this section of alignment (i.e. pedestrians, cyclists and users of the pedestrian precinct adjacent to the Cultural Centre would experience high levels of visual impact. Users of the surrounding road system and users of watercraft on the harbour would, by virtue of their transient nature, experience low to medium levels of visual impact.

7.5 Operational Impacts

7.5.1 The potential visual impacts of the project at operational stage would be limited to visual impacts of the above ground structures such as station entrances and ventilation systems. The sensitive receivers as well as the level of potential visual impact generated on those receivers at operational stage would be largely the same as that identified for the construction stage.

7.6 Mitigation Measures

7.6.1 Mitigation measures to control, reduce or remove landscape impacts which arise from the project are described below. The natural features of the area, particularly large trees, are considered to be of concern for their landscape and visual importance. Landscape and visual impact mitigation measures arising during the construction phase should include the following:

- alternative vehicular and pedestrian routes should be provided near the Hong Kong Colosseum to maintain access to the International Mail Centre and the rail marshalling yards;

- the landform and vegetation of Signal Hill should be reinstated and completely revegetated, a minimum depth of 1.2 m of topsoil should be provided for the growth of trees in all reinstated areas;

- alternative access arrangements should be made for the buildings located along Middle Road where construction works will be carried out immediately adjacent to these properties;

- the contractor's works areas (other than immediately above the station box) in Wing On Garden and Middle Road Garden should not involve disturbance to any of the existing mature trees, if this cannot be prevented, as much as possible of the works areas should be relocated to another part of Tsim Sha Tsui where there would be lower levels of landscape disturbance;

- boundary fences should be erected around construction sites before the commencement of works to reduce the potential visual impacts of the proposed works and to prevent tipping, vehicle movements and encroachment of personnel off site;

- site boundaries should be regularly checked to ensure that the works are properly controlled and that no damage is being caused to the surrounding areas;

- as much as possible of the existing vegetation, in particular mature trees within the sites, should be fenced off and retained if site area requirements permit;

- mature trees of good form and health could be transplanted prior to works commencing and returned to the general area after construction works have been completed;

- high standards of dust control should be applied to protect vegetation adjacent to work sites;

- all construction sites, particularly the areas of disturbed vegetation, should be reinstated to standards as good as, or better than the original at the earliest opportunity;

- the external appearance of all above-ground structures should be carefully detailed in terms of form, colour and finishes such that they are visually integrated as much as possible into the surrounding landscape.

7.7 Conclusions

7.7.1 The proposed development would generate high impacts on the physical landscape on many of the areas in which it would be located. These impacts generally take the form of tree losses, particularly those trees that are mature specimens and provide a valuable role in the landscape amenity of the areas in which they are located. The proposed ETS would generate high to severe impacts on the landscape of Signal Hill and this landscape feature should be reinstated and completely revegetated after completion of the construction works. Implementation of the proposed landscape and visual impact mitigation measures will help greatly reduce the level and quantity of these impacts.

8 ENVIRONMENTAL MONITORING AND AUDIT

8.1 Introduction

8.1.1 In this *Section*, recommendations for the KCR Extension EM&A programme are outlined, taking account of the findings of the EFS. These preliminary recommendations are based on the current KCR Extension Feasibility Study Design which is likely to undergo considerable changes before the construction works for the Project commence and are, therefore, only for guidance and will need to be thoroughly revised during the subsequent more detailed design stages of the Project.

8.1.2 The EFS has identified that EM&A will only be necessary for air quality and noise impacts during the construction of the KCR Extension. No water sensitive receivers will be affected during either the construction or operation of the KCR Extension as any potential impacts on the local drainage system will be controlled by the requirements of the wastewater discharge licence. No adverse impacts have been identified during the operational phase which cannot be effectively controlled through specified design criteria.

8.1.3 The roles and responsibilities of the Proponent, Contractor and Environmental Checker (EC), will be related through the application of Event Contingency Plans (ECPs) to deal with any exceedance of the established criteria, either in the course of normal construction working or through unforseen circumstances. *Figure 8.1a* shows the inter-relationships between the implementation of mitigation measures, the EM&A programme and the ECPs.

8.1.4 More detailed recommendations for the EM&A programme will be set out in the KCR Extension EM&A Manual which will be produced as part of the subsequent EIA Programme. The Manual should follow the recommendations of the *Generic Environmental Monitoring and Audit Manual, Environmental Protection Department, May 1996*. The outline elements presented here are based on the current information available from the KCR Extension Feasibility Study and these are expected to undergo a number of revisions during the subsequent EIA process.

8.2 Environmental Monitoring and Audit

8.2.1 The overall objectives of the EM&A programme which will be undertaken during the construction and operation of the KCR Extension are as follows:

- to monitor the performance of the project and to provide an early indication if any of the environmental mitigation measures fail to meet the established standards and guidelines;
- to take remedial action if unexpected problems or unacceptable impacts arise;
- to provide data to enable an environmental audit to be undertaken;
- to provide a data base against which the short or long term environmental effects associated with the KCR Extension may be determined; and

- to verify the environmental impacts predicted in the KCR Extension EFS and subsequent EIA.

8.2.2 The monitoring will consist of the following elements.

- In the construction phase, the EFS has identified sensitive receivers near the KCR Extension worksites where noise and dust monitoring will be required. Impacts on water sensitive receivers will not be monitored as part of the EM&A programme as the site discharges will be monitored, as necessary, in accordance with the site discharge licences.

- In the operational phase noise, and in emergencies exhaust air, from the ventilation systems have been identified as potential adverse impacts. These can be effectively controlled so that sensitive receivers are not adversely affected and their effects will be checked against the established criteria during commissioning.

8.2.3 In order that the environmental monitoring may be audited, the Proponent should establish strict procedures and protocols for carrying out, recording and reporting this work in the tender requirements. These procedures, protocols and reporting formats should be set out in the EM&A Manual.

8.3 Event Contingency Plans

8.3.1 The purpose of the ECPs is to provide, in association with the monitoring and audit activities, procedures for ensuring that if any deterioration of environmental quality occurs as a result of the KCR Extension works, either accidentally or through inadequate implementation of mitigation measures on the part of the contractor, that the cause can be promptly identified and remedied, and that the risk of a similar event re-occurring is reduced.

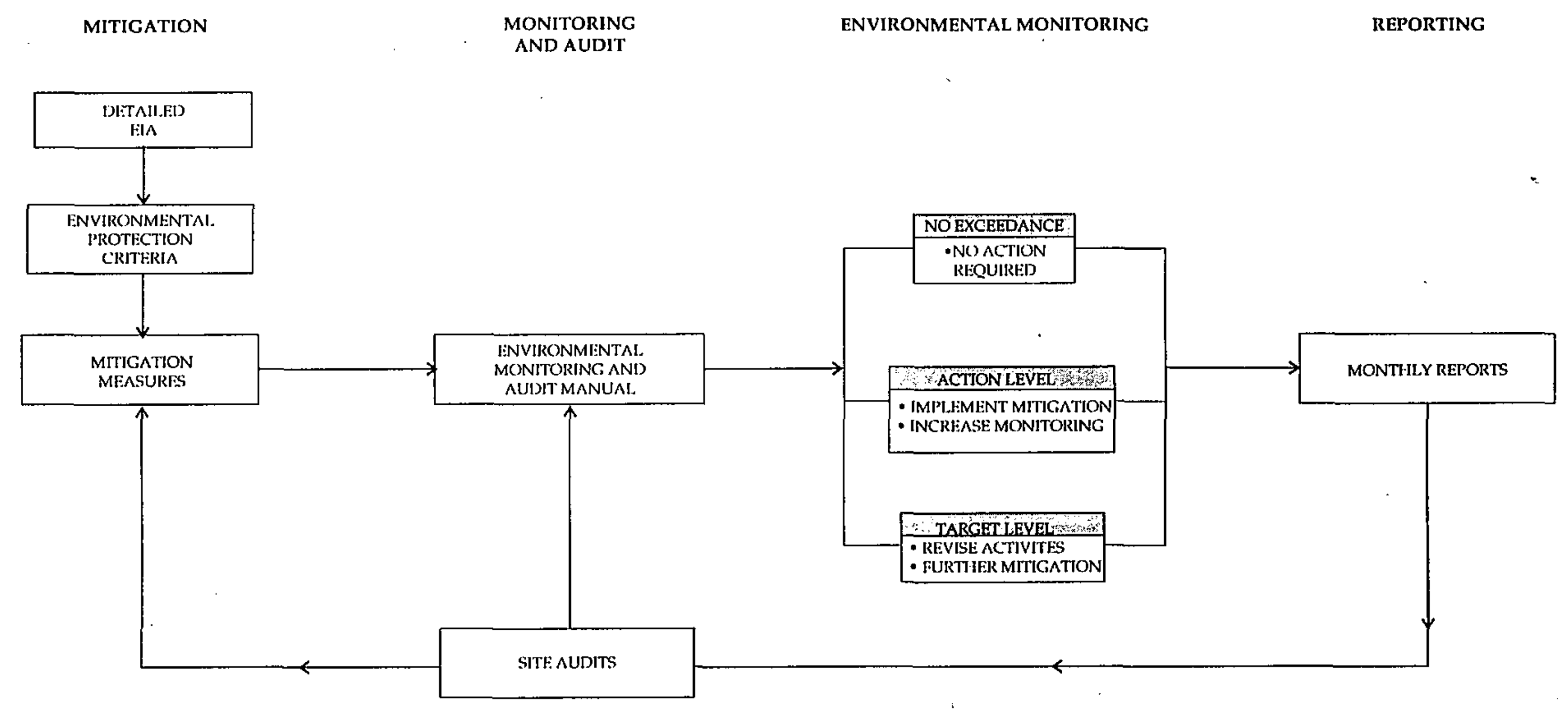
8.3.2 The principle upon which the ECPs are based is the prescription of procedures and actions associated with the measurement of certain defined levels of pollution by environmental monitoring, established prior to the commencement of the KCR Extension construction works. These are:

- *Action Level*, beyond which appropriate remedial actions may be necessary to prevent environmental quality deteriorating further; and

- *Limit Level*, the limits stipulated in the relevant Hong Kong statutes and guidelines, if these are exceeded, works should not proceed without appropriate remedial action, including a critical review of plant and working methods.

8.4 Air Quality Monitoring

8.4.1 Monitoring of dust in the form of Total Suspended Particulates (TSP) shall be undertaken to ensure that deteriorating air quality can be readily detected and timely action taken to remedy its cause. 24-hour TSP levels shall be measured to indicate the extent of construction dust impacts on sensitive receivers. 1-hour TSP



IMPLEMENTATION OF MITIGATION AND ENVIRONMENTAL MONITORING AND AUDIT

MAUNSELL CONSULTANTS ASIA LTD

DATE: APR 96

FIGURE No. 8.1a

SCALE:

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levels shall be monitored in response to complaints, exceedances or under other circumstances as directed by the EC.

8.4.2 Concurrent with the undertaking of 24-hour and 1-hour TSP monitoring, the recording of wind conditions in the vicinity of the construction sites shall also be undertaken. The measurement of wind speed and direction may enable the environmental team to distinguish between on site and external sources of dust during the evaluation of TSP monitoring results.

8.4.3 24-hour TSP concentrations shall be measured by the *High Volume Method for Total Suspended Particulates, Part 50 Chapter 1 Appendix B, Title 40 of the Code of Federal Regulations of the USEPA*. 1-hour sampling can be undertaken using a direct reading dust meter such as the MIE Data-Ram Portable Real Time Aerosol Monitor.

8.4.4 The criteria against which air quality shall be assessed are the statutory AQOs for daily TSP of 260 $\mu g\ m^{-3}$ and the non-statutory EPD recommended 1-hour TSP limit of 500 $\mu g\ m^{-3}$.

8.4.5 Equipment shall be properly maintained and calibrated at all times in accordance with the requirements stated in the manufacturers operating manual.

Air Sensitive Receivers

8.4.6 ASRs have been identified in the vicinity of the construction sites during the course of the KCR Extension EFS. The locations where it is recommended that air quality monitoring is undertaken during the construction works are listed below in *Table 8.4a*. The selection of monitoring sites should be reviewed during the EIA and agreed with the EPD.

Table 8.4a Preliminary Locations for TSP Monitoring

Site Name	ASR Location
Hung Hom to Signal Hill	AH2 Pak Sui Yuen
	AH4 Hotel Nikko HK
East Tsim Sha Tsui Station	AS1 Shangri-La Hotel
	AS4 Wang Fu Building
	AS6 Mariner's Club
	AS10 Far East Mansion
Overrun Tunnels	AO1 The Peninsula Hotel
	AO3 YMCA Building
	AO5 Marine Police Headquarters

Baseline Monitoring

8.4.7 Sufficient quantities of monitoring equipment shall be provided by the Proponent to complete the necessary 24-hour and 1-hour baseline sampling at the agreed monitoring locations before the commencement of any site works which may affect the monitoring results. Details of the baseline, Action and Limit TSP levels will be reported prior to the commencement of impact monitoring.

8.4.8 24-hour baseline monitoring shall be carried out for a continuous period of at least two weeks with daily ambient measurements taken at all the agreed monitoring locations. General meteorological conditions (wind speed and direction, precipitation, air pollution index, etc) and notes regarding any significant adjacent dust producing sources shall also be recorded throughout the baseline monitoring period. 1-Hour TSP sampling using the agreed instrument shall also be undertaken at least three times per day during normal working hours (07.00-19.00) concurrently with the 24-hour TSP baseline sampling.

8.4.9 Ambient conditions may vary seasonally and therefore baseline checking of dust levels shall be carried out every six months at all the agreed monitoring locations when construction activities are not taking place or when the contractor's activities are not generating dust in the proximity of the monitoring stations. Detailed notes shall be provided by the monitoring personnel as to significant dust producing sources during the baseline checking periods. The baseline monitoring activities will provide data for the determination of the appropriate A/L levels which shall be agreed with the EPD.

Impact Monitoring

8.4.10 Regular 24-hour impact monitoring shall be carried out throughout the duration of the construction works at a frequency of at least once every six days at all monitoring stations.

8.4.11 In cases of non-compliance with the air quality criteria, additional monitoring as specified in the ECP shall be conducted within 24 hours of the results being obtained. The additional monitoring shall be continued until the excessive dust emission or the deterioration in air quality abates.

Compliance Assessment

8.4.12 The A/L Levels provide an appropriate framework for the interpretation of monitoring results. The air quality monitoring data shall be checked against the agreed A/L Levels as listed in *Tables 8.4b* and *8.4c*.

Table 8.4b Derivation of Action and Limit Levels for 24-Hour Air Quality Monitoring

Level	Total Suspended Particulates ($\mu g\ m^{-3}$)
Baseline	Derived from physical measurements prior to construction commencing
Action	For baseline <108 $\mu g\ m^{-3}$, average of 130% of baseline and the Limit level 108< baseline >154, 200 $\mu g\ m^{-3}$ For baseline >154 $\mu g\ m^{-3}$, 130% of baseline level
Limit	AQO for TSP: 260 $\mu g\ m^{-3}$ averaged over 24 hours

Table 8.4c Derivation of Action and Limit Levels for 1-hour Air Quality Monitoring

Level	Total Suspended Particulates
Baseline	Derived from physical measurements prior to construction commencing
Action	For baseline <154 $\mu g\ m^{-3}$, average of 130% of baseline and the Limit level 154< baseline >269, 350 $\mu g\ m^{-3}$ For baseline >269 $\mu g\ m^{-3}$, 130% of baseline level
Limit	500 $\mu g\ m^{-3}$

Event Contingency Plan

8.4.13 The principle on which the ECP is based is the prescription of procedures and actions associated with the measurement of defined levels of air pollution recorded by the environmental monitoring process and defined in the *Tables* above. In cases where exceedance of these criteria occurs, Proponent, Contractor and EC shall strictly observe the relevant actions of the ECP shown in *Table 8.4d.*

Table 8.4d Event Contingency Plan for Air Quality

Exceedance	Action: Environmental Checker	Action: Proponent	Action: Contractor
ACTION LEVEL	Repeat measurement to confirm findings. Identify the source(s) of impact.	Confirm receipt of notification of exceedance and notify Contractor.	Submit proposals for remedial actions to EC within three working days of notification.
	Inform Contractor and Proponent in writing and discuss remedial actions required.	Check monitoring data trends and Contractor's working methods.	Amend proposals if required by the EC.
	Increase monitoring frequency to assess efficacy of remedial measures.	Remind the Contractor of his contractual obligations and discuss remedial actions to be implemented.	Implement the remedial actions immediately upon instruction from the Proponent.
	If exceedence continues, arrange meeting with Proponent to review implementation and identify further appropriate mitigation measures. If exceedence stops, cease additional monitoring.	Assess the efficacy of remedial actions and keep the Contractor informed.	Liaise with the EC to optimise the effectiveness of the agreed mitigation.
LIMIT LEVEL	Repeat measurement to confirm findings.	Confirm receipt of notification of exceedance and notify Contractor.	Take immediate action to avoid further exceedence.
	Identify the source(s) of impact. Inform Contractor and Proponent in writing.	Check monitoring data trends and Contractor's working methods.	Submit proposals for remedial actions to EC within three working days of notification.
	Discuss remedial actions required with Proponent. Increase monitoring frequency to assess efficacy of remedial measures.	Discuss with Contractor the remedial actions to be implemented.	Amend proposals if required by the EC. Implement remedial actions immediately upon instruction from the Proponent.
	If exceedence continues, arrange meeting with Proponent to identify further appropriate mitigation measures.	Assess the efficacy of remedial actions and keep the Contractor informed.	Liaise with the EC to optimise the effectiveness of the agreed mitigation.
	If exceedence stops, cease additional monitoring.		

8.5 Noise Monitoring

8.5.1 Whilst the NCO does not provide for the statutory control of construction activities occurring on weekdays during normal working hours (i.e. Monday to Saturday 07.00-19.00, excluding Public Holidays), a voluntary daytime limit of $L_{Aeq, 30 min}$ 75 dB for residential premises was proposed in ProPECC PN2/93 as the appropriate criterion. For educational establishments, a level of 70 dB(A) has been proposed and this would be further reduced to 65 dB(A) during examination periods. On all days during the evening (19.00-23.00) and night-time (23.00-07.00) and Sundays and Public Holidays (07.00-23.00), the statutory noise limits shall be applied.

8.5.2 Sound level meters and pistonphone calibrators shall comply with the *International Electrotechnical Commission Publications 651:1979 (Type 1)* and *804:1985 (Type 1)* specifications as referred to in the TM. The sound level meters shall be supplied and used with the manufacturers recommended wind shield and mounted on a tripod. Hand-held wind speed anemometers shall also be supplied for the measurement of wind speeds during noise monitoring periods. The maintenance of calibration of monitoring equipment shall be carried out in accordance with the manufacturer's requirements and verified by the manufacturers once every two years.

8.5.3 Noise level measurements shall be carried out by suitably qualified personnel using the methodology set out in Section 3 of the *Technical Memorandum on Noise from Construction Work other than Percussive Piling*.

8.5.4 NSRs have been identified in the vicinity of the construction sites during the course of the KCR Extension EFS. Those where it is recommended that noise quality monitoring is undertaken are listed below in *Table 8.5a*.

Table 8.5a Preliminary Locations for Noise Monitoring

Site Name	NSR Location
Hung Hom to Signal Hill	N2 Pak Sui Yuen
	N4 Hotel Nikko HK
	N6 Shangri-La Hotel
East Tsim Sha Tsui Station	N7 Wang Fu Building
	N8 Mariner's Club
	N12 Far East Mansion
Overrun Tunnels	N13 The Peninsula Hotel[1]
	N 15 YMCA Building
	N16 Marine Police Headquarters

Baseline Monitoring

8.5.5 The Proponent shall provide and install sufficient numbers of noise meters and support equipment to complete the necessary baseline sampling at the agreed monitoring locations before the commencement of any site works which may affect the monitoring results.

8.5.6 General meterological conditions, including a measurement of wind speed shall be recorded for each baseline measurement. Where the steady wind speed exceeds 5 m s^{-1}

or gusts above 10 m s^{-1}, or in the presence of fog or rain or evidence thereof, measurements shall be treated as invalid and repeated as soon as possible.

8.5.7 Baseline noise levels shall be measured over two consecutive 7-day calendar weeks at a minimum logging interval of 15 minutes. The quantities L_{Aeq}, L_{10} and L_{90} shall be recorded at the specified interval. The logger shall be visited for a period not less that one hour every two days to ensure its continued operation and to identify and record specific noise sources audible at the monitoring location. Observations of noise sources and weather conditions shall be made and reported on all monitoring occasions or at the minimum specified interval.

8.5.8 Checking for changes in the baseline noise levels shall be carried out by taking "sample" noise measurements every six months when no noisy KCR Extension construction activities are in progress. On other occasions, the monitoring staff shall note any operational construction equipment or other activities, arising from either the Contractor or any other sources noted to be emitting "dominant", "audible" or "noticeable" noise levels during the time of the measurement for the analysis and audit process.

8.5.9 The baseline monitoring results, agreed with EPD, will be used in conjunction with the A/L Levels to determine the validity of complaints, the significance of impact monitoring results and the requirements for action under the ECP.

Construction Impact Monitoring

8.5.10 During normal construction working hours (07.00-19.00 Monday to Saturday excluding Public Holidays), monitoring of $L_{Aeq, 30min}$ noise levels (as six consecutive $L_{Aeq, 5 min}$ readings) shall be carried out at the agreed monitoring locations once every six days in accordance with the methodology in the TM. If restricted hours works are undertaken, monitoring of $L_{Aeq\ 15min}$ noise levels (as three consecutive $L_{Aeq, 5 min}$ readings) shall be carried out at the agreed monitoring stations at the same frequency as specified for normal working hours.

8.5.11 In relation to the monitored noise levels, other noise sources such as road traffic may make a significant contribution to the overall noise environment. The EC, shall, therefore interpret the results of noise monitoring activities in the light of such influencing factors where such factors were not present during the baseline monitoring period.

Event Contingency Plan

8.5.12 The principle on which the ECP is based is the prescription of procedures and actions associated with the measurement of defined levels of noise impact recorded by the environmental monitoring process and defined in the tables above. In cases where a complaint is received or an exceedance of these criteria is measured, the Proponent, Contractor and EC shall strictly observe the relevant actions of the ECP shown in *Table 8.5c.*

Table 8.5c Event Contingency Plan for Construction Noise

Exceedance Event	Action: Environmental Checker	Action: Proponent	Action: Contractor
ACTION LEVEL	Undertake measurement to establish validity of complaint.	Confirm receipt of notification of complaint and notify Contractor if proven.	Submit proposals for remedial actions to EC within three working days of notification.
	Identify the source(s) of the complaint.	Check monitoring data trends and Contractor's working methods.	Amend proposals if required by the EC.
	Inform Contractor and Proponent in writing and discuss remedial actions required.	Remind the Contractor of his contractual obligations and discuss remedial actions to be implemented.	Implement the remedial actions immediately upon instruction from the Proponent.
	Increase monitoring frequency to assess efficacy of remedial measures.	Assess the efficacy of remedial actions and keep the Contractor informed.	Liaise with the EC to optimise the effectiveness of the agreed mitigation.
	If exceedence continues, arrange meeting with Proponent to review implementation and identify appropriate mitigation measures.	Inform complainant of actions taken.	
	If exceedence stops, cease additional monitoring.		
LIMIT LEVEL	Repeat measurement to confirm findings.	Confirm receipt of notification of exceedance and notify Contractor.	Take immediate action to avoid further exceedence.
	Identify the source(s) of impact.	Check monitoring data trends and Contractor's working methods.	Submit proposals for remedial actions to EC within three working days of notification.
	Inform Contractor and Proponent in writing and discuss remedial actions required.	Discuss with Contractor the remedial actions to be implemented.	Amend proposals if required by the EC.
	Increase monitoring frequency to assess efficacy of remedial measures.	Assess the efficacy of remedial actions and keep the Contractor informed.	Implement remedial actions immediately upon instruction from the Proponent.
	If exceedence continues, arrange meeting with Proponent to identify appropriate mitigation measures.		Liaise with the EC to optimise the effectiveness of the agreed mitigation.
	If exceedence stops, cease additional monitoring.		

8.6 Environmental Auditing

8.6.1 The EFS has identified noise and dust emissions as the key potential impacts associated with the construction of the KCR Extension, no adverse operational impacts are predicted. Other potential impacts, including those on water quality, waste and amenity, are amenable to mitigation subject to the effective implementation of recommended measures. The environmental auditing programme will focus on the regular assessment of the effectiveness of management systems, practices and procedures in ensuring that the required mitigation measures are routinely implemented and maintained.

8.6.2 The auditing of onsite environmental performance will be undertaken on the basis of criteria and methodologies contained within an Audit Protocol developed in advance of the commencement of construction works.

8.6.3 The criteria against which the audits will be undertaken will be derived from the recommendations of the EIA process and the environmental protection clauses within the Contractual Documentation. In addition, the management systems established by the onsite Project management team to monitor the Contractor's compliance with Contractual requirements will be included within the audit protocols.

8.6.4 The audit protocols will be included in the EM&A Manual. The protocols will include the auditing of the following activities:

- the allocation of responsibility for fulfilling environmental requirements and the effectiveness of lines of communication with regard to environmental issues;
- compliance with procedures established to enable an effective response to environmental incidents, exceedances or non-compliances;
- the extent and accuracy of record-keeping related to environmental performance indicators;
- the effectiveness of staff training in ensuring high levels of awareness with regard to environmental requirements; and
- the effectiveness of environmental management activities.

8.6.5 The protocols will comprise checklists of auditable requirements and will be amended, over the lifetime of the construction phase, to focus on areas of frequent non-compliance and to reflect the potential impacts associated with specific activities within the construction programme.

8.6.6 The findings of site audits will be made known to site staff at the time of the audit to enable the rapid resolution of identified non-compliances. Non-compliances, and the corrective actions undertaken, will also be reported in the monthly EM&A Report.

8.7 Reporting

8.7.1 A Monthly Report will be produced as part of the KCR Extension EM&A programme which should include a brief account of construction activities during the month, an interpretation of the significance of the monitoring results by verifying compliance and highlighting any failure to comply with the target levels and an account of any necessary remedial measures recommended by the Proponent and implemented by the Contractor.

9 CONCLUSIONS AND RECOMMENDATIONS

9.1 Introduction

9.1.1 The impacts identified in this EFS were derived from the RDS Phase II Feasibility Study engineering design for construction sites, methodologies and equipment, which are subject to change, being dependent on future, more detailed studies and ultimately, the preferred methodology of the successful Tenderer. However, the current findings clearly demonstrate that practicable mitigation measures are available to control the adverse impacts identified in Sections 2-7.

9.1.2 Whilst varying levels of construction impacts have been predicted, no insurmountable environmental problems have been identified at any of the locations considered in this assessment. No adverse operational impacts have been identified, largely due to the underground nature of the KCR Extension. *Table 9.1a* sets out the implementation programme for the proposed mitigation measures to be applied during the phases of the KCR Extension construction works.

9.2 Conclusions

Air Quality

9.2.1 Since the tunnel and station construction sites will be located in an urban area, and many of the land uses close to the potential sites are residential, dust impacts are unavoidable. However, sufficient mitigation measures and control can be incorporated in the planning and design stage in order to reduce the likely dust impacts on the ASRs to within the AQO standard and other recommended limits.

9.2.2 Adverse impacts on air quality during the operation of the KCR Extension are not expected as no potential sources were identified.

Noise and Vibration

9.2.3 This assessment has predicted that unmitigated construction noise associated with the KCR Extension works would cause adverse noise impacts at the nearby NSRs. Mitigation has been recommended to alleviate the high levels of construction noise. However, due to the proximity of some NSRs to construction sites, the use of general mitigation measures could not be fully effective in controlling all impacts and purpose built site boundary screens and noise enclosures have been recommended in these cases.

9.2.4 Whilst noise enclosures have been shown to be effective during the excavation phase, noise impacts during their erection are more difficult to mitigate. Some exceedances during the erection of the noise enclosures have been predicted, and further mitigation options are limited. It is considered that the minimal benefits associated with the reduction of noise levels to within the ProPECC guidelines, by further limiting site activities, would be negated by the delay in completing the noise enclosure and the extended period of noise (and dust) impacts.

9.2.5 The EFS has indicated that there will be no significant noise impacts at the NSRs from fixed plant noise during the operational phase of the KCR Extension provided that the recommended mitigation measures are incorporated into their design. As sufficient detailed information on track form and lithology is not available at this stage, the ground-borne noise from underground trains has not been assessed in this study. The impacts from ground borne vibration can be controlled by means of a suitably designed resilient track form and all vibration related impacts can be mitigated. The requirements for vibration measures will be determined in the detailed engineering design of the project.

Water Quality

9.2.6 The proximity of the work sites to Victoria Harbour could lead to adverse impacts if effective drainage control measures such as those recommended in the EFS are not applied during the construction and operation of the KCR Extension.

9.2.7 The only major area of concern, however, is the potential for the discharge of construction waste waters with excessive SS loadings. It is considered that the quantities of water involved can be readily controlled by the recommended measures, such that the quality of waste water leaving the site will be of a sufficient standard to meet the discharge licence requirements.

9.2.8 Operational water quality impacts could be readily mitigated through the installation and maintenance of appropriate interceptors and drainage. Provided there is full compliance with the WPCO effluent discharge standards, there will be no unacceptable water quality impacts associated with the KCR Extension.

Waste

9.2.9 Provided that the recommendations put forward in this report are followed, no unacceptable waste related environmental impacts as a result of the storage, handling, collection, transport, and disposal of wastes arising from the KCR Extension construction and operation are predicted.

9.2.10 The level of general refuse produced by the operation of the KCR Extension is not expected to be unduly high, but all feasible measures should be taken to avoid unnecessary wastes. Industrial and chemical waste from maintenance activities will be limited to station maintenance, as carriage maintenance will not occur at the stations.

Ecology

9.2.11 This study has revealed that, with the exception of individual mature trees on some of the proposed construction sites, there are no ecological concerns for the project. Where possible, protective measures are recommended, however, based on these preliminary findings, unacceptable impacts to ecological resources are not anticipated.

Landuse and Visual Impacts

9.2.12 The land use impacts of the proposed construction sites are generally high as there are sensitive adjacent land uses, for some sites there will also be traffic issues to be considered. Mitigation measures should be introduced to alleviate these problems and wherever possible, construction sites should be restored to their previous uses. There will be, however, no mitigation measures needed during the operational stage as the KCR Extension will be underground.

9.2.13 The proposed construction works will generate a high level of visual impact, however, a number of opportunities exist to mitigate these impacts. No significant potential landscape impacts are predicted at the operational stage of the project.

Table 9.1a Implementation of Mitigation Measures

Mitigation Measure	Site Preparation	Excavation	Structures	Reinstatement	Commissioning
Air Quality					
Site Watering & Compaction	All sites	All sites	All sites	All sites	-
Vehicle Speed Control	All sites	All sites	All sites	All sites	-
Vent Orientation	-	-	-	-	All sites
Noise					
Use of Quiet Plant	-	-	Hung Hom to Signal Hill	Hung Hom to Signal Hill	-
Quiet Plant and Moveable Barriers	-	-	-	-	-
Quiet Plant, Moveable Barriers and Limited Numbers of Plant	All sites	All Sites	Station and Overrun Tunnels	Station and Overrun Tunnels	-
Noise Enclosure	Overrun Tunnels	Overrun Tunnels	Overrun Tunnels	Overrun Tunnels	-
Further Measures Required	Station Site	Station Site	-	-	-
Additional Acoustic Control of Vents	-	-	-	-	All sites
Water Quality					
Site Boundary Drainage	All sites	All sites	All sites	All sites	-
Site Runoff Control and Drainage	All sites	All sites	All sites	All sites	-
Station and Tunnel Drainage	-	-	-	-	All Sites
Landuse and Visual					
Site Boundary Fencing	All sites	All sites	All sites	All sites	-
Vehicle Movement Controls	All sites	All sites	All sites	All sites	-
Revegetation and Reinstatement of Facilities	-	-	-	Hung Hom to Signal Hill and Station Site	-

9.3 Recommendations

9.3.1 The purpose of the EFS is to assess the Feasibility of the RDS Phase II (Part 1) in terms of potentially adverse environmental impacts arising from the various construction and operational activities and options for their effective control. Further changes to the design of the KCR Extension may affect the predictions of the EFS and will need to be revised at the preliminary and detailed design stages. Recommendations for further environmental impact assessment are provided below.

Air Quality

9.3.2 Air quality impacts will need to be reassessed in the light of any changes to the construction programme and methodology described in the EFS. The following updated and definitive information will then be required:

- location and layout of construction sites;
- construction schedules and plant inventories;
- quantities of excavated material;
- identification of all ASRs; and
- local meteorological records and background TSP levels.

9.3.3 Details will also be required of the precise location and orientation of vent louvres to check operational air quality impacts.

Noise and Vibration

9.3.4 Noise impacts will also need to be reassessed in the light of any changes in the final construction programme and methodology. The following information will then be required:

- location and layout of construction sites;
- construction schedules and plant inventories;
- identification of all NSRs; and
- local background noise levels.

9.3.5 Details will also be required of the precise location and orientation of vent louvres to check operational noise impacts.

9.3.6 It has not been possible at this stage to assess impacts caused by vibration from the operational railway due to a lack of detailed information on the locations and nature of existing foundations and other sub-surface structures along the proposed alignment. This aspect will need to be addressed at the detailed design stage, however, vibration from the operational railway can be controlled effectively by suitable trackform design.

Water Quality

9.3.7 It is considered that further water quality assessment work will be required to develop the necessary control and treatment systems to meet the wastewater discharge licence requirements.

Waste Management

9.3.8 Further refinement of the recommendations for waste management during construction and operation will be possible when more accurate information on waste arisings is available. The necessary construction phase information requirements are detailed above for air quality. It is envisaged that the operational requirements will be developed at a later stage, when better information will be available on the numbers and activities of station users.

Ecology

9.3.9 It is recommended that a survey of the works areas is undertaken by the Contractor to determine and map the distribution and abundance of vegetation types and to locate large trees which may be protected. This mapping will provide the basis for site restoration.

Landuse and Visual Impact

9.3.10 The potential for the mitigation of landuse and visual impacts will need to be reassessed when the preferred construction sites and methodologies have been identified and, in the case of visual impacts, detailed recommendations for noise mitigation measures, in the form of barriers and enclosures, are available. It is also recommended that a comprehensive tree survey should be included in the detailed design stage.

Environmental Monitoring and Audit

9.3.11 It is expected that an EM&A Manual will be produced as part of the future EIA process and that this will concentrate on the monitoring of TSP and noise impacts during construction works as other adverse impacts are not anticipated. The basic requirements for the EM&A Manual have been set out in *Section 8.0* and these include:

- representative TSP and noise monitoring locations;
- the types of monitoring equipment to be used; and
- the recommended EM&A procedures.

Annex A

KCR Extension Construction Noise Calculations

C1435 - TST KCR Extension Construction Noise Calculations

Section - Hung Hom to Signal Hill

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Preparation	Generator	CNP101	1	108	108	6.31E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Breaker, crawler-mounted	CNP028	1	122	122	1.58E+12
	Excavator	CNP081	1	112	112	1.58E+11
	Lorry	CNP141	2	112	115	3.17E+11
					Total SWL	123
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Service Diversions	Generator	CNP101	1	108	108	6.31E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Breaker, crawler-mounted	CNP028	1	122	122	1.58E+12
	Excavator	CNP081	1	112	112	1.58E+11
	Lorry	CNP141	2	112	115	3.17E+11
					Total SWL	123
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Sheet Piling for Tunnel	Mobile Crane	CNP048	1	112	112	1.58E+11
	Lorry	CNP141	1	112	112	1.58E+11
					Total SWL	115
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3A Sheet Piling (assess separately)	Pile Driver (Drop Hammer)	-	1	129	129	7.94E+12
					Total SWL	129
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Excavation for Tunnel	Generator	CNP101	1	108	108	6.31E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Breaker, crawler-mounted	CNP028	1	122	122	1.58E+12
	Excavator	CNP081	1	112	112	1.58E+11
	Lorry	CNP141	3	112	117	4.75E+11
					Total SWL	124
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Form and Construct Tunnel	Generator	CNP101	1	108	108	6.31E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Mobile Crane	CNP048	1	112	112	1.58E+11
	Poker Vibrator	CNP170	4	113	119	7.98E+11
	Concrete Lorry Mixer	CNP044	3	109	114	2.38E+11
					Total SWL	121
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
6 Backfill Reinstate Roads	Generator	CNP101	1	108	108	6.31E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Compactor, vibratory	CNP050	1	105	105	3.16E+10
	Lorry	CNP141	2	112	115	3.17E+11
	Poker Vibrator	CNP170	2	113	116	3.99E+11
	Concrete Lorry Mixer	CNP044	3	109	114	2.38E+11
					Total SWL	120

Section - Signal Hill Station

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Preparation	Generator	CNP101	1	108	108	6.31E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Breaker, crawler-mounted	CNP028	1	122	122	1.58E+12
	Excavator	CNP081	1	112	112	1.58E+11
	Lorry	CNP141	2	112	115	3.17E+11
					Total SWL	123
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Service Diversions	Generator	CNP101	1	108	108	6.31E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Breaker, crawler-mounted	CNP028	1	122	122	1.58E+12
	Excavator	CNP081	1	112	112	1.58E+11
	Lorry	CNP141	2	112	115	3.17E+11
					Total SWL	123
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Excavation for Station	Generator	CNP101	1	108	108	6.31E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Breaker, crawler-mounted	CNP028	2	122	125	3.17E+12
	Excavator	CNP081	2	112	115	3.17E+11
	Lorry	CNP141	3	112	117	4.75E+11
					Total SWL	126
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3A Sheet Piling for station const'n	Pile Driver (Drop Hammer)	-	1	129	129	7.94E+12
					Total SWL	129
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Form and Construct Tunnel	Generator	CNP101	1	108	108	6.31E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Tower Crane	CNP049	1	95	95	3.16E+09
	Mobile Crane	CNP048	1	112	112	1.58E+11
	Poker Vibrator	CNP170	4	113	119	7.98E+11
	Concrete Lorry Mixer	CNP044	3	109	114	2.38E+11
					Total SWL	121
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Backfill Reinstate Roads/Signal Hill	Generator	CNP101	1	108	108	6.31E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Compactor, vibratory	CNP050	1	105	105	3.16E+10
	Lorry	CNP141	2	112	115	3.17E+11
	Poker Vibrator	CNP170	2	113	116	3.99E+11
	Concrete Lorry Mixer	CNP044	3	109	114	2.38E+11
					Total SWL	120

Section - Overrun

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Preparation	Generator	CNP101	1	108	108	6.31E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Breaker, crawler-mounted	CNP028	1	122	122	1.58E+12
	Excavator	CNP081	1	112	112	1.58E+11
	Lorry	CNP141	2	112	115	3.17E+11
					Total SWL	123

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Service Diversions	Generator	CNP101	1	108	108	6.31E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Breaker, crawler-mounted	CNP028	1	122	122	1.58E+12
	Excavator	CNP081	1	112	112	1.58E+11
	Lorry	CNP141	2	112	115	3.17E+11
					Total SWL	123

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3A Diaphragm Wall for Tunnel	Concrete lorry mixer	CNP044	2	109	112	1.59E+11
	Generator	CNP101	1	108	108	6.31E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Poker Vibrator	CNP170	2	113	116	3.99E+11
	Piling, reverse circulation drill	CNP166	2	100	103	2.00E+10
	Piling, bentonite filtering plant	CNP162	1	105	105	3.16E+10
	Water Pump, electric	CNP281	2	88	91	1.26E+09
					Total SWL	118

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3B Bored Tunnel	Air Compressor	CNP001	2	100	103	2.00E+10
	Air Extraction Unit*	-	2	100	103	2.00E+10
	Compressed Air Drills*	-	4	120	126	4.00E+12
	Excavator	CNP081	2	112	115	3.17E+11
	Lorry	CNP141	2	112	115	3.17E+11
	Mobile Crane	CNP048	1	112	112	1.58E+11
					Total SWL	127

* Remark: - Source Data based on BS5228 Part 1, Table 13 Ref. 5 (compressor and pneumatic drilling rig) for Compressed Air Drills and the SWL for Air Extraction Unit is assumed to be the same as Air Compressor.

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Excavation for Tunnel	Generator	CNP101	1	108	108	6.31E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Breaker, crawler-mounted	CNP028	1	122	122	1.58E+12
	Excavator	CNP081	1	112	112	1.58E+11
	Lorry	CNP141	3	112	117	4.75E+11
					Total SWL	124

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Form and Construct Tunnel	Generator	CNP101	1	108	108	6.31E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Mobile Crane	CNP048	1	112	112	1.58E+11
	Poker Vibrator	CNP170	4	113	119	7.98E+11
	Concrete Lorry Mixer	CNP044	3	109	114	2.38E+11
					Total SWL	121

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
6 Backfill Reinstate Roads	Generator	CNP101	1	108	108	6.31E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Compactor, vibratory	CNP050	1	105	105	3.16E+10
	Lorry	CNP141	2	112	115	3.17E+11
	Poker Vibrator	CNP170	2	113	116	3.99E+11
	Concrete Lorry Mixer	CNP044	3	109	114	2.38E+11
					Total SWL	120

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Mitigation 1 - Use of Quiet Plant

Section - Hung Hom to Signal Hill						
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Preparation	Generator	CNP101	1	100	100	1.00E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	105	105	3.16E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	116
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Service Diversions	Generator	CNP101	1	100	100	1.00E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	105	105	3.16E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	116
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Sheet Piling for Tunnel	Mobile Crane	CNP048	1	105	105	3.16E+10
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	108
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3A Sheet Piling	Pile Driver (Drop Hammer)	-	1	129	129	7.94E+12
(assess separately)					Total SWL	129
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Excavation for Tunnel	Generator	CNP101	1	100	100	1.00E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	105	105	3.16E+10
	Lorry	CNP141	3	105	110	9.49E+10
					Total SWL	117
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Form and Construct Tunnel	Generator	CNP101	1	100	100	1.00E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Mobile Crane	CNP048	1	105	105	3.16E+10
	Poker Vibrator	CNP170	4	110	116	4.00E+11
	Concrete Lorry Mixer	CNP044	3	109	114	2.38E+11
					Total SWL	118
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
6 Backfill Reinstate Roads	Generator	CNP101	1	100	100	1.00E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Compactor, vibratory	CNP050	1	105	105	3.16E+10
	Lorry	CNP141	2	105	108	6.32E+10
	Poker Vibrator	CNP170	2	110	113	2.00E+11
	Concrete Lorry Mixer	CNP044	3	109	114	2.38E+11
					Total SWL	117

Section - Signal Hill Station						
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Preparation	Generator	CNP101	1	100	100	1.00E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	105	105	3.16E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	116
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Service Diversions	Generator	CNP101	1	100	100	1.00E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	105	105	3.16E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	116
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Excavation for Station	Generator	CNP101	1	100	100	1.00E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Breaker, crawler-mounted	CNP028	2	115	118	6.32E+11
	Excavator	CNP081	2	105	108	6.32E+10
	Lorry	CNP141	3	105	110	9.49E+10
					Total SWL	119
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3A Sheet Piling for station const'n	Pile Driver (Drop Hammer)	-	1	129	129	7.94E+12
					Total SWL	129
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Form and Construct Tunnel	Generator	CNP101	1	100	100	1.00E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Tower Crane	CNP049	1	95	95	3.16E+09
	Mobile Crane	CNP048	1	105	105	3.16E+10
	Poker Vibrator	CNP170	4	110	116	4.00E+11
	Concrete Lorry Mixer	CNP044	3	109	114	2.38E+11
					Total SWL	118
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Backfill Reinstate Roads/Signal Hill	Generator	CNP101	1	100	100	1.00E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Compactor, vibratory	CNP050	1	105	105	3.16E+10
	Lorry	CNP141	2	105	108	6.32E+10
	Poker Vibrator	CNP170	2	110	113	2.00E+11
	Concrete Lorry Mixer	CNP044	3	109	114	2.38E+11
					Total SWL	117

Section - Overrun

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Preparation	Generator	CNP101	1	100	100	1.00E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	105	105	3.16E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	116

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Service Diversions	Generator	CNP101	1	100	100	1.00E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	105	105	3.16E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	116

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3A Diaphragm Wall for Tunnel	Concrete lorry mixer	CNP044	2	109	112	1.59E+11
	Generator	CNP101	1	100	100	1.00E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Poker Vibrator	CNP170	2	110	113	2.00E+11
	Piling, reverse circulation drill	CNP166	2	100	103	2.00E+10
	Piling, bentonite filtering plant	CNP162	1	105	105	3.16E+10
	Water Pump, electric	CNP281	2	88	91	1.26E+09
					Total SWL	116

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3B Bored Tunnel	Air Compressor	CNP001	2	100	103	2.00E+10
	Air Extraction Unit*	-	2	100	103	2.00E+10
	Compressed Air Drills*	-	4	120	126	4.00E+12
	Excavator	CNP081	2	105	108	6.32E+10
	Lorry	CNP141	2	105	108	6.32E+10
	Mobile Crane	CNP048	1	105	105	3.16E+10
					Total SWL	126

* Remark: - Source Data based on BS5228 Part 1, Table 13 Ref. 5 (compressor and pneumatic drilling rig) for Compressed Air Drills and the SWL for Air Extraction Unit is assumed to be the same as Air Compressor.

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Excavation for Tunnel	Generator	CNP101	1	100	100	1.00E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	105	105	3.16E+10
	Lorry	CNP141	3	105	110	9.49E+10
					Total SWL	117

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Form and Construct Tunnel	Generator	CNP101	1	100	100	1.00E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Mobile Crane	CNP048	1	105	105	3.16E+10
	Poker Vibrator	CNP170	4	110	116	4.00E+11
	Concrete Lorry Mixer	CNP044	3	109	114	2.38E+11
					Total SWL	118

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
6 Backfill Reinstate Roads	Generator	CNP101	1	100	100	1.00E+10
	Air Compressor	CNP001	1	100	100	1.00E+10
	Compactor, vibratory	CNP050	1	105	105	3.16E+10
	Lorry	CNP141	2	105	108	6.32E+10
	Poker Vibrator	CNP170	2	110	113	2.00E+11
	Concrete Lorry Mixer	CNP044	3	109	114	2.38E+11
					Total SWL	117

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Mitigation 2 - Use of Quiet Plant + Barrier

Section - Hung Hom to Signal Hill

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Preparation	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	116
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Service Diversions	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	116
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Sheet Piling for	Mobile Crane	CNP048	1	105	105	3.16E+10
Tunnel	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	108
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3A Sheet Piling	Pile Driver (Drop Hammer)	-	1	129	129	7.94E+12
(assess separately)					Total SWL	129
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Excavation for	Generator	CNP101	1	90	90	1.00E+09
Tunnel	Air Compressor	CNP001	1	90	90	1.00E+09
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	3	105	110	9.49E+10
					Total SWL	116
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Form and Construct	Generator	CNP101	1	90	90	1.00E+09
Tunnel	Air Compressor	CNP001	1	90	90	1.00E+09
	Mobile Crane	CNP048	1	105	105	3.16E+10
	Poker Vibrator	CNP170	4	100	106	4.00E+10
	Concrete Lorry Mixer	CNP044	3	104	109	7.54E+10
					Total SWL	112
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
6 Backfill Reinstate	Generator	CNP101	1	90	90	1.00E+09
Roads	Air Compressor	CNP001	1	90	90	1.00E+09
	Compactor, vibratory	CNP050	1	105	105	3.16E+10
	Lorry	CNP141	2	105	108	6.32E+10
	Poker Vibrator	CNP170	2	100	103	2.00E+10
	Concrete Lorry Mixer	CNP044	3	104	109	7.54E+10
					Total SWL	113

Section - Signal Hill Station						
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Preparation	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	116
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Service Diversions	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	116
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Excavation for Station	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Breaker, crawler-mounted	CNP028	2	115	118	6.32E+11
	Excavator	CNP081	2	100	103	2.00E+10
	Lorry	CNP141	3	105	110	9.49E+10
					Total SWL	119
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3A Sheet Piling for station const'n	Pile Driver (Drop Hammer)	-	1	129	129	7.94E+12
					Total SWL	129
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Form and Construct Tunnel	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Tower Crane	CNP049	1	95	95	3.16E+09
	Mobile Crane	CNP048	1	105	105	3.16E+10
	Poker Vibrator	CNP170	4	100	106	4.00E+10
	Concrete Lorry Mixer	CNP044	3	104	109	7.54E+10
					Total SWL	112
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Backfill Reinstate Roads/Signal Hill	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Compactor, vibratory	CNP050	1	105	105	3.16E+10
	Lorry	CNP141	2	105	108	6.32E+10
	Poker Vibrator	CNP170	2	100	103	2.00E+10
	Concrete Lorry Mixer	CNP044	3	104	109	7.54E+10
					Total SWL	113

Section - Overrun

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Preparation	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	116

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Service Diversions	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	2	105	108	6.32E+10
					Total SWL	116

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3A Diaphragm Wall for Tunnel	Concrete lorry mixer	CNP044	2	104	107	5.02E+10
	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Poker Vibrator	CNP170	2	100	103	2.00E+10
	Piling, reverse circulation drill	CNP166	2	90	93	2.00E+09
	Piling, bentonite filtering plant	CNP162	1	95	95	3.16E+09
	Water Pump, electric	CNP281	2	78	81	1.26E+08
					Total SWL	109

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3B Bored Tunnel	Air Compressor	CNP001	2	90	93	2.00E+09
	Air Extraction Unit*	-	2	90	93	2.00E+09
	Compressed Air Drills*	-	4	110	116	4.00E+11
	Excavator	CNP081	2	100	103	2.00E+10
	Lorry	CNP141	2	105	108	6.32E+10
	Mobile Crane	CNP048	1	105	105	3.16E+10
					Total SWL	117

* Remark: - Source Data based on BS5228 Part 1, Table 13 Ref. 5 (compressor and pneumatic drilling rig) for Compressed Air Drills and the SWL for Air Extraction Unit is assumed to be the same as Air Compressor.

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Excavation for Tunnel	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	3	105	110	9.49E+10
					Total SWL	116

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Form and Construct Tunnel	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Mobile Crane	CNP048	1	105	105	3.16E+10
	Poker Vibrator	CNP170	4	100	106	4.00E+10
	Concrete Lorry Mixer	CNP044	3	104	109	7.54E+10
					Total SWL	112

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
6 Backfill Reinstate Roads	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Compactor, vibratory	CNP050	1	105	105	3.16E+10
	Lorry	CNP141	2	105	108	6.32E+10
	Poker Vibrator	CNP170	2	100	103	2.00E+10
	Concrete Lorry Mixer	CNP044	3	104	109	7.54E+10
					Total SWL	113

C1435 - TST KCR Extension Construction Noise Calculations

Mitigation 3 - Use of Quiet Plant + Barrier + Reduction in no. of plant

Section - Hung Hom to Signal Hill

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Preparation	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	116
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Service Diversions	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	116
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Sheet Piling for Tunnel	Mobile Crane	CNP048	1	105	105	3.16E+10
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	108
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3A Sheet Piling (assess separately)	Pile Driver (Drop Hammer)	-	1	129	129	7.94E+12
					Total SWL	129
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Excavation for Tunnel	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	116
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Form and Construct Tunnel	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Mobile Crane	CNP048	1	105	105	3.16E+10
	Poker Vibrator	CNP170	1	100	100	1.00E+10
	Concrete Lorry Mixer	CNP044	1	104	104	2.51E+10
					Total SWL	108
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
6 Backfill Reinstate Roads	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Compactor, vibratory	CNP050	1	105	105	3.16E+10
	Lorry	CNP141	1	105	105	3.16E+10
	Poker Vibrator	CNP170	1	100	100	1.00E+10
	Concrete Lorry Mixer	CNP044	1	104	104	2.51E+10
					Total SWL	110

Section - Signal Hill Station						
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Preparation	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	116
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Service Diversions	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	116
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3 Excavation for Station	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	116
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3A Sheet Piling for station const'n	Pile Driver (Drop Hammer)	-	1	129	129	7.94E+12
					Total SWL	129
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Form and Construct Tunnel	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Tower Crane	CNP049	1	95	95	3.16E+09
	Mobile Crane	CNP048	1	105	105	3.16E+10
	Poker Vibrator	CNP170	1	100	100	1.00E+10
	Concrete Lorry Mixer	CNP044	1	104	104	2.51E+10
					Total SWL	109
Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Backfill Reinstate Roads/Signal Hill	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Compactor, vibratory	CNP050	1	105	105	3.16E+10
	Lorry	CNP141	1	105	105	3.16E+10
	Poker Vibrator	CNP170	1	100	100	1.00E+10
	Concrete Lorry Mixer	CNP044	1	104	104	2.51E+10
					Total SWL	110

Section - Overrun

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
1 Site Preparation	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	116

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
2 Service Diversions	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	116

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3A Diaphragm Wall for Tunnel	Concrete lorry mixer	CNP044	1	104	104	2.51E+10
	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Poker Vibrator	CNP170	1	100	100	1.00E+10
	Piling, reverse circulation drill	CNP166	1	90	90	1.00E+09
	Piling, bentonite filtering plant	CNP162	1	95	95	3.16E+09
	Water Pump, electric	CNP281	1	78	78	6.31E+07
					Total SWL	106

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
3B Bored Tunnel	Air Compressor	CNP001	1	90	90	1.00E+09
	Air Extraction Unit*	-	1	90	90	1.00E+09
	Compressed Air Drills*	-	1	110	110	1.00E+11
	Excavator	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
	Mobile Crane	CNP048	1	105	105	3.16E+10
					Total SWL	112

* Remark: - Source Data based on BS5228 Part 1, Table 13 Ref. 5 (compressor and pneumatic drilling rig) for Compressed Air Drills and the SWL for Air Extraction Unit is assumed to be the same as Air Compressor.

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
4 Excavation for Tunnel	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Breaker, crawler-mounted	CNP028	1	115	115	3.16E+11
	Excavator	CNP081	1	100	100	1.00E+10
	Lorry	CNP141	1	105	105	3.16E+10
					Total SWL	116

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
5 Form and Construct Tunnel	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Mobile Crane	CNP048	1	105	105	3.16E+10
	Poker Vibrator	CNP170	1	100	100	1.00E+10
	Concrete Lorry Mixer	CNP044	1	104	104	2.51E+10
					Total SWL	108

Activity	PME	TM ref	UNIT	SWL	sub-SWL	10^(SWL/10)
6 Backfill Reinstate Roads	Generator	CNP101	1	90	90	1.00E+09
	Air Compressor	CNP001	1	90	90	1.00E+09
	Compactor, vibratory	CNP050	1	105	105	3.16E+10
	Lorry	CNP141	1	105	105	3.16E+10
	Poker Vibrator	CNP170	1	100	100	1.00E+10
	Concrete Lorry Mixer	CNP044	1	104	104	2.51E+10
					Total SWL	110

Annex B

Responses to Government Comments

Response to Comments
Railway Development Study - Phase II (Part 1) KCR Extension from Hung Hom to Tsim Sha Tsui
Report MV4/KV4 - Draft Environmental Feasibility Studies

No.	Department	Reference	Comments	Consultants' Response
1	Water Authority/ Tse Kam Pong/ 4 December 1996	(8)inWWO/M2/ 3120/95 II TJ2	I refer to your above quoted letter and I have no comment on the captioned report from water supply point of view.	Noted.
2	TDD/S C Wong/ 12 December 1996	(48) in UA 4/5/44 Pt4	I refer to your letter dated 28.11.1996 enclosing a copy of the above report and would advise that I have no comment on it.	Noted.
3	HD/H Y Wong/ 3 December 1996	HNT 401/ST/45	I have no comment on the above report from Highways point of view.	Noted.
4	AFD/K T Chan/ 13 December 1996	(30) in AF DVL 01/116/3 III	Page 113, Paragraph 6.2: All quoted ordinances should be updated to the latest editions.	Noted, the text will be amended as necessary.
			Page 114, Paragraph 6.3.4: The woodland is said to have low ecological value to "other animal groups of special ecological interest". Is there any literature or site investigation to support such view? Also, what are the "Other animal groups of special ecological interest"? Please explain.	The observation was based on a site visit on 30 August 1996. The animal groups referred to are those protected by current legislation. The text will be amended accordingly.
			Page 114, Paragraph 6.4: In line 3, "However, since the woodland area affected is only small..." It should be specified clearly the meaning of "small", in terms of absolute area coverage or proportion relative to the woodland.	Approximately 0.02 ha would be lost, this represents about 8% of the woodland edge area, the woodland itself would not be affected.
			Page 116, Paragraph 6.6.1: With reference to the text in section 6.3, the woodland near Wong Uk in Shatin is the only assemblage of native trees along the alignment. It is possible that this woodland is an important nesting site of urban birds among the highly urbanized area covered by the alignment, although it may not be important to other animals as mentioned in section 6.3.4. Nonetheless, "...low ecological value..." in line 2 seems to be not appropriate in describing the overall ecological importance of the woodland.	As described in para 6.3.3, the field survey of 30 August 1996 observed only ubiquitous species, well adapted to disturbed conditions. Whilst the survey was undertaken during the breeding season, no nesting activities were observed.

No.	Department	Reference	Comments	Consultants' Response
			Page 55, Paragraph 6.2: All quoted ordinances should be updated to the latest editions.	Noted, the text will be amended as necessary.
5	Water Supplies Department/ Lau Chi Ming/ 4 December 1996	(9) in WWO/M 3/3120/95 II T/J(2)	I have no comment on your above report for the section of Tai Wai to Ma On Shan Link from waterworks points of view.	Noted.
6	KCDO/C P Yeung/ 13 December 1996	(19) in CKC 14/861 Pt.9	Please be informed that this District Office has no comment on the above mentioned subject.	Noted.
7	USD/Cecilia Poon/ 6 December 1996	(10) in 26/402/95 VI	I note that your studies have all based on the Middle Road railway option. However, you are reminded that a final decision is yet to be made by Urban Council after Highways Department have gathered further information and have completed consultation with the DB.	Noted.
8	CED/R P Martin/ 13 December 1996	GCP 1/10/472 IX	The Civil Engineering Department has no comments to make on the captioned Report MV4/KV4.	Noted.
9	YTMDO/Belinda Kwan/14 December 1996	YTMDO 27/17 Pt4	I refer to your letters and hereby submit nil returns.	Noted.
10	TDD/C H Cheng/ 18 December 1996	TDD 4/1/728 Pt3	I have no comment on the captioned Report and note that PM/K has separately replied to you direct.	Noted.
11	PlanD/Arissa Lai/19 December	NLC:rl: 94595/13.11, 13.12 MOS/1096	Table 3.3b - (i) It is noted that the distances from sensitive receivers presented here are not consistent with those listed in Table 2.3b. (ii) Please clarify why Wing On Plaza is not included.	The distances listed are those used in the assessment modelling; for air quality (*Table 2.3b*) the distance from the site boundary is used, for noise (*Table 3.3b*) the distance from a point near the centre of the site is used. The Shangri-La Hotel has been selected as the representative sensitive receiver for this section.

No.	Department	Reference	Comments	Consultants' Response
			Table 3.3c - (i) The Cultural Complex at Salisbury Road should be included. (ii) In addition to hotel use, N15 is also used for community and education proposes. (iii) After the Marine Police is relocated by the end of the year, the site (N16) is intended for cultural, artistic and museum uses.	The YMCA was selected as a representative receiver, the Cultural centre is more distant and better screened by intervening buildings. Provided that the noise levels at the YMCA are satisfactory, lower noise levels will be achieved at the Cultural Complex. Noted. Noted.
			Figure 3.3b - It appears there is a proposed vent within site N16. As the site has been declared as monument and zoned "CDA" on the draft Tsim Sha Tsui OZP No. S/K1/10, any development within the site should require the approval of the Antiquities Advisory Board and Town Planning Board. The construction of a vent at this location should be avoided as it will adversely affect the landscape and architectural setting of the site.	The precise location of the vent will be determined at the detailed design stage. If a suitable location for the vent cannot be identified in Canton Road, it could be relocated to Kowloon Park Drive.
			Tables 3.4e and f - Please clarify why Wing On Plaza is not included.	Please see previous comment.
			Section 7 - (i) Plans/drawing/Photomontages should be provided to illustrate the proposed layout. In the absence of illustration, it is not able to assess the degree of visual and landscape intrusion caused by the construction and the effects of the proposed mitigation measures. Particularly, the impact on Signal Hill during construction and operation stage should be assessed.	A model has been prepared to illustrate the effect on Signal Hill and this was shown to the Urban Council when they were asked to approve the development of the Middle Road alignment as opposed to the Salisbury Road alignment. The final form of the development will depend upon the requirements of the Urban Council as to how they would like the area of Signal Hill redeveloped. This will be subject to further study and detailing in later design stages.
			(ii) A comprehensive tree survey is required to assess the likely impacts of the proposed alignment.	Such a survey is outside the scope of this study, although a preliminary survey has already been undertaken. A full tree survey will be undertaken at the detailed design stage.
			(iii) Para 7.5 - More information concerning the proposed above ground structures, such as the design of the station entrance and vent building, should be provided in order to assess their visual and operational impacts on the urban environment.	See response to (i) above.

No.	Department	Reference	Comments	Consultants' Response
12	DLO, KLN West/Alan K L Lo/17 December 1996	(9) in LND KW PD 113 V	I refer to the captioned report and have no specific comment other than a typographic error at P.4 of the KCR Extension Report: the word 'land use' appeared in the 1st bullet should be replaced by 'landscape'.	Noted, the text will be amended as advised.
13	DSD/Chu Chin-keung/16 Dec 1996	( ) in MS 12/MOS/1/0	I refer to your letter dated 28.11.96 and have no comment on the report from drainage point of view.	Noted.
14	DPO, ST, TP & North/Anthony C Y Lee/14 Dec 1996	(17) in PD/ST 4/5/9	We are still of the view that hotel developments should be proposed at Sha Tin Tau station. In Sections 2 and 3 of the report, the Study has indicated that Sha Tin Tau is subject to adverse air quality and noise impacts. Should residential development be pursued at the site, a series of mitigation measures would have to be adopted. This would sterilize the design flexibility of otherwise a potential landmark commanding a panorama view of Shing Mun River.	Noted, however, the Study Team believes that a hotel development is unlikely to be commercially viable.
			Considerations should be given to the incorporation of the following as ASRs and NSRs into the Study: a) Carado Garden, Tai Wai; b) Private residential development ("R(A)") at STTL 394, Yuen Chau Kok; c) Siu Lek Yuen Road Playground; d) Proposed rezoning area in Shek Mun. Although the land use scheme for Shek Mun has yet to be agreed, the Consultants should test the feasibility of a worst case scenario. e) Station-related developments in Tai Wai, Sha Tin Tau and Lee On. f) Areas located to the north of the Chevalier Garden Station and the Heng On Station in Areas 77 and 90B.	The sensitive receivers at Hin Yeung House and Tin Sam Village are at a similar distance from the alignment, mitigation measures for these locations will also prove satisfactory at Carado Garden. The STTL 394 is the part constructed godown opposite the CIO station, this is included within the scope of ASR58. Siu Lek Yuen Road Playground has been identified as ASR 62, it is not considered to be a noise sensitive receiver. No information was available in time for inclusion in the EFS, should the area be rezoned, this would be best addressed in the EIA which will accompany the detailed design stage. As these cannot be completed until after the construction of the railway, they have only been considered in terms of operational impacts. These areas are not likely to be affected by adverse dust impacts. They have been assessed for operational noise impacts.
			The figure showing ASRs including A87 to A100 is missing.	Noted, the Figure will be included in the Final Report
15	DO (ST)/Harvey Lau/19 December 1996	(44) in ST 9/163 V	I refer to your above referenced letter dated 28 November 1996. I have no comment on the captioned report. I understand that you will consult STDB and the affected residents on the alignment and design of the railway in due course.	Noted.

No.	Department	Reference	Comments	Consultants' Response
16	HD (K)/ Ronny S P Ma/5 December 1996	(14) in KH 8/4/136 (A) VI	I refer to your letter ref. NLC:rl:94595/13.11,13.12MOS/1096 dated 28 November 1996 and the attached MV4/KV4 Report. My only comment is that the proposed temporary noise barriers have to be located within the site boundaries and have to be approved by the relevant Government departments/parties.	Noted.
17	HKHA/Portia Yiu/ 20 December 1996	HD(P) 1/2/4/1 V	Noise and Vibration - It is noted that noise enclosure of 500 m long has been recommended between Sha Tin Tau to Tai Wai Station to mitigate noise impact to the nearby NSRs, including those in Pok Hong and Sha Kok Estate. A combination of 3.5 m track side barriers and 1.5 m centerline barriers has been recommended to protect the NSRs between MOS to Lee On Station, including those in Kam Lung Court and Lee On Estate. It is also noted from Fig 3.5a-3.5i, that noise lèvel will be significantly screened by station structure. However, please advise whether the noise contributed by air-ventilation/air-conditioning systems have been taken into account in the assessment.	Noise emissions from the roof mounted air-conditioning system of the proposed trains were addressed in para 3.5.7. The extent of impacts depend on the directivity of the source and the geometry between the source and the NSR, which in turn rely on the layout of the station structure. Noise impacts are considered minimal at the nearby NSRs, however this will be further investigated during the detailed design stage.
			Since some of the affected facades are only 10-20 m away from the station and rail alignment, due considerations should be given to the design and proper landscaping and screening of the suggested noise mitigation measures to minimise their possible visual impact.	Noted, this has been addressed and is reported in the Landuse and Visual Impact Section.
			Landscape and Visual Impacts - It is suggested that apart from text description, the assessment should be supported by photomontages or perspective sketches to assist the reader to appreciate the possible landscape and visual impacts as well as the effectiveness of the suggested mitigation measures.	Photomontages are outside the scope of the current Study, a number of illustrations have been produced for the RDS Phase II (Part 1) Feasibility Study - Planning Report and these will be included in the EFS where appropriate.
			I would like to clarify that the proposed railway viaduct, as described under 7.4.13 would be constructed over (rather than adjacent to) the existing basketball courts, badminton courts, car park and landscape area of Pok Hong Estate. Due to insufficient headroom clearance from the viaduct, the affected ball courts may not be suitable for playing. It is important that the affected facilities will be reprovided satisfactorily within the estate. In this regard, my comments on the rail alignment via letter dated 30.11.96 of the same series are still valid.	The viaduct height has been designed to provide sufficient clearance for the continued use of the basketball courts, the other facilities will be reprovisioned.

No.	Department	Reference	Comments	Consultants' Response
18	EPD/Alan Au/ 2 January 1997	(5) in An(6) to EP1/G/72 XI	RDS Phase II Tai Wai to Ma On Shan: Air Quality - Figure 2.3b - Please include the sports ground and the other schools adjacent to the Sha Tin Government Secondary School (A26) as ASRs.	Representative receivers have been selected for each section of the alignment, A24 and A26 have been identified as suitable for the north bank of the Shing Mun River.
			S.2.4.6 - Unless there is confirmation from relevant parties that the stations and alignment will not be constructed concurrently, the report should determine the cumulative dust impact on the air sensitive receivers from both the construction of the alignment and the station. "TPS impacts" in the 3rd line should read "TSP impacts".	Impacts from station and alignment construction have been considered together and the results are reported. *Tables 2.4c* and *2.4d* will be amended to include the cumulative levels.
			S.2.4.8 - Since there is no hourly AQO for TSP, the report should clarify whether the 24-hour cumulative TSP concentrations (with background concentration included) at the air sensitive receivers would exceed the respective AQO.	The text will be amended, as shown below, to explain how the effective mitigation of 1-hour TSP levels to meet the recommended level will be more than sufficient to ensure that 24-hour TPS levels are controlled to within the AQO. "The 1-hour levels shown in *Table 2.4c* represent the worst case impact, assuming that the wind is blowing from the worksite directly towards the receiver for the entire hour at the wind speed most effective for TSP transport. The 24-hour levels are based on the 1-hour predictions, factored to account for the construction works taking place for not more than 12 hours out of the 24 hour period (ie 50%). Unless the background level is already very high, the predicted levels will have a similar relationship to the 24-hour AQO (260 $\mu g\ m^{-3}$) as to the 1-hour limit (500 $\mu g\ m^{-3}$). However, during the whole day, the wind speed and direction will vary considerably and the actual 24-hour level will be noticably lower than the corresponding 1-hour value. Therefore, the effective mitigation of the predicted 1-hour levels to within the recommended limit will also control the 24-hour levels to within the AQO."
			S.2.4.25 and S.2.4.27 - Please clarify whether the mitigation measure referred to in "Section 2.4.5:" should be in S.2.4.30 instead. Please amend the text as appropriate.	Detailed mitigation measures are described in *Sections 2.4.30-33*, any other references should be to these *Sections*.

No.	Department	Reference	Comments	Consultants' Response
			S.2.4.31 - Please clarify the control efficiencies assumed and the mitigation measures proposed, in the calculation of the mitigated dust levels.	Based on AP-42 (section 11.2.4.4 of 4th edition), a control efficiency of 50% of dust emissions from heavy construction can be obtained through an effective watering program. This estimate was used to assess mitigated dust level from handling of dusty material and unpaved haul roads. In addition, a reduction of travelling speed from 20 to 10 kph can also assist in reducing the emissions from haul roads by a further 50% since the emission factor is proportional to vehicular speed.
			S.2.5.6 and S.2.5.7 - In addition to traffic emissions, please address impacts from other aerial emission sources in the vicinity of the proposed development.	As noted in Section 2.3, the main source of air quality impacts in the area is from vehicle exhaust fumes, other sources are considered to be of negligible impact.
			<u>Water quality</u> - S.4.3 Please include Shatin Seawater intake as one of the Water Sensitive Receivers which may be potentially affected by the MOS Rail construction. In addition, there is no mention in the report of any cooling water discharge from the proposed MOS Rail development. Depending on the quantity and the temperature of cooling water, type of biocide/chemical used in the intake water and location of the system, cooling water discharge could have major potential impacts on the surrounding waters during operation. Thus please confirm whether there will be any cooling water discharge. If yes, please carry out assessment accordingly.	Noted. Section 4.3.4 has been amended accordingly. Decisions on the requirements (if any) for cooling water will not be made until the detailed design stage. It is not, therefore, possible to assess potential impacts at this stage.
			<u>RDS Phase II KCR Extension: Air quality</u> - S.2.4.10, 2.4.11 - Since there is no hourly AQO for TSP, the report should clarify whether the 24-hour cumulative TSP concentrations (with background concentration included) at the air sensitive receivers would exceed the respective AQO.	Please see previous response.
			S.2.4.18, 2.4.22, 2.4.26 - Unless there is confirmation from relevant parties that the station and alignment will not be constructed concurrently, the report should determine the cumulative dust impact on the air sensitive receivers from both the construction of the alignment and the station.	Please see previous response.
			S.2.4.26 - Please clarify the control efficiencies assumed and the mitigation measure proposed, in the calculation of the mitigated dust levels.	Please see previous response.

No.	Department	Reference	Comments	Consultants' Response
			Water quality - S.4.2.2 - It should be Victoria Harbour phase II WCZ.	Noted. The text will be amended as advised.
			S.4.2.3 - Please add "which may adversely affect aquatic communities," at the end of the paragraph.	Noted. The text will be amended as advised.
			S.4.2.4 - Please change "DO levels should not be less than 2 mg l^{-1} at the sea bottom" to "DO levels should not be less than 2 mg l^{-1} within 2 m of the seabed."	Noted. The text will be amended as advised.
			S.4.2.6 - The WSD Standards of seawater for flushing for SS should be <10 m gl^{-1} and DO should be > 2 m gl^{-1}.	Noted. The text will be amended as advised.
			Please note that our comments above on cooling water for Tai Wai to Ma On Shan section are also valid for the KCRC extension to Tsim Sha Tsui.	Please see previous comment.
19	TD/K K Sin/ 12 December 1996	() in NR 182/140-18	I have no comment on the captioned report.	Noted.
20	HyD/Lam Yat-ming/28 Nov 1996	() in RD 6/3/3 pt.10	<u>Report MV4</u> In the assessment of environmental impacts, consideration should be given to the assumption that the MOS Rail will be expanded to 8 car trains in the future. Para. 9.3.7, Pg 149 - Preliminary appraisal of the impact caused by vibration from the operational railway based on experience from other similar systems shall be given.	 The consideration of the effects of 8 car trains is outside the scope of this study. A second sentence will be inserted, "However, vibration from the operational railway can be readily controlled by suitable viaduct and track form design."
			<u>Report KV4</u> Figs 2.3 a & b - As part of the Wing On Plaza will be used as the Contractor's works area during the construction of the KCR Extension, therefore there should be more Air Sensitive Receivers placed at the New World Hotel which is located on the opposite side of Salisbury Road.	 The assessment methodology described in S2.4.10 assumes a worst case where the wind blows directly towards the receiver. At this stage, therefore, no additional ASR is required. However, when historical met data is used at the detailed design stage the additional site at New World Hotel should be included.
			Figs 2.3 a & b - The locations of the Air Sensitive Receiver AS8 indicated on Fig 2.3a and fig 2.3b are different. Please clarity.	Noted, figure 2.3b will be revised accordingly.

No.	Department	Reference	Comments	Consultants' Response
			Para. 2.4, Pg 8 - The main activities which would generate dust impacts may also included piling works at the proposed ETS station if so required.	Dust generation from piling works is not significant when compared to the construction activities listed in S2.4.2.
			Para. 3.3.8, Pg 21 - What will be the effect of train vibration on the surrounding buildings in particular the existing UC facilities? You should explain further on the possible track forms that can be adopted and how proficient the vibration can be controlled. This is important as to assure USD that impacts on cultural activities can be minimized.	Vibration measurements taken on the existing MTR Island Line at Tai Koo Shing, for the assessment of impacts on proposed developments above the new Airport Railway, have indicated that tangible (feelable) vibration is unlikely to exceed the acceptable vibration limits defined by the *Guidance to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz), BS6472: 1992.* Vibration re-radiated as noise (perceived as a rumble) within adjacent structures may exceed acceptable limits, defined as NR35 and NR45 for residential buildings and hotels respectively. However, experience on the existing lines shows that with appropriate mitigation in the form of floating or isolated track all vibration related impacts can be controlled to acceptable levels. The requirement for vibration control measures will be determined at the detailed design stage.
			Para. 3.4.17, Pg 25 - How would it affect the overall construction programme of the KCR Extension if restricted hours working is required?	The current programme does not require restricted hours working. If restricted hours working were possible, the overall construction programme could be reduced.
			Para. 9.3.6, Pg 77 - As we commented on Para. 3.3.8, USD requires more detailed information on how various UC facilities will be affected by the noise and vibration of the railway to confirm the preference of the Middle Road Option, therefore it is necessary that some preliminary appraisal of the impacts caused by train noise and vibration for the two alignment options shall be provided.	Please see previous comment; however, it should be noted that existing underground railways, in Hong Kong and elsewhere, have dealt effectively with this problem through the use of suitable track form designs.
21	RSD/Doris Chow/ 17 January 1997	(30) in RSD 1/HQ 715/95(5) VII	We have the following comments on the Draft Environmental Feasibility Studies Report:- (A) Air Quality (i) Since the proposed track alignment will affect our Kong Pui Street Garden, air sensitive receiver should be set up at this Garden to monitor the air quality thereat.	 A series of representative receivers have been tentatively identified for EM&A purposes. The final selection of the most appropriate monitoring locations will be part of the detailed EIA process during the detailed design phase of the study.

No.	Department	Reference	Comments	Consultants' Response
			(ii) The ground level 1-hour TSP Concentrations (ug m^{-3}) at the affected RC venues are predicted in the following table. (See original fax for details) Although the dust impacts from either alignment construction or station construction at the above venues are below the 500ug m^{-3} guideline, we consider that a cumulative figure will be more realistic is assessing the dust impacts as the construction of the station and alignment will most likely be in progress simultaneously. Should my observation be correct, special dust suppression/environmental control measures should be considered to reduce the dust suppression/environmental control measures should be considered to reduce the dust impacts on our RC venues especially those active recreational facilities such as Hin Tin Playground, Hin Tin Public Swimming Pool, Tsang Tai Uk Recreation Ground and Sha Tin Wai Playground. Additional mitigation plans should also be considered to further suppress the dust level at Hin Tin Public Swimming Pool, or otherwise, the suspended particles may adversely affect the pool water quality as well as the filtration plants. Please also note that we have a planning project of Hin Tin Public Swimming Pool Phase II. The project site is located right next to the existing pool complex which is now temporarily used as a gateball court. Construction work is proposed to start in 1999/2000 for completion in 2000/2001. The Environmental Feasibility Studies should take into account of this Phase II development.	Your Table showing the unmitigated 1-hour TSP levels have included the background level twice, resulting in an artificially high figure by 73 $\mu g\ m^{-3}$. The mitigated cumulative 1-hour TSP levels, shown in Table 2,4d of the EFS, range from 25-50% of the recommended level, including the background level of 73 $\mu g\ m^{-3}$. It is not, therefore, considered necessary to provide further mitigation, particularly as these impacts are noted in S2.4.8 to be worst case predictions and unlikely to actually occur.

No.	Department	Reference	Comments	Consultants' Response
			(B) Noise Control In view of the close proximity to the track alignment and/or stations, NSRs should be set up at the following RC venues so that the noise impacts during the construction and operational phases of the proposed development can be assessed and appropriate mitigative device such as noise barriers and/or noise enclosure should be considered:- Hin Tin Playground; Hin Tin Public Swimming Pool; Tai Wai Playground; Tsang Tai Uk Recreation Ground; Sha Tin Wai Playground; Kong Pui Street Garden, and Siu Lek Yuen Road Playground	The protection of all sensitive receivers along the alignment has been addressed. Representative receivers have been identified along the entire alignment and appropriate mitigation measures put forward for control of construction and operational noise. The identification of receivers and the assessment of impacts will be thoroughly reviewed at the detailed design stage.
			(C) Landscape and Visual Impacts It is noted in the report that groups of mature/semi-mature trees especially those at Sha Kok Street, Sha Tin Tau, Tsang Tai Uk Recreation Ground and Sha Tin Wai Road would be affected by the project. The loss of these trees would represent medium to high level landscape impact. As such, consideration should be made to preserve these trees. Funds should be reserved in the project vote to transplant those with high amenity value. No roadside trees should be felled without prior approval from RSD. Re-landscape compensatory proposal should be incorporated into the project.	The EFS has identified preservation, transplanting and replanting as suitable mitigation measures. However, the consideration of financial provision or compensatory planting is not within the scope of the EFS.

No.	Department	Reference	Comments	Consultants' Response
22	EPD/Alan Au/ 20 January 1997	(7) in An(6) to EP1/G/72 XII	RDS Phase II Tai Wai to Ma On Shan S.1.1 The report should stress that the proposed railway is from Ma On Shan to Tai Wai only. Hin Seng Station is only an option that may not be implemented, and no hazard assessment has been carried out for Hin Keng Station at this state, in view of WSD's hazard assessment to be carried out for their 8 Water Treatment Works including Shatin Water Treatment Works. We would like to reiterate again that the Hin Keng Station is very unlikely to comply with the Government Risk Guidelines given its proximity to the Shatin Water Treatment Works. We are very concerned that illustration of Hin Keng Station in figures 2.3a, 3.3a, 3.5a may confuse readers that Hin Keng Station is acceptable and will be built. These figures should be amended to show the optional nature of Hin Keng Station.	Section 1.1 will be amended to include "The ongoing assessments have been assumed in the current report and it is noted that due to the proximity of Shatin Water Treatment Works, the area has a high societal risk and a hazard assessment must be undertaken before any development can be considered. All references to Hin Keng Station must be considered provisional at this stage." Section 9.2 will also include an additional Section 9.2.5: "Should the option to develop a station at Hin Keng be taken up at the detailed design stage, a hazard assessment of the impact of Shatin Water Treatment Works will be required before the development can be considered." All references to Hin Keng Station will be amended to "...the provisional Hin Keng Station..."
23	USDP/Cecilia Poon/ 22 January 1997	(38) in USDP 55/402/95	I note that among the UC facilities in TST area, only Wing On Plaza Garden, Signal Hill Garden and Hong Kong Cultural Centre have been classified as <u>air</u> sensitive receivers in section 2 of the Report. Even these are, however, not included in the list of <u>noise</u> sensitive receivers under study in the Report. Actually, the very noise sensitive UC facilities including the Hong Kong Coliseum and Hong Kong Cultural Centre Complex including the Salisbury Garden, Space Museum, Museum of Art and Hong Kong Cultural Centre which lie in close proximity to the railway alignment or overrun tunnel have <u>not</u> been included in the list of noise or air sensitive receivers contained in the caption Report. Similarly, the TST Promenade and the Middle Road Children's Playground are not included in the report.	The Hong Kong Planning Standards and Guidelines, which is the basis for the identification of sensitive receivers, only identifies areas for active recreational use as falling within this category. However, your concerns regarding the UC facilities will be addressed, since the recommended mitigation measures will provide an equal measure of protection along the entire alignment. The Coliseum would be classified as an NSR, however, as the construction programme for the KCR Extension involves only daytime working, adverse impacts during evening performances will not occur. The Study Team have advised that, should construction works interfere with daytime events or practices, the works would be reduced in scope to a satisfactory level. Since the Hong Kong Cultural Centre is a considerable distance form the proposed alignment and a number of intervening ASRs and NSRs have been identified, the recommended mitigation measures for these other receivers will provide a sufficient level of protection to more distant receivers.

No.	Department	Reference	Comments	Consultants' Response
				The Promenade along the northern section of Salisbury Road and the Middle Road Children's Playground will be utilised for construction sites, and public access will be restricted for safety reasons.
			As I have pointed out in the First Meeting of the Environemntal Study Management Group, the above-mentioned UC facilities are mostly prestigious and unieque facilities which serve both local and overseas visitiors. Thus the well-bing of these facilities should be maintained at a very high standard both at the construction stage and operational stage of the railwya. In many previous correspondences, I have reiterated the above points.	The value of the UC facilities is recognised by the Study Team and they have been given the same consideration as all other potential sensitive recievers and will be effectively portected by the same mitigation measures.
24	EPD/Alan Au/ 21 January 1997	(9) in An(6) to EP1/G/72 XII	Fig. 2.3b - Choice of ASRs Please elaborate and justify why only A24 & A26 are considered "suitable for the north bank of the Shing Mun River" and why the impact on the sports ground and the other schools adjacent to the Sha Tin Government Secondary School, which are also air-sensitive uses, are not assessed.	For the Environmental Feasibility Study, a series of representative ASRs have been identified. It is not, therefore, considered necessary to model all identified ASRs.
			S2.4.6 Your response stated that impacts from station and alignment construction have been considered together. Please pass the assessment results for our comments and in particular, clarify whether the dust level at the ASRs will all comply with the relevant guideline and HKAQO. Also, from the model input/output files submitted in your letter ref C1435\50086\CONSULT dated 11.12.1996, we note that, in assessing the dust impact from construction of the alignment, you had considered only one segment of the alignment (and not all the segments between any two stations). Please justify why this is so and revise the assessment as necessary.	The *Tables* have been revised to include the cumulative impacts of both sation and alignment construction, it is clear from these that the proposed mitigation measures are sufficient to control impacts to within the established criteria. Pages 18-21 and 26-30 are enclosed. Worst case dust impacts are modelled assuming that the wind is blowing directly from the source to the receiver and that dust is raised along the entire 120 m segment. As the same wind conditions would apply to adjacent segments, dust from adjacent segments would not be blown towards the specific ASR. The above response is also applicable to Report KV4.

No.	Department	Reference	Comments	Consultants' Response
			S2.5.6 & 2.5.7 Please clarify which part of section 2.3 states that impacts of the ohter sources are of negligible impacts and hence only traffic emission was considered in assessing impact on the proposed development. S.2.4.18, 2.4.22 &2.4.26 The above comments on S2.4.6 of Report MV4 also apply.	Section 2.3.2 notes that the main source of polluntants is vehicle exhaust fumes and notes that the only industrial uses are in the Shek Mun Industrial Area, Sections 2.3.11 and 2.3.12 also make the same observation.
25	EPD/Peter Y Lee	Annex (6) to EP1/G/72	As stated in the SMG meeting on 7.3.1997, we have no objection to your proposal of using SoundPLAN CRN'95 model for the prediction of train noise levels for the MOS Rail Link EFS provided that the agreed methods/corrections (such as source strength on aerial structure, limits of barrier attenuation, etc.) are properly incorporated into the model. We have also in-principle endorsed the amended report. However, there are the following comments which should be incorporated into the final report. (1) Table 3.4a NSR NC in this table should be NSR NB as indicated in other tables and figures. NSR N62 should be from Heng On to Ma On Shan as indicated in figure 3.5q. NSRs N70, N73 and N75 should be from Ma On Shan to Lee On as indicated in Figure 3.5r.	The NSR reference will be amended as advised. The NSR groupings are based on the first source of impact travelling from west to east and are, therefore, correct.
			(2) Para. 3.5.31 In the last bullet , the cantilever barriers should be *absorptive* cantilever barriers with acoustic lining on the inner face of the lower portion, similar to the absorptive barrier design in the second bullet. As agreed earlier prior to acceptance of your model, the maximum noise attenuations are 15 and 12 dB(A) for absorptive barrier and non-absorptive barrier, respectively. In checking your calculation of attenuation of the cantilever barriers, 15 dB(A) is assumed. Thus, the cantilever barriers need to be absorptive in order to achieve the assumed attenuation.	Noted, the text will be amended as advised.

No.	Department	Reference	Comments	Consultants' Response
			(3) Table 3.5b NSR N62 should be from Heung On to Ma On Shan as indicated in Figure 3.5q. NSRs N70, N73 and N75 should be from Ma On Shan to Lee On as indicated in Figure 3.5r.	The NSR groupings are based on the first source of impact travelling from west to east and are, therefore, correct.
			(4) Table 3.5c In the title of the table, insert the word "Absorptive" before "Barriers". NSR N62 should be from Heng On to Ma On Shan as indicated in Figure 3.5q. NSRs N70, N73 and N75 should be from Ma On Shan to Lee On as indicated in Figure 3.5r.	The text will be amended as advised. The NSR groupings are based on the first source of impact travelling from west to east and are, therefore, correct.
			(5) Para. 3.5.34 Insert the word "absorptive" before "barriers" in the first line.	The text will be amended as advised.
			(6) Para. 3.5.35 Insert the word "absorptive" before "barriers" in the first line.	The text will be amended as advised.
			(7) Table 3.5d In the title of the table, insert the word "Absorptive" before "Barriers". NSRs N70, N73 and N75 should be from Ma On Shan to Lee On as indicated in Figure 3.5r.	The text will be amended as advised. The NSR groupings are based on the first source of impact travelling from west to east and are, therefore, correct.
			(8) Para. 3.5.36 Insert the word "absorptive" before "barriers" in the first line and the fourth line.	The text will be amended as advised.
			(9) Table 3.5e In the title, insert the word "Absorptive" before "Barriers" in the second line. NSRs N70, N73 and N75 should be from Ma On Shan to Lee On as indicated in Figure 3.5r.	The text will be amended as advised. The NSR groupings are based on the first source of impact travelling from west to east and are, therefore, correct.
			(10) Table 3.5f In the title, insert the word "Absorptive" before "Barriers" in both lines. NSRs N70, N73 and N75 should be from Ma On Shan to Lee On as indicated in Figure 3.5r.	The text will be amended as advised. The NSR groupings are based on the first source of impact travelling from west to east and are, therefore, correct.
			(11) Table 3.5g In the title, insert the word "Absorptive" before "Barriers" in both lines. NSRs N70, N73 and N75 should be from Ma On Shan to Lee On as indicated in Figure 3.5r.	The text will be amended as advised. The NSR groupings are based on the first source of impact travelling from west to east and are, therefore, correct.

No.	Department	Reference	Comments	Consultants' Response
			(12) Para. 3.5.39 Insert the word "absorptive" before "barriers" in the second and third lines.	The text will be amended as advised.
			(13) Table 3.5h In the title, Insert the word "absorptive" before "barriers" in both lines.	The text will be amended as advised.
			(14) Para. 3.5.40 and the heading above Insert the word "Absorptive" before "Cantilever".	The text will be amended as advised.
			(15) Table 3.5i Insert the word "Absorptive" before "Cantilever".	The text will be amended as advised.
			(16) Table 3.5j Location Chainage 9000-9400 with 2.5m trackside barriers (bottom third row of table) should be from Heng On to Ma On Shan as shown in Figure 3.5q.	The NSR groupings are based on the first source of impact travelling from west to east and are, therefore, correct.
			(17) Figure 3.5r Should the noise enclosure be extended to the Ma On Shan Station? If not, please provide the types of noise mitigation measures required for NSRs N70, N71 and N73.	The report has been amended to include 3.5 m trackside and 1.5 m centerline barriers on this section.
			(18) Traffic Noise Assessment on Station Related Developments (Para. 3.5.42 to 3.5.57 in the original EFS) We have no in-principle objection to the method and results on the traffic noise assessment for the three proposed station related developments at Tai Wai, Sha Tin Tau and Lee On.	Noted.

Response to Comments
Railway Development Study - Phase II (Part 1) Feasibility Study for the Tai Wai to Ma On Shan Rail Link and the KCR Extension from Hung Hom to Tsim Sha Tsui Reports MV4/KV4 Environmental Feasibility Study - Executive Study

No.	Department	Reference	Comments	Consultants' Response
1	DSD/Chu Chin-keung 28 February 1997	MS 8/CE1295	I refer to your letter dated 19.2.97 and have no comment on the executive summaries from drainage point of view.	Noted.
2	PD/KDPO/Anissa Lai 3 March 1997	K-R/TT/116 B XI	I refer to your above quoted letter dated 20.2.97 addressed to EPD copied to this office among others. I have the following comments on the KCR Extension draft Executive Summary and the draft minutes to the 2nd SMG meeting. a) Draft minute -Para 17 - Suggest to add the sentence "The meeting agreed to make the recommendation that a comprehensive tree survey should be included in the detailed design stage of the proposed KCR Extension." after the 1st sentence.	The sentence has been added at the end of para 19.
			b) Draft Executive Summary - Para 2.7.1, 2nd para i) Suggest to add the sentence "As such, it is recommended a comprehensive tree survey should be included in the detailed design stage." after the 2nd sentence. ii) Suggest to add "and Wing On Plaza Garden" after "Signal Hill" at line 6. iii) Impact on the Tsim Sha Tsui East Promenade should also be included.	The text has been amended as advised. The text has been amended as advised. The text has been amended.
3	PD/KDPO/Anissa Lai 5 March 1997	K-R/TT/116 B XI	I refer to your above quoted letter dated 25.2 97 and have the following comment on above amendments to text: As the SMG meeting held on 31.1.97 has agreed to make the recommendation that a comprehensive tree survey should be included in the detailed design stage of the proposed KCR Extension, it should be incorporated into the EFS Report.	The text has been amended accordingly.

No.	Department	Reference	Comments	Consultants' Response
4	USD/Cecilia Poon/ 3 March 1997	(43) in USDP 26/402/95 VII	I am very concerned about the comment in para. 2.3.2 of your KV4 Environmental Feasibility Study - Executive Summary the "Unmitigated noise impacts from the station and alignment construction are predicted to exceed the recommended voluntary daytime noise limits at all of the sensitive receivers during one or more stages of the works".	The purpose of the EFS is to predict unmitigated impacts and then, if adverse impacts are identified, to set out recommendations for appropriate mitigation measures to control the impacts to within established criteria. Such measures are referred to in the following sentence of S.2.3.2 and detailed in S.2.3.3.
			I have pointed out in my previous letter dated 22.1.97 ref. (38) in USD 55/402/95, many of the prestigious UC facilities lie in rather close proximity to the railway alignment and station, such as the Hong Kong cultural Centre, Space Museum, the Museum of Art and the Hong Kong Coliseum etc. You should ensure that the daily operation of these UC facilities concerned would not be inadvertently affected.	The EFS has considered sensitive receivers closer to the works than the UC facilities. If the closer receivers are effectively protected, then more distant receivers, including the UC facilities will also be protected. This work will also be revisited at the detailed design stage when more detailed information will be available for the assessment.
5	TDD/KDO/S C Wong 3 March 1997	UA 4/5/44	Since the proposed KCR Extension will be underground and its environmental impacts are assessed as minimal, I have no comment on the draft Executive Summaries.	Noted.
6	ASD/K T Chan/ 3 March 1997	(22) in AF DVL 01/116/3 IV	There is no comment from this department on the Draft Executive Summaries of the MOS Rail and KCR Extension, and Response to Comments to the draft minutes to the 2nd Study Management Group Meeting (31/1/97).	Noted.
7	EPD/C K Yuen/ 3 March 1997	(45) in A(2)EP20/H1/01 VI	I have consulted Mr John Wrigley, the following changes on the EFS text are proposed: Para 1.1.3 - Please replace the last two paragraphs "These have both ... at this stage." by "These have both been assumed in the current report, however, it should be noted that due to the proximity of chlorine store at Shatin Water Treatment Works the local Hin Keng area is considered to have a high societal risk and a hazard assessment must be undertaken before any further development can be considered. As a hazard assessment is outside the scope of the present Study, all references to the feasibility of Hin Keng Station must be considered provisional at this stage."	The text has been amended as advised.
			Para 9.1.3 - Please replace "for the potential impacts from" by "of risks associated with the chlorine store at the". Para 9.2.5 - Please insert "to the satisfaction of the Director of Environmental Protection" after "a hazard assessment".	The text has been amended as advised. The text has been amended as advised.

No.	Department	Reference	Comments	Consultants' Response
8	LND/KW/Alan K L Lo/26 February 1997	(17) in LND KW PD/113 VI	I have no comment on the captioned issue.	Noted.
9	Highways Dept/ Tong Wai Man/ 3 March 1997	RD 6/3/6	1) Draft Tai Wai to Ma On Shan EFS - Executive Summary a) 1st line, 4th para. in Section 1.1 - "MVA/Maunsell at al,..." should read "MVA/Maunsell et al,..."	The text has been amended as advised.
			b) 4th and 5th lines, 5th para. in Section 1.1 - "...the railway extension." should read "...the railway."	The text has been amended as advised.
			c) 2nd line, 2nd para. Section 5.2 - DEIA appears first time in the text and should be in full.	The text has been amended as advised.
			2) Draft KCR Extension EFS - Executive Summary a) 2nd para. in Section 2.1 - The construction work of other projects which will likely be implemented at the same period and cause cumulative effect that is of great concern shall be specified. It is important to ensure that mitigation measures can be undertaken in a coordinated manner.	Reference has been included to the Salisbury Road Underpass.
			b) 2nd para. in Section 4.2 - DEIA appears first time in the text and should be in full.	The text has been amended as advised.
			3) Chinese version of the EFS Executive Summary should be prepared.	The Chinese version cannot be prepared until the English version has been agreed.
			4) Draft 2nd Study Management Group meeting minutes a) Item 3 - The second sentence should read "He also noted that the possible extension of the MOS Rail to Hin Keng was not to be covered in the Study as it was not a firm proposal at this time."	The minutes have been amended as advised.
			b) Item 9 - At the end of this paragraph, please add "ERM advised that the consideration of the effects of 8-car trains was outside the scope of this study. ERM believed that operation of 8-car train should not raise insurmountable environmental problems but that mitigation measures had to be modified or extended to cater for a higher level of noise."	The text has been amended as advised. Please note, however, that the mitigation measures *may need* to be modified.
			c) Item 13 - "C Y Chan (HyD)" should read "W M Tong (CE/R)".	The minutes have been amended as advised.

No.	Department	Reference	Comments	Consultants' Response
			d) Item 22 - The 1st sentence should read "W M Tong (CE/R) advised that the Consultants' proposed implementation programme for both railways envisaged a 48 month construction period with completion scheduled for mid 2003.	The minutes have been amended as advised.
			e) Item 23 - i) 4th line, "CE/HyD" should read "HyD (CE/R)". ii) Please add the following post meeting note: "CE/R had confirmed that the EFS be submitted to ACE EIA Subcommittee for their discussion on 7.4.97."	The minutes have been amended as advised. The minutes have been amended as advised.
10	EPD/Peter Y Lee/ 4 March 1997	Annex(6) to EP1/G/72	I refer to your fax of 4.3.97 and the amended noise impact assessment report for the MOS Rail Link. After reviewing the amended noise assessment report, our comments are: 1) Page 72 of the amended report is missing.	Page 72 was not amended and not, therefore, reissued.
			2) A comparison of your amended Table 3.5a with the same table in the original report shows that the increases of unmitigated train noise levels on elevated concrete viaduct are typically in the range of +1 to +2 dB(A). The only exception is at NSR N40 (Pamela Youde Child Assessment Centre) where there is a +7 dB(A) increase in the amended table. Obviously, there are inconsistencies in your model and analyses. As we have agreed before, the source level of MOS trains on elevated viaduct is 5 dB(A) higher than the at-grade source level. With the at-grade Lmax source level of 83 dB(A) including corrugation, the Lmax source level on elevated structure would be 88 dB(A). In your original report, the source level on elevated viaduct was assumed to be +1 dB(A) higher than the at-grade level or 84 dB(A). Therefore, when you insert the new source level into your model and re-calculate, you would expect the LAeq, as given in the table, to increase by exactly 4 dB(A) for NSRs at elevated viaduct sections unless there are problems in the algorithm or the mode.	A data entry problem with the SoundPLAN model was identified and resolved prior to the re-running of the model. This has resulted in somewhat lower noise levels than those originally predicted which is why an increase of 5 dB(A) is not noted. We are preparing additional checking data for your approval.

No.	Department	Reference	Comments	Consultants' Response
			3) Because of the problem identified in para. 2, we would not comment on the report any further. The reason is that if the source levels are incorrectly applied, it would affect the rest of the calculations and the recommended noise mitigation measures given in Tables 3.5b to 3.5i. In this respect, we would seek your immediate response because of the tight schedule.	Please see the previous response.
11	EPD/T S So/ 4 March 1997	(13) in EP 1/F/72 Annex(6) XIII	In addition to the letter (45) in A(2)EP20/H1/01 VI of 3 March 1997, we provide the following comments on draft Executive Summary:	
			Water Quality (a) MV4: Please revise Section 4.4 to "Stormwater runoff related impacts from stations and depot should be effectively controlled through the design and implementation of appropriate drainage system(s) including silt traps and oil interceptors prior to discharge to stormwater drains. Wastewater generated by the detergent wash plant in the proposed depot will be collected and transferred to a dedicated on-site treatment plant for treatment. The treated effluents from the on-site treatment plant and any other wastewater generated from the depot and stations will have to meet the criteria specified in the TM, prior to discharge to sewers. With the implementation of all the proposed mitigation measures, all future potential water quality impacts arising from the operation of the proposed rail development will be well within all the established standards and guidelines under the WPCO."	The text has been amended as advised.
			Air Quality (b) MV4: Section 3.1, last para., page 9: "Table 2.1a" should read "Table 3.1a".	The text has been amended as advised.
			Section 3.2.1, page 9: The description of the receivers being affected at the various sections of the rail should make reference to the worst case scenario, i.e. the cumulative station and alignment level predicted (e.g. the predicted cumulative level at Sha Tin playground has exceeded the hourly limit contrary to what was described in the draft Executive Summary). The consultants should review the description and amend the texts accordingly.	The description of affected receivers in both the EFS and the Executive Summary have been amended in the light of the cumulative impact totals.

No.	Department	Reference	Comments	Consultants' Response
			Section 5.1, page 19: For clarity, please amend the first sentence as "No adverse environmental impacts,...".	The text has been amended as "No adverse unmitigated environmental...."
			(c) KV4: Section 4.1, page 13: For clarity, please amend the first sentence as "No adverse environmental impacts, ...".	The text has been amended as "No adverse unmitigated environmental...."
			Noise (d) Noise Impacts During Construction (Section 3.3): We have no in-principle objection to the summaries presented in this section on construction noise impact.	Noted.
			(e) The summaries presented in this section on operational noise impact are based on information in the draft EFS report (MV4/KV4) dated November 1996. The draft EFS report have not been accepted by us because a number of technical issues were not yet agreed. As such, we could not accept this section, and this section should be amended so as to be consistent with the final EFS report to be available after the SMG meeting on 7 March 1997.	Table 3.3a has been revised to reflect the changes to the operational noise predictions, no changes to the text of the Executive Summary should be necessary.
			2) As certain amendments have been proposed to the draft EFS report which will be discussed at the SMG meeting on 7 March, please check and refine the Executive Summaries in order to ensure consistency with the information in the final EFS report once the EFS report is available.	Please see previous response.
			3) After incorporating this department's and other departments' comments on the draft Executive Summaries and making consistency with the final EFS report, please submit HyD and this department each with an advanced copy of the final version for our checking before printing the document.	The amended texts of the Executive Summaries have been circulated to all SMG members so that all necessary changes can be confirmed at the SMG Meeting on 7 March.
12	PD/STN DPO/K T Ng 5 March 1997	(20) in PD ST 4/5/9 VII	I refer to your letter dated 20.2.97 to DEP and copied to us among others about the above subject. I have the following comments on the minutes of the 2nd SMG meeting: (a) Para 15 - Please amend as :"Both K T Ng (DPO/STN) and Portia Yu (HD) advised that at the last Working Group Meeting, Urbis had agreed to provide visual representations of the alignment options for Ma On Shan Town Centre in the DFR."	The minutes have been amended as advised.