

Mass Transit Railway Corporation

Lantau and Airport Railway:
*Environmental Impact Study:
Final Report*

Volume 2: Main Report

January 1994

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CONSULTING SERVICES BY ENVIRONMENTAL RESOURCES MANAGEMENT

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Railway: *Environmental
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Reference C1092

For and on behalf of ERM Hong Kong

Approved by: C. Man

Position: MANAGING DIRECTOR

Date: 5 JANUARY 1994

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1 INTRODUCTION

1.1 BACKGROUND TO THE ENVIRONMENTAL IMPACT STUDY

This report has been prepared by ERM Hong Kong on behalf of the Mass Transit Railway Corporation (MTRC). It is the Final Report of an Environmental Impact Study (EIS) which has been undertaken by ERM to examine the proposed design, construction and operation of the Lantau and Airport Railway (LAR) and to provide information on the nature, extent and magnitude of environmental impacts associated with this project. The study has also developed recommendations which may be used to help avoid any significant and unacceptable impacts, or reduce these to acceptable levels.

The LAR EIS is intended to provide the assessment of environmental impacts associated with the construction and operation of the current specific alignment of the LAR, while major issues relating to the general alignment have already been discussed in the Airport Railway Feasibility Study (ARFS).

1.2 THE LANTAU AND AIRPORT RAILWAY (LAR)

The MTRC are proposing to build new railway lines, principally to serve the new Hong Kong International Airport which is being built at Chek Lap Kok, but also to provide improved access to public transport in the Territory, in particular by relieving the pressure in the Nathan Road Corridor.

The proposed Lantau and Airport Railway will be approximately 34 km in length. It will run northwards from a new station on reclaimed land at Central, Hong Kong Island via West Kowloon and Kwai Chung, then west via Tsing Yi Island, the Lantau Fixed Crossing, Ma Wan and the north coast of Lantau Island, terminating at the new airport on Chek Lap Kok.

Two services will be operated on the railway:

- *The Airport Express Line (AEL)* will provide a dedicated high speed service between Hong Kong Central and Chek Lap Kok, stopping only at Kowloon and Tsing Yi.
- *The Lantau Line (LAL)* will be a public service linking Central to North Lantau, with stations at Kowloon, Tai Kok Tsui, Lai King (connecting with the existing Tsuen Wan Line), Tsing Yi and Tung Chung.

A more detailed description of the proposals is given in *Section 2* of this Report.

1.3 PREVIOUS AND OTHER RELATED ENVIRONMENTAL STUDIES

Prior to the commencement of the LAR EIS, a number of studies had already been undertaken which related to the LAR. Some of these were specific preliminary engineering and EIS studies of parts of the alignment. Others are EIS studies for developments taking place concurrently in the LAR corridor. In undertaking the LAR EIS, ERM drew extensively on the material in these documents. Much

information on the existing environment in the vicinity of the proposed alignment is contained in them, together with preliminary predictions and evaluations of the likely environmental impacts associated with the construction and operation of the LAR, and tentative proposals for mitigation measures. The information and recommendations contained in these documents were reviewed by ERM for their completeness, consistency, accuracy and currency, and were updated or augmented where necessary. *Table 1.3a* lists the documents to which ERM referred during the course of the study.

A number of parallel environmental studies have also been progressing at the same time as the LAR EIS. These relate to particular sections of the alignment where the potential environmental problems require more in-depth consideration (*ie* at Kwai Chung Park) and to the proposed Comprehensive Development Areas designated over some of the proposed LAR stations. Reference is made in this report where appropriate to the most-recent findings of these studies.

An additional desk-top study on the cumulative effects of construction from the LAR and Route 3 is currently being carried out. The results are expected shortly and it is planned to include them in the final version of this report.

1.4 OBJECTIVES OF THE STUDY

The specific objectives for the LAR EIS study were set out in *Section 2* of the Consultancy Agreement between ERM and MTRC, and are:

- To describe the proposed LAR installations and related facilities and the requirements for their formation.
- To use the elements of the community and the environment covered by the ARFS, LFC, NLE, NLD, WKE, WKR, Route 3 and CWR environmental assessments (*See Table 1.3a*) likely to be affected by the proposed project.
- To identify, predict and evaluate the environmental impacts and the cumulative effects which may be expected to arise during the construction and operation phases of the LAR.
- To identify and specify methods, measures and standards to be integrated into the detailed design (of the LAR) and suggest appropriate works which are necessary to mitigate these impacts to environmentally acceptable levels in accordance with Hong Kong Planning Standards and Guidelines (HGPSG) and relevant Government Ordinances.
- To minimise environmental impacts arising from the LAR in both construction and operation.
- To design and specify the particular environmental monitoring requirements for impact and compliance monitoring to ensure that the conditions referred to above are met. Account should be taken as appropriate of the baseline monitoring undertaken as part of the ARFS, LFC, NLE, NLD, WKE, WKR, Route 3 and the CWR environmental assessments.

Table 1.3a Key Previous Environmental and Other Studies Reviewed in the LAR EIS

Airport Railway Feasibility Study (ARFS)

Central and Wanchai Reclamation Development Phase 1 Focused Environmental Assessment Study (CWR)

Draft Ma Wan Environmental Impact Assessment (MWEIA)

Lantau Fixed Crossing Environmental Assessment (LFC)

New Airport Masterplan Environmental Assessment (NAMP)

North Lantau Expressway Environmental Assessment Report (NLE)

North Lantau Development Study (NLDS)

Route 3 Study Technical Report 19: Environmental Assessment (Route 3 EIA)⁽¹⁾

Tung Chung Town Centre Study (TCTCS)

West Kowloon Reclamation Study Environmental Assessment (WKR)

West Kowloon Expressway Environmental Assessment (WKE)

Western Harbour Crossing Study (WHCS)

Note: (1) Route 3 is the Expressway running from the end of the West Kowloon Expressway in Sham Shui Po, to connect with the New Territories Circular Road.

- To design and specify the environmental monitoring requirements for compliance and the post-project audit. The post-project audit shall include the review of data from monitoring against target, trigger and action levels to ensure that statutory requirements are met and that the necessary remedial works are identified, designed and implemented to remedy any unacceptable consequential or unforeseen environmental impacts of the LAR and its operation with respect to the HKPSG and relevant Government Ordinances.
- To identify and advise on environmental policies, standards and guidelines.
- To produce construction and operation guidance notes as appropriate.
- To devise suitable, acceptable and effective contract clauses for construction tender documents that lead to the use and incorporation of the environmental mitigation measures recommended in the LAR EIS.

1.5 HOW TO USE THIS DOCUMENT

This Final Report, as noted above, presents the conclusions of the LAR EIS. The study was based on a process known as "Environmental Assessment", a rigorous, internationally-recognised procedure which has been widely used in Hong Kong for studying the likely environmental impacts of proposed major development projects like the LAR.

For ease of use, the report has been divided up into three volumes, as follows:

- *Volume One* contains an *Executive Summary* of the report, explaining briefly how the study was carried out and the conclusions of the Final Report. This is intended to focus on the key issues addressed by the LAR EIS.
- This is *Volume Two*, which forms the main body of the report. It is intended to provide an understanding of the key environmental issues relating to the LAR in more depth, and allow the reader to focus on the impacts likely to be caused at specific locations along the LAR alignment if required. Here, the proposed LAR route is described in detail, and the prediction and evaluation of environmental impacts associated with the construction and operation of the LAR are discussed in four separate route sections, which correspond to District Board Boundaries. The structure of *Volume Two* is set out in more detail in *Paragraph 1.6* below.
- *Volume Three* comprises a number of Technical Annexes which contain more detailed information on the assessment carried out by the consultants in support of the material set out in *Volume Two*. They provide the detailed methodologies and technical basis of the assessment, and cover the following issues:

- *Annex A* sets out the criteria agreed with the Environmental Protection Department for use by ERM in the study for evaluating the significance of predicted environmental impacts.
- *Annex B* deals with noise and vibration issues.
- *Annex C* discusses impacts on air quality.
- *Annex D* concerns impacts on water quality.
- *Annex E* discusses land use and visual impacts.
- *Annex F* deals with waste management issues.
- *Annex G* sets out the arrangements for environmental monitoring and audit.

1.6 STRUCTURE OF THIS VOLUME

After this introductory Section, *Volume Two* of the report is set out as follows:

- *Section 2* describes the proposed alignment of the LAR, giving preliminary details of the activities associated with the construction of the railway (as far as these are available at this stage), design features of the proposals which influence their impacts on the environment and an initial overview of the potential environmental effects of the scheme.

Sections 3 to 6 take the reader along the proposed route from Central to the new Chek Lap Kok Airport, section by section, summarising the impacts predicted along the alignment and identifying recommendations for mitigation measures. The four route sections comprise:

- Central and Yau Tsim Districts;
- Mong Kok and Sham Shui Po Districts;
- Kwai Tsing District; and
- Tsuen Wan and Islands District.

Section 7 sets out the conclusions of the LAR EIS.



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2 DESCRIPTION OF THE PROJECT

2.1 INTRODUCTION

The LAR alignment comprises 15 civil construction contracts and 2 design and construction contracts, together with works associated with an additional temporary contract. For the purposes of this Final Report, ERM has divided the route into four sections to correspond with District Board boundaries as follows:

- Central and Yau Tsim Districts (C501 to C504);
- Mong Kok and Sham Shui Po Districts (C505 to C507, and C520);
- Kwai Tsing District (C507 to C512);
- Tsuen Wan and Islands Districts (C513 to C518).

The alignment is shown in *Figure 2.1a*.

2.2 GENERAL DESCRIPTION

2.2.1 Central and Yau Tsim District

Contract 501 and 501A

This includes the construction of the new Hong Kong Station, located on newly reclaimed land (Central and

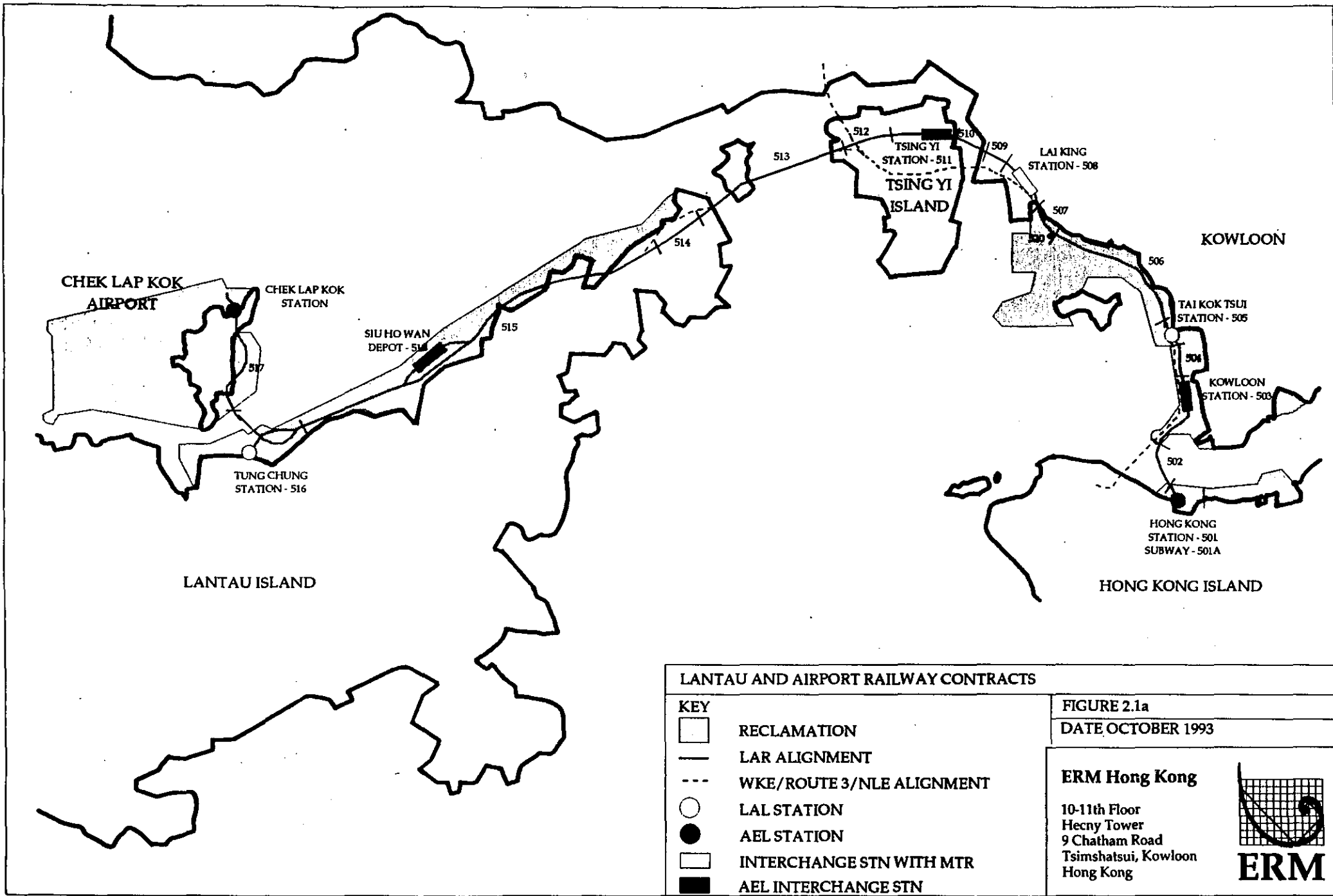
Wanchai Reclamation) to the north of the Exchange Square development on Hong Kong Island. It will form the terminus of the AEL and the LAL, with provision for the future extension of the LAL eastwards. A 250 m long cut and cover structure will join a section of tunnel already incorporated into the seawall. Close to this connection there will be a ventilation and traction substation building. Overrun tunnels, some 600 m in length, will also be constructed eastwards from the station at a later stage. Extensive property development and podium structures will be constructed by others above and adjacent to the station. Contract 501A will comprise the construction of a pedestrian subway link between the new LAR station and the existing Central MTR station.

Contract 502

The Western Immersed Tube Tunnel will link Hong Kong Station with Kowloon Station. The tunnel will be approximately 1250 m long and will have a curved alignment carrying two tracks, separated by a continuous structural wall. It will rest in an excavated trench on the bed of Victoria Harbour by connecting concrete units together to form a continuous sealed tube.

Contract 503, 503A and 503B

Contract 503, 503A and 503B will comprise 800 m of cut and cover tunnels between the Western Immersed Tube Tunnel and the Kowloon Station, located on newly reclaimed land on the west side of the Kowloon Peninsula between Jordan Road and Austin Road. Property development above the station will be built by others and



LANTAU AND AIRPORT RAILWAY CONTRACTS		FIGURE 2.1a	
KEY		DATE OCTOBER 1993	
	RECLAMATION	ERM Hong Kong 10-11th Floor Hecny Tower 9 Chatham Road Tsimshatsui, Kowloon Hong Kong	
	LAR ALIGNMENT		
	WKE/ROUTE 3/NLE ALIGNMENT		
	LAL STATION		
	AEL STATION		
	INTERCHANGE STN WITH MTR		
	AEL INTERCHANGE STN		

does not form part of Contract 503. At the northern side of the station a cut and cover tunnel box will extend some 100 m to connect with Contract 504 at a similar depth to the southern tunnels. At the southern end of this section there will be a ventilation and traction substation building extending upwards from track level to form a two storey structure above ground. Sea water inlet and outfall facilities to serve the cooling water system will be constructed adjacent to this building.

Contract 504

This links the Kowloon Station to Tai Kok Tsui Station. The Contract has been entrusted to the Highways Department as the alignment will pass under the extensive works associated with the WKE. It will comprise 850 m of cut and cover tunnels, and 100 m of open cut. The alignment will curve gently to the west for half its length before moving on a straight track into Tai Kok Tsui Station. The southern extent of the Contract begins just south of the planned Jordan Road Extension. At this point the vertical alignment of the LAL up line will be approximately 5 m lower than the other three lines as they emerge from the station. The lines return to a side-by-side arrangement approximately 700 m from the southern extent of the Contract.

All tracks gently descend in a northerly direction away from Kowloon Station to provide clearance under the Waterloo Road Culvert. The tracks begin to rise again under the proposed Yau Ma Tei Interchange approximately 400 m from the Jordan Road Extension and eventually emerge in a sunken open cut 100 m from the end of the Contract length, and 250 m from Tai Kok Tsui

Station. The tracks reach grade just before moving into Contract 505. A ventilation building will be situated immediately to the north of the Yau Ma Tei Interchange. A set of impulse fans will be installed close to the interface between Contracts 503 & 504.

2.2.2 Mong Kok and Sham Shui Po Districts

Contract 505

Contract 505 will comprise a new station at Tai Kok Tsui. The AEL will not stop at the station which will be located at the south-west corner of the Tai Kok Tsui peninsula. A 24-hour thoroughfare through the station concourse will provide pedestrian access between the new Comprehensive Development Areas (CDAs) and across Road P1 and the WKE. There will be no public vehicular access to the station. A service slip road off Road P1 will provide cash and waste collection facilities. There will be no parking facilities for station staff. CDAs are planned to the north-east, north-west and south-east of the station beyond Road P1 and the WKE. These developments will be served by the station and linked, for pedestrian access, by footbridges running into the station concourse. The area to the south west of the station is also likely to be developed, however, at present no definite plans beyond the footbridge spur exist. The Tai Kok Tsui infeed and traction substation, a stand-alone structure, will be located at the north west corner of the Prince Edward Road interchange.

Contracts 506 and 520

This section between Tai Kok Tsui Station and Lai Chi Kok will be entrusted works, constructed as part of the WKE. A temporary depot will be constructed nearby as part of Contract 520, comprising two sections connected by tunnel, covering a total area of approximately 9 ha. The LAR will follow the WKE alignment, running under the viaduct at a point some 400 m north of Tai Kok Tsui station. After a further 100 m the four tracks will converge under Prince Edward roundabout and continue north as a two track line. Provision will be made to allow for the addition of a further two lines, as needed, due to increases in service frequencies.

Contract 507 (South of Kwai Chung Road)

The construction of Contract 507 will also be part of the entrusted works for the construction of Route 3 and will rise from grade after passing under the Mei Foo roundabout onto an embankment and then a viaduct below Route 3 (the boundary between Contracts 506 and 507 is to the east of the Mei Foo roundabout). The track follows the alignment of Route 3 for most of the section and separates, where Route 3 turns away to the west of Lai King Hill, just before crossing Kwai Chung Road to enter the Lai King Tunnel (Contract 508). It will run between the piers of the Route 3 viaduct until the two alignments separate just south of Kwai Chung Road. Contract 507 also includes the viaducts north of Lai King Station (see *Paragraph 2.2.3*).

2.2.3 Kwai Tsing District

Contract 508

Contract 508 will comprise approximately 450 m of bored tunnels in rock and a new station at Lai King. The proposed tunnel alignments will run from a portal beneath Lai King Hill Road some 100 m south east of the Salvation Army Building (Block A), beneath residential blocks at Kai Him Lau (Block 13) and Chung Ling Sheh, under King Cho Road and beneath Cho Yiu Chuen (Blocks E, F and car park) to emerge in the new station. The depth of the tunnels ranges between approximately 30–40 m below existing ground level, where these pass beneath potentially sensitive receptors. The new Lai King Station will be situated alongside, and to the south of, the existing MTR station, comprising a concrete box with platform extensions in tunnel under Lai King Road. A roof spanning the new station is proposed over some of its length. A number of modifications to the existing station will also be made, such as the provision of new escalators and stairs, and the opening up of existing sections of the side wall.

Contract 507 and 509

Contract 507 also includes a viaduct between Lai King Station and Kwai Chung Park, which will be built by the Government as part of the entrusted works for Route 3. Contract 509 comprises approximately 200 m of open cut through Kwai Chung Park (which was previously a landfill site). The viaduct will leave Lai King Station, heading north west at high level (*ie* the AEL will be at

approximately 13 m PD, the up LAL at approximately 23 m PD) and passing over Kwai Chung Road and joining the Route 3 structure close to Container Port Road. The LAR will be accommodated beneath the new Route 3 highway within the structure.

Under Contract 509, the viaduct continues and enters Kwai Chung Park with the AEL at a level of approximately 29 m PD. The Kwai Chung Park section will be built by excavating a 200 m long open cut through the former Gin Drinkers Bay Landfill. The maximum depth to track level will be approximately 12 m with provision for four AEL and LAL tracks side by side at the eastern side, this may increase to six tracks side by side on separate viaducts at the western side if this site, within the park, is selected for the turn out for the proposed North West New Territories Line (NWL). On the south east side of the park the tracks emerge onto the elevated structure. Construction of the cut will involve up to 15 m of excavation into the landfill, the upper 5-8 m being through a relatively inert capping layer. The surrounding ground level will be up to 44 m PD and the rail level will be approximately 32 m PD. As the route lies through a former landfill, special construction techniques will be required to eliminate risks associated with potentially explosive and asphyxiant landfill gas and potentially toxic and corrosive leachate. Within the park section the vertical alignment of the lines is fixed by the Rambler Channel bridge to the west and Lai King station to the southeast. This alignment requires the railway to pass up to 15 m below the existing surface of the landfill. The vertical alignment of the individual tracks also varies within the park section from level to up to 7 m apart.

Contract 510

This comprises an elevated structure over the Public Cargo Working Area (PCWA) and a bridge spanning the Rambler Channel and typhoon shelter, linking Kwai Chung Park and Tsing Yi Station. The main bridge will carry four tracks along a 835 m length between the movement joints. Spans will range between 105 m – 170 m (the main navigation channel span). The Rambler Channel will be crossed transversely south-east to north-west. It is most likely that the structure will be a concrete bridge with a double track configuration. The bridge construction will include parapets which will act as both a safety feature and a noise barrier to mitigate impacts at Greenfield Garden and Riviera Gardens.

Contract 511

Contract 511 will comprise a new station serving both the LAL and AEL, with associated commercial and residential development provided by others. The proposed Tsing Yi station will be situated to the south of Tsing Tsuen Road. The station site is classified as a CDA, located in Tsing Yi Area 3. The station will form part of a six level development, including three levels of retail space with car parking above. The top of the station development, approximately 33 m above ground, will form the podium for a residential development comprising 12 cruciform towers and associated facilities. The development will also contain the Operational Control Centre for all MTRC train operations throughout the Territory.

Contract 512

The proposed viaduct alignments for LAL and AEL within Contract 512 extend westwards from Tsing Yi station for approximately 500 m of viaducts, to the Tsing Yi Tunnels, passing through the Green Belt area immediately to the south of Tsing Tsuen Road. The alignment of the viaducts passes south of Tsing Tsuen Road, and above Fung Shue Wo Road ending just to the south-west of the Tsing Tsuen Road/Fung Shue Wo Road Roundabout, where this abuts with the Tsing Yi Tunnels at the tunnel portal.

The Tsing Yi tunnels will link the viaducts to the Route 3 toll plaza adjacent to the Lantau Fixed Crossing (Contract 513). Two rock tunnels will be driven from the eastern end. The main drives will be twin horseshoe-shaped concrete lined tunnels with 5.2 m internal diameter and 1700 m long. A pedestrian cross passage and a central refuge siding (the position of which is as yet undecided) are also proposed. Impulse fans will be required in the tunnels. There will also be an open turnback siding of approximately 175 m which will be located on the eastern side of the hill, and will allow LAL trains to reverse. At the west end of the tunnels, a combined ventilation and portal building will be provided. This will also include a traction sub-station. The building will be four storeys high with two basement levels, the lower being at track level.

2.2.4 *Tsuen Wan and Islands Districts*

Contract 513

The works for Contract 513 are being designed and constructed by the Government on behalf of the MTRC as

part of the LFC Project, linking North Lantau and Tsing Yi. The Tsing Ma Bridge will be a high level suspension bridge of a relatively light steel and concrete construction with a centre span of 1377 m. The Kap Shui Mun Bridge and the Ma Wan Viaducts will be designed by the contractor, although the tender specifies that the structure should be built of concrete. The bridges and viaducts will have two decks. The top deck will carry the three lane dual carriageway expressway whilst the lower deck will carry LAR (flanked by two dual lane road carriageways which will provide protected vehicular access to Lantau). At the west end of the contract, a building will be provided to house ventilation equipment and a traction supply substation for the LAR.

Contract 514

Contract 514 will comprise the East Lantau tunnels, linking the Lantau Fixed Crossing (Contract 513) to the Lantau Viaducts (Contract 515). Twin concrete lined tunnels with a horseshoe-shaped bore of 5.2 m internal diameter and approximately 900 m long will run from the toll plaza for the Lantau Fixed Crossing to a ventilation building at the western portal at Tsing Chau Tsai. The tunnels are planned to be excavated through the rock from the west portal, working eastwards. This will be a four level structure with two levels above ground, partly under the NLE. An access road from the lower bridge exit will be provided. At the western portal, a two level ventilation building is also to be built adjacent to the portal within the platform and retaining areas. No vehicular access will be provided to the building.

Contract 515

Contract 515 is being designed and constructed by the Government as part of the NLE. The route of the NLE will be along approximately 13.5 km of the generally sloping northern shoreline of Lantau. The NLE will be built partially on reclamation at the toe of the hillsides and partially within large cuttings into the slope. From the abutment with the North Lantau Tunnels at Tsing Chau Tsai, the alignment of the NLE and LAR will run via Ngong Shuen Au, Yam O, Sham Shui Kok, Tai Ho Wan and Tai Po. Just before Tung Chung, the two track LAL and AEL will divide. The LAL will run in tunnel to terminate at Tung Chung Station. The AEL will continue on the alignment of the NLE, the new bridge north of Tung Chung and the abutment with the airport works.

Contract 518

Contract 518 comprises MTRC Depot at Siu Ho Wan on the north shore of Lantau Island, approximately 4 km east of Tung Chung. The Depot will be sited on newly reclaimed land and will comprise:

- Main depot building;
- Depot trackform;
- Internal and external roadways;
- Permanent way maintenance depot;
- Utilities and drainage;
- Ancillary buildings and facilities; and
- LAL box structure grade separations.

The Depot site will be located on a 30 ha site on the northern side of the LAR. The site will be roughly

trapezoidal, with the base parallel to the LAR tracks. The sidings and main building will be located in the centre of the site with permanent way facilities at the northern end. The main building is expected to be a single-storey structure of approximately 42,500 m² of which 22,000 m² consists of offices and repair facilities and the rest will be covered trackwork. The building will be constructed with a reinforced concrete or steel frame to a height of about 8 m. This will contain the offices, repair and maintenance workshops, general storage, cleaning and maintenance sidings and staff facilities. There will also be uncovered sidings adjacent to the building. In general all sidings will be at grade and will incorporate trenches or inspection pits with suitable drainage. Vehicular access to the western end of the site will be from the NLE via the Siu Ho Wan Interchange. The seawall access maintenance road will also provide access to the site at the eastern end via the Sham Shui Kok underpass. Rail access will be from both ends of the Depot site and mooring facilities for barges will be provided on the seawall. A helicopter pad will be sited on the northern side of the site for emergency access. The permanent way depot will provide a track maintenance and renewal centre including sidings, workshop, storage and staff facilities. It is planned to have the Depot operational by 1995 in order to provide track installation and light maintenance facilities for the track construction. A number of other structures will be built on the site which will be considered in this study. These include:

- Traction and other sub-stations;
- Dangerous goods store;
- Water pumping and treatment plant;
- Permanent way offices;

- Waste disposal facilities; and
- Car parking sites.

Three concrete box structure grade separations will be built at the Depot entry and exit where the LAL crosses the AEL.

Contract 516

Contract 516 comprises Tung Chung Station, together with approximately 1500 m of cut and cover tunnels on reclaimed land, including overrun tunnels for the station. Tung Chung Station will be the western terminus of the LAL, and will be located next to the NLE, to the south-west of Tung Chung Town Centre. The station will be built as a cut and cover box. Further levels above this within the commercial bridge link across the NLE will be provided by others. From the abutment with Contract 515, where it is at surface level, the LAL alignment within Contract 516 goes into an open cut approximately 240 m in length. On reaching a track level depth of approximately 5 m below ground level, this becomes a cut and cover tunnel. The tunnel continues on to the station for approximately 1200 m, with the maximum track level depth being about 12 m below ground level. The overrun tunnel continues for approximately 110 m beyond the station. The works will include a bridge across the airport island channel at grade for the AEL and the NLE, the LAL track having terminated at Tung Chung Station.

Contract 517

The works for Contract 517 of the LAR will be entrusted to the Provisional Airport Authority. Track and fittings

will be supplied by MTRC in 1996. The AEL track will run north along the eastern side of the new airport island to the airport terminal building. A train cleaning platform will be built beyond the airport terminal, and this may be available as an alighting point for airport staff.

2.3 ACTIVITIES DURING THE CONSTRUCTION PHASE

2.3.1 General

The construction of the LAR will commence in late 1993, and continue until mid-1997. The provisional construction programme for the LAR contracts is shown in *Figure 2.3a*. At the same time as the LAR is under construction, other major infrastructure and development projects will also be being built in the vicinity. Environmental impacts associated with the construction of these projects have been taken account of in this study as part of baseline environmental conditions, so cumulative environmental effects of these projects can be considered. The construction programmes for these other projects are indicated in *Figure 2.3b*.

The following construction plant and equipment will be typically used on site for all the LAR contracts:

- Generators;
- electric pumps;
- concrete (poker) vibrators;
- mobile and tower cranes;
- circular saws (for formwork fabrication);
- concrete pumps;

Figure 2.3b Construction Programmes for Concurrent Projects

	1993				1994				1995				1996				1997																			
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
North Lantau Expressway																																				
Lantau Fixed Crossing																																				
Route 3 (CRA1)																																				
West Kowloon Expressway																																				
Western Harbour Crossing																																				
New Airport Master Plan - 1st Runway																																				
Central Reclamation - Phase I																																				
Proposed Development on Ma Wan																																				
Village Development Area - Phase I																																				
Phase II																																				
Phase III																																				
Residential Blocks - Phase I																																				
Phase II																																				
Phase III																																				
North Lantau Development																																				
Construction of Site Formation:																																				
- Tung Chung																																				
- Tai Ho East																																				
Infrastructure Construction:																																				
- Tung Chung																																				
- Tai Ho																																				
Tung Chung Development																																				

N.B. These programmes are taken from the various studies listed in figure 1.3a. Supplemented by information provided by the relevant Government Departments.
ERM does not take responsibility for the accuracy of the information presented

- arc welders;
- lorries (10–14 tonnes);
- excavators;
- loaders.

It is also anticipated that equipment such as bulldozers and mechanical shovels will be used during excavation works on site. The activities likely to take place in relation to each of the LAR contracts are discussed in the following paragraphs. Locations of the main construction sites are shown in *Figure 2.3c*.

2.3.2 *Central and Yau Tsim Districts*

Contract 501 and 501A

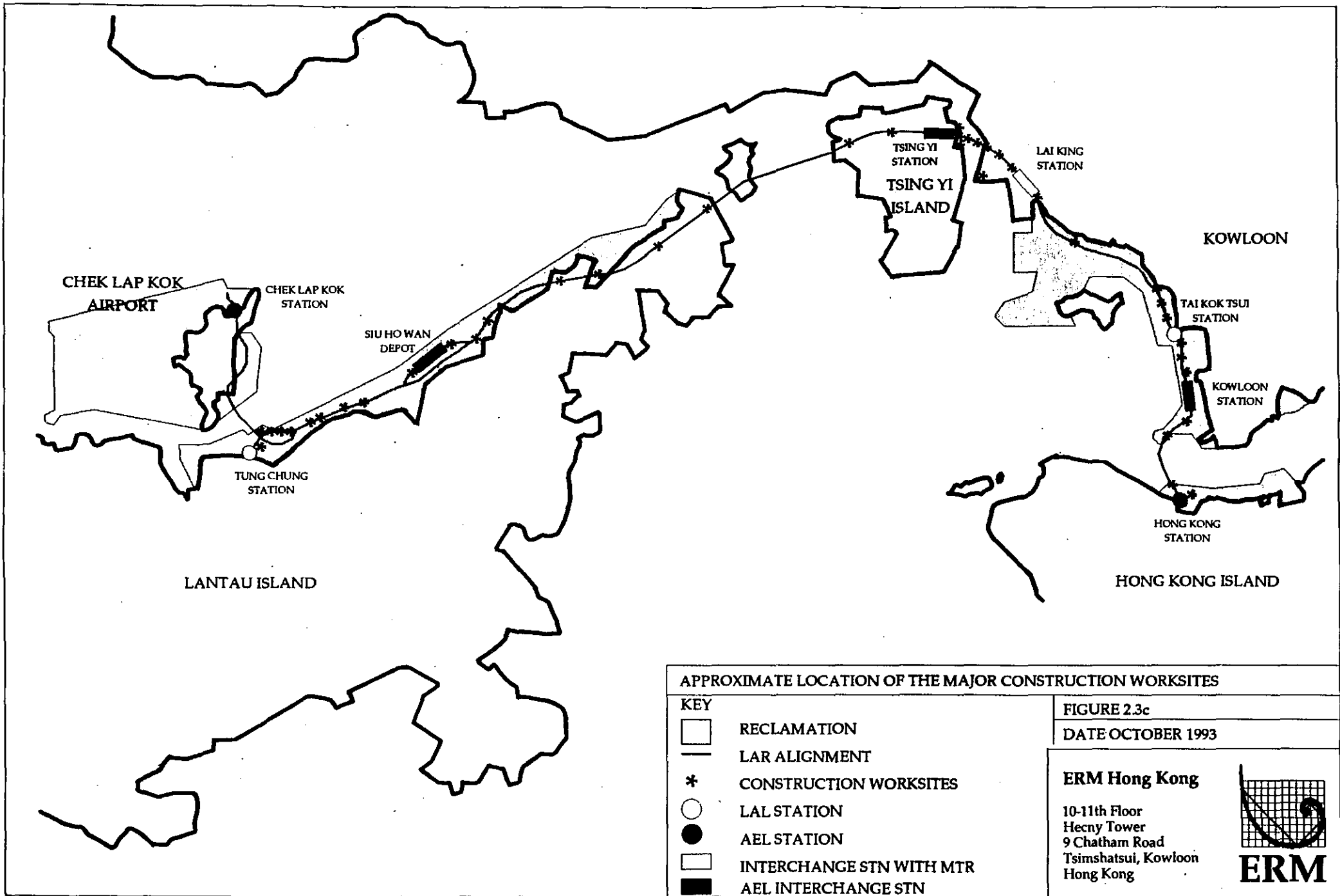
Construction of Contract 501 will begin in late 1995 and continue until the middle of 1997 (86 weeks). Contract 501A will run from mid-1994 to early 1996 (88 weeks). The initial stage of the works will be concentrated on an area of approximately 20,000 m² initially (57,300 m² at the final stage) for the station, 10,000 m² for the main tunnels and 20,000 m² in the final stage for the overrun tunnels. The overrun tunnels will be constructed only to a length of between 30–70 m. The construction of the full 600 m overrun tunnels will be related to the construction of later stages of the Central and Wanchai Reclamation.

During the first three months, diaphragm walling rigs will be used while bored piling and driven sheet piling is undertaken on the site. Provided the relevant permits are obtained, works are likely to be continuous for 24 hours per day. The first year of the construction phase will

comprise excavation and disposal of reclamation sand and de-watering. Some 125,000 m³ of such spoil (including material from the secant wall) will be removed for Contract 501A, and this will possibly include some marine deposits present below the reclamation material. A further 550,000 m³ of spoil will be generated by the works for Contract 501, of which 150,000 m³ will come from the works for the station itself. All spoil is expected to be saturated on excavation. Excavated material will be removed from the site to an appropriate disposal site, probably by barge. A concrete batching plant will be located to the north of the site. There will be no stockpiles of materials, other than for the batching plant, kept at the site.

Contract 502

This will commence in late 1993, and continue for 30 months. Bulk dredging works will take place over one year, from about early 1994. Trim dredging will be required along the tunnel alignment just prior to the laying of the units and will occur intermittently for up to seven months after the bulk dredging has been completed. The tunnel sections will probably be made of precast concrete or a steel/concrete composite. When required, the units will be floated into position and sunk into a pre-formed trench on the sea bed. Once the tunnel sections are in place and sealed to adjoining units, the trench will be backfilled to approximately 2 m above the top of the tunnel units, thus following the vertical alignment of the tunnel. In general the backfill level is lower than the sea bed although it will protrude above the surface where the southern extent of the tunnel rises to landfall. The units



APPROXIMATE LOCATION OF THE MAJOR CONSTRUCTION WORKSITES

- KEY**
- RECLAMATION
 - LAR ALIGNMENT
 - * CONSTRUCTION WORKSITES
 - LAL STATION
 - AEL STATION
 - INTERCHANGE STN WITH MTR
 - AEL INTERCHANGE STN

FIGURE 2.3c
DATE OCTOBER 1993

ERM Hong Kong
10-11th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong



will be constructed in batches at an off-site casting basin. A number of potential fabrication sites have been identified in previous studies. However, the implications of the construction and operation of the casting basin is outside the scope of this study.

The initial construction activity will involve a bulk dredging operation taking up to 550,000 m³ of mud and silt from the harbour bed to form the trench. Subsequent activities include the deposition of sand to act as the foundation layer and the sinking of the tunnel sections into the trench.

Each tunnel section will have a small positive buoyancy which will be altered to a negative buoyancy by pumping water into temporary ballast tanks within the unit. The section will then be lowered into place using winches mounted on pontoons and connected to the adjoining unit. Permanent concrete ballast will later replace the temporary tanks to achieve the required factor of safety against flotation. The trench and tunnel will be backfilled using selected granular material and covered by a protective layer of rock armour.

Contracts 503, 503A and 503B

Contracts 503, 503A and 503B will commence in late 1993, and continue until mid-1996 (33 months). The worksite will be about 200,000 m². The main activities during this period will comprise excavation for and construction of:

- Kowloon Station;
- tunnel ventilation building;
- seawater intake;

- seawater outfall;
- south cut & cover Tunnel;
- north cut & cover Tunnel;
- western elevated road;
- storm and foul drainage; and
- deep compaction under structural elements.

Diaphragm walling rigs and bored pile rigs will be used, and driven sheet piling will also be undertaken. Barges will be used, in preference to lorries, to remove spoil. Excavation, de-watering and disposal of reclamation sand will be carried out in three stages during the first year of construction. 1,030,000 m³ of spoil will be removed, which may include some marine deposits present below the reclamation material. Of this 169,000 m³ is expected to contain Bentonite, making it unsuitable for use as fill material. The excavated sandfill spoil is likely to have a water content of 30-40%. It is anticipated that a concrete batching plant with a capacity of 600-700 m³ per day will be located on the site. There will be no stockpiles of dusty materials, other than for the batching plant, kept at the site. Working hours are likely to be from 08.00 to 18.00, with the workforce peaking at 600-700. Traffic flows are not expected to exceed 2-3 vehicles per hour at peak times.

Construction of the station will commence with the installation of cut-off walls, piezometers and de-watering wells. The excavation for the station box will then be undertaken, followed by piling and slab casting. After base slab casting, the station box will be constructed up to the concourse level, and backfilled to ground level. Installation of plant, escalators, E&M equipment and railway works will then commence, as will the erection of

the steel roof above the concourse. Fitting out and finishing will follow this.

Construction of the tunnels will again commence with the installation of cut-off walls, piezometers and de-watering wells. The excavation of the tunnel cut will then be undertaken. After the casting of the base slab, a travelling tunnel shuttering system will be erected on temporary rails, and the tunnel walls and roof will be cast together in sections. Backfilling will then be carried out around the tunnel box, the waterproofing of the tunnel roof constructed, and backfilling to reclamation level completed. Following this, the installation of trackwork, trackside E&M equipment, overhead line and signalling equipment will be undertaken.

Contract 504

Contract 504 will be undertaken as works entrusted to the Government under the WKE project. The LAR route will be excavated by open cut through the reclamation area, although some work will take place within cofferdams. The total amount of excavated material will be over 800,000 m³, but the final surplus will only be approximately 142,000 m³. A small amount of clay may need to be excavated from around the existing breakwater and removed to an appropriate disposal site. The excavation is likely to begin parallel with the Man Cheong Street extension serving the Public Cargo Working Area (PCWA). This area is a priority as the road will need to be protected from the works by the installation of cofferdams. In addition, work on the Waterloo Road Culvert will need to begin soon after the tunnels are completed. Work will proceed north, with the link

between Man Cheong Street south to Contract 503 due to be completed when the Jordan Road Culvert is due for construction.

The sequence of construction is likely to be as follows;

- Compaction of the sand beneath the tunnels using vibrocompaction methods, and the installation of dewatering wells.
- De-watering to below works and establishment of cut-offs (by sheet piles or slurry walls).
- Initial excavation to formation levels.
- Placement of base slabs and wall starter bars.
- Construction of tunnel walls and roofs, placement of waterproofing and tanking screed, and backfilling and compaction around.
- Backfill above tunnel structures.

2.3.3 *Mong Kok and Sham Shui Po Districts*

Contract 505

Contract 505 is scheduled to begin in early 1994 with the main works continuing until early 1996 (approximately 23 months). The worksite will cover an area of 42,350 m² with a separate area for the batching plant, with a capacity of about 350 m³ per day, 500 m to the west and the traction sub-station 700 m to the north west. Plant to be used on-site specific to this contract will comprise:

- pile drivers;
- rollers;
- boring machines;
- air compressors; and
- barges.

Normal working hours are proposed to be 08.00 to 18.00, with the peak workforce in the region of 200 - 250. 15 - 25 vehicles will be used during construction operations, peak traffic flows are expected to be on average 2 - 3 vehicles per hour. Excavation and backfill work will be carried out during the first 12 - 18 months of construction. Some 60,000 m³ of material will be extracted but 12,000 m³ of this will be used as backfill, with 48,000 m³ removed from site by lorry or barge. The concrete batching plant will be located to the west of the main site, and it is anticipated there will be no stockpiling of materials, other than for the batching plant, at the site. After base slab casting, the station box will be constructed up to the concourse level, and backfilled to ground level. Installation of plant, escalators, E&M equipment and railway works will then commence, as will the erection of the steel roof above the concourse. Fitting out and finishing will follow this.

Contract 506

Contract 506 will be carried out as part of the WKE programme and will therefore be entrusted to government and not be under the control of MTRC. The construction of the WKE is planned to commence in September 1993. There will be superficial excavation for the general formation and the column foundations which will be created by bored piling. The expressway will be elevated

and fabricated from pre-cast concrete sections with feeder roads rising from grade on both sides. The LAR trackbed will be constructed below the WKE between the supporting piers. The completed sections of the trackway will be handed over to MTRC in two stages, the northern half in mid-1995 and the southern half in early 1996. The sub-ballast formation will be part of the entrusted works and the permanent way construction, consisting of ballast, sleepers and rails, will be laid as part of Contract 520. The tracklaying activities outside the Depot are not included in this study.

Contract 507 (South of Kwai Chung Road)

This will be carried out as part of the Route 3 programme. The contract will be entrusted to Government and outside the control of MTRC. The programme in the vicinity of Contract 507 is expected to run from May 1993 until Sept 1996. The viaduct foundations will consist of bored piles with in situ substructures comprising columns with crosshead beams and frames, supporting precast beams with an in situ slab. The LAR viaducts will be located below the Route 3 viaduct. The LAR foundation and substructure will be similar to the Route 3 viaduct. The superstructure will be precast segments post-tensioned together.

Contract 520

The Depot site will be occupied for two years during construction of the LAR from mid-1995. Construction work will be limited to the creation of hardstanding for trackwork, service roads and temporary buildings and provision of service infrastructure. The connecting tunnel

between the two depot areas will be entrusted works undertaken by the Highways Department and returned to them along with the rest of the site after the completion of the MTRC works. The Depot will be operational 24 hours per day but the majority of work, including the noisier activities will be scheduled for 0700-2300 wherever possible. The Depot, covering an area of some 9 ha, will be used as a base for the permanent way and E&M operations and will also provide storage facilities. Trains used for permanent way construction will be loaded with rail sections, sleepers and ballast in the depot for track construction work. E&M activities will include the prefabrication of track and station equipment for installation following track laying. In addition to providing stabling for the permanent way trains a track tamping train and other engineering equipment will also be based at the Depot. Up to 75 staff will be based at the Depot with a similar number using it as a work base for off-site construction activities.

2.3.4 Kwai Tsing District

Contract 508

The main contract will commence in early 1994 and will be substantially completed by mid-1996. The new station will come into partial operation in August 1996, although fitting out in the new station and limited modifications to the existing station will continue thereafter. Construction of the new Lai King Station will require substantial excavation into the hillside to the south of the existing station to accommodate both the platform tunnels and concrete structures. Steel props will support the existing station against out of balance earth forces during the

construction phase. The works for site preparation and tunnelling will involve the following at both the station site and the southern portal site:

- Diversion and reinstatement of existing utilities.
- Bulk excavation of soft material and rock, requiring blasting.
- Installation of anchors into the excavated slopes and adjacent to existing tunnels (the latter needing to be carried out at nighttime).
- Construction of retaining walls, including hand dug caissons.
- Demolition of Lai King Community Hall and existing cantilevered walkways to the south of the existing station.
- Provision for pedestrian access to the station, including replacement stairways in structural steelworks and a temporary staircase to the Yeung King housing estate.
- Propping the existing station box.
- Diversion of an existing stream and provision of a new reinforced concrete culvert.
- Establishment of tunnel eyes and tunnelling from the station site, including primary shotcrete lining and rock supports.

Construction of miscellaneous drainage and site access works.

Access to and from the station worksite will be from Kwai Chung Road. Peak lorry movements have been estimated by the station design consultants as 15 trips (30 movements) per hour, including a maximum 60 vehicles per day delivering concrete to the site. Construction of the new station will require removal of the existing walkway alongside the old station and disrupt pedestrian access across the existing station roof and Kwai Chung Road footbridge. All existing pedestrian routes will be re-provisioned during and after construction. Work at the station site would be likely to be required up to 2300 hours most days, with the workforce peaking at 200 men.

The tunnels will be driven by blasting. Surface excavation works will involve the construction of a caisson wall to the east of the site, close to the Winifred Mary Cheung Morninghope School and the excavation by blasting of the area for the worksite. Tunnelling will be carried out for 24 hours per day, six or seven days per week. Finishing of the tunnel portals at either end would be by hand-operated power tools. Shotcreting is likely to be used both for supports for the rock slopes and for tunnel linings. Plant for concrete/shotcrete batching may also be required, but this would be of relatively small size (20–30 m³ per hr). Alternatively, concrete may be delivered by lorries (maximum 50 per day) with access from Kwai Chung Road or Lai King Hill Road. During tunnelling, the rock excavated will reach a peak of 600 m³ per day during the first 14 months of the contract, with minor arisings thereafter. This will require a maximum of approximately 120 lorry trips (240 movements) per day to

remove the spoil. The total spoil removed from the tunnels will be approximately 80,000 m³. Specialised tunnel maintenance plant will be used. Noise sources will include ventilation fans and air compressors. As five tunnels will be excavated, there will be up to fifteen explosions per day. Some of these will be small due to the need to limit vibrations in existing MTRC tunnels and other utilities. The work force at the southern site will probably peak at 150.

Contract 507 and 509

The construction of the viaduct between Lai King Station and Kwai Chung Park will be entrusted works carried out by the Government under Contract 507 as part of the works for Route 3. Section 9.5 of the Route 3 study describes the construction works for the viaduct as comprising:

- *Formation of substructure:* Bored pile construction will be used.
- *Pile cap construction:* Using concrete delivered to site and poured or pumped into place, then compacted using vibrators. Jackhammers will be used for breaking out excess concrete.
- *Deck Construction:* This will comprise tabletop construction cast in situ, with the use of scaffolding. Precast concrete beams will be craned into position between the tabletops. These will either be cast in the contractors work areas, or possibly off-site. The

railway viaducts will be constructed with launching girders.

Work is anticipated to take place over a 3½ year period between May 1993 and September 1996.

The construction works at Kwai Chung Park are scheduled to start in early 1994 and continue till early to mid-1996 (26 months). The excavation of the cut through the park will require the removal of some 250,000 m³ of material. As the site was formerly a landfill, the spoil will be treated as hazardous, and will require special handling and disposal. The construction through the park will be a continuation of the structures on either side. The reinforced and prestressed concrete work required is relatively simple, and a workforce of only some 80 people will be required. The delivery of materials to the site will also not be required in significant quantities, although the likely traffic routes to the site are already heavily trafficked. The park has not yet been gazetted, and is closed to the public at present. It will be necessary for the park to remain closed to the public for the duration of the works, and the works site itself will be secured and sealed off from the public for safety and health reasons.

Contract 510

Construction of the main bridge will commence in late 1993, and be complete by mid-1996. The Eastern Approach Viaduct will have a similar programme, finishing slightly earlier. The Western Approach link will be constructed late in the programme, between mid-1995 and early 1996. Piers P2 and P3 on either side of the main navigation fairway will be spread footings bearing on

bedrock, constructed inside sheet piled cofferdams. Piers P4 and P5 will rest on bored piles, although P4 will require substantial protection works extending into the channel from the typhoon shelter. Pier P6 will rest on bored piles on the dockside of the existing Public Cargo Working Area (PCWA). Pile caps will be constructed within steel sheet piled cofferdams. The Pier P7 foundation will be a mass concrete block and backfill construction. The viaduct will be supported by six sets of piers on bored piles. Temporary jetties will probably be constructed from one or both banks into the channel to support the piling rigs. The superstructure of the bridge will be a balanced cantilever construction of either precast or cast in-situ concrete. The viaduct will be constructed in-situ on a span-by-span basis.

Contracts 511 and 511A

Contracts 511 and 511A will commence from late 1993 for 33 months. Work will take place for 16 hours per day, seven days per week over the construction period, provided the necessary permits are obtained. Peak workforce at the site will be in the order of 450 people. The works areas will extend over approximately 7.8 ha. The main construction activities will be:

- Excavation of slurry cut off wall, bored piling, hand-dug caissons and an underground pump house.
- Concrete works for foundation and superstructure up to podium level.
- Builder's works and finishes.

Approximately 120,000 m³ of spoil will be excavated, of which 90% will be removed from the site. The material is expected to comprise:

- Silty sand fill with cobbles and boulders;
- clayey silty fine to medium sand marine deposits;
- medium dense clayey silty fine to medium sand alluvial deposits; and
- fine to medium grained granodiorite bedrock.

Removal and disposal of the spoil from site will be by barge from a pier at North Tsing Yi, and will require the equivalent of 15 trucks per hour at peak. Piling rigs, tower cranes, hand breakers, hoists and loading barges are anticipated to be in use. A site concrete batching plant is envisaged, with a capacity of approximately 600 m³ per day.

Contract 512

Contract 512 will begin in early 1994 and continue until mid-1996 (29 months). Construction activities for the viaducts will include:

- Bored piling.
- Concrete works for foundation piers and bridge deck (which may include prestressing of the viaducts).

The tunnelling works area will occupy an area of about 3,200 m² and be located at the east portal. At the eastern end, the works at each of the three portal areas will include site formations for:

- The tunnel platforms;
- vertical rockface;
- stable slopes above and around the tunnel face;
- concrete portals; and
- viaduct abutment plinths.

The main construction activities will be:

- Works to form the portal slope;
- drilling and blasting of tunnels;
- mucking out;
- provision of tunnel supports (*ie* rockbolts);
- provision of shotcrete and concrete (in-situ) tunnel linings;
- ground treatment/grouting (when necessary); and
- portal building works.

The tunnels will be driven by drill and blast methods from the eastern portal. Tunnelling will be carried out for 24 hours per day, six days per week. There will be up to six explosions per day. A travelling tunnel shuttering system will be erected on temporary rails, and the tunnel linings

will be cast together in sections. Finishing of the tunnel portals at either end would be by hand-operated power tools. Shotcreting will be also be used both for supports for the slopes and for tunnel linings. Plant for concrete/shotcrete batching may also be required, but this would be of relatively small size (20–30 m³ per hr). This would be located within the works area at the west portal of Contract 514 on East Lantau. Following this, the installation of trackwork, trackside E and M equipment, overhead line and signalling equipment will be undertaken. Specialised tunnel plant under maintenance etc will be used. Noise sources will include ventilation fans and air compressors. The main items of such plant and equipment will be:

- Pneumatic drills;
- rocker shovels;
- locomotive;
- muck cars;
- sliding shutters;
- excavators; and
- shotcreteing machines.

During tunnelling, the rock excavated will reach a peak of 600 m³ per day. This will require a maximum of approximately 60 lorry trips (120 movements) per day to remove the spoil. The total spoil removed from the tunnels will be approximately 130,000 m³. It is estimated that the workforce at the site would be in the order of about 200 people.

2.3.5 *Tsuen Wan and Islands Districts*

Contract 513

The construction of the LFC commenced in mid-1992 and will continue until July 1996. The following description of construction activities is based on the information given in the LFC Environmental Assessment Study. The main construction activities are:

Ma Wan substructures: The initial activity was to excavate the working space behind the anchorage, requiring rock blasting, which has already been completed, as has the subsequent reclamation. After this, concreting for the anchor will be carried out at a rate of about 500 m³ per day, followed by work on the ship impact protection in front of the anchorage, requiring excavation including blasting. These activities will continue until about mid-1995. In addition, concreting for the bridge piers will be carried out until Spring 1994.

Tower construction: Two towers are being constructed, one on Tsing Yi and one just off Ma Wan. Both towers require excavation in rock, including blasting. The towers comprise two legs, with four post-tensioned crossbeams, built in concrete by slipforming. Tower construction will continue for most of the contract period.

Tsing Yi substructures: After excavation and tunnelling of about 650,000 m³ of material for the anchor, this will be concreted, followed by the concreting of the abutment. On completion of this, excavation and concreting of the three piers will be undertaken.

Suspension cables: The work on the cables is scheduled to start by mid-1994. First, a cable catwalk and aerial tramway will be constructed, taking about 9 months. When this is in place, the main cable construction will commence. The cable will be winched out from an unreeling machine on the Ma Wan side, and the operation will continue 24 hours a day for 7 months.

Deck superstructure: The deck units will be prefabricated off-site and brought to the site by barge, from which they will be raised into place and supported by a lifting wheeled mechanism running on top of the suspension cables. Finally, the separate units will be bolted and welded together over about a three month period.

Contract 514

The construction works for Contract 514 are scheduled to begin in early to mid-1994 and continue for 30 months. The site formation at the western portal, including a level platform, retaining walls, vertical rockface and stable slopes around the tunnel entrance will be carried out by others under the Lantau Fixed Crossing contract (Contract 513 of LAR). The site formation at the eastern portal, including stable slopes and platform, will also be carried out under the Lantau Fixed Crossing contract, as will the design and construction of the ventilation building at the east portal. At the west portal, the works area will occupy an area of about 6,000 m². The main construction activities will be as described in relation to Contract 512 above (see pages 25-26). The tunnels will be driven by drill and blast methods from the western portal for 24 hours per day, six days per week. As two tunnels will be excavated, there

will be up to six explosions per day. The tunnel linings will be cast and finished as described in relation to Contract 512 above. Plant for concrete/shotcrete batching may also be required, but this would be of relatively small size (20-30 m³ per hr), and located within the works area at the west portal. The total spoil removed from the tunnels will be approximately 65,000 m³. It is estimated that the workforce at the site will be in the order of 100 people.

Contract 515

The construction of the NLE commenced in the spring of 1992 and will continue until mid-1996. The description of the activities taking place during the construction period is based on the information given in the NLE Environmental Assessment. Construction of the Yam O and Tai Ho sections of the NLE will involve:

- Excavation of 2.5 million m³ of material at Yam O Tuk, including drilling and blasting.
- Dredging and reclamation.
- Formation of twenty three major drainage culverts.
- General earthworks, including the forming a cut on the headland east of Yam O Tuk and through the valley towards Penny's Bay, and filling and shaping of the reclamation.
- Construction of 1320 m of expressway viaduct, 1530 m of interchange and ramps, and 800 m of railway viaduct.

- Construction of the Sea Channel Bridge between Tung Chung and Chek Lap Kok Island.
- Provision for the expressway paving and finishes.
- Installation of utilities.

Contract 518

Construction work is expected to start in mid-1994 when the first section of reclamation is programmed for availability, and continue for 15 months. The bulk of the work will be carried out in the first phase which will provide facilities for the railway construction and operations until 1999. Phase 2 will increase the Depot capacity in 2000, to meet the full requirements of the LAR system. The overall size of the works areas, including Work Sites is expected to be approximately 35 ha. Excavation activities will result in the removal of some 95,300 m³ of spoil. As the site of the depot is on newly reclaimed land, this will consist mainly of marine sand which may be re-used for later stages of the North Lantau Reclamation (NLR).

✓ The main construction activities will include:

- the laying of underground drainage pipes;
- structural concrete construction;
- steelwork;
- track laying; and
- architectural works.

Transport of plant and materials to site will be mainly by sea. Vehicle movements are not expected to exceed 20 per

hour at peak periods. A concrete-batching plant will be located on site with a capacity of 80 m³ per hour. It is anticipated that the contractor will work up to 16 hours per day, seven days per week during the critical stages of the contract. The peak workforce during the construction phase will be about 500 persons.

Contract 516

The construction work for Contract 516 is scheduled to commence in early 1994, and continue until December 1996 (a period of 36 months). The overall size of the Works Areas (including the Works Site) for Contract 516 will be approximately 130,000 m². The main construction activities will be as follows:

- Open cut excavation;
- sheetpiling (for the station);
- construction of Slurry Walls (for the tunnels);
- structural concrete construction; and
- architectural works.

The contractor will work up to 16 hours a day, seven days a week during the critical stages of the contract. The peak workforce is estimated to be approximately 500 people. Sheetpiling rigs will be required for the station construction and a concrete batching plant with a capacity of approximately 80 m³ per hr. will be set up on site. It is also anticipated that some materials deliveries and spoil removal will be by barge. Traffic generated from the site at peak times is estimated to be in the order of 30 trips (60 movements) per hour. Only the main haul road near the cargo handling area will be paved. The construction method for Tung Chung Station will be as described for

Kowloon Station (Contract 503) above (see page 19). Some 100,000 m³ of marine sands will be excavated from the reclamation, of which approximately 70% will need to be removed from the site. The rest will be stockpiled on-site for backfilling.

The construction method for the tunnels will be as described above for Contract 503 (see page 19). Some 500,000 m³ of marine sands will be excavated from the reclamation for the tunnel cut, and as for the station, approximately 50% will need to be removed from the site.

Contract 517

The main construction activities will be as follows:

- Open cut excavation;
- construction of slurry walls;
- structural concrete construction; and
- architectural works (for the station).

The design for the Airport station has yet to be undertaken, but it is understood that this will be located above ground about 70 m from the airport terminal and connected to this by bridges. The detailed design of the station will proceed in parallel with the design of the terminal.

2.4 ACTIVITIES DURING OPERATION

2.4.1 LAR Train Services

The LAR will link Central and Kowloon with Lantau and the new Chek Lap Kok Airport. Two services will be operated:

- The *Airport Express Line (AEL)* will provide a dedicated high-speed service between Central and Chek Lap Kok, stopping only at Kowloon and Tsing Yi Stations.
- The *Lantau Line (LAL)* will be a public service linking Central to North Lantau, with stations at Kowloon, Tai Kok Tsui, Lai King (providing a connection with the existing Tsuen Wan Line), Tsing Yi and Tung Chung.

Trains on both services will operate at up to 135 kph, sharing running tracks over most of the route. The LAR is scheduled to be fully operational for the opening of the new Chek Lap Kok Airport in mid-1997. The preferred service pattern for the LAR in the year 2012 (the year for which operational impacts will be assessed for the purposes of the LAR EIS) is shown in *Table 2.4a*.

2.4.2 Other Operational Activities

Central and Yau Tsim Districts

The main passenger entrance to the Central Station will be to the north, facing onto a dedicated road adjacent to the

Table 2.4a *Lantau and Airport Railway Service Patterns: 2012 Preferred Case (Headways in minutes)*

Time Period	LAL - Hong Kong to Tsing Yi	LAL - Tsing Yi to Tung Chung	Airport Railway
0600 hrs - 0700 hrs	4.5	4.5	4.5
0700 hrs - 1000 hrs	2.3	4.5	4.5
1000 hrs - 1630 hrs	4.5	4.5	4.5
1630 hrs - 2000 hrs	2.3	4.5	4.5
2000 hrs - 0100 hrs	8	8	8

new highway. Vehicular access will be by ramp down to the AEL platform level from the east and north-west. The main chiller, heat exchanger and ventilation plant will be located at the western end of the building. In the initial phase of operation, some 85 car parking spaces will be provided at ground level, which is planned to be given over later to an enlarged check-in hall if ITCI facilities are provided. In the final phase, at the AEL platform level a vehicle circulation area and carparking for 140 vehicles will be provided. A further 96 carparking spaces will be provided at the intermediate level between the AEL platforms and the LAL concourse. A ventilation building will be located over the cut-and-cover tunnel close to the previously placed submersed tube tunnel unit on the north western shore of the Central reclamation. A pumphouse for the MTRC stations will be located under the proposed promenade on the new seawall, between Piers 3 and 4. Further commercial development above and adjacent to the station and more underground car parking spaces will be provided by others on the northern part of the site (ie to the north of the new road traversing the site) in the final phase of operation.

The main vehicular and pedestrian entrances of Kowloon Station will be on the western side of the station with additional pedestrian access from podium level and the bus station on the eastern side of the development. Restaurants and retail facilities will be located in the concourse and paid areas, as will public toilets and other support facilities. At the main entrance, vehicular access will be provided for passenger drop off, private vehicles will then exit the station whilst an internal road is available to taxis in order to pick-up from the AEL

arrivals hall on the eastern side of the station. Pick-up and parking facilities for private cars, mini-buses and hotel limousines will also be available on the eastern side of the station complex, these will be accessed from the boundary road which will also provide access to parking areas for the other developments above the station. Passenger access from the concourse to platform level will be by escalator. Safety screens will be erected at platform edges with automatic platform screen doors which will only open when aligned with open train doors. The main tunnel ventilation building will be located at the southernmost point of the WKR. Station air vents and auxiliary tunnel vents will be mounted on the station roof. Ventilation for the development's internal roadway and vehicle parking areas will exhaust onto the station access road on the western side of the complex. It is expected that the chiller unit for the station air conditioning will be sited at ground level in the southeastern corner of the station building.

Mong Kok and Sham Shui Po Districts

There will be a single pedestrian entrance, to the LAL only, from the atrium above Tai Kok Tsui station concourse. No public vehicular access will be provided. A slip road off Road P1 will provide service access on the eastern side of the station but this will not be available for staff who will use the public access facilities. Service plant and equipment such as chillers, heat exchangers and ventilation plant will be located on the roof and enclosed where appropriate. Sanitary, mess and other facilities will be provided for staff at the station, but public facilities will not be provided.

Kwai Tsing District

The new Lai King Station will comprise 3 levels open to the public. The lowest level will accommodate the new AEL (which will not stop at Lai King) and the down LAL platform, allowing cross platform transfer with the down TWL in the existing station. The middle level will provide the new station concourse, and will be linked into the concourse of the existing station. The upper level will form the platforms for the up LAL and the diverted up TWL, which will provide for cross-platform interchange. Beneath the lowest public level of the new station, a traction sub-station will be provided at the north west end, together with vehicular access to this from Kwai Chung Road. Ventilation and chiller plant will be located at both ends of the new station, which include some plant located on the roof at the south-east end. Sanitary, messing and other facilities will be provided for staff at the station, but public facilities will not be provided.

At Tsing Yi Station, the ground floor level main passenger access to the station will be to the south of the site, from Tsing King Road, shared with access to the retail floorspace in the development. A bus terminus will be provided to the north of the site. A substation and other plant equipment will be located on the north side of the development at ground floor level, as will retail parking provision. Further retail parking will be provided on a ground floor mezzanine level. The first floor level will accommodate the main passenger concourse for the LAR, and extensive retail floorspace. The down LAL and AEL platforms will be at second floor level, with the up platforms for both services on the third floor level. There will also be extensive retail floorspace on the second and

third floor levels. A slip road will be provided from the westbound carriageway of Tsing Tsuen Road (Tsing Yi North Bridge) to provide access to the station. The forth and fifth floor levels will contain parking spaces associated with the residential blocks above the station. The residential development itself will be in the form of 12 cruciform towers, with associated facilities provided at the podium level. Approximately 180 MTRC staff are estimated to be employed at the station.

Tsuen Wan and Islands Districts

The Siu Ho Wan Depot will operate 24 hours per day, seven days per week. By 2016, staff numbers will be about 150 on morning and afternoon shifts and 350 on the night shift. Most will travel to work via the MTR or by bus although a limited number of parking spaces will be available. Regular activities will be carried out at night when the trains are not in service. Similarly, trackway maintenance and repair work will normally be undertaken at night when the LAR is not operational. Other permanent way operations such as rail welding and train loading will be carried out during the day to prepare for night time operations. The three main elements of the Depot are laid out such that:

- All activities which require frequent access by non-authorised personnel are concentrated in the north-western area of the site, close to the main entrance.
- The central area of the site contains the main depot building, covered and uncovered sidings where virtually all train cleaning, maintenance and repair work will be carried out.

- The permanent way section, at the north-eastern end of the site, which will contain track construction and maintenance facilities.

Access will be primarily from the north side of the Tai Ho Wan Interchange, via a public area to a main access road around the northern boundary of the site and a southern boundary perimeter road with cross-site access by gated level crossings. A secondary access will be located at the north-eastern end of the site off the seawall maintenance access road. The north-eastern end of the site will contain the permanent way depot buildings and sidings, the dangerous goods store and barge moorings at the sea wall. This area will not be fitted with 1500 v overhead power lines to enable crane operations to be carried out and also to provide a safe site for the emergency helicopter pad. The main operations in this area will include:

- Unloading of barges (track ballast, rails, sleepers and heavy equipment including LAR carriages);
- rail welding and handling;
- loading of track maintenance trains (ballast, rails and sleepers);
- overhead line workshop; and
- locomotive light repairs facility.

The central area of the Depot will contain the train cleaning, maintenance and repair facilities. This will be developed in two phases over a period of five years from 1994 to 1999 with the Depot capacity increasing to keep

pace with the LAR requirements. When fully operational the main depot building will contain:

- Heavy repair shop and tracks;
- heavy maintenance tracks;
- running maintenance tracks;
- heavy cleaning track;
- heavy and light stores;
- offices and workshops; and
- Staff training and rest facilities.

Adjacent open sidings will be used for stabling and cleaning of rolling stock. Rolling stock washing facilities will be located near the Depot entrances and if required an additional acid wash unit will be sited on the south side of the sidings. A traction substation and a wheel lathe facility will be located towards the western end of the Depot. A through line/test track will run along the southern boundary of the site.

At Tung Chung, the main pedestrian entrance to the station will be at ground floor level, with a spine linking the station with the commercial developments on the bridge across the NLE. At ground floor level, there will be a bus station located to the north of the station and a taxi/"kiss and ride" drop off point located to the south. Sanitary, messing and other facilities will be provided for staff at the station, but public facilities will not be provided. Principal plant rooms will be located at the level between the platforms and concourse. It is estimated that approximately 45 MTRC staff will be employed at the station.

3 CENTRAL AND YAU TSIM DISTRICTS

3.1 INTRODUCTION

In this section of the report, the predicted environmental impacts which are likely to arise from the construction and operation of the LAR in Central and Yau Tsim Districts are discussed, together with the measures proposed by the consultants to avoid any significant impacts, or reduce these to acceptable levels.

The impacts likely to arise during the construction of the LAR are discussed first, followed by those which will occur during operation of the railway. The impacts are discussed under the following headings:

- Noise and vibration;
- air quality;
- water quality;
- land use and visual impacts;
- waste management; and
- environmental monitoring and audit.

More detailed information on the way in which impacts have been assessed is given in the Technical Annexes contained in *Volume 3* of this Report.

The alignment in this Route Section is described in *Section 2.2.1*, while the activities which will take place there during construction and operation of the LAR are described in *Sections 2.3.2* and *2.4.2* respectively. The main

features of this section of the alignment are shown in *Figure 3.1a*.

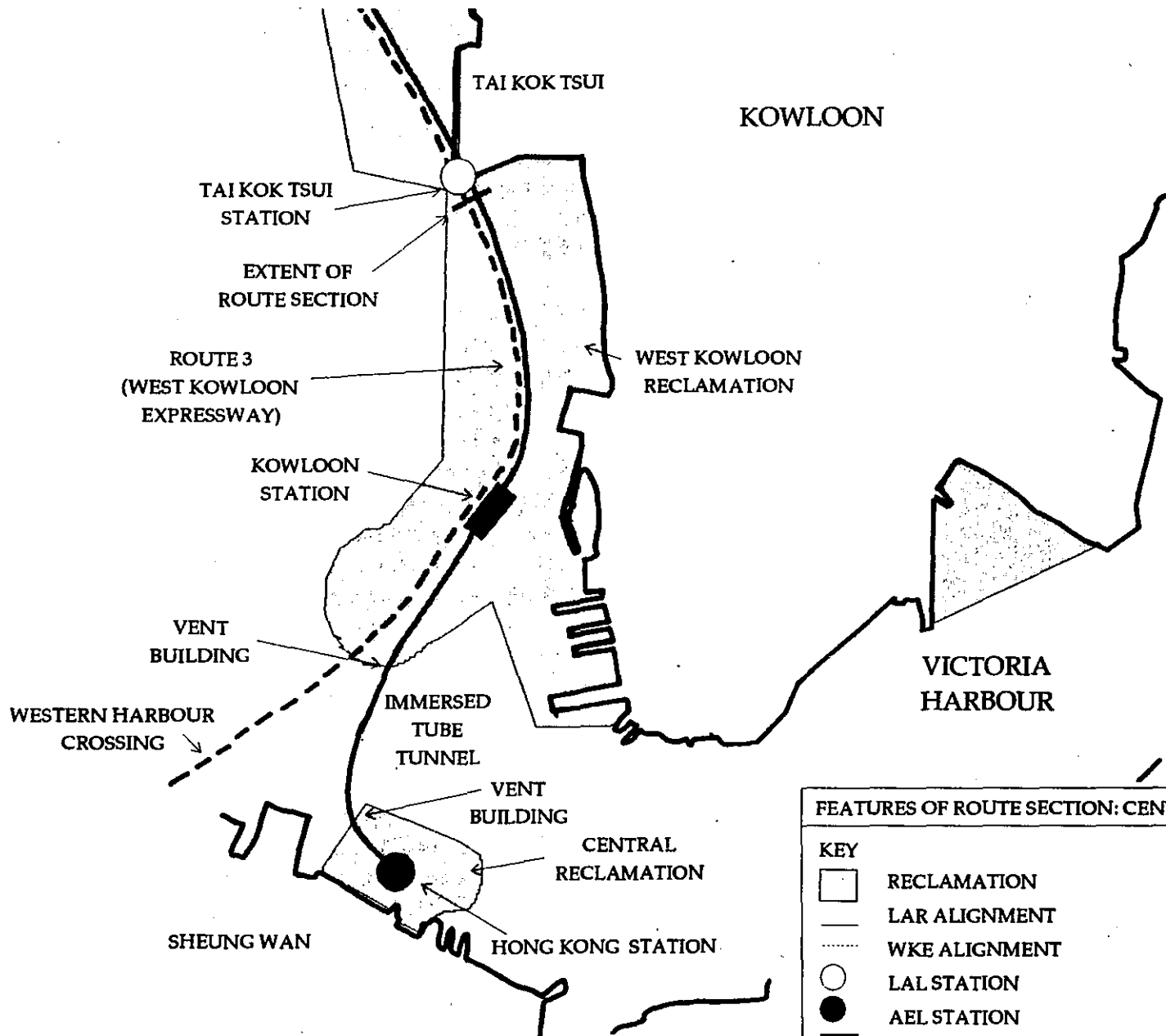
3.2 IMPACTS DURING CONSTRUCTION

3.2.1 Noise and Vibration

Predicted Impacts

For general construction noise, levels emitted from the Hong Kong Station worksite will exceed acceptable levels during the daytime at the United Building. They will also exceed the requirements of the Noise Control Ordinance (NCO) at other locations if night-time working is carried out. Noise from dredging works in the Harbour will be about 75 dB(A) in the worst case on Hong Kong side (at Victoria Hotel), which would be significant at all times. On Kowloon side it will be about 55 dB(A) at the Cultural Centre, which would equal the NCO night-time criterion.

Construction of Kowloon Station and adjacent tunnels will cause noise levels of up to 75 dB(A) in the worst case, which would be at Site 10 on the WKR. Other sites on the reclaimed area will be similarly affected. Levels of 73 dB(A) would be experienced at Man Wui Street and Man Cheong Street. Mitigation measures will be required if evening or night-time working is to be allowed to take place. Between Kowloon and Tai Kok Tsui, the evening and night-time NCO criteria will also be exceeded in a number of locations. In relation to percussive piling works, activities at the Hong Kong Station worksite will lead to significant noise impacts at Exchange Square, the General




FEATURES OF ROUTE SECTION: CENTRAL AND YAU TSIM DISTRICTS

KEY	
	RECLAMATION
	LAR ALIGNMENT
	WKE ALIGNMENT
	LAL STATION
	AEL STATION
	AEL INTERCHANGE STN

FIGURE 3.1a
DATE JULY 1993

ERM Hong Kong
10-11th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong



Post Office, the New Hang Seng Bank Building and the Connaught Centre.

In Kowloon, no significant noise impacts from piling activities will occur, with noise levels not exceeding the NCO requirements in any case.

Also, due to the proximity of Exchange Square to piling works for Hong Kong Station, vibration impacts may be sufficient to cause nuisance. Mitigation of these effects will be required.

Measures for Mitigation

Contractors will generally be required to implement a number of measures to mitigate construction noise, such as:

- Care in the location of plant and equipment;
- use of silencers, mufflers, acoustic shields, sheds and screens;
- regular maintenance of plant and equipment; and
- specification and use of "quiet" plant and equipment.

It is also recommended that site practices such as the shutting down or throttling back of plant and equipment between work periods should be employed by the contractors.

At the Hong Kong Station Worksite, a 3.5 m barrier should be erected along the southern boundary of the site, and all plant operating within 150 m of the United Building should be limited to 120 dB(A). Further mitigation may be required to comply with the requirements of a Construction Noise Permit (CNP) if evening or night-time working is necessary.

All dredging near the proposed site of Hong Kong Station should be accomplished during daytime hours as far as is practicable consistent with the requirements of the construction programme. If evening or night-time dredging proves necessary, the Contractor will be responsible for obtaining a CNP, and some limitations on dredging works may be necessary to ensure compliance with any conditions imposed by the CNP.

For works entrusted to the Highways Department, the relevant Government contracts will specify the mitigation measures to be implemented in relation to this. It is understood that construction work in this area will be restricted to between 0800 and 1800, and no night-time works are proposed.

Cumulative impacts arising from construction work at Tai Kok Tsui Station have been addressed and the mitigation measures described in *Paragraph 4.2.1* (see *Page 49*) have taken account of these.

To mitigate impacts from percussive piling at Hong Kong Station worksite, it may be necessary to limit hours of working. It is also recommended that the affected parties

should be informed in advance by the contractor when piling is to take place.

Vibration impacts are predicted to occur at Exchange Square due to percussive piling on the station worksite. If alternative techniques are available then percussive piling within 100 m of Exchange Square or other vibration sensitive receivers should be avoided whenever possible.

3.2.2 Air Quality

Predicted Impacts

The construction works for the new Hong Kong Station will be going on at the same time as the reclamation works are still being completed. High levels of dust (eg over $700 \mu\text{g m}^{-3}$) from the station construction works alone will exceed acceptable hourly limits. When combined with dust from the reclamation works as well, levels of over $800 \mu\text{g m}^{-3}$ may occur. However, most of the existing buildings in the vicinity are centrally ventilated and the dust impacts will therefore be less significant, although mitigation measures will still be required.

No significant dust impacts will occur from construction works associated with the Immersed Tube Tunnel.

In Kowloon, dust impacts from the construction of the WKE will be much more significant than those from Kowloon Station. The predicted maximum dust impacts from construction of the LAR in this area are about $183 \mu\text{g m}^{-3}$, and relatively low if compared to the EPD-recommended hourly limit of $500 \mu\text{g m}^{-3}$. These

maximum impacts will only occur in the first year of construction of the LAR, when most of the bulk excavation works will occur.

It is unlikely that dust from the construction of the Kowloon tunnels alone will exceed acceptable limits. However, the combined dust impacts from the various concurrent construction activities from different projects in the area will probably be above these, and mitigation measures will be required.

Measures for Mitigation

The following measures are recommended to be implemented by contractors to help ensure that dust levels are kept to within acceptable limits during construction of the LAR and to comply with the provisions of the Air Pollution Control Ordinance:

- No burning of debris shall take place on site.
- Final compaction of reclaimed and excavated areas should be completed as quickly as possible, taking account of the needs of the construction programme.
- Water bowsers with spray bars shall be used, particularly during delivery and handling of dusty materials, or during dry and windy weather.
- Stockpiles of dusty materials shall be adequately enclosed, and located at least 100 m from sensitive uses wherever practicable.

- Conveyors shall be fitted with windboards, or enclosed and fitted with cleaners where carrying dusty materials. Transfer points and discharge areas should be enclosed.
- Enclosures, fitted with exhaust fans with filters, shall be provided for areas used for discharging dusty materials to vehicles.
- Cement and other fine-grained materials shall be stored in enclosed silos, fitted with alarms.
- Weigh-hoppers shall be vented to suitable filters.
- The contractor should apply for a licence for concrete batching plant, and design and operate them in accordance with the "Best Practicable Means" Requirements.
- Batching plant should be located at least 100 m from sensitive land uses.
- Site areas where there is regular movement of vehicles should be paved and kept clean.
- All haulage and delivery vehicles on-site should be restricted to designated roads, and all motorised vehicles restricted to a maximum speed of 15 kph.
- All off-road vehicles should have exhausts directed away from the ground wherever practical.

- Open haulage vehicles should be covered by tarpaulins.
- Wheel-washing facilities will be provided at site exits.

3.2.3 *Water Quality*

Predicted Impacts

Oxygen demand and nutrient loading from dredging will be low compared to that from existing sewage discharges into Victoria Harbour. High velocity flows in the central part of the harbour will also quickly disperse any nutrients arising. The potential suspended solids (SS) load, however, is high in comparison with current sewage discharges and mitigation measures will be required.

Backfilling will not produce large amounts of SS due to the general use of coarse grained materials in the process. If fine grain material is used then mitigation measures will need to be employed to reduce turbidity and the loading of SS into the surrounding waters.

Dredged spoil from the Immersed Tube Tunnel can only be accepted at authorised dump sites. The most contaminated mud will have concentrations of heavy metals which fall within the guidelines for already existing dump sites. Less contaminated mud can also be accepted at existing dump sites. The contractor shall be required to confirm contamination levels by carrying out a survey and analysis of the muds prior to dredging.

Runoff will occur at the station worksites, which will be exposed to erosion and this has the potential to cause adverse impacts on the performance of seawater intakes. Elevated turbidity in near shore areas may occur if drains discharge directly into the harbour, especially during heavy rainfall. Such runoff will lead to high levels of loading of SS into near shore waters, causing discolouration of waters and potential damage to sea water intakes. Such potential problems can be avoided through appropriate mitigation measures. Construction site runoff will require a discharge consent, and should be controlled and treated if necessary prior to disposal. However, it is extremely unlikely that the Water Quality Objective (WQO) for SS will be breached in Victoria Harbour due to LAR construction.

Measures for Mitigation

Loss of dredged material in the Harbour during transport can be substantial. To mitigate against this potential impact to the water body the mud will be loaded so as to cause a minimum of loss and will be well contained at all times during the transport process. Measures such as the use of sealed grabs, sealed bottom openings of barges and the control of barge and hopper loading are recommended. Also marine muds will be disposed of only at appropriate dumping grounds so as to minimise the impact on the surrounding waters.

The Contractor will be required to appoint an independent hydrographic surveyor to undertake bathometric surveys in the disposal area to ensure that the muds are disposed of accurately. Determination of the precise amount of

contaminated mud to be excavated and transported by the contractor will also be required.

Proper site management is essential to minimise runoff during rainy seasons and "good housekeeping" practices should be implemented to ensure that debris and rubbish cannot gain access to nearby water bodies. Sand traps should be installed where appropriate to prevent sediment from entering the drainage system.

In addition, regular site inspections and clean ups should ensure that fuels and solvents do not enter the water bodies. Construction materials such as chemicals, paints and solvents should be contained. Dumping of prohibited substances as listed in the *Technical Memorandum on Standards of Effluents Discharged into Drainage and Sewage Systems, Inland and Coastal Waters* (TM) should not be allowed.

Sewage discharges should be connected to the local public sewer if available. Alternatively, chemical toilets or similar facilities with appropriate desludging arrangements will be required. Any effluent discharges will have to meet the standard as stipulated in the TM.

Construction site runoff will be subject to discharge consents. A number of standard mitigation measures are recommended for control and treatment. These include the following:

- Provision of drainage channels and settlement lagoons;

- settling of concrete batching discharges and pH adjustment;
- oil interceptors and sediment traps;
- treatment of stockpiles to reduce erosion and sediment release;
- Bentonite interception channels; and
- discharge points located to avoid embayments and reprovisioned seawater intakes.

3.2.4 *Land Use and Visual Impacts*

The new Hong Kong and Kowloon Stations will be built on reclaimed areas. The land uses in these areas have been planned taking into account that the stations will be built there. Therefore, there will be no significant land use impacts arising during the construction of the LAR in this section of the route.

3.2.5 *Waste Management*

Predicted Impacts

In this route section, over 2,620,000 m³ of sandfill will be excavated from the reclamations to build the LAR, 660,000 m³ on Hong Kong side and almost 2,000,000 m³ on Kowloon side. This material will be dewatered and temporarily stockpiled on-site. It will then either be reused on site, sold for use on other reclamation or construction projects, or as a last resort sent for ultimate

disposal at a public dump or landfill. The material may be removed from the sites by truck, or preferably by barge.

Dredging works for the Immersed Tube Tunnel will generate some 550,000 m³ of marine deposits (plus a further 100,000 m³ from trim dredging). These will be saturated and probably contaminated, and therefore will be transported by barge to designated marine dumping sites.

Measures for mitigation

Measures which will be required of the contractors to ensure that any environmental impacts associated with waste management are kept to acceptable limits include:

- Segregation of wastes for disposal;
- agreement with the Fill Management Committee and the Environmental Protection Department of marine mud disposal methods, followed by a formal application for a dumping licence;
- use of only licensed waste collectors; and
- obtaining any necessary waste disposal permits required under the Waste Disposal Ordinances.

Mitigation measures relating to water quality impacts arising from marine mud disposal activities are discussed in *Paragraph 3.2.3* above.

3.2.6 *Environmental Monitoring and Audit Requirements*

Introduction

As a means of ensuring the effectiveness of mitigation measures, MTRC will undertake environmental monitoring and employ appropriate audit practices in association with this. The data collected in this manner will be used in association with Event Contingency Plans to ensure that any accidental or other exceedance of the statutory requirements are remedied. More details of this are set out in the relevant Technical Annexes in *Volume 3* of this report. This section sets out the locations recommended for monitoring of the various categories of impact for this part of the LAR route.

Noise and Vibration

On Hong Kong side, construction noise monitoring is recommended at the following locations. The exact locations and direction of monitoring equipment will be determined by the Engineer:

- United Building;
- Victoria Hotel;
- Mandarin Hotel;
- Exchange Square;
- City Hall;
- General Post Office; and
- Hang Seng Bank New Headquarters.

In relation to these, it should be noted that other noise sources (such as road traffic) will make a significant

contribution to the noise climate. For this reason it is recommended that the daytime construction noise limit shall be 75 dB(A), but with the proviso that the Engineer shall interpret the monitoring results in the light of potential influencing factors such as road traffic.

In relation to Kowloon Station and the adjacent tunnels, noise monitoring is recommended at the following sites:

- Man Cheong Street; and
- Canton Road.

The construction of the tunnels between Kowloon and Tai Kok Tsui Stations will be carried out under Government contracts as entrusted works. Any noise monitoring required will be specified in these Government contracts.

Air Quality

On Hong Kong side, dust monitoring stations are recommended at the following locations:

- Exchange Square;
- Swire House;
- General Post Office;
- Harbour Building; and
- New Hang Seng Bank Building.

In relation to Kowloon Station and the adjacent tunnels, dust monitoring is recommended at;

- Man Cheong Street.

The construction of the tunnels between Kowloon and Tai Kok Tsui Stations will be carried out under Government contracts as entrusted works. Any dust monitoring required will be specified in these Government contracts.

Water Quality

Water quality monitoring within Victoria Harbour will be undertaken by a specialist consultant retained by MTRC at ten designated monitoring stations to determine the impacts arising during construction, with a further five control stations. The exact location of the stations will be determined by the Engineer.

Data on mean suspended solids and mean DO concentrations will be collected. Monitoring will be carried out roughly perpendicular to the immersed tube tunnel route, with stations laid out in pairs with one station near the works area, to monitor effects of dredging, and another placed at an appropriate distance from the site to act as a control.

3.3 *IMPACTS DURING OPERATION*

3.3.1 *Noise and Vibration*

Predicted Impacts

Since the design of the rolling stock for the Lantau and Airport Line (LAL) and the Airport Express Line (AEL) is currently still progressing, there is no definitive source noise data available. The appropriate source noise level has been the subject of a study undertaken by ERM which is reported in detail in *Annex B*. Three sources of information have been studied.

Firstly, train noise measurement data supplied by EPD was studied. This data set indicated a noise level of 89 dB(A) would be most appropriate. However, it was poorly substantiated and did not relate to the relevant train type and consequently of limited value to the study.

Secondly, a review of documented noise measurements of rolling stock similar in design and function to that of the LAR was undertaken. A selection of existing and generally older designs of rolling stock were studied, and it was concluded that an $L_{AMax, (fast)}$ level of 86 dB was typical of this class of rolling stock. This noise level refers to a train passing at 135 kph on ballasted track, and is measured at a distance of 25 m in accordance with ISO 3095: 1975.

The third source of information is the MTRC specification for the rolling stock. Whilst the measured noise data studied was of existing stock that are generally several

years old using older designs, the LAR trains will be a brand new design and consequently can be expected to be quieter. The MTRC specification for the design of the rolling stock is:

- Design level of 80 dB; and
- Maximum allowable level upon delivery of 81 dB \pm 2 (ie 83 dB).

MTRC will operate a rigorous maintenance programme, combined with extensive train noise monitoring, which they are confident will make it possible to achieve an operational level of 83 dB(A).

EPD, MTRC and ERM concluded that the assessment, and the mitigation, of train noise in the Final Report should, therefore, be based on an agreed reasonable worst case scenario, the "86 dB(A) Train", and the LAR be designed to incorporate appropriate mitigation. However, the precise mitigation requirements will only be known once the actual LAR train noise level has been established. MTRC will phase the implementation of these measures in an appropriate manner to meet the NCO limits.

Between Hong Kong Station and a point approximately 250 m south of Tai Kok Tsui Station, the LAR will run in tunnel. Consequently, there will be no operational noise impacts from trains in this part of the alignment. No impacts have been predicted where the LAR runs in an open cut section south of Tai Kok Tsui Station.

For ground-borne noise and vibration, no significant impacts have been identified as likely to occur from the

passage of LAR trains, due to the resilient track mounting system which will be used, and the fact that the speeds of trains will be limited by the relatively short distances between stations in this section of the route.

No significant impacts have been identified as arising from fixed plant sources or station activities in this section of the route. Maximum sound pressure level specifications have been made for fixed plant to ensure that sensitive receptors are protected from excessive noise. Where these levels cannot be met for operational or other reasons, alternate means of protection, such as orientating vents away from sensitive receptors or the use of baffles, screens and other acoustic techniques will need to be adopted.

Measures for Mitigation

As no significant train rolling noise impacts have been identified in this route section, therefore, no noise mitigation measures will be required to be provided.

The proposed track mounting system is likely to provide adequate mitigation of ground-borne noise.

Major ventilation discharges and openings in buildings housing noisy plant should be oriented away from NSRs (eg facing towards the harbour). Where openings may face onto public areas (eg the proposed promenade along the shore of the new Central reclamation), these should be fitted with acoustic louvres or other suitable attenuation hardware. Acoustic silencers for the station ventilation fans are recommended at Kowloon Station, and the attenuation requirement should be defined in the detailed

system design to limit the overall noise level at 1 m from the ventilation openings to 68 dB(A). Consideration of absorptive lining in plantroom, and vibration isolation of machinery equipment, mainly pumps, chillers, and pipeworks are recommended for inclusion at the detailed design stage.

3.3.2 *Air Quality*

All the identified sources of air pollutants during the operation of the LAR will only give rise to very small levels of emissions and concentrations. No significant air quality impacts will be associated with the operation of the LAR in this route section.

3.3.3 *Water Quality*

Predicted Impacts

As the majority of this section of the LAR is covered, the volume of track runoff will be minimal. In addition, the tunnel lining will reduce the amount of drainage (maximum tunnel seepage rates for the MTR are approximately 5 l per m² per day). However, the potential exists for water quality impacts to result from discharges of contaminated runoff and drainage. No adverse water quality impacts are anticipated, provided that the mitigation measures set out below are implemented.

Maximum daily flow rates from the station cooling systems are expected to exceed the maximum discharge of 6000 m³ per day specified under the TM. The governing criteria will, therefore, be the WQO for the relevant Water

Control Zone (WCZ), that is to say, the effluent discharge should not cause the normal daily temperature range to change by more than 2°C.

The Consultants have estimated that, based on a worst case scenario of some 24000 m³ of cooling water per day at a temperature of 10°C above intake level, the 2°C temperature envelope would be confined to an area approximately 120 m offshore. As there are no biologically sensitive receivers such as mariculture zones, or bathing beaches, within this zone, no unacceptable impacts are anticipated.

The proposed sewerage network in the vicinity of the stations will be commissioned in time to serve the MTRC developments, and these can therefore be connected to the local sewer. The flow will be screened and then pumped to a sewage treatment works. As the sewerage system will be in phase with the development, no significant impacts on water quality are anticipated.

Measures for Mitigation

The potential for contaminated track runoff and tunnel drainage to arise will be the principal concern from railway operations. The following measures have been identified to mitigate potentially significant impacts on water quality as a result of operation of the LAR and will be incorporated into the Code of Operational Practice (COP):

- Traps to collect suspended solids in drainage or runoff (including metals) at stations;

- interceptors to collect oil and grease at stations;
- regular inspection of the lining and seals of the tunnels to monitor ingress of groundwater, and appropriate actions to reduce the volume of tunnel drainage arising from this source; and
- procedures for maintenance practices shall be implemented such that the volume of all wastewaters or effluents arising are minimised.

3.3.4 *Land Use and Visual Impacts*

The LAR alignment and associated structures in this route section will all be located in reclaimed areas which have undergone extensive planning exercises, and no significant impacts will therefore occur. Similarly, as most of the structures are below ground, or incorporated into larger developments, there will be no adverse visual impacts.

3.3.5 *Waste Management*

Refuse collection within stations and tunnels will be MTRC's responsibility. Waste will be collected and stored temporarily at refuse chambers, then either delivered by private contractor to public Refuse Collection Points or collected directly by Urban Services Department. No adverse environmental impacts are predicted to arise from these arrangements.

4 MONG KOK AND SHAM SHUI PO DISTRICTS

4.1 INTRODUCTION

In this section of the report, the predicted environmental impacts which are likely to arise from the construction and operation of the LAR in Mong Kok and Sham Shui Po Districts are discussed, together with the measures proposed by the consultants to avoid any significant impacts, or reduce these to acceptable levels.

The impacts likely to arise during the construction of the LAR are discussed first, followed by those which will occur during the operation of the railway. The impacts are discussed under the following headings:

- Noise and vibration;
- air quality;
- water quality;
- land use and visual impacts;
- waste management; and
- environmental monitoring and audit.

More detailed information on the way in which impacts have been assessed is given in the Technical Annexes contained in *Volume 3* of this Report.

The alignment in this Route Section is described in *Section 2.2.2*, while the activities which will take place there during construction and operation of the LAR are described in *Sections 2.3.3* and *2.4.2* respectively. The main

features of this section of the alignment are shown in *Figure 4.1a*.

4.2 IMPACTS DURING CONSTRUCTION

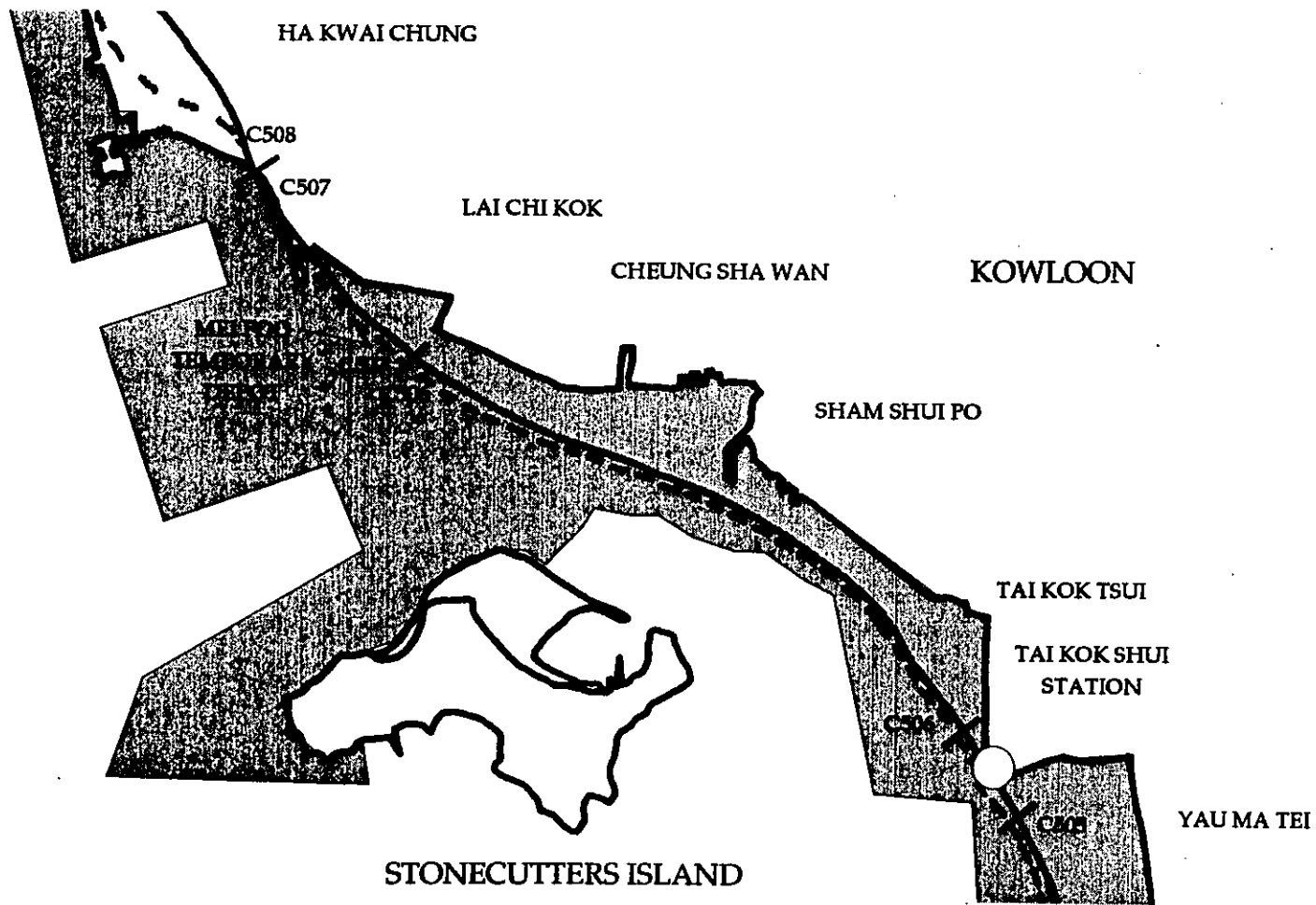
4.2.1 Noise

Predicted Impacts

Cumulative noise impacts some 10–12 dB(A) in excess of acceptable daytime limits will occur in the Cherry Street/Hoi King Street Intersection neighbourhood from the construction of Tai Kok Tsui Station and Cherry Street Underpass (the latter being part of the works entrusted to Government under Contract 504). The development at CDA Site B, adjacent to the station site, will be constructed simultaneously with the station. In its early stages it will add to noise levels at the Hoi King Street residential units, while in its later stages it may act as a screen, reducing station construction noise impacts at these same locations.

For the entrusted works relating to Contract 506, the WKE Environmental Assessment concluded that, for the WKE alone, daytime noise impacts along the waterfront of West Kowloon will be minimal, but noise levels will exceed the night time Acceptable Noise Level (ANL) by 10–15 dB(A). No significant construction noise impacts will occur in the vicinity of Contract 507, due to noise limits being set against already high baseline noise levels.

At the temporary depot at Mei Foo, noise from trains, including wheel squeal, at a distance of 300 m (the



FEATURES OF ROUTE SECTION: MONG KOK & SHAM SHUI PO DISTRICTS

KEY





-  RECLAMATION
-  LAR ALIGNMENT
-  WKE/ROUTE 3 ALIGNMENT
-  TAI KOK TSUI STATION

FIGURE 4.1a

DATE JULY 1992

ERM Hong Kong

10-11th Floor
 Hecny Tower
 9 Chatham Road
 Tsimshatsui, Kowloon
 Hong Kong



minimum distance to the NSR) are within the acceptable limits for daytime and evening work without any additional noise control. Materials stockpiling and handling and the loading of engineering trains will produce noise levels of a similar magnitude to other general construction activities in the area. They will, however, be of limited duration and frequency and will not make a significant contribution to the overall noise levels. Some track and station equipment prefabrication work may be carried out in the open if suitable buildings are not available. This may lead to elevated noise levels if cutting and grinding tools are used. Deliveries of materials and heavy goods will be limited to daytime hours, and most depot staff will be bussed in or use public transport. The additional road traffic will not be significant when compared to other development traffic.

Measures for Mitigation

The following measures will be required to be implemented by the Contractor to mitigate noise impacts from the construction of Tai Kok Tsui Station:

- Erection of a 3.5 m noise barrier along the northern and eastern boundaries of the site.
- Specification and use of "quiet" plant and equipment.

General noise mitigation measures, which are described in relation to the contracts in Central and Yau Tsim Districts in *Paragraph 3.2.1 (Page 37)* above, will also be required.

The relevant Government contracts will specify the noise mitigation measures to be implemented in relation to the entrusted works for Contracts 506 and 507. These will include a landscaped buffer zone which will be provided by the Government as part of the Route 3 mitigation measures.

It should also be noted ERM consider it will be necessary for the Government contractors for the WKE to provide partial enclosure of the piling rigs and the erection of a 6 m high noise barrier during construction of the Cherry Street underpass to ensure that people in the Foo Kwai, Hoi King and Cherry Street/Hoi King Street Intersection neighbourhoods are protected from excessive noise levels.

4.2.2 *Air Quality*

Predicted Impacts

Near Tai Kok Tsui Station, dust impacts will be most significant from the construction of the WKE, while impacts from the Tai Kok Tsui CDAs are likely to be more significant than those from the adjacent station and tunnel works. Maximum dust impacts from the construction of Contract 505 alone will range from 86–192 $\mu\text{g m}^{-3}$, and are well below the acceptable hourly limit of 500 $\mu\text{g m}^{-3}$. However, cumulative dust impacts from all the different construction activities in the area will exceed the acceptable hourly limit. Dust from Contract 505 will also not exceed the daily Air Quality Objective (AQO) for Total Suspended Particulates (TSP) even when the background of 105 $\mu\text{g m}^{-3}$ is added. On the other hand, the cumulative impacts from various projects may threaten the

for TSP because of high dust impacts from the construction of the WKE. As existing air quality is poor (the annual AQO for TSP was exceeded in 1991), cumulative impacts will further threaten the annual AQO.

Concrete batching for the entrusted works to construct the LAR Contract 506 and the WKE will create dust nuisance at Mei Foo Sun Chuen under worst case winds if the batching operations are uncontrolled. Dust concentrations from unpaved haul roads will be very much higher than the acceptable level for construction dust during the construction of the northern section of the WKE. Aggregate stockpiling is not predicted to result in any major dust impacts. Similarly, no significant impacts were predicted in the vicinity of the LAR Contract 507 and the mitigation measures and monitoring programme detailed in the WKE EA should ensure that dust concentrations are within acceptable levels.

Activities at the temporary depot may make a small contribution to the increase in TSP levels in the area during construction. Excavation and handling of dusty materials will be restricted to initial site preparation and site roads will be treated to minimise dust generation. There are no plans to stockpile dusty materials at the depot. Any banking around the site boundary will be treated or covered to prevent fugitive emissions.

Measures for Mitigation

Measures for mitigation of dust impacts which will be required for Contract 505 and 520 will be the same as

described in *Paragraph 3.2.2 (page 38)* in relation to the contracts in Central and Yau Tsim Districts.

The relevant Government contracts will specify the dust mitigation measures to be implemented in relation to the entrusted works for Contracts 506 and 507.

4.2.3 *Water Quality*

Increased SS concentrations in site runoff may affect the performance of seawater intakes as well as the aesthetic quality of the harbour water. However, with appropriate measures to control and treat construction runoff and drainage, it is unlikely that SS in the receiving waters will exceed the acceptable level for seawater intakes of 180 mg per litre. Effects on water quality from other construction activities will be minimal. Also, provided that sewage from the on-site construction workforce receives adequate treatment or can be directed to the local sewer, effects from sewage arisings will not be significant. Any potentially harmful liquids kept at the temporary depot should be stored within bunds with a capacity of at least 110% of the stored volume.

Measures for Mitigation

Construction work for the station will be concurrent with other construction activities such as the WKE. Therefore, it is important that appropriate measures be implemented to minimise cumulative impacts.

Proper site management is essential to minimise runoff during rainy seasons and "good housekeeping" practices

should be implemented to ensure that debris and rubbish cannot gain access to nearby water bodies. Sand traps should be installed where appropriate to prevent sediment from entering the drainage system.

In addition, regular site inspections and clean ups should ensure that fuels and solvents do not enter the water bodies. Construction materials such as chemicals, paints and solvents should be contained. Dumping of prohibited substances as listed in the relevant Technical Memorandum should not be allowed.

Sewage should be connected to local public sewer where available. Alternatively, chemical toilets or similar facilities with appropriate desludging arrangements will be required to handle the sewage from the on-site construction workforce. Any effluent discharges will have to meet the standard as stipulated in the TM.

Construction site runoff will be subject to discharge consents. A number of standard mitigation measures are recommended for control and treatment. These include the following:

- Provision of drainage channels and settlement lagoons;
- settling of concrete batching discharges and pH adjustment;
- oil interceptors and sediment traps;

- treatment of stockpiles to reduce erosion and sediment release;
- Bentonite interception channels; and
- Discharge points located to avoid embayments and re-provisioned seawater intakes.

4.2.4 *Land Use and Visual Impacts*

As the alignment through this route section will be built on areas newly reclaimed for Container Terminals 7 and 8, there will be no land use impacts arising during the construction of the LAR. Similarly, the construction works for the LAR will be undertaken against the backdrop of the other construction works being undertaken on the reclaimed areas, and no additional visual impacts are likely to arise from these sources.

4.2.5 *Waste Management*

Excavation for Tai Kok Tsui Station will generate some 60,000 m³ of sandfill. Wherever possible any suitable material will be reused on-site for landscaping, cover and fill material. 12,000 m³ will be reused as backfill in the Station construction and 48,000 m³ will need to be exported. The excavated material will be dewatered prior to reuse on-site or transportation. It is likely that disposal of this material would be to nearby construction works by covered truck, and up to 75 haul vehicles per day may be required. Transport to sites requiring marine access such as Chek Lap Kok, or to other land based sites will be by truck to a loading point for movement by barge.

Contracts 506 and 507 between Tai Kok Tsui and Lai King will be entrusted to the Government and constructed as part of the WKE contract. The environmental assessment undertaken for the WKE did not specifically quantify the amount of excavated reclamation fill material which would arise for Contracts 506 and 507 of the LAR.

4.2.6 *Environmental Monitoring and Audit Requirements*

Introduction

As a means of ensuring the effectiveness of mitigation measures, MTRC will undertake environmental monitoring and employ appropriate audit practices in association with this. The data collected in this manner will be used in association with Event Contingency Plans to ensure that any accidental or other exceedance of the statutory requirements in relation to pollution are remedied. More details of this are set out in the relevant Technical Annexes in *Volume 3* of this report. This section sets out the locations recommended for monitoring of the various categories of impact for this part of the LAR route.

Noise

In relation to construction of Tai Kok Tsui Station, construction noise monitoring is recommended at the following locations. The exact location and direction of monitoring equipment will be determined by the Engineer:

- Foo Kwai Street;
- Hoi King St/Cherry St Intersection; and
- Sharon Lutheran School.

In relation to these, it should be noted that other noise sources (such as road traffic) will make a significant contribution to the noise climate. For this reason it is recommended that the daytime construction noise limit shall be 75 dB(A), but with the proviso that the Engineer shall interpret the monitoring results in the light of potential influencing factors such as road traffic.

In relation to the temporary depot at Mei Foo, noise monitoring will not be required of the Contractor during the construction phase. This is because the distance between the site and the nearest sensitive receptors makes this unnecessary.

The construction of Contracts 506 and 507 will be carried out under Government contracts as entrusted works. Any noise monitoring required will be specified in these Government contracts.

Air Quality

Dust monitoring stations are recommended to be set up during the first year of the construction of Tai Kok Tsui Station at the following locations; the exact location to be determined by the Engineer:

- Hoi King Street; and
- Cherry Street.

Dust monitoring is not recommended in relation to Contract 520.

The construction of Contracts 506 and 507 will be carried out under Government contracts as entrusted works. Any dust monitoring required will be specified in these Government contracts.

4.3 *IMPACTS DURING OPERATION*

4.3.1 *Noise*

Predicted Impacts

In relation to Contracts 506 and 507, train noise in excess of the NCO requirements will be experienced by residents at Ching Lai Court, Mei Foo Sun Chuen, Nam Cheong Estate and Block 19 of Chi Yui Estate, as well as at Princess Margaret Hospital. Noise levels at WMC Morninghope School will meet the requirements of the NCO but may be higher than desirable for a school. Train mounted plant is unlikely to contribute significantly at the speeds relevant to this section of the line.

For ground-borne noise and vibration, no significant impacts have been identified as likely to occur from the passage of LAR trains, due to the resilient track mounting system which will be used.

No significant impacts have been identified as arising from fixed plant sources or station activities in this section of the route. Maximum sound pressure level specifications have been made for fixed plant to ensure that sensitive receptors are protected from excessive noise. Where these levels cannot be met for operational or other reasons,

alternate means of protection, such as orientating vents away from sensitive receptors or the use of baffles, screens and other acoustic techniques will be adopted.

Measures for Mitigation

The barriers specified in *Table 4.3a* will be required to mitigate against airborne train noise.

The proposed resilient track mounting system is likely to provide adequate mitigation of ground-borne noise.

Major ventilation discharges and openings in buildings housing noisy plant should be oriented away from sensitive uses. Where openings may face onto public areas, these should be fitted with acoustic louvres or other suitable attenuation hardware. Acoustic silencers for the station ventilation fans are recommended at Tai Kok Tsui Station, and the attenuation requirement should be defined in the detailed system design to limit the overall sound power level of ventilation openings to 86 dB(A).

Consideration of absorptive lining in plantroom, and vibration isolation of machinery equipment, mainly pumps, chillers, and pipeworks are recommended for inclusion at the detailed design stage.

Table 4.3a Noise Barriers for the 86 dB(A) Train Recommended for Contracts 506 and 507

Barrier Type ⁽¹⁾	Railway Line	NSR Protected	Start Chainage (Up AEL)	Finish Chainage (Up AEL)	Total Barrier Length (m)
Contract 506					
Type 2b	North of AEL Up	Mei Foo Sun Chuen South (24)	2400	3000	600
Type 2b	North of LAL Down	24	2400	3000	600
Type 2	North of all 4 lines	Nam Cheong Estate (25)	600	1100	2000
Contract 507					
Type 2b	North of AEL Up	24	3000	3400	400
Type 2b	North of LAL Down	24	3000	3400	400
Type 2	North of all 4 lines	Ching Lai Court (23), Princess Margaret Hospital (30), Block 19, Cho Yiu Chuen Estate (31)	3400	4500	4400

Note: (1) Barrier types recommended for the LAR are described below.

Type 1: wayside barrier incorporated into or fixed to track supports, normally 1.4 m high with a density of 30 kg m⁻², located 2.575 m from the centre line of the track.

Type 2: as for Type 1 but incorporating absorptive acoustic panelling, on the inside face, to a depth of 75 mm.

Type 2a: as for type 1 but fitted with transparent material (plexiglass or equivalent) 2.4 m high of a superficial density of 20 kg m⁻² above the denser section.

Type 2b: as for Type 2a but fitted with the same acoustic panelling as Type 2 barriers.

Enclosure: full screening on one side and overhead, with partial screening to permit ventilation on the side facing away from the NSR. Constructed from the same specification materials as the Type 2a barrier.

4.3.2 *Air Quality*

All the identified sources of air pollutants during the operation of the LAR will only give rise to very small levels of emissions and concentrations. No significant air quality impacts will be associated with the operation of the LAR in this route section.

4.3.3 *Water Quality*

Predicted Impacts

As the majority of this section of the LAR is covered, the volume of track runoff will be minimal. However, the potential exists for water quality impacts to result from discharges of contaminated runoff and drainage. No adverse water quality impacts are anticipated, provided that the mitigation measures set out below are implemented.

Maximum daily flow rates from the station cooling systems are expected to exceed the maximum discharge of 6000 m³ per day specified under the TM. The governing criteria will, therefore, be the WQO for the relevant WCZ, that is to say, the effluent discharge should not cause the normal daily temperature range to change by more than 2°C.)

The Consultants have estimated that, based on a worst case scenario of some 24000 m³ of cooling water per day at a temperature of 10°C above intake level, the 2°C temperature envelope would be confined to an area approximately 120 m offshore. As there are no biologically

sensitive receivers such as mariculture zones, or bathing beaches, within this zone, no unacceptable impacts are anticipated.

(The proposed sewerage network in the vicinity of the Tai Kok Tsui Station will be commissioned in time to serve the MTRC development, and this can therefore be connected to the local sewer. The flow will be screened and then pumped to sewage treatment works. As the sewerage system will be in phase with the development, no significant impacts on water quality are anticipated.)

Measures for Mitigation

The potential for contaminated track runoff and tunnel drainage to arise will be the principal concern from railway operations. Regular inspection of the lining and seals of the tunnels to monitor ingress of groundwater, and appropriate actions to reduce the volume of tunnel drainage arising from this source, together with procedures for maintenance practices are recommended, so that the volume of all wastewaters or effluents arising are minimised.

4.3.4 *Land Use and Visual Impacts*

The LAR alignment and associated structures in this route section will all be located in reclaimed areas which have undergone extensive planning exercises, and no significant impacts will therefore occur. Similarly, as most of the structures are below ground, or incorporated into larger developments, there will be no adverse visual impacts.

4.3.5 *Waste Management*

Refuse collection within the tunnels will be MTRC's responsibility. Waste will be collected and stored temporarily at refuse chambers, then either delivered by private contractor to public Refuse Collection Points or Urban Services Department will collect the wastes directly. No adverse environmental impacts are predicted to arise from these arrangements.

4.3.6 *Environmental Monitoring and Audit*

Train Rolling Noise

To help ensure that noise levels from trains during operation of the LAR come within the requirements of the NCO and the HKPSG, monitoring of noise levels will be carried out at the following locations:

- Tower 9, site B, Tai Kok Tsui Station Related Property Development;
- Tower 27, site C, Tai Kok Tsui Station Related Property Development;
- Nam Cheong Estate;
- Mei Foo Sun Chuen;
- Ching Lai Court;
- Block 19, Cho Yiu Estate;
- Princess Margaret Hospital; and
- Winifred Mary Cheung Morninghope School.

The exact location of the monitoring stations will be determined by MTRC in discussion with EPD.

5 KWAI TSING DISTRICT

5.1 INTRODUCTION

In this section of the report, the predicted environmental impacts which are likely to arise from the construction and operation of the LAR in Kwai Tsing District are discussed, together with the measures proposed by the consultants to avoid any significant impacts, or reduce these to acceptable levels.

The impacts likely to arise during the construction of the LAR are discussed first, followed by those which will occur during operation of the railway. The impacts are discussed under the following headings:

- Noise and vibration;
- air quality;
- water quality;
- land use and visual impacts;
- waste management; and
- environmental monitoring and audit.

More detailed information on the way in which impacts have been assessed is given in the Technical Annexes contained in *Volume 3* of this Report.

The alignment in this Route Section is described in *Section 2.2.3*, while the activities which will take place there during construction and operation of the LAR are described in *Sections 2.3.4* and *2.4.2* respectively. The main

features of this section of the alignment are shown in *Figure 5.1a*.

5.2 IMPACTS DURING CONSTRUCTION

5.2.1 Noise and Vibration

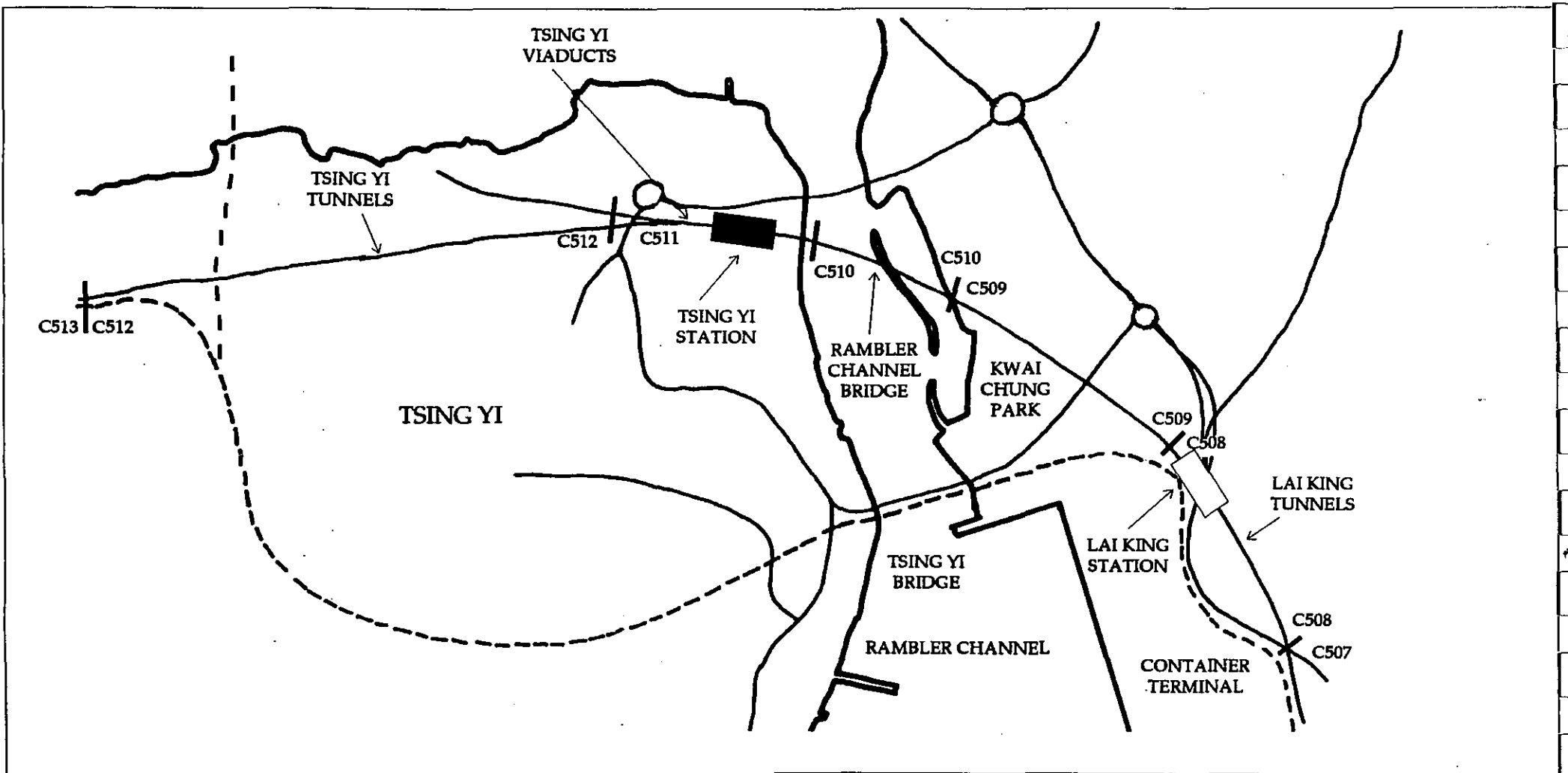
Predicted Impacts

At the South Portal of the Lai King Tunnels, occasional construction noise levels in excess of 90 dB(A) may be experienced at the WMC Morninghope School. However, no significant noise or vibration impacts will occur from blasting operations associated with tunnelling.

The school is soon to benefit from an insulation scheme to mitigate traffic noise, however, the traffic noise insulation package will not include all the classrooms that may be affected by construction noise.

In the vicinity of Lai King Station, significant noise impacts will be experienced by a large number of residents, and in one case, levels of over 90 dB(A) will occur. The worst case will be during the excavation works and the demolition of the Lai King Community Hall, although these works will be of limited duration.

The Route 3 EA concluded that works on the viaducts between Lai King Station and Kwai Chung Park (entrusted to Government) would cause significant impacts at Block 1 of Lai King Estate (Ming King House) and Lok Sin Tong Lau Sai Yan School. Noise in excess of the acceptable



FEATURES OF ROUTE SECTION: KWAI TSING DISTRICT		
KEY LAR ALIGNMENT ROUTE 3/NLE ALIGNMENT INTERCHANGE STN WITH MTR AEL INTERCHANGE STN	FIGURE 5.1a DATE JULY 1993	
	ERM Hong Kong 10-11th Floor Hecny Tower 9 Chatham Road Tsimshatsui, Kowloon Hong Kong	 ERM

levels was also predicted at the crematorium in Tsuen Wan Cemetery due to works at both Kwai Chung Park and the Rambler Channel Bridge. Residents at Riviera Gardens will experience noise levels in excess of the NCO requirements if work takes place in the evenings and at night. Construction noise will also affect the Marine Department Offices in the Public Cargo Works Area. With the exception of these offices, noise levels from piling works required for the bridge piers will not exceed levels specified in the NCO.

On Tsing Yi, noise from works for the bridge will exceed the NCO levels at St Paul's Village and Greenfield Gardens if they take place at night. Also construction of Tsing Yi Station and viaducts will cause significant noise impacts at St Paul's Village and Cheung On Estate. On Pak House at Cheung On Estate will experience the highest levels, which will reach over 85 dB(A).

Works at the east portal of the Tsing Yi Tunnels will not cause noise levels in excess of acceptable limits during the daytime, although Cheung On Estate will experience significant noise impacts from this source in the evening. There will also be widespread impacts in excess of the NCO limits (including effects as far away as Ting Kau) if work continues here through the night. However, no significant noise or vibration impacts will occur from blasting operations associated with tunnelling.

Measures for Mitigation

The following measures for the mitigation of construction noise impacts will be required to be implemented by the various Contractors:

- A 3 m noise barrier will be erected around the boundary of the Winifred Mary Cheung Morninghope School along the boundary facing the Lai King Tunnels southern portal worksite.
- The remaining exposed classroom windows will be insulated.
- 3 m noise barriers will be erected around each caisson wall hole site at the southern portal worksite.
- The Contractor for Contract 508 will be advised to keep local people informed as much as possible of the blasting schedule.
- Detailed discussions will be held between the Contractor and the Commissioners for Transport and Police to determine the roads along which spoil and other material will be transported.
- A 3 m barrier will be erected along the Lai King Hill Road boundary of the Lai King Station worksite.
- An acoustic cover will be erected over the southern end of the Lai King Station worksite during excavation works.

- A 3 m barrier should be erected along the first 100 m of the western boundary of the Kwai Chung Park worksite to protect the Crematorium from noise impacts.
- A 5 m barrier will be erected along the western boundary of the Tsing Yi Station worksite.
- Mobile 3.5 m barriers will be used in association with any piling rig at the Tsing Yi Station and tunnels portal worksites.
- A 4 m barrier will be erected along the north and south boundaries of the Tsing Yi viaducts worksite.
- A 4 m barrier will be erected along the northern boundary of the Tsing Yi Tunnel Portal Worksite.
- No spoil material will be removed from the Tsing Yi Tunnel Portal Worksite at night. Mobile plant and equipment will be placed within the tunnel portal at night.
- Site clearance, access road and ventilation building construction at the Tsing Yi Tunnel Portal Worksite will be limited to between 07.00 and 23.00 hours.

General noise mitigation measures, which are described in relation to the contracts in Central and Yau Tsim Districts in *Paragraph 3.2.1 (Page 37)* above, will also be required.

The relevant Government contract specifies the noise mitigation measures to be implemented in relation to the

entrusted works for the viaducts between Lai King Station and Kwai Chung Park.

5.2.2 *Air Quality*

At Lai King maximum dust impacts are anticipated at WMC Morninghope School and Chan Nam Cheong School. Dust impacts will be more than twice the acceptable hourly limit during blasting, tunnelling and excavation works at the Southern Portal Works Area in the worst cases. This will only occur during the early stage of tunnelling, as during later stages blasting operations will be carried out within the tunnel. Dust impacts at Lai King Station, whilst high initially, will be minimised by the erection of the acoustic cover over the excavation works.

At Kwai Chung Park, dust impacts from the construction of the LAR/Route 3 Viaduct between Kwai Chung Park and Lai King Station will be well below the acceptable limits.

Odour impacts arising from the construction activities at the former Gin Drinker's Bay Landfill at a distance of 50 m will be within acceptable limits, and will decrease exponentially with distance. There will therefore be no significant impacts from this source.

To the east of the Rambler Channel, no significant dust impacts will occur during the construction of the Rambler Channel Bridge. Dust impacts from Contract 511 will exceed the acceptable limits at Cheung On Estate, the school at Cheung On Estate and St Paul's Village. The maximum daily cumulative dust impacts (*ie* taking

account of Contract 510, 511 and background) will be at the School at Cheung On Estate and St Paul's Village. These cumulative effects will produce an exceedance of the daily TSP AQO of $260 \mu\text{g m}^{-3}$ at Cheung On Estate and the school at Cheung On Estate, Ching Tai Court and St Paul's Village. Since dust levels in excess of the annual TSP AQO were recorded in this area in 1991, cumulative dust impacts from the two Contracts will further threaten the annual AQO throughout the construction period.

All TSP predictions are based on a worst case assumption that the entire site area is being worked, however, at any time much of the site will be undisturbed and the actual dust levels are likely to be considerably lower than those predicted (this is discussed in detail in *Volume 3*).

In the vicinity of the east portal of the Tsing Yi Tunnels, the hourly TSP limit and the daily TSP AQO will not be threatened by dust emissions during the site formation works. The worst dust impacts will be at Cheung On Estate, being in close proximity to the Works Area and the assumed haul road. In the very early period of tunnelling when the blasting surface is exposed, significant quantities of dust will be blown up into the atmosphere. After this, blasting will be carried out within the excavated tunnels and the dust emissions will be very much reduced. During the early stage of tunnelling, Contract 512 alone will cause exceedance of the hourly dust limit at all identified sensitive receptors, and of the daily dust AQO at Cheung On Estate. The maximum hourly impacts at Cheung On Estate and Ching Tai Court will be four to five times higher than the hourly TSP limit of $500 \mu\text{g m}^{-3}$. The later stage of tunnelling would only cause exceedance of

the hourly dust limit at Cheung On Estate and would not threaten the daily TSP AQO at any sensitive receptors. As noted above, existing air quality in the area was already in excess of annual TSP AQO in 1991. Dust impacts from the construction of Contract 512 therefore will further threaten the annual AQO throughout the construction period.

Measures for Mitigation

Measures for mitigation of dust impacts which will be required for Contracts in the Kwai Tsing District will be the same as described in *Paragraph 3.2.2* in relation to the contracts in Central and Yau Tsim Districts.

The relevant Government contract specifies the dust mitigation measures to be implemented in relation to the entrusted works for the viaduct between Lai King Station and Kwai Chung Park.

The Contractor for Contract 509 will be required to implement the following mitigation measures in relation to odours from the excavation and handling of material from the former landfill:

- Excavated landfill waste is taken off-site for disposal.
- Landfill waste is properly covered if stockpiled and during transit, and the stockpiles of waste are removed as soon as possible.

- Leachate and bentonite slurry is handled in a closed-loop system of pipes and tanks to avoid odour emission.
- Use of covered containers, trucks, or barges, sealed so far as is practical, to avoid odours when transporting waste for off-site disposal.

5.2.3 Water Quality

Predicted Impacts

Construction runoff will occur chiefly at the stations, all of which may be exposed to erosion. Increased SS concentrations have the potential to cause adverse impacts on the performance of seawater intakes. Until the contractors finalise their working arrangements, there is insufficient data available to enable estimates of the volumes of likely discharges and possible contaminants to be made. However, water quality data from EPD monitoring in Rambler Channel show that there is some margin for increase before unacceptable levels of SS will be reached. The stream at the Lai King South Portal Site is polluted and adjoins an existing concrete culvert. The diversion of the Kau Wa Keng Stream and the provision of a new culvert will not have significant impacts. There are no known abstractions of groundwater for potable or other significant uses within this District, and groundwater drawdown is therefore not considered likely to result in any adverse impacts. In addition, the possibility that the groundwater in the area of the tunnels is contaminated is considered slight, and the drainage

from the tunnelling works will be acceptable for direct discharge.

In total, about 7000 m³ of waste water will be removed from the landfill pile bores with the saturated waste. Contaminated water will also arise from washing down vehicles used for transporting waste from the landfill for disposal. This will be disposed of to foul sewer.

At the Rambler Channel Bridge, computer modelling predicted that SS concentrations associated with dredging would only exceed 1 ppm within 3 km to the south and 2 km to the northwest of Pier 2. Concentrations exceeding 10 ppm are only likely to occur in an area no wider than 400 m. During dredging on dry season neap tides, sediment deposition from the dredger plume is likely to occur throughout the plume area.

In the Rambler Channel, the EPD's marine water quality monitoring programme shows that natural SS concentrations are low. Total SS concentrations will be within their natural range. The dredging and construction activity would be of relatively short duration and any physical impacts of the disturbed sediment will not be significant.

SS concentrations of less than 10 mg per litre are predicted to occur over the main area of the plume. The increase in oxygen demand will be small and well within the natural range of the measured BOD for the short duration of the dredging and construction works.

The effects on water quality from other construction activities will be minimal. Good construction practice will be observed on sites close to the coastline to ensure that litter, fuels and solvents do not enter the harbour waters.

Sewage generated from construction sites will receive adequate treatment or will be directed to the local sewer, and so effects from sewage arisings will not have any significant impacts.

Measures for Mitigation

To mitigate against loss of dredged material from the Rambler Channel, the bridge piers within the channel will be constructed within cofferdams or similar. The excavated mud will be loaded so as to cause a minimum of loss and will be well contained at all times during the transport process. Measures such as the use of sealed grabs, sealed bottom openings of barges, silt curtains, and the control of barge and hopper loading will be used. Also marine muds will be disposed of only at appropriate dumping grounds and so as to minimise the impact on the surrounding waters.

MTRC will appoint an independent hydrographic surveyor to undertake a bathometric surveys in the Rambler Channel, in the same manner as described for Contract 502 in *Paragraph 3.2.3* (see *Page 40*). Other mitigation measures relating to water quality impacts, the same as those also described in *Paragraph 3.2.3* are recommended to be implemented (see *Pages 40-41*).

5.2.4 *Land Use and Visual Impacts*

Works for the new Lai King Station will require substantial excavation to accommodate both the platform tunnels and concrete structures. The Lai King Community Hall and the existing cantilevered walkways to the south of the station will be demolished and the pedestrian access to the station and the Kwai Chung Road footbridge will also be disrupted. Replacement stairways in structural steelworks and a temporary staircase to Yeung King House will be built. Much of the construction work at Lai King will be concentrated on both ends of the tunnel portals, and therefore land use and indirect severance impacts will be most significant at these areas. Beside the permanent occupation of the amenity area at the southern portal, tunnel blasting, excavation activities, and the associated construction traffic may cause intense inconvenience and interference to the nearby residents.

The construction of Contract 509 requires landtake within Kwai Chung Park, although this is not officially gazetted as a park and it is not open to the public, it will be restored after the construction works are completed. The construction of the viaduct on Kwai Tsing Road and Kwai Tai Road will however disrupt the existing traffic movement in the area. Also, as a result of the construction of the viaduct and the Route 3 alignment, part of the container stacking area near the Container Port Road will also have to be given up.

At Tsing Yi Station construction Work Areas, there will be disruption to the traffic along Tsing Tsuen Road, Tsing King Road and the Tam Kon Shan Interchange.

Accessibility will be reduced, thereby causing a severance effect between the areas north and south of Tsing Tsuen Road.

For the area around Tam Kon Shan Interchange where construction works for the LAR viaduct will be concentrated, the limited space available in the immediate area may result in the loss of amenity land and vegetation. Disruption to the temporary cargo handling area is not considered likely to be severe as similar facilities will be provided on the island in the future.

In the west of Tsing Yi, the LAR tunnels will pass through the ridgeline underground, and significant direct land use impacts are therefore unlikely. However, the tunnel alignment may pass close beneath the Water Services Department reservoir in this area, however, no potential impacts on the water-retaining structure are predicted. Permanent land take will be necessary at the portal areas and will result in loss of some amenity area in the Green Belt. In addition, temporary land take by construction Works Areas including site offices, material storage, reinforcement preparation, concrete batching etc will occur, and will lead to temporary loss of amenity area.

Disruption and severance impacts are likely to occur as there are a number of construction projects being carried out at the same time, especially at the western end of the Tsing Yi tunnels. However, as there are no sensitive land uses at this location, the significance of the impacts will be limited. The graves and the pavilion are also potentially affected by the construction activities.

5.2.5 Waste Management

At the Southern Portal of the Lai King Tunnels, tunnelling will result in the excavation of approximately 50,000 m³ of rock. Disposal of this by truck will require about 60 haul vehicles (120 trips) per day. Bulk excavation of soft material and rock will also be carried out adjacent to the existing Lai King Station as part of the advance works for site preparation, but no estimate of the amount of material to be excavated from here is available at this time.

At Kwai Chung Park, the cut through the former Gin Drinker's Bay Landfill will require excavation of almost 250,000 m³ of material. Of this 127,000 m³ is likely to be contaminated refuse material. A further 98,000 m³ of capping material (completely decomposed granite/clay) and granular crushed rock fill from the drainage layer will also be generated. Some 5,000 m³ of the capping material will be uncontaminated and suitable for re-use. The rest will be disposed of at suitable landfills, probably at Pillar Point.

At the Rambler Channel Bridge, land based bored piling for Piers 1 and 6 will result in the excavation of approximately 3,000 m³ of alluvial clay, sand and completely degraded granite. This will be stockpiled and used, where possible, for spread footing and general fill. Piling for Pier 1 is scheduled over a six week period, resulting in the generation of 36 m³ per day of material, while about 54 m³ per day of material would be generated over a four-week period from Pier 6. Where not reused on-site, this will be stockpiled and transported by barge,

via a temporary pier on North Tsing Yi, to Chek Lap Kok or to other such sites. Bored piling for the bridge will generate approximately 10,000 m³ of marine spoil, which will need to be transported by barge to designated marine dumping sites. This will generate approximately 67 m³ per day of marine muds consisting primarily of marine sand and clay.

On Tsing Yi, surplus excavated material from the construction of the station and viaducts is expected to be approximately 108,000 m³. It is expected that during the first year of construction, the equivalent of 15 truck loads per hour may be required to remove this material, transported via the temporary pier to the north of the construction site.

Excavation from the tunnelling in the west of Tsing Yi will generate a total of 130,000 m³ of rock spoil requiring disposal. During peak excavation activities, approximately 600 m³ per day of spoil will be generated. Disposal of this material would be to nearby construction works on North Lantau, moved via the temporary pier to the north of Tsing Yi Station and then transported by barge, to Chek Lap Kok or to other such sites.

5.2.6 *Monitoring and Audit Requirements*

Introduction

As a means of ensuring the effectiveness of mitigation measures, MTRC will undertake environmental monitoring and employ appropriate audit practices. The data collected in this manner will be used in association

with Event Contingency Plans to ensure that any accidental or other exceedance of the statutory requirements in relation to pollution are remedied. More details of this are set out in the relevant Technical Annexes in *Volume 3* of this report. This section sets out the locations recommended for monitoring of the various categories of impact for this part of the LAR route.

Noise

In Kwai Tsing District, monitoring stations will be required at the following locations during construction of the LAR. The exact location and direction of monitoring equipment will be determined by the Engineer:

- Cho Yiu Chuen Estate, Block 19
- Winifred Mary Cheung Morninghope School
- Lai King Estate, Yeung King House, On King House and Ming King House;
- Lok Sin Tong Lau Sai Yan School;
- Yuet Lai Yuen Estate, Lai Wan House;
- Tsuen Wan Cemetery (Crematorium);
- Riviera Gardens;
- Greenfield Garden;
- Cheung On Estate, On Pak House, On Chiu House, On Tao House and school;
- St Paul's (Lam Tin) Village, two sites;
- Tsing Yi Estate, school; and
- Broadview Gardens.

In relation to these, it should be noted that other noise sources (such as road traffic) will make a significant

contribution to the noise climate. For this reason it is recommended that the daytime construction noise limit shall be 75 dB(A), but with the proviso that the Engineer shall interpret the monitoring results in the light of potential influencing factors such as road traffic.

The construction of the viaducts between Lai King Station and Kwai Chung park are being carried out under Government contracts as entrusted works. Any noise monitoring required will have been specified in these Government contracts.

Air Quality

Dust monitoring stations are recommended to be set up during the first year of the construction of Lai King Station at the following locations, the exact location to be determined by the Engineer:

- Chan Nam Cheong Memorial College;
- Winifred Mary Cheung Morninghope School;
- Yuet Lai Yuen;
- Lai King Estate (Blocks 1, 3, 4, 5 and 6);
- Lok Sin Tong Lau Sai Yan School;
- Yin Lai Court;
- St Paul's (Lam Tin) Village and/or school;
- Tsing Yi Estate and school;
- Cheung On Estate and school; and
- Tsing On Temporary Housing Area.

The construction of the viaducts between Lai King Station and Kwai Chung Park are being carried out under Government contracts as entrusted works. Any dust

monitoring required will be specified in these Government contracts.

An olfactometric assessment will be carried out at Kwai Chung Park during the early stage of construction. During the later stage of construction, olfactometric measurements will be carried out as agreed with EPD.

A routine odour patrol will be carried out as part of the duties of the Contractor's Site Safety Officer, and will be audited by MTRC.

Water Quality

Water quality monitoring in the Rambler Channel will be undertaken by MTRC at two designated monitoring stations to determine the impacts arising during construction (one north and one south of the works area), with a further two control stations. The location of the stations will be determined by the Engineer and agreed with EPD.

Data on turbidity, mean suspended solids and mean dissolved oxygen concentrations will be collected.

5.3 IMPACTS DURING OPERATION

5.3.1 Noise

Predicted Impacts

At the Lai King Tunnels Southern Portal, train noise levels at the top floor of the WMC Morninghope School will be

up to L_{Aeq} 65 dB and L_{Amax} 80 dB for the 86 dB(A) Train. The school is soon to benefit from an insulation scheme to mitigate traffic noise and so will not rely on open windows when the LAR becomes operational. This would give internal noise levels that would be far more acceptable. However, the traffic noise insulation package will not include all the classrooms that may be affected by train noise.

From the Lai King Tunnels, no significant ground-borne noise levels will be experienced by receptors located above the tunnels.

In relation to fixed plant at Lai King Station:

- An L_{eq} of 50 dB(A) is predicted at Yeung King House as a result of trains noise from ventilation shafts, which is within the NCO requirements;
- tunnel ventilation fans are designed with up-stream and downstream silencers, that easily surpass the NCO requirements, and hence significant noise impacts are not expected from this source; and
- the individual sound power level for each of the three chillers must be no higher than 87 dB(A) to meet the NCO requirements, by providing enclosed housings compressors, and silencers at air intakes and discharges.

West of Lai King Station, L_{eq} train noise levels at Ming King House (Block 1 of Lai King Estate) would be in excess of the NCO requirements, at up to 61 dB(A) for the

standard viaduct design. At the Lok Sin Tong Lau Sai Yan Primary School, the daytime L_{eq} train noise level will be below 70 dB(A), and therefore the NCO criterion will be met. Furthermore, the secondary glazing already in place at the school facing the viaduct, will ensure no significant impacts on the activities within the school.

At Kwai Chung Park, a noise level of 70 dB(A) will be experienced at the proposed pavilion overlooking the LAR alignment, equal to the acceptable level agreed between ERM and EPD. No adverse effects from ground-borne vibration will be experienced in the Park. At the nearby Tsuen Wan crematorium, noise levels will be also be within acceptable limits.

In the vicinity of the Rambler Channel Bridge, train noise levels will not exceed the NCO requirements, except at the developments above Tsing Yi Station. In relation to the Station itself and the viaducts to the west of the station, the NCO limits will be exceeded at St Paul's Village and Cheung On Estate. Allowable maximum noise levels for fixed plant at the station will ensure that these meet the NCO requirements.

No significant noise impacts will result from the operation of trains or fixed plant in or at the Tsing Yi Tunnels.

Measures for Mitigation

The following measures for mitigation of operational train noise impacts, detailed in *Table 5.3a*, are recommended:

- 1.4 m barriers fitted with acoustic lining on the east side of all the lines between Lai King Station and 50 m beyond the point where each line passes beneath the Route 3 structure;
- a 1.4 m barrier on both sides of the LAL and AEL through Kwai Chung Park;
- standard 1.4 m parapet barriers on the Rambler Channel Bridge and Tsing Yi viaducts;
- the Design Contractor for the Rambler Channel Bridge should undertake a Finite Element Analysis to ensure that the design of the bridge minimises noise re-radiated from the bridge structure;
- a 50 m-long noise cover over the LAR tracks between Tsing Yi Station and the sea wall to the east;
- a noise cover over the LAR tracks to the west of Tsing Yi Station, provided as part of the CDA development;
- a 1.4 m barrier incorporating acoustically absorbent materials on the north side of the Tsing Yi viaducts; and
- a 3.8 m composite barrier (including a transparent upper section) on the south side of the Tsing Yi viaducts.

5.3.2 *Air Quality*

At Kwai Chung Park, control measures for landfill gas will minimise any possible odour migration from the waste mass to the operational areas of the railway. The movement of trains, will further disperse any odours. No odour nuisance will occur during normal operation of the LAR.

All the other identified sources of air pollutants during the operation of the LAR will only give rise to very small levels of emissions and concentrations. No significant air quality impacts will be associated with the operation of the LAR in this route section.

5.3.3 *Water Quality*

Predicted Impacts

The volume of track runoff from this section of the LAR will not be excessive, although the potential exists for water quality impacts to result from discharges of contaminated runoff and drainage. No adverse water quality impacts are anticipated, provided that the mitigation measures set out below are implemented.

Maximum daily flow rates from the station cooling systems are expected to exceed the maximum discharge of 6000 m³ per day specified under the TM. The governing criteria will, therefore, be the WQO for the relevant WCZ, that is to say, the effluent discharge should not cause the normal daily temperature range to change by more than 2°C.

Table 5.3a Noise Barriers for the 86 dB Train Recommended for Contracts 509, 510 and 511

Barrier Type ⁽¹⁾	Railway Line	NSR Protected	Start Chainage (Up AEL)	Finish Chainage (Up AEL)	Total Barrier Length (m)
Contract 509					
Type 2	East of both AEL lines	Lai King Estate (40)	Lai King Station	50 m under Route 3	580 (290 m each)
Type 2	East of both LAL lines	40	Lai King Station	50 m under Route 3	760 (380 m each)
Type 1	Both sides of AEL	Kwai Chung Park			800
Type 1	Both sides of LAL	Kwai Chung Park			800
Contract 510					
Enclosure	All lines	Tsing Yi Station Towers 1 & 7 (48)	Waterfront	Tsing Yi station	50
Type 1	All lines	Greenfield Garden (41), Riviera Gardens (59)	East end of bridge	West end of bridge	Bridge reference design
Contract 511					
Enclosure	All lines	48	Western end of Tsing Yi Station		Integrated within Station
Type 2a	South of AEL and LAL Up (shared tracks)	St Paul's Village (47)	Western end of Tsing Yi Station	Viaduct pier 6	180
Type 2a	South of AEL and LAL Down (shared tracks)	47	Western end of Tsing Yi Station	Viaduct pier 6	180
Type 2	North of AEL and LAL Up (shared tracks)	On Pak House (45) & On Yun House (46), Cheung On Estate	Western end of Tsing Yi Station	Viaduct pier 6	180
Type 2	North of AEL and LAL Down (shared tracks)	45, 46	Western end of Tsing Yi Station	Viaduct pier 6	180
Type 1	Both Lines	45, 46	Viaduct pier 6	Tunnel Portal	Viaduct reference design
Note: (1) Barrier types recommended for the LAR are described in detail in Table 4.3a.					

The Consultants estimate that, based on a worst case scenario of some 24000 m³ of cooling water per day at a temperature of 10°C above intake level, the 2°C temperature envelope would be confined to an area approximately 120 m offshore. As there are no biologically sensitive receivers such as mariculture zones, or bathing beaches, within this zone, no unacceptable impacts are anticipated.

The stations in this section will be connected to the local sewer. The flow will be screened and then pumped to sewage treatment works. No significant impacts on water quality are anticipated.

Measures for Mitigation

The potential for contaminated track runoff and tunnel drainage to arise will be the principal concern from railway operations. The following measures have been identified to mitigate potentially significant impacts on water quality as a result of operation of the LAR and will be incorporated into the Code of Operational Practice (COP).

- Traps to collect suspended solids in drainage or runoff at stations;
- interceptors to collect oil and grease at stations;
- regular inspection of the lining of the tunnels to monitor ingress of groundwater, and appropriate actions to reduce the volume of tunnel drainage arising from this source; and

procedures for maintenance practices shall be implemented such that the volume of all wastewaters or effluents arising are minimised.

5.3.4 Land Use and Visual Impacts

At Lai King, amenity land at the southern tunnel portal and adjacent to the existing station will be occupied by LAR structures, and Lai King Community Hall will be demolished. West of Kwai Chung Road, the LAR and Route 3 viaducts will reduce the area for container stacking and the height of stacking also are to be reduced.

The cutting through Kwai Chung Park will be landscaped and integrated into the overall design of the restored park before this becomes open to the public.

West of the park, the pier foundations for the Rambler Channel Bridge may affect the cargo working area and the planned waterfront promenade on Tsing Yi. The Tsing Yi viaduct may also represent a 'bad neighbour' to surrounding land uses and may restrict any future land use under the structure.

The southern tunnel portal at Lai King will have a moderate visual impact on Cho Yiu Estate. The enlarged Lai King Station will also be a more massive and visually intrusive structure. This will be mitigated by building the station into the existing rock face, but will remain highly visible from the housing estates at Lai King.

Kwai Chung is a highly industrialised area and the railway will be less intrusive than it would be elsewhere.

The alignment passing through the Park in cut will provide substantial screening. In addition, MTRC will be using the services of a landscape designer from RSD in preparing a layout for the restored park. Nevertheless, there will be moderate visual impacts on the Lai King Estate and Kwai Chung Park.

The Rambler Channel Bridge may lead to some visual intrusion, although the extent of this is unlikely to be significant. The design of Tsing Yi Station and its associated CDA will have a positive effect on the visual quality of the area. Since the alignment of the LAR viaduct on Tsing Yi will be along an existing transport corridor with established visual character, significant visual impacts are not anticipated, although care will be necessary in the design and visual treatment of these structures.

5.3.5 *Waste Management*

Refuse collection within the stations, tunnels and elsewhere along the track will be MTRC's responsibility. Waste will be collected and stored temporarily at refuse chambers, then either delivered by private contractor to public Refuse Collection Points or Urban Services Department will collect the wastes directly. No adverse environmental impacts are predicted to arise from these arrangements.

5.3.6 *Environmental Monitoring and Audit*

Train Rolling Noise

To help ensure that noise levels from trains during operation of the LAR come within the requirements of the NCO and the HKPSG, monitoring of noise levels will be carried out at the following locations:

- Ming King House, Lai King Estate;
- Tower 1, Tsing Yi Station Development;
- Tower 7, Tsing Yi Station Development;
- St Paul's village;
- On Tao House, Cheung On Estate;
- On Chiu House, Cheung On Estate; and
- Broadview Gardens.

The exact locations of the monitoring stations will be determined by the Engineer.

6 TSUEN WAN AND ISLANDS DISTRICTS

6.1 INTRODUCTION

In this section of the report, the predicted environmental impacts which are likely to arise from the construction and operation of the LAR in Tsuen Wan and Islands Districts are discussed, together with the measures proposed by the consultants to avoid any significant impacts, or reduce these to acceptable levels.

The impacts likely to arise during the construction of the LAR are discussed first, followed by those which will occur during operation of the railway. The impacts are discussed under the following headings:

- Noise and vibration;
- air quality;
- water quality;
- land use and visual impacts;
- waste management; and
- environmental monitoring and audit.

More detailed information on the way in which impacts have been assessed is given in the Technical Annexes contained in *Volume 3* of this Report.

The alignment in this Route Section is described in *Section 2.2.4*, while the activities which will take place there during construction and operation of the LAR are described in *Sections 2.3.5* and *2.4.2* respectively. The main

features of this section of the alignment are shown in *Figure 6.1a*.

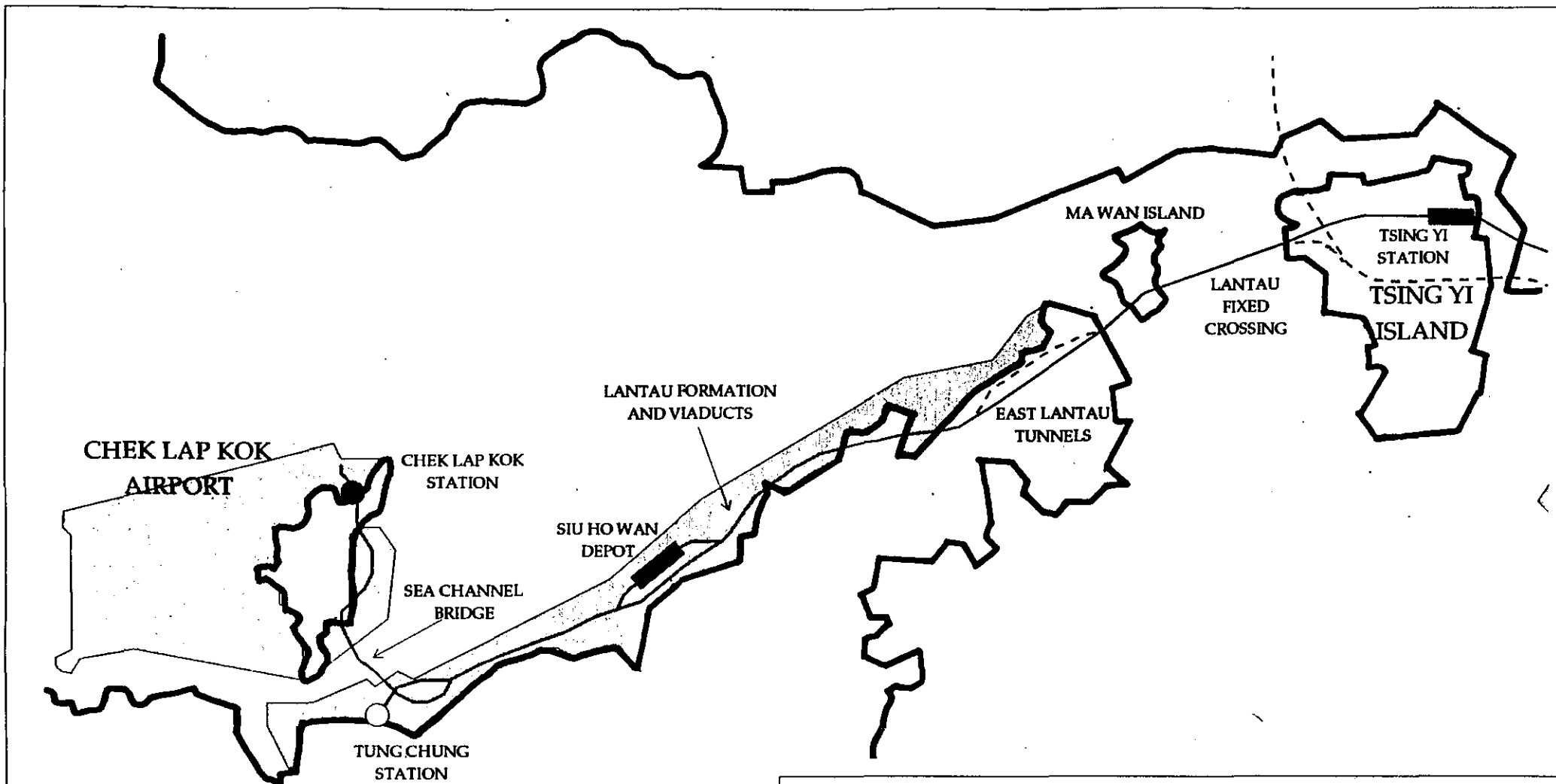
6.2 IMPACTS DURING CONSTRUCTION

6.2.1 Noise

Predicted Impacts

In the vicinity of the Tsing Ma Bridge, few exceedances were predicted in the LFC environmental assessment for evening construction work. However, significant and severe construction noise impacts from night-time construction activities will be experienced by all identified sensitive receptors. The worst night-time exceedances (*ie* by up to 18 dB(A)), were predicted to occur at NSRs along Castle Peak Road. Severe noise impacts were predicted for both evening and night-time construction work at all identified sensitive receptors from both Kap Shui Mun Bridge and Ma Wan Viaducts construction activities. The worst evening and night-time exceedances for Kap Shui Mun Bridge construction, 36 dB(A) and 51 dB(A) respectively, were predicted to occur on North Lantau. The worst evening and night-time exceedances for Ma Wan Viaducts construction were predicted as 29 dB(A) and 42 dB(A) respectively.

The worst case at Tsing Chau Tsai will be if spoil removal, building construction and viaduct construction occur simultaneously, when levels would rise to 82 dB(A) for excavation and piling, and 83 dB(A) for building erection. Therefore, the proposed construction activities singly or in



FEATURES OF ROUTE SECTION: TSUEN WAN & ISLANDS DISTRICTS

- KEY**
- RECLAMATION
 - LAR ALIGNMENT
 - - ROUTE 3/NLE ALIGNMENT
 - LAL STATION
 - AEL STATION
 - AEL INTERCHANGE STN

FIGURE 6.1a
DATE OCTOBER 1993

ERM Hong Kong
10-11th Floor
Hecny Tower
9 Chatham Road
Tsimshatsui, Kowloon
Hong Kong



combination have the potential to produce significant impacts in this area. However, the relocation of Tsing Chau Tsai village will remove the only vulnerable NSR in the area.

The NLDS predicted that there would be unacceptable noise impacts from many activities associated with all NLD construction phases. Reclamation and dredging will produce unacceptable noise levels during night-time working and that this should not be permitted unless the noise levels in the NCO can be achieved. Four main activities would cause severe impacts at Tai Po Village and the Youth Camp and one activity would cause severe impacts at Ma Wan Chung and Ma Wan Villages. Daytime impacts were expected at some of the dwellings in Wan Tuk, Pak Mong, Tai Ho Wan and Tin Liu at various times during the construction phase. Impacts were expected at all identified sensitive receptors during night-time work.

At Siu Ho Wan, there will be no significant noise impacts during the construction of the depot.

The noise levels at Tai Po Youth Camp from both Tung Chung tunnel and station construction will be within the acceptable daytime level, however, the NCO requirements for the evening (1900-2300) will be exceeded.

Noise at Ma Wan Chung Village will not exceed acceptable levels due to the natural geography and vegetation, which should reduce noise levels by at least 10 dB(A).

Measures for Mitigation

The measures for mitigation which will be required to be implemented by the Contractors for Contacts 514, 516 and 518 will be the general noise mitigation measures, which are described in relation to the contracts in Central and Yau Tsim Districts in *Paragraph 3.2.1 (Page 37)* above. It should also be noted that residents of Tai Tsing Chau and Tai Po Villages have been relocated prior to the commencement of construction work.

In order to protect Tai Po Youth Camp from excessive construction noise, barriers are recommended thus:

- 4 m high barriers along the station site eastern boundary; and
- a 3.5 m high barrier along the south site boundary of the cut and cover tunnel construction site, 200 m in length, centred opposite the Youth Camp.

The relevant Government contracts specify the noise mitigation measures implemented in relation to the entrusted works for the Lantau Fixed Crossing, the Lantau Formation and Viaducts, and the Airport Works.

6.2.2 *Air Quality*

The Lantau Fixed Crossing Environmental Assessment estimated the highest hourly TSP and RSP levels to be 13,550 and 6,660 $\mu\text{g m}^{-3}$ from LFC construction. Acceptable hourly TSP levels will be exceeded at many locations. The combined impacts from the Route 3 and

LFC construction will pose a threat to the daily AQOs for TSP and RSP. The highest 24 hour TSP and RSP levels will exceed the daily AQOs for TSP and RSP.

At the East Lantau Tunnels, the dust impacts from the general construction will be within acceptable levels. However, high dust concentrations will occur at the proposed Yiu Liun dockyard due to blasting, although this will only last for a very short period of time (2-4 weeks). The maximum hourly average TSP levels predicted at the receptors due to general construction activities range from $73 \mu\text{g m}^{-3}$ to $363 \mu\text{g m}^{-3}$. These maximum impacts will only occur in the first year of construction of the tunnels, when most of the bulk excavation works take place. Work for the tunnels alone will not pose any threat to the daily AQO for TSP.

The North Lantau Formation and Viaducts for the LAR and the NLE will be entrusted works undertaken by the Government. The NLE EA predicts that blasting and drilling will give rise to high short term levels of dust at source. A peak concentration of $230,000 \mu\text{g m}^{-3}$ over an averaging period of 1 hour was predicted at Yam O. Despite the relatively high hourly dust concentration due to blasting, acceptable levels will not be exceeded at any of the identified sensitive receptors. Peak 24 hourly concentrations of TSP may reach $9,000 \text{ mg m}^{-3}$, however the impact will be confined to a relatively small area close to the source. The maximum 24 hour averaged TSP and RSP levels will be at Tin Tsui Tau where the predicted particulate concentration will approach the AQO. Due to the short duration of blasting and drilling, they will not

cause any significant impact on sensitive receptors when considering dust impacts averaged over 24 hour period.

Also in relation to Contract 515, CO, SO₂ and NO₂ results for an one hour averaging period vary with distance from the asphalt mixing plant. Emission from the asphalt mixing plant will not pose any significant impacts on the air quality at any of the ASRs. Emission of CO, SO₂ and NO₂ were predicted to be within the AQOs.

The cumulative impacts from all the developments in the area will pose a threat to the daily AQO for TSP of $260 \mu\text{g m}^{-3}$. From the construction of the Lantau Fixed Crossing only, the predicted 24 hour average dust levels at San Po Tsui, Yi Chuen and Tso Wan will exceed the daily AQO for TSP.

Dust impacts from the construction of the Depot at Siu Ho Wan will be much less significant than those from construction of the NLE and NLD. The predicted maximum dust impacts at Tai Ho Wan Temple from the construction of the depot alone are well within acceptable limits. However, the cumulative dust impacts from all construction activities under different projects would likely to cause the dust concentrations at the sensitive receptor to exceed these. Building the depot is also unlikely to pose any threat to the daily AQO, although again the cumulative impacts from all the different projects may threaten the daily AQO for TSP because of the significant impacts from the construction of the NLD.

In the area of Tung Chung Town Centre, dust concentrations at the receptors are predicted to exceed

acceptable limits due to these works being carried on at the same time as construction of the airport at Chek Lap Kok and the North Lantau Development. However the New Airport Master Plan EA also considered the impacts from the most frequent wind direction, easterly winds, at Chek Lap Kok. Under easterly winds dust impacts from construction activities carried out at Chek Lap Kok for the new airport on the receptors along the northern coast of Lantau would be minimal.

Construction of the Tung Chung Station and Tunnels alone is unlikely to cause significant dust impacts on the receptors. The maximum hourly dust concentration predicted at the receptors in the range 144 - 487 $\mu\text{g m}^{-3}$. The maximum hourly TSP level of 487 $\mu\text{g m}^{-3}$ will be at Tai Po. However it should be noted that Tai Po village is scheduled to be relocated in 1993. The cumulative impacts from all the different developments in the area will pose a threat to the daily AQO for TSP. From the construction of the new airport at Chek Lap Kok only, the predicted 24 hours average dust level at Tai Po will exceed the daily AQO for TSP. The dust levels predicted at Ma Wan Chung due to the construction associated with the North Lantau Development will also exceed the daily AQO for TSP.

Within the area of the new Chek Lap Kok Airport (Contract 517), the most significant dust impacts identified in the New Airport Masterplan EA were from blasting, excavation/loading, hauling, dumping, drilling and over burden removal. The worst case hourly TSP and RSP concentrations were predicted to be 5882 $\mu\text{g m}^{-3}$ and 538 $\mu\text{g m}^{-3}$ respectively, being in excess of acceptable

levels. Under the most probable scenario (*ie* with wind direction from the east and 5 m per second wind speed), the predicted hourly TSP levels and 24 hour RSP levels at the receptors from both blasting and excavation reclamation works will be within the AQOs.

Measures for Mitigation

Measures for mitigation of dust impacts which will be required for Contracts 514, 516 and 518 will be the same as described in *Paragraph 3.2.2 (page 38)* in relation to the contracts in Central and Yau Tsim Districts.

The relevant Government contracts have specified the dust mitigation measures to be implemented in relation to the entrusted works for Contracts 515 and 517.

6.2.3 *Water Quality*

Predicted Impacts

The LFC EA predicted that the impact on water quality near Tsing Ma Pier will be minimal and that changes in water movements will not cause significant changes in the beach profile. If Penny's Bay is used for off-site construction work and reclamation reduces circulation, water would still be exchanged with mainstream flows. Pollutants entering the bay may exert an oxygen demand, but this is unlikely to result in unacceptable water quality impacts. Water quality at Kung Tsai Wan could deteriorate, although accidental spillages would be transported away from the works site and dispersed by the main tidal flow in the Kap Shui Mun Channel and

therefore is not likely to have major water quality impacts.

Drainage from the East Lantau Tunnels worksites into the coastal waters off North Lantau should be controlled. The introduction of polluted waters will have detrimental effects on fishing grounds in this area, which could still remain in these waters following the NLE and NLD Reclamation, but the sheltered and shallow inlets which are used for spawning will have been lost, and the diversity of the species in the area will diminish. However, unacceptable water quality impacts will not arise at the Mariculture Zone at Kung Tsai Wan, although it is important that the quality of discharges into the adjacent coastal waters are strictly controlled in order to maintain good water quality and to minimise impacts on the fishing grounds.

Construction activities will concentrate at the tunnel portals and the diversion of stream courses where necessary is therefore not expected to be significant. However, construction runoff and drainage should be controlled to prevent pollutants from entering these surface waters, which are considered to be of good water quality. Groundwater drawdown and discharge in this area will not result in any adverse impacts. The effects on water quality from other construction activities also will be minimal.

As there are no existing foul sewers to connect to in the area, it is likely that interim sewage treatment facilities will be necessary to pretreat the sewage before discharge

Along the North Lantau Formation, dredging and reclamation works associated with the NLE in this section were not predicted to cause significant water quality impacts, although there will be some effects on fish fry and benthic biota. Works associated with LAR construction, including construction of the Siu Ho Wan Depot, will not lead to any other significant water quality impacts.

At Tung Chung, the effects of construction of the tunnel and station will also not lead to any significant impacts on water quality, provided the quality of discharges is controlled.

At Chek Lap Kok, the works for the LAR may lead to elevated suspended solids levels in runoff due to the large volumes of water which will be used for dust suppression, although otherwise no significant effects will occur.

Measures for Mitigation

Measures for the mitigation of potential water quality impacts which will be required to be implemented by the Contractors for Contracts 514, 516 and 518 will be the same as described for Contract 505 in Mong Kok District (see *Paragraph 4.2.3, Pages 50-51*).

Mitigation measures in relation to the Government-entrusted works for Contracts 513, 515 and 517 have been specified in the Government contracts for these works.

6.2.4 *Land Use and Visual Impacts*

Because of their scale, the major bridge structures associated with the Lantau Fixed Crossing cannot be effectively screened, and they will change the character of the landscape completely. However, the impact will generally be a positive one, as the design of the Tsing Ma Bridge will act as a cultural or civic feature for Hong Kong and a symbol for the city.

On North Lantau, the tunnelled section will have no visual impacts. Also, the visual impacts associated with the North Lantau Developments and the new airport at Chek Lap Kok will completely outweigh any additional impacts associated specifically with the LAR.

6.2.5 *Waste Management*

Information regarding the likely characteristics, volume and scheduling of excavated and dredged material was not given in the environmental assessment of the Lantau Fixed Crossing project.

Excavated material from the tunnelling works at East Lantau will comprise largely of rock material. Given the inert nature of this material, reuse on-site or at reclamations is not likely to have any significant environmental impact. The only likely impacts associated with the excavated material are related to air quality and dust generation during excavation, stockpiling and transport. During tunnelling, the rock excavated will reach a peak of 600 m³ per day. All rock will be disposed of off-site, although no specific disposal location has been

identified at this stage. This will require the equivalent of approximately 60 lorry loads per day to remove the spoil, which is likely to be transported by barge. The total spoil removed from the tunnels will be approximately 65,000 m³.

The environmental assessment for the NLE did not specifically identify the amount of excavated material which would be generated during the construction of this section of the LAR alignment.

At Siu Ho Wan, excavation from the depot construction is expected to generate a total of 95,300 m³ of saturated sand from the reclamation requiring disposal. It is likely that disposal of this material would be to nearby construction works on North Lantau. Given the quantity of material to be exported and its suitability for use in reclamations or nearby developments with a material deficit, the material should be exported to such nearby sites. However, prior to transportation, some degree of dewatering may be required. For transport to these sites, covered trucks would be used and during peak periods approximately 60 haul loads per day would be required. Should disposal at nearby sites not be possible and transport to sites requiring marine access is needed, such as Chek Lap Kok or other similar sites, the material may be transported by barge. In any event, transport by barge may be the only available route as the construction of access roads is unlikely to be completed by the time that the excavation work for Contract 518 is carried out.

At Tung Chung (Contract 516), approximately 100,000 m³ of marine sands will be excavated for the construction of

the LAL Station on reclaimed land, together with a further 500,000 m³ for the cut-and-cover tunnels. Some of the material will be stockpiled on site for use in backfilling with the remaining quantity (approximately 70%) exported from site. Hence, the total surplus of excavated material is expected to be approximately 420,000 m³. It would be recommended that wherever possible any material be reused on-site for landscaping, cover and fill material. It is likely that disposal of this material would be to nearby construction works in the North Lantau area and possibly Chek Lap Kok. Given the relatively large quantity of material to be exported and its suitability for use in reclamations or other developments with a material deficit, the material should be exported to such nearby sites. Barge transport would be used for Chek Lap Kok and for other land based sites on North Lantau, covered trucks would be used. During peak periods up to 25-30 haul trucks per hour may be required to remove this material.

In the vicinity of the new airport at Chek Lap Kok, the construction of the LAR will be entrusted to the Provisional Airport Authority as part of the new airport works. The environmental assessment for the airport did not specifically identify the amount of excavated material from the construction of the LAR which will require disposal.

6.2.6 *Monitoring and Audit Requirements*

Introduction

As a means of ensuring the effectiveness of mitigation

measures, MTRC will undertake environmental monitoring and, in association with this, employ appropriate audit practices. The data collected in this manner will be used in association with Event Contingency Plans to ensure that any accidental or other exceedance of the statutory requirements in relation to pollution are remedied. More details of this are set out in the relevant Technical Annexes in *Volume 3* of this report. This section sets out the locations recommended for monitoring of the various categories of impact for this part of the LAR route.

Noise

In relation to the construction of Tung Chung Station, a monitoring station will be required at Tai Po Youth Camp. The exact location and direction of monitoring equipment to be agreed between the Contractor and the Engineer.

The construction of Contracts 513, 515 and 517 will be carried out under Government contracts as entrusted works. Any noise monitoring required will be specified in these Government contracts.

Air Quality

Dust monitoring stations will be set up at the following locations, the exact location to be decided between the Contractor and the Engineer:

- Yiu Liun Dockyard;
- Tai Po Youth Camp; and
- Ma Wan Chung.

6.3 IMPACTS DURING OPERATION

6.3.1 Noise

Predicted Impacts

For the LFC, predictions of noise impacts from the operation of the LAR were made in the LFC EA. This predicted that noise levels from the LFC will exceed the NCO requirements at sensitive receptors on Ma Wan. Mitigation of these impacts will be addressed by the LFC Project Management Office and is beyond the scope of the LAR EIS.

No significant noise impacts will occur from the operation of the LAR through the East Lantau Tunnels, or from the ventilation buildings at the tunnel portals.

On North Lantau, train noise impacts in excess of the NCO requirements will occur at Luk Keng Tsuen Village, the proposed residential developments at Tai Ho Wan and at Tung Chung, impacts also in excess of these requirements will occur at the residential blocks and schools which will be located north of the AEL lines.

At the Depot Site, noise levels from train movements in the busiest night-time periods will be approximately $L_{Aeq, 30min}$ 50 dB and, $L_{AMax,F}$ 68 dB (with the use of effective wheel-track lubrication) and will therefore be within the NCO requirements. However, it is possible that noise from wheel squeal in the fan area may cause annoyance at future developments near the depot.

Measures for Mitigation

The following measures, detailed in *Table 6.3a*, are recommended for the mitigation of operational noise:

- a 6 m high enclosure over the LAL lines from the tunnel portal to a point 220 m to the east.
- a type 2b barrier on the northern side of the AEL Down line and a type 2 barrier on the northern side of the AEL Up line, from the Sea Channel Bridge to a point 950 m east of the NLE interchange.
- a 6 m high enclosure over both AEL lines, in place of the above barriers, 260 m long running west from a point 120 m to the west of the NLE interchange.

In addition, provision should be made for to accommodate the following barriers which may be required subject to the findings of future studies:

- a 1.4 m absorptive barrier about 1 km in length to the west of Yam O;
- 3.8 m barriers north of both lines, 1400 m in length, west from Siu Ho Wan Interchange; and
- 1.4 m barriers south of both lines, 900 m in length, west of Siu Ho Wan Interchange.

Train wheel and rail lubrication techniques should be employed to mitigate wheel squeal in the depot fan area. However, potential for annoyance from wheel squeal, and

Table 6.3a Noise Barriers for the 86 dB Train Recommended for Contracts 515 and 516

Barrier Type ⁽¹⁾	Railway Line	NSR Protected	Start Chainage (Up AEL)	Finish Chainage (Up AEL)	Total Barrier Length (m)
Contract 515					
Type 2	North of northern line	Luk Ken Tsuen (83)	Yam O Station	1000 m West	1000 ⁽²⁾
Type 2a	North of both lines	Residential Area 27 (85), Areas 18 & 22 Tai Ho Wan	Near NLE Siu Ho Wan Interchange	1400 m West	2800 (1400 each) ⁽²⁾
Type 1	South of both lines	Special Residential Area 14 (86) & Area 15 Tai Ho Wan	Near NLE Siu Ho Wan Interchange	900 m West	1800 (900 each) ⁽²⁾
Type 2b	North of AEL Dn line	Residential Towers and Scholls in Tung Chung (91)	Southern end of Sea Channel Bridge (approx 900 m west of NLE interchange)	950 m east of NLE interchange	1510 ⁽²⁾
Type 2	North of AEL Up line	91	Southern end of Sea Channel Bridge (approx 900 m west of NLE interchange)	950 m east of NLE interchange	1510 ⁽²⁾
Enclosure	Over both AEL lines	91	120 m west of NLE interchange	380 m west of NLE interchange	260
Contract 516					
Enclosure	Over both LAL lines	91	LAL tunnel portal	220 m east of tunnel portal	220
Notes:	(1) Barrier types recommended for the LAR are described below.				
	Type 1: wayside barrier incorporated into or fixed to track supports, normally 1.4 m high with a density of 30 kg m ⁻² , located 2.575 m from the centre line of the track.				
	Type 2: as for Type 1 but incorporating absorptive acoustic panelling, on the inside face, to a depth of 75 mm.				
	Type 2a: as for type 1 but fitted with transparent material (plexiglass or equivalent) 2.4 m high of a superficial density of 20 kg m ⁻² above the denser section.				
	Type 2b: as for Type 2a but fitted with the same acoustic panelling as Type 2 barriers.				
	Enclosure: full screening on one side and overhead, with partial screening to permit ventilation on the side facing away from the NSR. Constructed from the same specification materials as the Type 2a barrier.				
	(2) Barrier recommendation which may be altered in the light of further studies concerning future development planning.				
	(3) Total length of barriers, excluding 260 m enclosure.				

the consequent need for mitigation, can only be assessed once the Depot is operational. It is therefore recommended that the Depot be designed to allow for the possible erection of a noise cover and/or barriers, over the fan area, to protect future developments.

6.3.2 *Air Quality*

All the identified sources of air pollutants during the operation of the LAR will only give rise to very small levels of emissions and concentrations. No significant air quality impacts will be associated with the operation of the LAR in this route section.

6.3.3 *Water Quality*

Predicted Impacts

Significant water quality impacts may occur if contaminated drainage and effluents from the Depot are discharged directly into the adjacent coastal waters. However, with the implementation of appropriate mitigation measures set out below no adverse water quality impacts are anticipated. Contaminated wastewaters from the depot washing and cleaning plants will require collection and treatment on site prior to discharge. An on-site wastewater treatment plant will provide the required treatment of effluent discharges. A complete drainage system shall be provided throughout the Depot and ancillary buildings. This will serve the washwaters and acid wastewaters arising at the washing and cleaning plants. Drainage channels will be incorporated in the design of the heavy cleaning facility to

collect any effluent which may spill out of the car doors during the cleaning process. In addition, the wash plants will contain drainage, settlement tanks and recirculation valves, and the bogie wash plant equipment will be contained inside a structure to prevent overflow and contamination of adjacent areas.

The volume of track runoff and tunnel drainage from this section of the LAR will not be excessive, although the potential exists for water quality impacts to result from discharges of contaminated runoff and drainage. No adverse water quality impacts are anticipated, provided that the mitigation measures set out below are implemented.

Maximum daily flow rates from the station cooling systems are expected to exceed the maximum discharge of 6000 m³ per day specified under the TM. The governing criteria will, therefore, be the WQO for the relevant WCZ, that is to say, the effluent discharge should not cause the normal daily temperature range to change by more than 2°C.

The Consultants have estimated that, based on a worst case scenario of some 24000 m³ of cooling water per day at a temperature of 10°C above intake level, the 2°C temperature envelope would be confined to an area approximately 120 m offshore. As there are no biologically sensitive receivers such as mariculture zones, or bathing beaches, within this zone, no unacceptable impacts are anticipated.

Tung Chung Station will be connected to the local sewer and the flow will be pumped to a sewage treatment works. No significant impacts on water quality are anticipated.

Measures for Mitigation

The potential for contaminated runoff and drainage at the depot and Tung Chung Station will be the principal concern from railway operations. The following measures have been identified to mitigate potentially significant impacts on water quality as a result of operation of the LAR and will be incorporated into the Code of Operational Practice (COP).

- Traps to collect suspended solids in drainage or runoff at the depot and Tung Chung Station;
- interceptors to collect oil and grease at the depot and Tung Chung Station;
- regular inspection of the lining of the tunnels to monitor ingress of groundwater, and appropriate actions to reduce the volume of tunnel drainage arising from this source; and
- procedures for maintenance practices shall be implemented such that the volume of all wastewaters or effluents arising are minimised.

6.3.4 Land Use and Visual Impacts

The LAR alignment and associated structures in this route section will be mostly located in reclaimed areas which have undergone extensive planning exercises, and no significant impacts will therefore occur. Similarly, as most of the structures are below ground, or incorporated into larger developments, there will be no adverse visual impacts.

6.3.5 Waste Management

The amount of general refuse generated from the operation of the Depot will depend on the staffing levels and facilities present on site. The North Lantau Refuse Transfer Station (NLRTS) will be commissioned in late 1996 with the depot scheduled to be completed by mid-1996. Once operational, the transfer station will be accepting both domestic and commercial/industrial waste from the North Lantau area.

General refuse and industrial waste from the depot would be suitable for disposal to the NLRTS providing that the industrial waste is not bulky (ie. disused lengths of track and sections of carriages). The waste would most likely have to be collected and delivered to the transfer station by a private waste collector, however, RSD may provide this service for the depot.

Chemical wastes would need to be stored in approved containers supplied by Enviropace, the Chemical Waste Treatment Facility (CWTF) operators. In addition,

Enviropace will collect the chemical waste for disposal at CWTF.

Refuse collection within stations, tunnels and elsewhere along the track will be MTRC's responsibility. Waste will be collected and stored temporarily at refuse chambers, then either delivered by private contractor to public Refuse Collection Points or Urban Services Department will collect the wastes directly. No adverse environmental impacts are predicted to arise from these arrangements.

6.3.6 *Environmental Monitoring and Audit*

Train Rolling Noise

To help ensure that noise levels from trains during operation of the LAR come within the requirements of the NCO and the HKPSG, monitoring of noise levels will be carried out at the following locations:

- Ma Wan (7 NSRs are identified in Table 4.2 of the LFC EIA);
- Commercial/residential Area 27 at Siu Ho Wan Depot;
- Residential developments in Tai Ho Wan (after 2011);
- Luk Keng Tsuen Village;
- Residential Area R1(c2) at Tung Chung;
- Residential Areas R1(b2) at Tung Chung; and
- Residential Area R1(a) at Tung Chung.

The exact locations of monitoring stations will be determined by the Engineer and agreed with EPD.

7 CONCLUSIONS

From the previous Sections, the following conclusions may be drawn from the LAR EIS:

- The construction and operation of the LAR can be undertaken without contravention of the standards set out in the various Government Ordinances covering environmental protection, the HKPSG and EPD's established standards.
- It will, however, be necessary to incorporate a number of engineering and environmental management measures into the design of, and working arrangements for, the building and operation of the LAR. These are specifically listed as measures for mitigation in each of the preceding chapters covering the four route sections identified for the purposes of the LAR EIS.
- The only remaining concern over residual impacts will occur during the construction of the new station at Lai King, where a few dwellings are predicted to experience noise levels in excess of acceptable levels. However, ERM anticipate that when the relevant Contractor finalises working arrangements, it will be possible to identify specific measures to mitigate these residual effects.
- MTRC will engage independent environmental consultants to undertake monitoring of the environmental effects caused during construction

and operation of the LAR. Data from this will be used with Event Contingency Plans, implemented by the Contractors, to ensure that the relevant environmental standards are met, as required by the contracts (Further details regarding this are given in *Annex G, Volume 3* of this Final Report).

From this, it may be seen that no significant environmental impacts have been predicted by ERM as likely to occur during the construction or operation of the LAR which are not capable of being avoided or reduced to acceptable levels by implementation of appropriate mitigation measures, as recommended in this report. These recommended measures are summarised in *Table 7.1a*.

However, it must be noted that the process of Environmental Impact Assessment inherently includes elements of uncertainty. In relation to the LAR, these include:

- *Details of the proposals:* The detailed design of the LAR will continue for some time yet, and the precise final form of the proposals will not be known until this is complete;
- *Construction methods and working arrangements:* Until the construction contracts are put out to tender and awarded, and the chosen contractors have finalised their preferred methods of working, the precise construction programme, working arrangements and plant to be used on site will not be known.

Input Data: The EIS has been undertaken using the best available information on existing and future environmental conditions, and relating to concurrent and future developments.

Modelling: The models used by ERM for the prediction of the extent and magnitude of impacts invariably are subjected to margins of error, which means that caution needs to be employed in interpreting the results obtained by their use.

The measures for mitigation recommended by ERM in this Final Report indicate the type of measures to be employed to ensure compliance with the statutory requirements, Government guidelines and other environmental standards agreed with EPD and set out in this report. They have been put forward as representing the most likely approaches which could be adopted in achieving this aim, and to demonstrate that the construction and operation of the LAR are possible without causing significant damage to the environment. Many of the measures recommended by ERM have already been included as contract clauses in the General Specification for the LAR works, and others will be similarly be incorporated into the Particular Specifications of individual contracts before they are let. Notwithstanding this, the means by which the construction contractors and the operator of the LAR achieve compliance with statutory and other environmental standards may in some instances differ from those recommended in the LAR EIS. However, the environmental monitoring and audit programme which will be adopted during construction and operation

of the LAR will help ensure compliance whatever means of mitigation are used.

It has been estimated that the costs to MTRC of providing the measures for the mitigation of construction noise impacts alone will be approximately HK\$14 million for noise control at source, including HK\$6.25 million for the enclosure at Lai King, and an additional sum for the partial insulation of WMC Morninghope School and the Marine Department Offices.

For the mitigation of operational noise impacts HK\$160 million will be required for the 86 dB Train. The operational mitigation costs may rise to HK\$260 million depending upon the extent of future development along the North Lantau coast.

Table 7.1a Schedule of LAR Mitigation Measures

Contract Number	Construction Activities	Operational Activities	Construction EM&A⁽⁴⁾	Operational EM&A
General ⁽¹⁾ Mitigation Measures	<p>Noise:</p> <ul style="list-style-type: none"> · good site practice including the use of "quiet" plant and acoustic screens (B7.1-8)⁽²⁾. <p>Air Quality⁽³⁾:</p> <ul style="list-style-type: none"> · dust suppression by damping, containment and general good site practice (C7.2.1). <p>Water Quality⁽³⁾:</p> <ul style="list-style-type: none"> · containment and treatment of all waste waters to appropriate discharge standards (D7.1.5). <p>Land Use and Visual Impact⁽³⁾:</p> <ul style="list-style-type: none"> · good site practice; · maintenance of boundary fencing; · protection of existing pedestrian and vehicular access (E6.2.1). · screening of unsightly features; · use of recessive colours and controlled lighting; and · landscaping and revegetation of the site as soon as possible (E6.2.2). 	<p>Noise:</p> <ul style="list-style-type: none"> · effective track mounting design (B7.2-8). <p>Air Quality⁽³⁾:</p> <ul style="list-style-type: none"> · station air vents directed to protect ASRs (C7.3.1). <p>Water Quality⁽³⁾:</p> <ul style="list-style-type: none"> · containment and treatment of trackbed run-off from stations and tunnels (D7.2). <p>Land Use and Visual Impact:</p> <ul style="list-style-type: none"> · none required for any contract. 	<p>Noise:</p> <ul style="list-style-type: none"> · establish baseline data; · monitor at specified NSRs; and · observe the requirements of the Event Contingency Plan (G3.1-2). <p>Air Quality:</p> <ul style="list-style-type: none"> · establish baseline data; · monitor at specified ASRs; and · observe the requirements of the Event Contingency Plan (G4). <p>Water Quality:</p> <ul style="list-style-type: none"> · establish baseline data; · monitor at specified WSRs; and · observe the requirements of the Event Contingency Plan (G5). <p>Land Use & Visual Impact:</p> <ul style="list-style-type: none"> · none required for any contract. 	<p>Noise:</p> <ul style="list-style-type: none"> · noise measurements input into maintenance schedule (G3.3.1); and on-train noise monitoring along LAR route (G3.3.4). <p>Air Quality:</p> <ul style="list-style-type: none"> · none required for any contract. <p>Water Quality⁽³⁾:</p> <ul style="list-style-type: none"> · routine inspection and maintenance of tunnels and drainage systems (G5). <p>Land Use and Visual Impact:</p> <ul style="list-style-type: none"> · none required for any contract.

Contract Number	Construction Activities	Operational Activities	Construction EM&A ⁽⁴⁾	Operational EM&A
	Waste Management ⁽⁵⁾ : · segregation of waste types (F5.3). · disposal at appropriate sites by licensed collectors (F5.4).	Waste Management: · none required for any contract.	Waste Management: · none required for any contract.	Waste Management: · none required for any contract.
C501	Noise: · general measures; and · restriction of piling times (B7.2.1).	Noise: · general measures; and limits on vent noise levels (B7.2.1).		Noise: · general measures (G3.3.1).
C502	Noise: · restricted dredging activities outside normal working hours (0700-1900) (B7.2.2). Air Quality: · none required. Water Quality: · use of suitable dredging and backfilling methods (D7.1.1&2); · effective transport and proper disposal of marine muds (D7.1.3&4). Landuse and Visual Impact: · none required. Waste Mgt: · proper transport and disposal of marine muds at appropriate sites (F5.2.1); and · restrict and remove floating refuse (F5.2.2).	Noise: · general measures (B7.2.2). Air Quality: · none required.		Noise: · general measures (G3.3.1).
C503	Noise: · general measures (B7.3.1).	Noise: · general measures; and control of vent noise levels (B7.3.1).		Noise: · general measures (G3.3.1).

Contract Number	Construction Activities	Operational Activities	Construction EM&A ⁽⁴⁾	Operational EM&A
C504	Entrusted Works ⁽⁶⁾ (B7.3.2).	Noise: · general measures (B7.3.2). Air Quality: · none required.		Noise: · general measures (G3.3.1); and · train noise monitoring at specified NSRs (G3.3.2) ⁽⁶⁾ . Water Quality: · none required.
C505	Noise: · site boundary noise barrier; and · general measures (B7.4.1).	Noise: · general measures; and limits on vent noise levels (B7.4.1).		Noise: · general measures (G3.3.1); and · train noise monitoring at specified NSRs (G3.3.2) ⁽⁶⁾ .
C506	Entrusted Works ⁽⁶⁾	Noise: · general measures; and · trackside barriers ⁽⁷⁾ (B7.5.1). Air Quality: · none required. Water Quality: · none required.		Noise: · general measures (G3.3.1); and · train noise monitoring at specified NSRs (G3.3.2) ⁽⁶⁾ . Water Quality: · none required.
C520	Noise: · control of wheel squeal; and · screening of noisy activities (B7.4.2).	The depot will only be used during the construction phase of the LAR.		The depot will only be used during the construction phase of the LAR.
C507	Entrusted Works ⁽⁶⁾	Noise: · general measures; and · trackside barriers ⁽⁷⁾ (B7.5.1). Air Quality: · none required. Water Quality: · none required.		Noise: · general measures (G3.3.1); and · train noise monitoring at specified NSRs (G3.3.2) ⁽⁶⁾ . Water Quality: · none required.

Contract Number	Construction Activities	Operational Activities	Construction EM&A ⁽⁴⁾	Operational EM&A
C508	<p>Noise:</p> <ul style="list-style-type: none"> · site boundary noise barriers; · general measures; · secondary glazing at NSR 29; · enclosure over excavation works at station, use of specified "quiet" plant; and · advanced warning of blasting (B7.6.1). <p>Air Quality:</p> <ul style="list-style-type: none"> · appropriate blast control (C7.2.1). 	<p>Noise:</p> <ul style="list-style-type: none"> · control of vent and plant noise levels; · general measures; and · trackside barriers⁽⁷⁾ (B7.6.1). 		<p>Noise:</p> <ul style="list-style-type: none"> · general measures (G3.3.1); and · train noise monitoring at specified NSRs (G3.3.2)⁽⁶⁾. <p>Water Quality:</p> <ul style="list-style-type: none"> · none required.
C509	<p>Noise:</p> <ul style="list-style-type: none"> · site boundary noise barrier; and · general measures (B7.6.2). <p>Air Quality:</p> <ul style="list-style-type: none"> · general measures; and · minimal handling and prompt disposal of odourous material (C7.2.2). <p>Water Quality:</p> <ul style="list-style-type: none"> · containment and treatment of all waste waters, including leachate from the landfill mass, to appropriate discharge standards (D7.1.5&6). 	<p>Noise:</p> <ul style="list-style-type: none"> · general measures; · trackside barriers⁽⁷⁾; and · park design (B7.6.2). <p>Air Quality:</p> <ul style="list-style-type: none"> · controlled venting of landfill gas (C7.3.2). <p>Water Quality:</p> <ul style="list-style-type: none"> · none required. 	<p>Air Quality:</p> <ul style="list-style-type: none"> · regular odour patrols; and · observe the requirements of the Odour Event Contingency Plan (C8.5). 	<p>Noise:</p> <ul style="list-style-type: none"> · general measures (G3.3.1); monitoring at permanent site (G3.3.3). <p>Water Quality:</p> <ul style="list-style-type: none"> · none required

Contract Number	Construction Activities	Operational Activities	Construction EM&A ⁽⁴⁾	Operational EM&A
C510	<p>Noise:</p> <ul style="list-style-type: none"> · general measures; and · restricted piling times (B7.6.3). <p>Water Quality:</p> <ul style="list-style-type: none"> · use of appropriate dredging and backfilling techniques (D7.1.1&2); · effective transport and proper disposal of marine muds (D7.1.3&4); and · general measures (D7.1.5). <p>Waste Mgt:</p> <ul style="list-style-type: none"> · proper transport and disposal of marine muds at appropriate sites; (F5.2.1) and · restrict and remove floating refuse (F5.2.2). 	<p>Noise:</p> <ul style="list-style-type: none"> · general measures; and · trackside barriers (bridge parapet) & cover over station approach⁽⁷⁾ (B7.6.3). <p>Air Quality:</p> <ul style="list-style-type: none"> · none required. <p>Water Quality:</p> <ul style="list-style-type: none"> · none required. 		<p>Noise:</p> <ul style="list-style-type: none"> · general measures (G3.3.1); and · train noise monitoring at specified NSRs (G3.3.2)⁽⁶⁾. <p>Water Quality:</p> <ul style="list-style-type: none"> · none required
C511	<p>Noise:</p> <ul style="list-style-type: none"> · site boundary noise barriers; · general measures; · restricted activities outside normal working hours (0700-1900) (B7.6.4). 	<p>Noise:</p> <ul style="list-style-type: none"> · control of vent noise levels; · trackside barriers & cover over station viaducts⁽⁷⁾; and · general measures (B7.6.4). 		<p>Noise:</p> <ul style="list-style-type: none"> · general measures (G3.3.1); and · train noise monitoring at specified NSRs (G3.3.2)⁽⁶⁾.
C512	<p>Noise:</p> <ul style="list-style-type: none"> · site boundary noise barriers; · general measures; and · restricted activities at night (2300-0700) (B7.6.5). 	<p>Noise:</p> <ul style="list-style-type: none"> · none required. 		<p>Noise:</p> <ul style="list-style-type: none"> · general measures (G3.3.1).

Contract Number	Construction Activities	Operational Activities	Construction EM&A ⁽⁶⁾	Operational EM&A
	Air Quality: · general measures; and · appropriate blast control (C7.2.1). Water Quality: · general measures (D7.1.5); and · protection of WSD reservoir (D7.1.7).	Air Quality: · none required.		
C513	Entrusted Works ⁽⁶⁾ Noise: (B7.7.1).	Noise: · general measures; and · NCO relaxed (B7.7.1).		Noise: · general measures (G3.3.1); and · train noise monitoring at specified NSRs (G3.3.2) ⁽⁶⁾ .
	Water Quality: (D7.1.8)	Air Quality: · none required. Water Quality: · none required.		Water Quality: · none required.
C514	Noise: · relocation of affected residents (NSR 76); and · general measures (B7.7.2).	Noise: · general measures; and · limit on vent noise levels (B7.7.2).		Noise: · general measures (G3.3.1).
	Air Quality: · general measures; and · appropriate blast control (C7.2.1).	Air Quality: · none required.		
C515	Entrusted Works ⁽⁶⁾	Noise: · general measures; and · trackside barriers and enclosure ⁽⁷⁾ (B7.8.3).		Noise: · general measures (G3.3.1); and · train noise monitoring at specified NSRs (G3.3.2) ⁽⁶⁾ .
	Air Quality: · general measures; and · appropriate blast control (C7.2.1).	Air Quality: · none required.		
	Water Quality: (D7.1.10)	Air Quality: · none required. Water Quality: · none required.		Water Quality: · not required.

Contract Number	Construction Activities	Operational Activities	Construction EM&A ⁽⁴⁾	Operational EM&A
C516	Noise: <ul style="list-style-type: none"> · relocation of Tai Po village (NSR 77); · site boundary noise barriers; · general measures; · restricted activities outside normal working hours (0700-1900) (B7.8.4). 	Noise: <ul style="list-style-type: none"> · general measures; and · enclosure at tunnel portal & trackside barriers⁽⁷⁾ (B7.8.4). 		Noise: <ul style="list-style-type: none"> · general measures (G3.3.1); and · train noise monitoring at specified NSRs (G3.3.2)⁽⁶⁾.
C517	Entrusted Works ⁽⁵⁾ Water Quality: (D7.1.12)	Noise: <ul style="list-style-type: none"> · general measures (B7.8.5). Air Quality: <ul style="list-style-type: none"> · none required. Water Quality: <ul style="list-style-type: none"> · none required. 		Noise: <ul style="list-style-type: none"> · general measures (G3.3.1). Water Quality: <ul style="list-style-type: none"> · not required.
C518	Noise: <ul style="list-style-type: none"> · general measures (B7.8.2). 	Noise: <ul style="list-style-type: none"> · building insulation; · limits on plant noise levels; · barriers⁽⁷⁾; and · rail treatment (B7.8.2). Air Quality: <ul style="list-style-type: none"> · none required. 		Noise: <ul style="list-style-type: none"> · general measures (G3.3.1); and · train noise monitoring at specified NSRs (G3.3.2)⁽⁶⁾.

- Notes:
- (1) General construction controls described in the Technical Annexes of *Volume 3* will be applied on all MTRC contract sites.
 - (2) Figures in brackets refer to the appropriate sections on the fully detailed measures in the Technical Annexes.
 - (3) Unless otherwise specified the general mitigation measures are recommended for all sites.
 - (4) Unless otherwise specified, construction EM&A requirements are the same at each site for the whole LAR alignment.
 - (5) Whilst mitigation measures for the entrusted sections of the LAR do not fall within the remit of this study the findings of previous studies have been reported.
 - (6) Details of the locations of monitoring stations are given in *Annex G, Volume 3*.
 - (7) Full details of operational noise barriers are given in the chapters of this volume concerning each of the LAR route sections.



Appendix A

List of Abbreviations

List of Abbreviations

Abbreviation	Definition
AEL	Airport Express Line
ANL	Acceptable Noise Level
APCO	Air Pollution Control Ordinance
AQO	Air Quality Objectives
ASR	Area Sensitivity Rating (for noise)
ASR	Air Sensitive Reciever
BOD	Biochemical Oxygen Demand
BU	Beneficial Uses (for water)
CBD	Central Business District
CCP	Code of Construction Practice
CDA	Comprehensive Development Area
CED	Civil Engineering Department
CLK	Chek Lap Kok
COP	Code of Operational Praticce
dB	Decibel
dB(A)	"A"-weighted decibel
DEP	Director of Environmental Protection
DO	Dissolved Oxygen
E and M	Electrical and Mechanical
ECP	Event Contingency Plan
ECS	Environmental Control System

Abbreviation	Definition
EEC	European Economic Community
EIA	Environmental Impact Assessment
EIS	Environmental Impact Study
EPD	Environmental Protection Department
Exco	Executive Council
FMC	Fill Management Committee
GI\C	Government, Institutional or Community use
GS	General Specification
HKPSG	Hong Kong Planning Standards and Guidelines
ISCST	Industrial Source Complex Short Term Model
ISO	International Standards Organisation
L_{A10}	The noise level exceeded for 10% of the time, "A"-weighted
L_{A90}	The noise level exceeded for 90% of the time, "A"-weighted
L_{Aeq}	Continuous Equivalent Noise Level, "A"-weighted
LAL	Lantau Line
L_{AMAX}	Maximum noise level, "A"-weighted
LAR	Lantau and Airport Railway
LFC	Lantau Fixed Crossing
MTRC	Mass Transit Railway Corporation
NAMP	New Airport Masterplan
NCO	Noise Control Ordinance
NENT	North-east New Territories
NLD	North Lantau Development
NLE	North Lantau Expressway

Abbreviation	Definition
NSR	Noise Sensitive Receptor
NWW	North West Waters
ODP	Outline Development Plan
OZP	Outline Zoning Plan
PA	Public Address
PADS	Ports and Airport Developments
PCD	Pollution Control Division
PCP	Preferred Concept Plan
PCWA	Public Cargo Working Area
PME	Powered Mechanical Plant
PS	Particular Specification
RSP	Respirable Suspended Particulates
SENT	South-east New Territories
SR	Sensitive Receptor
SS	Suspended Solids
SSDS	Strategic Sewage Disposal Scheme
SSSI	Site of Special Scientific Interest
STW	Sewage Treatment Works
TEF	Trackway Exhaust Fan
THA	Temporary Housing Area
TM	Technical Memorandum
TSF	Tunnel Supply Fan
TSP	Total Suspended Particulates
TVF	Tunnel Ventilation Fan

Abbreviation	Definition
TWL	Tsuen Wan Line
USEPA	United States Environmental Protection Agency
WAHMO	Water Quality and Hydraulic Model
WCZ	Water Control Zone
WENT	West New Territories
WHC	Western Harbour Crossing
WKE	West Kowloon Expressway
WKR	West Kowloon Reclamation
WPCO	Water Pollution Control Ordinance
WQO	Water Quality Objectives
WSR	Water Sensitive Receivers

Appendix B
Project Team

PROJECT TEAM

Project Director
Chandran Nair

Project Manager
Steve Laister

Project Co-ordinators
Chris Ferrary
John Cawley, Erik Bichard

Noise
Steve Mitchell
Jordan Woods
Frederick Chan
Simon Okotie
Ashdown Environmental Limited

Air Quality
David Yip
Edith Tam

Water Quality
Ralphaelynne Lee
Jane Carbray
Jordan Woods

Land Use and Visual Impacts
Josh Lam
Wan Choi Lam
Andrew Chan

Waste Management
Richard Tipping
David Diestel
Marika Svardstrom

Special Advisors
Eric Turner
Simon Hewitt

Mitigation Costs
Tim Pierson-Smith
Mott MacDonald (Hong Kong)

Project Co-ordinators' Assistant
Andrew Chan

Administrative Support
Virginia Cheung
Ivy Kwan

Graphics
Martin Clayton

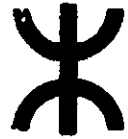
MTRC Liaison
Dr. Glenn Frommer

Appendix C

Confirmatory Correspondence Between MTRC and EPD

香港地下鐵路公司
Mass Transit Railway Corporation

GPO Box 9916 Hong Kong



C/SEEN/LAR/H100
Our Ref.
Please quote reference in all replies
Your Ref.

URGENT

By Fax & Post
(591 0558)

Date 28 December 1993

Environmental Protection Department
Environmental Assessment & Planning Group
27/F Southorn Centre
130 Hennessy Road
Wanchai

Attention: Mr Simon Hui

Dear Mr Au,

**Lantau and Airport Railway
Noise Mitigation Measures**

As agreed in the Pre-SMG meeting, the MTRC is to confirm the following with Noise Policy Group (NPG).

- The mitigation measures to be installed at the opening of the railway;
- Indicate how the MTRC will identify the timing of barrier enhancement and
- Outline a process by which EPD will be kept informed of barrier enhancement.

While the identification of the day one mitigation measures at this point is voluntary, the Corporation is interested in concluding these matters with regard to public consultations.

The following is proposed.

1. General Policy

- 1.1 It is understood that regardless of the noise mitigation suite proposed herein for the day one operation of the LAR, the MTRC is responsible for

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To: EPD, Attn: Mr S Hui
28 December 1993

Page 2

compliance with the Noise Control Ordinance (NCO) at the nearby Noise Sensitive Receivers (NSRs).

2. *Day One Operating Conditions*

2.1 It is assumed that the train in question will have a maximum passby noise of 86 dB(A).

2.2 The current day one operating conditions are as follows.

AEL - 7 Cars, 8 minute headway from start up to 0700 hours

LAL - 6 Cars, 8 minute headway from start up to 0700 hours

2.3 For simplicity the ultimate development conditions (2011) were assumed in the LAR EIS; LAL trains were 8 cars long and the AEL trains were 10 cars long, with a headway of 4.5 minutes for the start up to 0700 hours period, for both lines.

2.4 Considering the shorter trains and the longer headway, the critical night time L_{Aeq} (0630 - 0700) will be 4 dB(A) less on day one than that predicted in the LAR EIS for 2011 implying an 82 dB(A) train noise source.

2.5 However, for clarity and an increased degree of conservatism, noise mitigation measures are based on the measures presented in the Draft Final LAR EIS for the 83 dB(A) train excluding the barriers for future developments. Responsibility for any additional barriers in contracts 506 and 507 lies with the MTRC.

3. *Day One Mitigation Measures*

3.1 The Corporation will include the noise mitigation measures at day one operations of the LAR as specified in the attached table.

3.2 Foundations for future at grade section noise mitigation measures will be included at day one if these cannot be installed cost-effectively at a later date.

4. *Process of Barrier Enhancement*

4.1 Commissioning tests of the LAR rolling stock will provide a base case to check the compliancy of the proposed day one measures.

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To: EPD, Attn: Mr S Hui
28 December 1993

Page 3

- 4.2 If measurements indicate the noise from the rolling stock exceeds the predicted values and cannot be rectified, the Corporation will ensure the construction of any additional barriers necessary to meet the NCO at the NSRs prior to railway opening.
- 4.3 EPD will thereafter be advised of the results of the commissioning test and barrier suitability.
- 4.4 Measurements of the LAR within the first year of operation will establish both the sufficiency of the barrier configurations and the requirements for further barriers at the NSRs given proposed changes in train length and headway.
- 4.5 Prior to a change in train timetable, EPD will be advised of the nature of the change and the implications regarding noise barriers.
- 4.6 Additional noise barriers will be installed at the NSRs where proven necessary, prior to changes in train operation.
- 4.7 Measurements will be made by the MTRC to ensure NCO compliancy at the NSRs.
- 4.8 EPD will be advised of the results of these measurements.

The Corporation seeks confirmation from EPD of their acceptance with the principles, details and the text presented herein. If necessary I welcome the opportunity of discussing the contents with yourselves as soon as possible.

Yours sincerely,


Glenn Frommer
Senior Environmental Engineer

Encl

cc EPD - Mr Maurice Yeung (NPG) Fax 802 4511

GF/db

LAR OPERATIONAL MITIGATION REQUIREMENTS DAY ONE



CONTRACT	DAY 1 TRAIN
506	Type 1 barriers on the northern side of all lines (2400 - 3000)
507	<p>Type 1 north of AEL up (3000-4500)</p> <p>Type 1 north of AEL down (3000-4500)</p> <p>Type 1 barrier on all lines between north end of Lai King station and 50m beyond crossing Route 3</p>
509	Type 1 barrier on the west side of AEL up and the east side of the future proposed turnout for the NWNT down line for the whole section of the LAR alignment through Kwai Chung Park
510	Type 1 barrier across bridge all lines
511	<p>Enclosures of the eastern and western ends of the station</p> <p>Type 1 barrier all lines from station to tunnel portal</p>
515	Type 1 barrier north of northern line 400m west of Yam O to 600m west nearest to Luk Keng Tsuen Village
516	<p>Noise enclosure over both LAL lines extending 50 metres from the tunnel portal</p> <p>Type 2a barrier extending 300 metres from the end of the enclosure forming the support of the future enclosure</p> <p>Enclosure over the AEL lines from 120m west of the axis of the NLE interchange to 380m west, with southern side of the enclosure open</p>

C/SEEN/LAR/H100

By Fax & Post
(591 0558)

f(134) in EP 2/N9/18

6 January 1994

Environmental Protection Department
27/F Southorn Centre
130 Hennessy Road
Wanchai
Hong Kong

Attention: Mr Elvis Au

Dear Mr Au,

Lantau and Airport Railway
Noise Mitigation Measures

As requested in your letter of 4 January 1994 the Corporation wishes to verify the following conditions.

1. Adequate structural design has taken into consideration the installation of the ultimate noise mitigation measures (i.e. for the 86 dB(A) trains) should these measures be needed; and
2. The MTRC confirms that future installation works of mitigation measures which are not implemented in Day One can be undertaken in non-operation hours after the LAR becomes operative.

Furthermore the Corporation confirms our intention to install the 86 dB mitigation measures when proven necessary.

Yours sincerely,

Original signed by
G H Frommer

Glenn Frommer
Senior Environmental Engineer

bcc PEM - A J Budge-Reid
REM - N G Wilson

GF/cb

To: EPD, Attn: Mr E Au
11 January 1994

Page 2

Your letter of 4 January 1994 notes that day one mitigation measures are considered acceptable subject to two conditions. These conditions were verified in our letter of 6 January 1994.

Despite the assurances afforded in our letter of 28 December your letter of 4 January notes the mechanism for barrier enhancement to remain outstanding.

Following the meeting in your offices of 7 January the Corporation wishes to offer the requested assurances regarding the mechanism for barrier enhancement.

1. Further noise mitigation measures to avoid exceedance of the NCO at existing and planned Noise Sensitive Receivers (NSR) are foreseen as LAR headway changes in 2001, 2005 and 2008.
2. The MTRC agrees to install additional barriers at these dates in a staged barrier programme unless otherwise agreed with EPD.
3. Within the first year of LAR operation the Corporation agrees to supply EPD with further details of the staged barrier programme for agreement.
4. To avoid exceedances of the NCO at planned NSRs, the MTRC agrees to install the 86 dB noise mitigation measures as detailed in the EIS, unless otherwise agreed with EPD.

The Corporation concludes that this letter completes the final requirements stipulated by the SMG for full endorsement of the Final Report by EPD.

The Corporation looks forward to discussing the report with EPCOM on 31 January.

Yours sincerely,

Original signed by
G H Frommer

Glenn Frommer
Senior Environmental Engineer

bcc REM - N G Wilson
PEM - A J Budge-Reid
DOD - R Kynaston
CE(O) - P Gaffney

ERM - S Laister (By Fax)

C/SEEN/LAR/E1005

By Fax & Post

11 January 1994

Environmental Protection Department
27/F Southorn Centre
130 Hennesy Road
Wanchai
Hong Kong

Attn: Mr Elvis Au

Dear Mr Au,

Lantau and Airport Railway
Environmental Impact Study

It was concluded in the final SMG meeting 25 November that the LAR EIS was endorsed by the EPD subject to the following four points.

1. The report refer only to the 86 dB(A) train;
2. Agreement by MTRC to outline their programme for agreement and implementation of the mitigation measures up to the worst case;
3. Final resolution of the operational noise barriers in Tung Chung; and
4. The Route 3 desk top study be included if available.

All mention of the 83 dB(A) or "Day one train" have been removed from the Final Report. Additionally the operational noise barriers in Tung Chung have been agreed with Noise Policy Group.

As the Corporation has not yet received a letter from EPD confirming acceptance of the Route 3 Study this document cannot be included in the Final Report.

To conclude point 2 above the Corporation has written to you on 28 December 1993 detailing the day one mitigation measures and the Corporation's general policy regarding Noise Mitigation.

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