Highways Department
Western Harbour Link Office

Agreement No. CE 27/92

ROUTE 3
COUNTRY PARK SECTION
AND TING KAU BRIDGE

PRELIMINARY DESIGN STAGE 2

Country Park Section - Ting Kau Bridge

Environmental Assessment - Supplementary Paper

Haul Road

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ROUTE 3

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Chapter

LIST OF ABBREVIATIONS

HAR	Haul/Access Road
RSP	Respirable Suspended Particulate
TKB	Ting Kau Bridge
TMRW	Tuen Mun Road Widening Project
TSP	Total Suspended Particulate
RSD	Regional Services Department
TDS	Terrestrial Development Station
FDM	Fugitive Dust Model
WBWCZ	Western Buffer Water Control Zone
OZP	Outline Zoning Plan

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INTRODUCTION

CHAPTER 1

1. INTRODUCTION

1.1 BACKGROUND

The Route 3 Country Park Section (CPS) project environmental assessment has been divided into two separate studies, delineated according to sections of the alignment:- the southern section from Tsing Yi to (and including) Ting Kau Bridge called the Ting Kau Bridge Section (TKB) and the northern section from Ting Kau to Au Tau called the Tai Lam Tunnel and Yuen Long Approach Road (TLT & YLA).

The design process has identified the need for a haul/access road in the Ting Kau area to remove spoil and to provide access for site vehicles to the works areas. The proposed haul and access road will not only be used by the TKB project, but also by the Tuen Mun Road Widening (TMRW) Project, as the construction works for these projects will overlap in time.

This report comprises the Supplementary Paper which assesses the environmental implications of the construction and use of the haul/access road, including the cumulative effects of the TMRW project and also the use of the road as an access route for the early stages of the CPS works. The detailed environmental assessment of the reclamation works at Ting Kau has been covered in detail in the Route 3 CPS, TKB Environmental Assessment - Technical Report Volume 4A. The Supplementary Paper, does however, cover the use of the reclamation for spoil receiving/disposal operations plus the operation of the concrete batching plant. It is intended that this Supplementary Paper will be released as a separate document.

This environmental assessment covers the proposed haul area road presented in Figure 1.1 and will be referred to as the 'Haul/Access Road' (HAR) throughout the Report.

1.2 SCOPE OF THE STUDY

The scope and objectives of the study draws broadly upon the *Route 3 - CPS and TKB Sections, Stage 2 Preliminary Design, Environmental Impact Assessment, Study Brief No. CE27/92.* In common with the overall study, the HAR gives rise to a number of environmental issues which need to be addressed including :

- air quality impacts;
- noise impacts;
- marine and fresh water quality impacts;
- spoil and fill management.
- visual and landscape issues; and
- effect on terrestrial ecology;

The Study Area is located in the Ting Kau area, which is described in detail in the Route 3 Country Park Section, TKB EIA and is shown in Figure 1.1.

1.3 STRUCTURE AND CONTENT

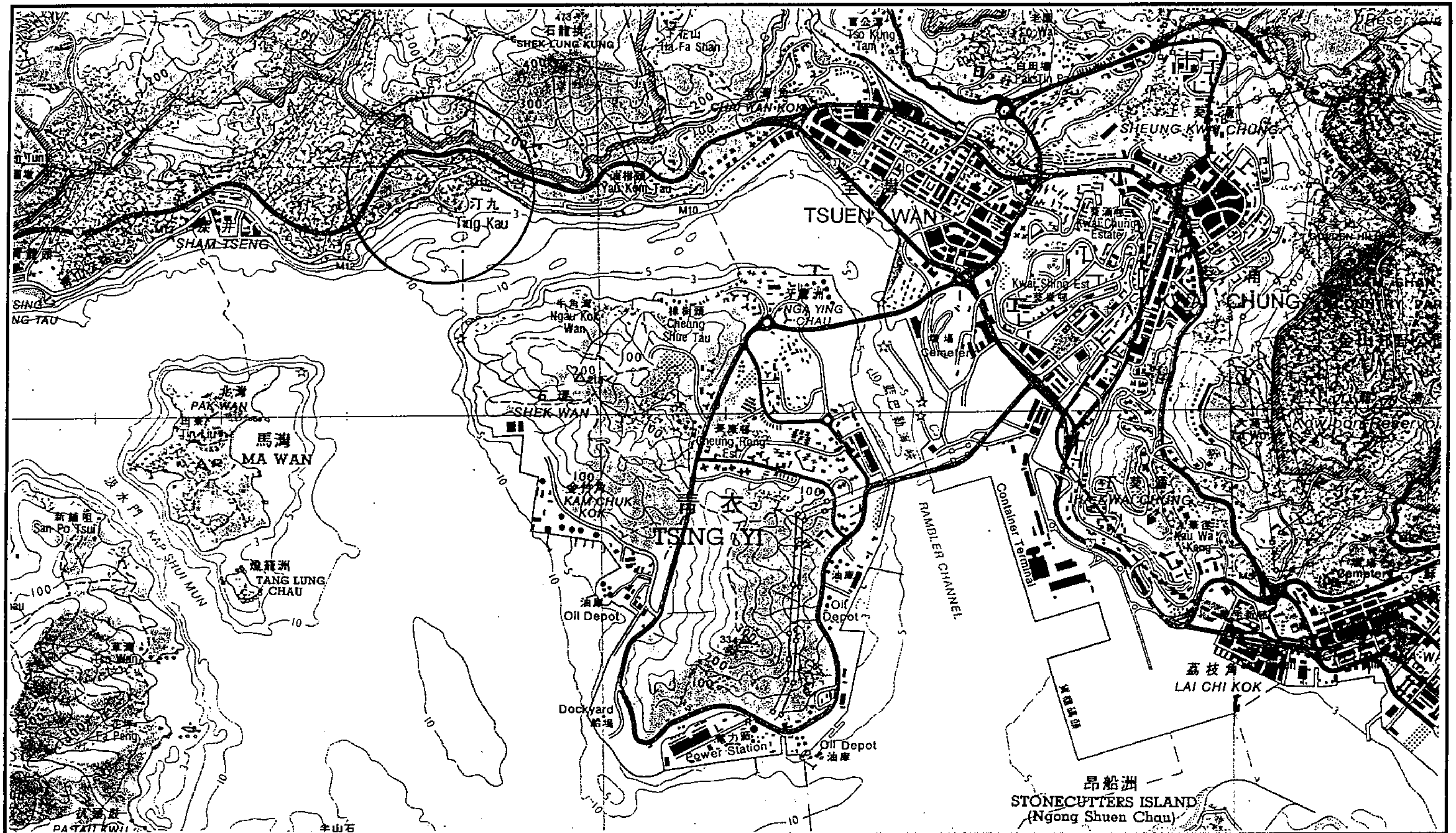
In addition to this introductory chapter, this Supplementary Paper comprises eleven further Chapters and Appendices containing supporting information:

- **Chapter 2** details the project in terms of structural requirements, construction activities and operational phase.

- **Chapter 3** describes the baseline conditions in the Study Area and identifies existing and committed impact sources and sensitive receivers.

- **Chapters 4 - 11** detail the environmental implications, involving the assessment, of the alignment air, noise and water quality, spoil management, landscape and visual assessment, community issues, ecology, and environmental monitoring and audit.

- **Chapter 12** provides the overall conclusions resulting from the environmental assessment of the HAR.



FREEMAN FOX MAUNSELL	Drg. Title : STUDY AREA	Job Title : ROUTE 3 - HAUL/ACCESS ROAD SUPPLEMENTARY PAPER	
		Scale : N.T.S	Job No. 058 007
		Date Nov. 93	Fig No. 1.1

PROJECT DESCRIPTION

CHAPTER 2

2. PROJECT DESCRIPTION

2.1 GENERAL

The HAR runs from the headland between Lido Beach and Ting Kau Beach, (and the proposed reclamation situated off the coast), northwards on a bridge structure across Castle Peak Road. A sliproad from Castle Peak Road links with the HAR, originally proposed to be used by the TMRW Project. The route then runs on a steep slope north towards the Tuen Mun Road, where it divides into two branches (see Figure 2.1) to the west of the alignment.

One branch runs in a loop south down to an area where a large cut is required for the construction of Ramp G. The other branch runs below Tuen Mun Road following the already existing Catchwater Service Road, and then turns west, across a small stream, to connect with the large earth works area at Tuen Mun Road.

The length of the proposed HAR for the TKB works is 775m and the length of the proposed haul road to serve the Tuen Mun Road Widening is 910m. The shared section of road is approximately 280m in length.

2.2 STRUCTURAL CONSIDERATIONS

The main features of the HAR are presented in Figure 2.1 and comprise:

- a reclamation/seawall which will be constructed off the Lido Beach headland to facilitate a concrete batching plant and two barge loading points. It will be constructed using a block wall on a dredged foundation. There will be 110,000m^3 of dredged spoil arising which will require disposal. The reclamation will be formed by infilling behind the wall with excavated material from the HAR and ramps G and H;

- a large area of cut which will occur east of Lido Beach, immediately north of the proposed reclamation;

- on the reclamation at Lido Beach a concrete batching plant is proposed, covering an area of approximately 2,500m^2. There will be a need for one barge loading point located on the reclamation for the supply of aggregate to the concrete batching plant and a second barge loading point to facilitate the disposal of spoil;

- the HAR heads north, from the reclamation, on a long substantial temporary bridge, from the area behind Lido Beach, to north of Castle Peak Road. This part of the HAR will only be used by vehicles for the TKB works;

- large areas of cut which will be associated with the road section just north of Castle Peak Road;

- north of Castle Peak Road, a link road joins from Castle Peak Road. This link road connects with Castle Peak Road via a temporary bridge and terminates in a car parking area behind the Ting Kau headland, and it is understood that vehicles from the TMRW will use Castle Peak Road for transport of spoil from this point;

- the two separate roads join and form a common section of road which runs down the western side of the valley following the stream course. Embankment works to support the road will infringe upon portions of the stream bed and bank.

- South of the Tuen Mun Road, the HAR splits into two arms, of which one runs in a loop south across the valley. This section of road will serve to transport spoil from the cuttings needed for ramps G and H of the TKB. This northern section of the HAR requires areas of cut and fill and embankment works on the western side of the valley; to provision for the road platform.

- the second arm of the HAR runs beneath Tuen Mun Road then heads west to serve the TMRW works and will form part of the access road to the TLT & YLA area. The route runs north east along the valley beneath the Tuen Mun Road, partly following the Catchwater Access Road. It traverses the valley, diagonally crossing the permanent stream associated with it. There are areas of cut and fill required for the construction of this section of the road; and

- drainage works for the northern section of road which crosses the stream course 3 times running at right angles to it.

2.3 CONSTRUCTION PHASE

A review of the construction sequencing indicates that it will take three months to finish the reclamation and the seawall.

Ideally, construction of the reclamation would only occur outside of the Bathing Season. However the works programme is only tentative at this stage and Highways Department, Lantau Fixed Crossing Project Management Office have stated that this would therefore be unacceptable. It is thought that the construction of the sea wall and the reclamation would be undertaken at the same time. However it would be environmental preferable if the sea wall could be completed in advance of the reclamation works as this would act to retain much of the suspended solids and prevent potential dispersion to nearby gazetted beaches. Alternatively other mitigation measures could be applied and this is discussed further in Chapter 6.

The HAR could be completed within the first six months of the Contract Period and will include bridges and retaining walls with paved carriageway. The whole HAR will be used for the duration of the contract for a period of up to 4 years.

The main construction activities associated with the HAR are :

- excavation works;
- fill/embankment works;
- temporary bridge building; and
- concrete batching.

Excavation Works

Excavations are required along various sections of the haul road and to the north of the reclamation. It is assumed that any excavated material obtained from these areas will be utilised as fill for adjacent embankments or the reclamation.

Fill/Embankment Works

Sections of the HAR will need to run on embankment and the steep topography dictates substantial infilling particularly in the valley. Materials excavated from the cuttings for the haul road (and the projects that it is being built for) will be transported and used on the areas of embankments as needed.

Temporary Bridges

Two temporary bridges will be constructed at the southern sections of the HAR. One bridge will enable the crossing of Castle Peak Road and the steep slope along the west side of Lido Beach down to the excavation north of the reclamation. The other bridge will bring traffic from the carpark at Castle Peak Road, above the same and join with the HAR going north. The bridges are assumed to be constructed as Bailey bridges using trussed steel. To the north above Tuen Mun Road a further three small temporary bridges will be constructed. A further small temporary bridge will be constructed just south of Tuen Mun Road.

2.4 OPERATION PHASE

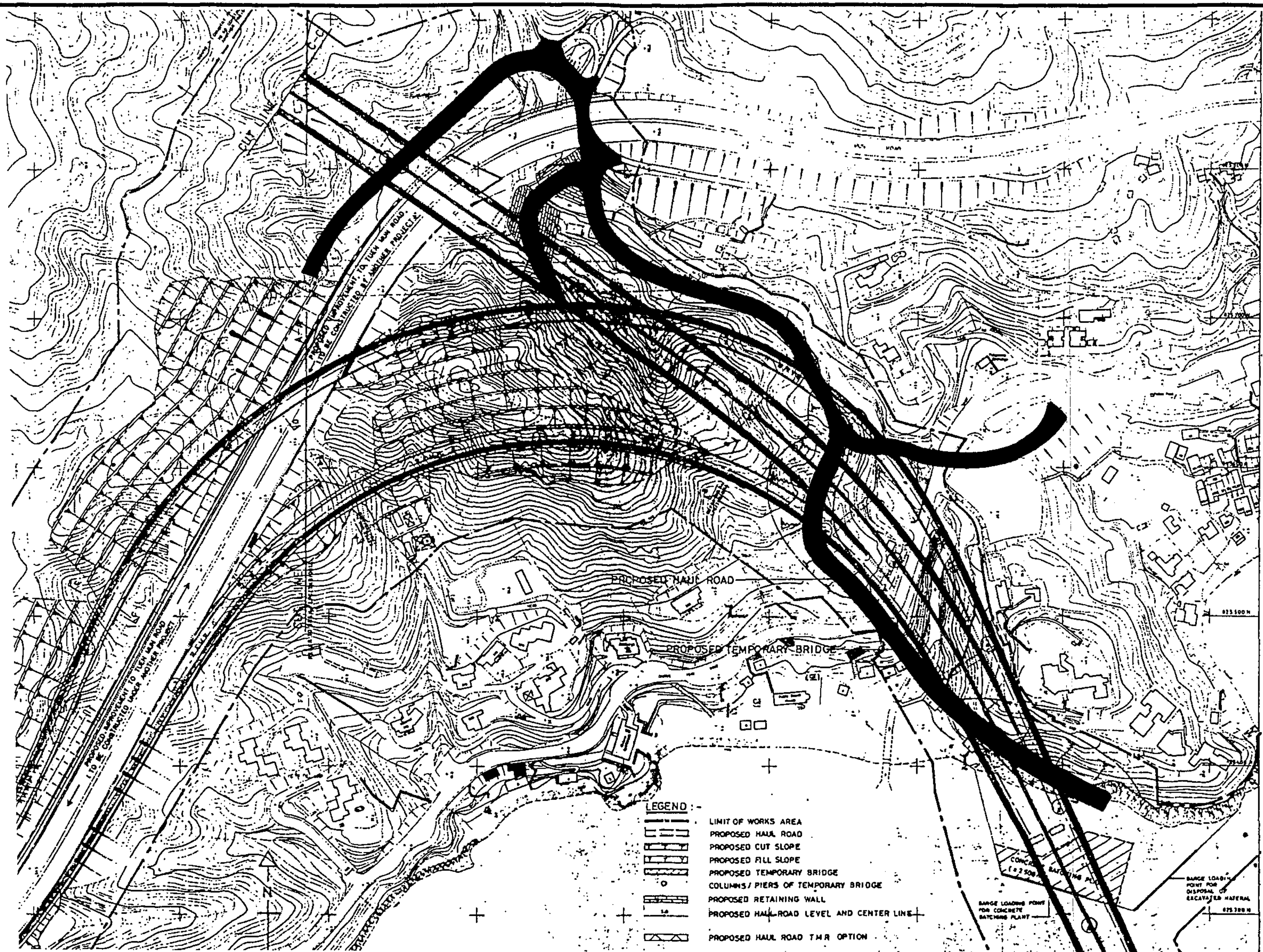
The HAR will provide access to the works areas for the TKB and the TMRW Project, and in particular the areas where large excavation and spoil removal is required. In addition, a limited number of vehicles associated with the CPS will use the road for access to sites north of Tuen Mun Road. The HAR will be in use for approximately 4 years.

Significant work areas will be required at the two areas of cutting, one will be associated with the TMRW works and the other will be located at the cutting site needed for ramps G and H of the TKB. Loading of excavated material will take place using a combination of excavators and loaders. The excavated material from these areas along with excavated material from the HAR itself will be used as fill for the haul road.

A large works area is to be provisioned at the reclamation. The reclamation will be used for the site of the concrete batching plant, two barge loading points, one for concrete and aggregate deliveries and a second barge point for disposal of excavated material.

Construction traffic will be comprised of heavy dump trucks, heavy trucks and concrete mixers for the transportation of spoil, fill, construction materials e.g steel and concrete. The traffic flows of hauling trucks required for transportation of the excavated material from the TMRW and the TKB ramps is 104 Dumpers per hour for two-way or 52 Dumpers per hour for one-way. The number of $9m^3$ Dumpers is 6.

The additional non-haulage traffic flows will result from movement of $6m^3$ concrete delivery trucks and the occasional 8 ton truck carrying steel. This will add up to give an additional 8 one-way vehicle movements per hour.



FREEMAN FOX MAUNSELL	Drg. Title : MAIN FEATURES OF THE HAUL/ACCESS ROAD AT TING KAU	Job Title : ROUTE 3 - HAUL/ACCESS ROAD SUPPLEMENTARY PAPER		
		Scale : N.T.S Date Nov. 93	Job No. 058 007	Fig No. 2.1

EXISTING ENVIRONMENT

CHAPTER 3

3. EXISTING ENVIRONMENT

3.1 INTRODUCTION

In order to determine existing environmental conditions in the Study Area a number of site surveys have been conducted, including air quality monitoring and baseline noise monitoring of selected noise sensitive receivers. In addition, a review of aerial photographs, maps, previous reports and other existing data has been undertaken.

3.2 GENERAL DESCRIPTION OF THE STUDY AREA

The Study Area (Figure 1.2.) encompases the hillsides and coastal areas running from just above Tuen Mun Road in the north to the Rambler Channel in the south. The hills are steep with a deeply incised valley running north south which gives rise to a small permanent stream which meets the sea at Lido Beach. Vegetation in the undeveloped areas is composed primarily of scrub and stands of mature trees, this creates a green view of the hillside.

The settlement pattern is dispersed and is comprised of low-rise residential housing of not more than 2 or 3 storeys. The majority of the housing is single storey. There is no major industrial development in the Study Area. The traffic in the area is primarily local, serving residences via Castle Peak Road. The road network consists of Tuen Mun Road and Castle Peak Road.

3.3 EXISTING AND COMMITTED IMPACT SOURCES

3.3.1 Introduction

Existing and committed impact sources in the Study Area have been identified in relation to their effect upon the existing environment. These sources are outlined below:

3.3.2 Noise

Road traffic from Castle Peak Road and Tuen Mun Road represent the main noise sources in the Study Area. A further noise impact source is the on-going construction activity opposite the Study Area at north-west Tsing Yi.

3.3.3 Air Quality

The major source of impact on air quality in the Study Area is currently vehicular emissions. In addition construction on Tsing Yi and at Ting Kau will currently affect air quality by introducing dust, fugitive emissions from plant and vehicle emissions.

3.3.4 Water Quality

A small permanent stream runs south in the valley originating above Tuen Mun Road and discharges to Lido Beach. The stream's discharges are generally clean and silt free with the exception of extraordinary weather conditions. Lido Beach which forms a part of the northern Rambler Channel suffers from marine water pollution by bacteria shown by high levels of *E.coli*. This is primarily due to the presence of sewage and storm water outfalls located on the mainland coast between Sham Tseng and Tsuen Wan.

3.4 KEY EXISTING AND COMMITTED SENSITIVE RECEIVERS

Key Sensitive Receivers (SRs) in the Study Area have been identified with respect to noise, air, water and visual impacts, community, ecology and spoil management related impacts, and include:

- Permanent stream course in the valley at Ting Kau;
- Rambler Channel;
- Residential development in Ting Kau;
- Gazetted beaches along the Rambler Channel and possibly on Ma Wan;
- Lido Beach and its recreation facilities; and
- Areas of secondary woodland in the ravine and on hill slopes at Ting Kau.

The Ma Wan FCZ is not considered to be a sensitive receiver, due to the distance from the reclamation dredging site, the slow current speeds encountered in the area and the rapid decrease in suspended solids concentration over relatively short distances.

3.5 ENVIRONMENTAL QUALITY

3.5.1 Air Quality

Baseline air quality monitoring was carried out as part of the Preliminary Design Stage 1 studies in 1990, and included measuring variations in particulate and gaseous pollutants at a number of different locations in the Study Area. The results from the study indicated that the levels for the measured parameters do not exceed the Hong Kong Air Quality Objectives (AQO) such that even when considering the prevailing south east wind, the SRs are not subject to unacceptable air quality levels.

3.5.2 Noise

A detailed baseline noise survey was carried out during April, May and October of 1993 to determine background noise levels in the Study Area. The area is characterised by its quiet nature with low background levels in the

region of 50-55 dB(A). The only significant noise sources are from the road traffic on Castle Peak Road and Tuen Mun Road.

3.5.3 Water Quality

The Study Area lies within the Western Buffer Water Control Zone. A water quality monitoring station is located in Tsuen Wan bay to the east of the Study Area where monthly water sampling is carried out by EPD.

The marine waters in western Hong Kong are greatly affected by the Pearl River which carries significant levels of pollutants. In the government publication *'Bacteriological Water Quality of Bathing Beaches in Hong Kong'* (EPD, 1992) the water quality at Lido Beach was ranked as *Fair*. By May 1993 the water quality rating at Lido Beach had been down graded to *Poor*.

The discharges from the permanent water course at Ting Kau is generally clean and silt free.

3.5.4 Marine Sediment Quality

The various surveys and sampling programmes undertaken in the course of the TKB and other studies (see Route 3 CPS TKB Final EIA for details) have identified many of the sampling sites as being seriously contaminated (i.e. Category C).

3.5.5 Ecology

The site provides a diverse range of micro-habitats due to the diversity and maturity of the vegetation and the availability of a fresh water source. The area between Lido beach and Castle Peak road supports mature woodland, a habitat type which has been dramatically reduced in extent throughout Hong Kong. This area is of conservation significance.

AIR QUALITY ASSESSMENT

CHAPTER 4

4. AIR QUALITY

4.1 INTRODUCTION

The HAR will accommodate two-way traffic flow and will be paved. The HAR will be used concurrently on three projects: the widening of Tuen Mun Road (TMRW), the construction of the Ting Kau Bridge (TKB), and the TLT & YLA section of Route 3. The sections of the HAR to be used for these projects will differ. For this study a maximum haul road flow of 140 vehicles per hour (two ways) is expected, composed of 104 dumptrucks, 12 concrete mixers, 4 steel delivery vehicles, and miscellaneous vehicles associated with the TLT & YLA section.

The Hong Kong Planning Standards and Guidelines (HKPSG) recommend that dust generators, including concrete batching plants and open storage areas, should be sited on new reclamation areas that have not undergone full development. A buffer distance of at least 100 m from other uses is required. Further, transportation routes to and from such dust generators should be designed, and necessary protective measures taken, to minimise dust nuisance.

In the presence of high traffic flows on Tuen Mun Road and Castle Peak Road, and the particulate levels due to construction activities, the contribution of 140 additional vehicles on the haul road will have a negligible effect on exhaust-generated RSP concentrations. For this reason modelling for exhaust-generated RSP concentrations was considered unnecessary.

4.1.1 Assessment Criteria

For construction dust, EPD's maximum acceptable TSP level in air over a one-hour period is 500 $\mu g/m^3$. The maximum acceptable TSP concentration averaged over a 24-hour period is 260 $\mu g/m^3$.

4.1.2 Assessment Methodology

One-hour and 24-hour average concentrations of TSP have been calculated using the Fugitive Dust Model (FDM). Dust sources have been modelled as area sources, with area size, location, dust generation and density provided as inputs. Emission factors from the 1985 US EPA publication Compilation of Air Pollutant Emission Factors (AP-42) have been used, along with 1992 continuous weather data from the Royal Observatory's Tuen Mun Station.

The level of construction activity will vary over the lives of the projects, and some overlap of the TMRW and TKB construction programmes is expected with those listed below. In order to examine the worst case combination of construction activities, the following set of concurrent works has been assessed:

- construction of the Ting Kau Bridge;
- construction of HAR;
- hauling along the Ting Kau Bridge section of the HAR;

- hauling along the Tuen Mun Road Widening section of the HAR;
- widening of Tuen Mun Road; and
- access traffic to the TLT and YLA area.

Further, a concrete batching plant has been assumed to be operating on the reclamation at the foot of the TKB section of the HAR during construction of Ting Kau Bridge.

Given the rate of dust generation, the impacts on the air quality at sensitive receivers will depend primarily on the settling rates of the particulates under both calm and windy conditions. Particles with size greater than 30 microns tend to settle out within a few metres of the source under typical wind conditions; smaller particles have much slower rates of settling, and are therefore more affected by wind turbulence. One category of particle size (0 to 30 microns) with a particle density of 2500 kg/m^3 has been assumed.

FDM input parameters associated with the haul road and concrete batching plant are as follows, where U = mean wind speed (m/s):

- Concrete Batching Plant: 7.2 kg/hr
- Haul Road (paved) 36.2 kg/km
- Aggregate Handling 0.0409 U kg/hr

Major aggregate stockpiles are not anticipated.

4.2 EXISTING ENVIRONMENT

South of Tai Lam Tunnel

No baseline air quality measurements are available from this site; due to Route 3 construction activities currently taking place at Tsing Yi Island, monitoring cannot now be performed. However, baseline air quality monitoring was conducted from 14 September to 11 October 1990 at the rooftop of Ching Pak House, Cheung Ching Estate (Tsing Yi Island). Ambient concentrations of TSP and RSP were monitored, and are shown in Table 4.1. This assessment has used the mean concentration value to represent background pollutant levels in the study area.

Table 4.1 Monitored Pollutant Concentrations Cheung Ching Estate, Tsing Yi Island September - October 1990

Pollutant	Pollutant Concentration ($\mu g/m^3$)
	Mean
Total Suspended Particulates (TSP)	72
Respirable Suspended Particulates (RSP)	34

Source: Route 3 Technical Report No. 13: Environmental Impact Assessment (Draft)(SPHW, November 1990), quoted in Table 4.1, Route 3 Country Park Section and Ting Kau Bridge, Preliminary Design Stage 2: Initial Environmental Assessment (Freeman Fox Maunsell, 1993).

4.3 AIR QUALITY IMPACT ASSESSMENT

The results of FDM modelling to determine dust concentrations due to haul road traffic and construction activities are shown in Figures 4.1 (1-hour average) and 4.2 (24-hour average).

The isopleths show that most dwellings in the area of the haul road and slope works will be exposed to dust concentrations exceeding the 1-hour criteria. Fewer receivers are expected to be exposed to excessive 24-hour concentrations. The need for mitigation measures to control dust emissions from the paved haul road and from exposed earth surfaces is anticipated.

Construction of Ting Kau Bridge is expected to contribute most of the dust shown in Figures 4.1 and 4.2; the total dust emission being 55.7 g/s. Haul road traffic also contributes significantly with the total dust emission being 18.5 g/s assuming an average vehicle flow of 80 veh/hr. Minor sources of dust include Tuen Mun Road widening with a total dust emission of 3 g/s and construction of the HAR with 1.56 g/s of dust emissions.

The cumulative effects of other large construction projects in the area south of the tunnel (such as CRA1 and Lantau Fixed Crossing) are not included in the above assessment, and will further degrade air quality.

4.4 MITIGATION MEASURES

For receivers very close to the concrete batching plant, mitigation measures to reduce dust impact are particularly important. As cited above, the HKPSG recommends that a buffer distance of at least 100 m be provided between dust generating activities (such as the batching plant) and sensitive uses. This buffer distance is not observed in the current layout.

The control of dust during earthworks is commonly achieved by wetting or covering exposed earth. Watering is the most common dust control method for exposed site surfaces, but its effectiveness depends on the degree of coverage and the frequency of application. A twice-daily watering, with complete coverage, can reduce dust emissions by up to 50 percent, depending on a number of other factors such as ambient temperature and level of site activity. The effectiveness of wetting can be prolonged by the use of the wetting agents that agglomerate dust particles; however, the use of chemical wetting agents may have adverse effects on plants and animals exposed to contaminated runoff.

Effective water sprays may be used during handling of fill when dust is likely to escape. At active excavations, chemical stabilization is not effective because of the degree of disturbance caused by mechanical equipment. Chemical stabilizers are more useful on completed cuts and fills to reduce wind erosion.

The use of fast-growing vegetation to reduce dust emissions is encouraged, particularly where it may replace chemical stabilizers that could contribute to water pollution. However, the effectiveness of vegetation in reducing wind erosion is a function of its density and its root structure and strength. Even fast-growing vegetation will require at least one to two weeks to develop the necessary strength and density. If weather conditions during this time are conducive to wind erosion (e.g., windy and dry), dust concentration levels could be undersirably high.

The use of synthetic fabric gauze that disintegrates with outdoor exposure is now widespread in Hong Kong. This material is used to cover and protect seeded soil while grass seed sprouts. One or more layers of this gauze, placed over a seeded cut or fill, may be sufficient to reduce windborne dust to acceptable levels until the grass has grown sufficiently to prevent wind erosion.

To help control dust generated by the transport of soil by dumptruck, materials with the potential to create dust should not be loaded to a level higher than the side and tail boards, and should be dampened and covered before transport.

At all vehicle exit points leading from unpaved construction areas onto the paved haul road, wheel washing troughs should be provided.

At the concrete batching plant, dust is subject to control at several stages in the process: during handling of sand and aggregate, handling of concrete, and loading of dry concrete mix. Control of fugitive dust can be accomplished by enclosing the handling areas, conveyors and elevators, and using a baghouse filter to extract dust. The vents of concrete storage bins should also be filtered.

With particular reference to baghouse filters, dust reduction efficiency is a function of several factors. The type of filter fabric is significant. A woven cloth fabric is generally more efficient than felted fabric. The latter is generally more difficult to clean, and therefore fails to collect extremely fine dusts or aerosols. However, the efficiency of a woven fabric filter can be compromised by high moisture, abrasion, shrinking, and stretching. The fabic material (cotton or synthetic) is also a factor in determining baghouse efficiently.

Baghouse filters have the potential to be highly efficient, with removal rates of 99 percent by weight where the range of particle sizes is small. However, high efficiency requires proper design of both the housing and the filter itself.

An adequate amount of cloth must be provided, with an adequate air-to-cloth ratio (about 3:1 for concrete batching) and an appropriate filtration branch velocity (about 4000 fpm). Further, proper operation and maintenance are crucial to the efficient performance of the filter. It must be properly cleaned at appropriate intervals, using a cleaning method appropriate for the fabic.

If a belt conveyor is used to transfer aggregate, it should be enclosed on the top and two sides by dust curtains, and provided with wind boards on bottom to prevent dispersion of dust from the crushed stone products. Water spray nozzles should be used to wash off any dust deposited on the bottom wind boards, and scrapers fitted at the discharge end of the belt to remove dust on the belt surface. A water spray should be used whenever aggregate transfer is in operation.

4.5 EFFECTIVENESS OF DUST CONTROL MEASURES

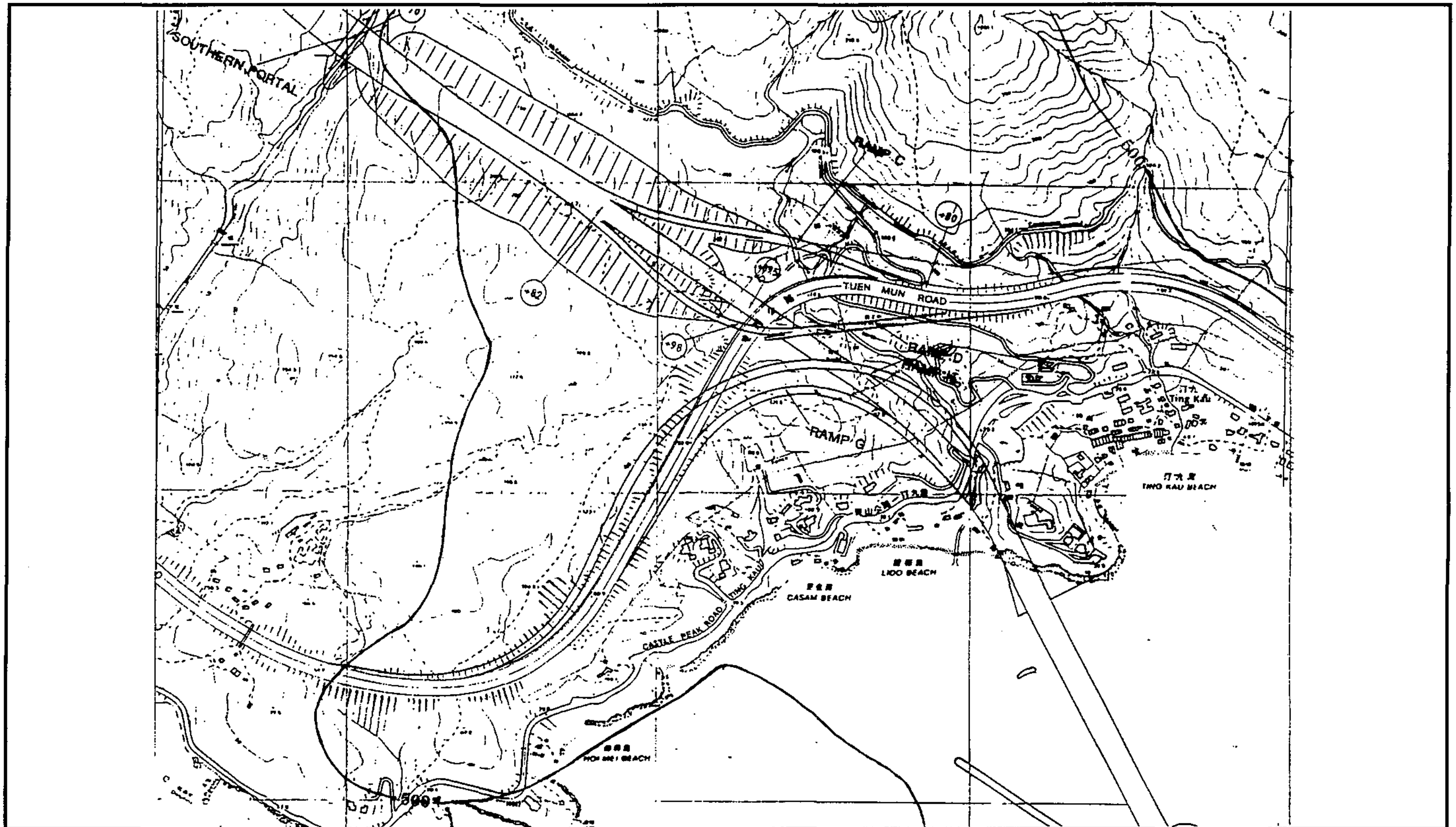
The overall dust reduction obtained by using the above measures is difficult to quantify, since it is very dependent on the weather conditions, on-site practices, and maintenance of mitigation measures. Rough estimations of the reductions that are possible are listed below:

- Twice-daily waterings of exposed earth surfaces can reduce dust emissions by up to 50% (assuming complete coverage).
- When handling aggregate, reducing the drop height by half reduces dust emission by about 50%.
- The efficiency of baghouse filters at the concrete batching plant varies with the size of particle. Generally, a reduction of about 70% may be expected.
- At inactive completed cuts and fills, the use of chemical stabilizers to reduce wind erosion can reduce emissions by about 80%.

Due to the concurrent activities on multiple construction sites, it is possible that the above mitigation measures may be inadequate to bring dust concentrations within acceptable limits. This is particularly so if dry and windy conditions prevail during part of the construction period.

Dust control measures should be incorporated in the contract documents and the contractor should follow the Guidelines on Dust Suppression Measures for Construction Sites, March 1992.

Monitoring and audit programmes need to be implemented during both the construction and use of the HAR. The requirements are outlined in the Route 3 TKB EIA.



FREEMAN FOX MAUNSELL	Drg. Title : MAXIMUM DUST CONCENTRATION 1 HOUR AVERAGE	Job Title : ROUTE 3 HAUL/ACCESS ROAD SUPPLEMENTARY PAPER		
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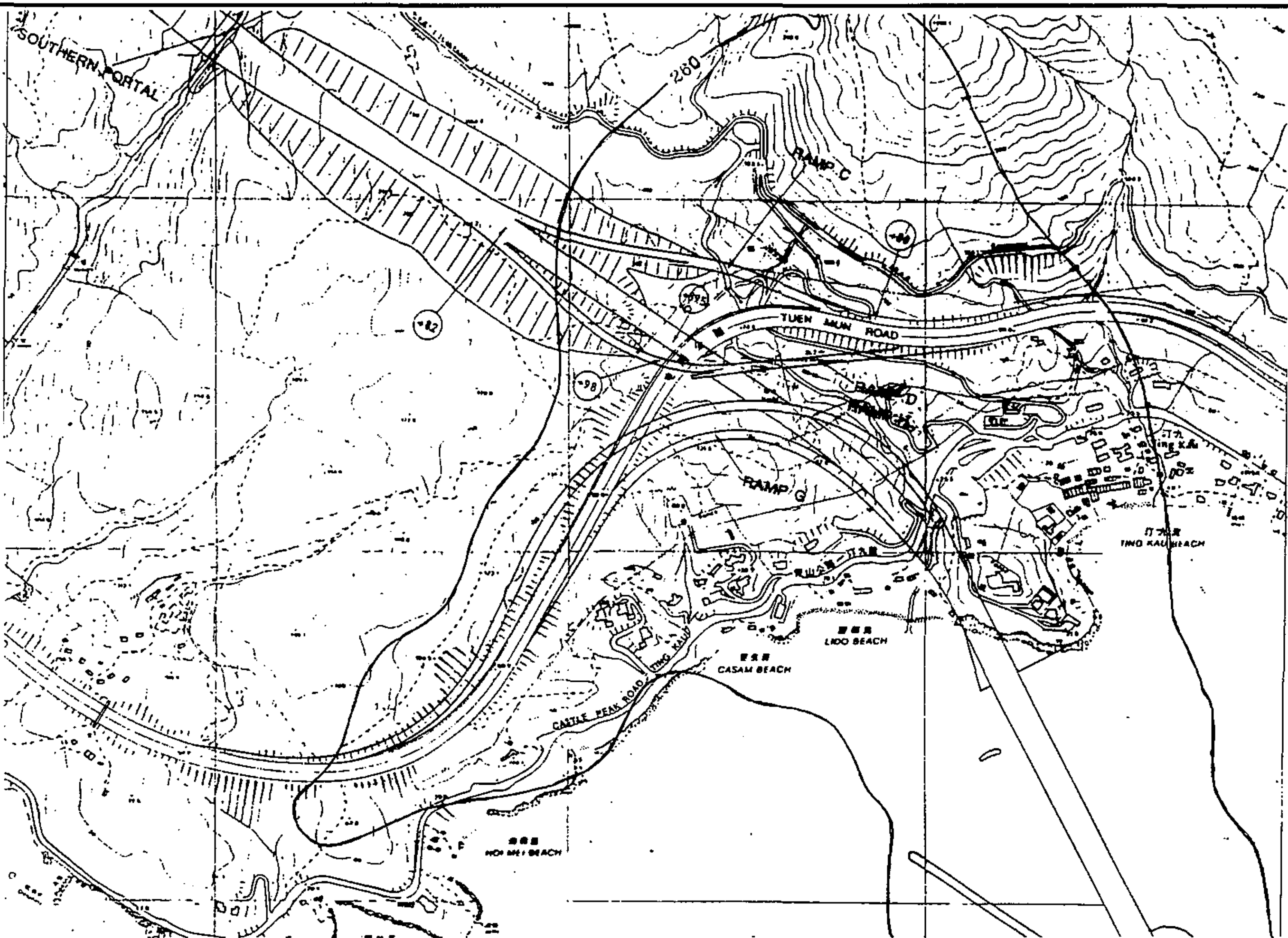


FREEMAN FOX MAUNSELL

Drg. Title : MAXIMUM DUST CONCENTRATION 24 HOUR AVERAGE

Job Title : ROUTE 3 HAUL/ACCESS ROAD SUPPLEMENTARY PAPER

Scale : N.T.S	Job No. 058 007	Fig No. 4.2
Date Dec. 93		

NOISE ASSESSMENT

CHAPTER 5

5. NOISE ASSESSMENT

5.1 CONSTRUCTION NOISE ASSESSMENT

5.1.1 Introduction

The proposed HAR will be constructed for two-way traffic flow with bridges and retaining walls, and will be paved. The haul/access road will be used concurrently for three projects: the widening of Tuen Mun Road (TMRW), the construction of the Ting Kau Bridge (TKB), and the TLT and YLA section of Route 3. The sections of the HAR in use for these projects will differ. The construction plant schedule supplied in Table 5.1 has been used in the noise assessment resulting from construction schedule.

The HAR will run through several cuttings that will form effective barriers to noise propagation. These topographic barriers have been included in the noise assessment.

5.1.2 Assessment Criteria

No existing legislation controls construction noise (other than that from percussive piling) during the daytime on normal weekdays. However, government contracts commonly include a noise limit of 75 dB(A) L_{eq} (30-min) for construction work in urban areas. For the purpose of this assessment, this limit has been taken as the daytime assessment criterion.

5.1.3 Assessment Methodology

Noise levels resulting from construction of the HAR are estimated using the procedure outlined in the Technical Memorandum on Noise from Construction Work other than Percussive Piling. The following equipment schedules are assumed:

Table 5.1 Haul Road Construction: Equipment Requirements and SWL Values

Task and Equipment Type	SWL per piece dB(A)	Pieces required for	
		TMRW	TKB
Task: Excavation and filling of HAR			
backhoes	112	2	--
loader	112	1	--
roller	108	1	--
excavators	112	--	4
dumptrucks	117	5	8

Task and Equipment Type	SWL per piece dB(A)	Pieces required for	
		TMRW	TKB
Task: Construction of retaining walls			
excavator	112	1	1
lorry mounted crane	102	1	1
Task: Erection of Bailey Bridges			
cranes	112	2	2
generators (silenced)	100	2	1

Note: SWL sources from Table 3, Technical Memorandum on Noise from Construction Works other than Percussive Piling.

An alternative set of calculations using a lower sound power level (SWL) for dumptrucks has also been performed (Table 5.4), based on the average SWL of 27 noise samples in Table 12 of BS 5228: Part 1: 1984. These samples were obtained from operating dumptrucks ranging in size from 20 to 50 tonnes. Of 27 samples, only 3 matched or exceeded the SWL value of 117 dB(A) provided in the Technical Memorandum, and the average SWL was 109.2 dB(A).

The methodology used in the present assessment of the haul road follows that provided in BS 5228: Part 1: 1984 (Noise control on construction and open sites) in Section A.3.4.2.

Selection of Noise Sensitive Receivers

Representative Noise Sensitive Receivers (NSRs) in the area of the HAR have been selected, and are shown in Figure 5.1. Multiple facades have been selected for certain receivers to determine the worst exposure. Four NSRs were selected for assessment in the previous construction noise impact assessment for Route 3 Ting Kau Bridge EIA, Chapter 5; these correspond approximately to the current NSRs as follows:

Table 5.2 Noise Sensitive Receivers

Ting Kau Bridge EIA (Preliminary Design Stage 2)	Route 3 Haul Road
NSR 1	NSR 63
NSR 2	NSR 52, 53, 54
NSR 3	NSR 72
NSR 4	NSR 45

5.1.4 Impact Assessment

The results of noise modelling to determine facade noise levels due to construction of the HAR are shown in Table 5.3:

Table 5.3 Noise Levels During Construction of HAR Sections (based on Sound Power Levels from Technical Memorandum)

NSR	Facade Noise Levels dB(A)		
	TMRW Haul Road only	TKB Haul Road only	Combined Noise Level
45	68	71	73
46	73	78	79
47	73	77	79
48	73	77	79
49	72	77	78
50	74	76	78
51	75	79	81
52	77	79	81
53	78	84	85
54	78	83	84
55	74	77	79
56	73	77	79
57	76	84	85
58	76	84	85
59	75	84	85
60	77	94	94
61	77	95	95
63	78	88	88
64	82	85	87
65	83	84	87
66	77	78	91
67	80	77	82
68	80	76	82
69	79	75	81

70	86	77	87
71	92	74	92
72	87	89	91
73	--	94	94
74	74	71	76
75	73	71	75
76	76	87	87

Note: Combined noise level assumes worst-case scenario of concurrent construction at the nearest points of both haul road alignments.

Due to the proximity of one or both sections of the HAR, 94% of the calculated noise levels significantly exceed 75 dB(A) L_{eq} at the facades of the selected NSRs.

If the reduced dumptruck SWL value of 109.2 dB(A) is used, the following predicted noise levels are obtained:

Table 5.4 Noise Levels During Construction of Haul Roads (Quieter Dumptrucks)

NSR	Facade Noise Levels dB(A)		
	TMRW Haul Road only	TKB Haul Road only	Combined Noise Level
45	62	66	65
46	68	72	74
47	68	72	74
48	68	72	74
49	67	71	73
50	69	70	73
51	70	74	76
52	72	73	76
53	73	79	80
54	73	77	79
55	68	72	74
56	68	71	73
57	71	79	80

58	71	79	80
59	70	79	80
60	72	89	89
61	72	90	90
63	73	82	83
64	76	80	82
65	78	78	81
66	72	73	76
67	75	72	77
68	75	71	77
69	74	69	75
70	81	71	81
71	87	--	87
72	--	83	83
73	--	88	88
74	69	66	71
75	68	66	70
76	71	81	81

Although facade noise levels are decreased, the resultant calculations show that 70% of the calculated noise levels significantly exceed 75 dB(A) L_{eq} at the facades of the selected NSRs close to the HAR alignment. The noise levels are sufficiently high in order to conclude that significant noise mitigation measures would need to be adopted.

Bailey Bridge Placement

Due to reduced equipment requirements, placement of the trussed bridges of the Bailey Bridge type is not expected to have as great a noise impact on nearby NSRs, as shown in Table 5.5:

Table 5.5 Noise Levels During Placement of Bailey Bridges

NSR	Ting Kau Bridge: Access Road	Tuen Mun Road Widening: Access Road
57	65	--
58	65	--
60	69	67
61	69	67
63	77	67
64	69	71
65	69	71
66	67	65
67	66	66
68	65	67
69	64	66
70	65	70
71	--	70
72	--	73
76	72	64

During placement of the bridges, only NSR63 is expected to experience facade noise levels exceeding 75 dB(A) L_{eq}. This activity will be temporary lasting two weeks in duration at maximum.

5.2 OPERATION NOISE ASSESSMENT

5.2.1 Introduction

The HAR will be constructed for two-way traffic flow with bridges and retaining walls, will be paved and will be used concurrently for three projects: the TMRW, the construction of TKB, and the TLT and YLA section of Route 3. The sections of the HAR in use for these projects will differ. A maximum haul road flow of 140 vehicles per hour (two ways) is expected, composed of 104 dumptrucks, 12 concrete mixers, 4 steel delivery vehicles, and miscellaneous vehicles associated with the TLT & YLA Section.

The HAR will run through several cuttings that form effective barriers to noise propagation. These topographic barriers have been included in the noise assessment.

5.2.2 Assessment Criteria

No existing legislation controls construction noise (other than that from percussive piling) during the daytime on normal weekdays. However, government contracts commonly include a noise limit of 75 dB(A) L_{eq} (30-min) for construction work in urban areas. For the purpose of this assessment, this limit has been taken as the daytime assessment criterion.

5.2.3 Assessment Methodology

The methodology used in the present assessment follows that provided in BS 5228: Part 1: 1984 (Noise control on construction and open sites) in Section A.3.4.2.

Representative Noise Sensitive Receivers (NSRs) in the area of the HAR have been selected, and are shown in Figure 5.1. Multiple facades have been selected for certain receivers to determine the worst exposure. Four NSRs were selected for assessment of Route 3 Ting Kau Bridge Section EIA; these correspond approximately to the current NSRs as shown in Table 5.2.

The analysis has been based on an assumed flow of 140 vehicles per hour, the maximum HAR traffic flow. The assumed speed is 10 kph, due to steep gradients, and the assumed sound power levels of the mobile plant are:

117 dB(A) for dumptrucks,
109 dB(A) for concrete mixing trucks,
112 dB(A) for steel trucks.

5.2.4 Impact Assessment

The results of noise modelling to determine facade noise levels due to HAR traffic are shown in Table 5.6:

Table 5.6 Haul Road Noise Predictions

Receiver		Noise Level (dB(A))
Identification	Location	
45	Unnamed residence	69
46	Unnamed residence	75
47	374 Castle Peak Road	73
48		72
49	372 Castle Peak Road	73

50	370 Castle Peak Road (Edinburgh Villa)	73
51		75
52	368 Castle Peak Road	75
53		78
54		75
55	360 Castle Peak Road (Riviera Apartments)	74
56		73
57	Lifegaurd utility building	76
58		78
59	Lifegaurd station	78
60	Lifegaurd utility building	83
61		84
63	Unnamed residence	80
64	Unnamed residence	80
65		79
66	Unnamed residence	75
67	Unnamed residence	75
68	Unnamed residence	75
69	110A Castle Peak Road	75
70	Unnamed residence	79
71	Unnamed residence	77
72	Unnamed residence	78
73	Unnamed residence	86
74	Unnamed residence	75
75	Unnamed residence	75
76	Unnamed residence	76

Noise from the operation or use of the HAR must be combined with noise from other construction activities associated with the TKB project to obtain an indication of cumulative noise levels at selected NSRs. Combining construction noise levels previously obtained for discrete NSRs 1 - 4 in the TKB Environmental Assessment - Technical Report Volume 4A with noise generated during use of the HAR, the following cumulative noise levels are obtained:

Table 5.7 Cumulative Noise Levels - HAR Use and TKB Construction (Discrete NSRs)

Receiver	Construction Noise exclusive of haul road[1]		Cumulative Construction Noise with haul road	
	unmitigated	mitigated	unmitigated	mitigated[2]
NSR 1	84	81	86	84
NSR 2	83	78	83	80
NSR 3	88	83	89	84
NSR 4	84	79	84	80

NOTES: 1. Obtained from Chapter 5 of *Route 3 Ting Kau Bridge Section EIA* (Tables 5.2 and 5.3).
2. Assumes mitigation on haul road from topographical barriers only.

Table 5.7 shows the NSRs evaluated with the previous noise levels from construction works at TKB. These noise levels are presented with and without mitigation. The cumulative impact is assessed by adding the subsequent noise levels that are expected to arise due to the inclusion of the HAR in the study area. The mitigated and unmitigated noise levels are expected to exceed the desirable daytime limit of 75 dB(A) L_{eq} (30 min). Mitigation at the receivers, in the form of glazing and air conditioning, was recommended in the TKB Environmental Assessment - Technical Report Volume 4A.

Also contained in the Volume 4A Report was a plan (Figure 5.2) showing the free-field mitigated TKB construction noise contours. Using approximate noise levels obtained from that figure, the following cumulative mitigated noise levels are obtained. Note that a facade correction of 3 dB(A) has been added to the noise level levels obtained from the noise contours in order to arrive at the figures in column 3 of Table 5.8:

Table 5.8 Cumulative Noise Levels - HAR Use and TKB Construction (Non-Discrete NSRs)

NSR	Facade Noise Level dB(A)		
	HAR Traffic only	Approximate Mitigated TKB Construction Noise	Cumulative Noise Level HAR Traffic and TKB Construction
45	69	77	78
46	75	77	79

47	73	74	77
48	72	74	76
49	73	80	81
50	73	77	78
51	75	77	79
52	75	77	79
53	78	77	81
54	75	80	81
55	74	80	81
56	73	80	81
57	76	80	81
58	78	80	83
59	78	80	83
60	83	89	90
61	84	89	90
63	80	83	85
64	80	89	90
65	79	89	89
66	75	89	89
67	75	89	89
68	75	89	89
69	75	89	89
70	79	89	89
71	77	83	84
72	78	80	82
73	86	84	88
74	75	79	80
75	75	79	80
76	76	86	86

Table 5.8 shows that the HAR will have little effect on most receivers, who are already exposed to high construction noise levels over the desired

maximum daytime level of 75 dB(A) L_{eq} (30 min).

At a small number of receivers, represented here by NSRs 47 and 48, noise levels of 74 dB(A) are expected to be experienced. These levels are marginally below the 75 dB(A) criterion. These levels are raised by the presence of the HAR to a level above it. The increase in the noise levels at the NSRs are 3 and 2 dB(A) respectively. On average the increase in noise levels (due to the HAR) above the existing calculated TKB construction noise levels is 1.3 dB(A). The highest increases are experienced at NSRs 53 and 73 which will increase from 77 to 81 dB(A) and 84 to 88 dB(A) respectively.

5.2.5 Mitigation Measures

The most effective mitigation measure is to control noise at its source. In the case of powered mechanical equipment, this involves either selecting silenced equipment, or reducing the transmission of noise using mufflers, silencers, or acoustic enclosures.

Reducing noise at source is preferable to blocking it at the receiver. However, given the scale of construction, its duration and its proximity to NSRs, it may not be possible to reduce it to below 75 dB(A) without imposing hardship on the contractor.

Construction noise may be mitigated through several measures:

General Construction Noise Reduction Measures:

- Noisy equipment and activities should be sited by the Contractor as far from sensitive receivers as is practical.

- Noisy plant or processes should be replaced by quieter alternatives where possible. Silenced diesel and gasoline generators and power units, as well as silenced and super-silenced air compressors, can be readily obtained. Manual operations are generally quietest, but may require long periods of time.

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

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

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

- Construction activities can be planned so that parallel operation of several sets of equipment close to a given receiver is avoided.

- If possible, reduce the numbers of operating items of powered mechanical equipment.

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

- Limited hours of use for powered mechanical equipment are recommended; a ten-hour period from 8.00 a.m. to 6.00 p.m. is suggested. Hours of use could be further restricted by the Resident Engineer if sufficient and justifiable complaints from affected residents are received.

- Temporary noise barriers or earth embankment may be used to screen specific receivers. A mobile acoustic enclosure may be used, which should have a mass per unit of surface area of at least 7 kg/m^2, and should have acoustic lining.

It is suggested that all of the above mitigation measures be used where practicable, however, evaluation of the exact effectiveness of these measures at a given receiver requires a knowledge of the detailed construction schedule, which is not available at this stage. Estimates of the noise reductions capable are provided below:

Stationary and Earth-moving Plant: These pieces of equipment include compressors, concrete pumps, excavators, bulldozers, loaders, and dumptrucks. Noise reduction can be achieved through proper maintenance of the exhaust system, and through exhaust silencers. Additionally, engine noise is amenable to reduction through isolation of vibrating engine components, installation of partial or full acoustic enclosures of noise-generating components, and damping of vibrating panels. U.S. tests have shown that partial or full enclosures can achieve noise reductions of 10 and 25 dB(A) respectively.

Super-silenced compressors incorporate acoustic casing linings, mufflers, and anti-vibration mounts to isolate the engine and compressor unit for the chassis. A reduction of 5 dB(A) can be achieved with the use of a super-silenced compressor relative to a silenced compressor.

Barrier: A purpose-built mobile noise barrier, located close to the noise source, can be fabricated to protect sensitive receivers. Assuming that the barrier has no gaps, and that it blocks the line of sight between noise generator and noise receiver, reductions of 5 to 10 dB(A) can be achieved.

Operational Noise Reduction Measures

The construction of purpose-built barriers to supplement topographic barriers has been considered to reduce the noise from the haul road traffic during its operation. A further model run assuming barriers at the southern end of the HAR was undertaken to determine the effectiveness of this approach. The barriers were located on both sides of the southern portion of the HAR, running north from the reclamation for approximately 250m.

The result indicates that even 5m high barriers along the southern part of the haul road will have little effect at most receivers producing a reduction in facade noise levels of less than 1 dB(A). Only three NSRs have been identified which would benefit from this measure during the operational phase of the haul road. The three receivers are those identified (see Figure 5.1) by the NSR numbers 46 (residence), 50/51 (Edinburgh Villa), and 52/53 (No.368 Castle Peak Road). This is due to the fact that for most receivers, noise from other construction operations dominates, so the net reduction in cumulative noise levels is minimal.

Given the recommendation contained in the previous TKB Environmental Assessment - Technical Report Volume 4A, which included providing mitigation at the receivers, such as sealed glazing and air conditioning, it is recommended that the above 3 NSRs be similarly mitigated rather than noise barrier mitigation.

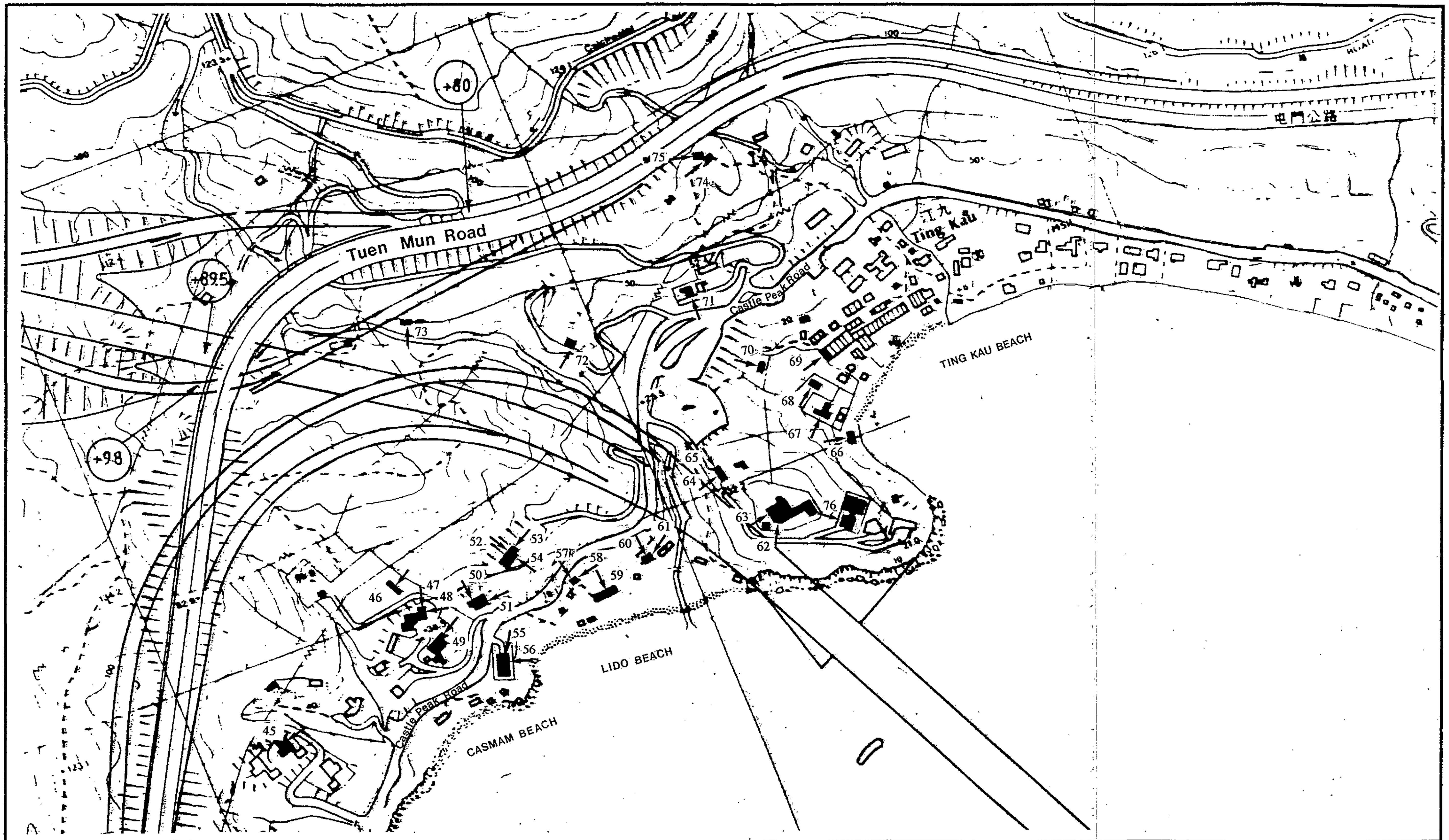
A closed window provides a barrier to block the transmission of noise to the residence's interior. Air conditioning is suggested only to provide adequate filtered ventilation while the windows are closed. The effectiveness of the window as a barrier depends on a number of factors, including the frequency spectrum of the noise, the size and thickness of the window unit (single or double glazed), the quality of the edge seal, and the characteristics of the interior. A 6-mm single glass pane with gasketted perimeter seal in a typical uncarpeted living room would reduce noise at the interior by 20-25 dB(A).

Measures other than Noise Reduction (Liaison and Good Community Relations):

Though not effective in reducing noise levels, the establishment of good community relations can be of great assistance to both the contractors and receivers. Residents of homes surrounding the haul road should be notified in advance of planned operations, and informed of progress. Notification of blasting operations, if any, is particularly important. If necessary, a liaison body can be established to bring together representatives of the affected communities, the government, and the contractors. In addition, residents may be provided with a telephone number for the Supervising Officer's office, where they may register complaints concerning excessive noise. If justified, the Supervising Officer may recommend noisy operations cease or are conducted at more restricted hours.

Conclusion

It is anticipated that HAR generated noise levels will exceed 75dB(A) at some NSRs. A range of general mitigation measures have been identified and should be enforced wherever practicable. In addition it is recommended that three NSRs are mitigated by indirect technical remedies.



FREEMAN FOX MAUNSELL	Drg. Title : SELECTED NSRs	Job Title : ROUTE 3 HAUL/ACCESS ROAD SUPPLEMENTARY PAPER

Scale : N.T.S	Job No. 058 007	Fig No. 5.1
Date Dec. 93		

WATER QUALITY

CHAPTER 6

6 WATER QUALITY

6.1 INTRODUCTION

The construction and operation of the proposed HAR has the potential to result in deterioration in the surrounding marine environment. This Chapter identifies and assesses this aspect in detail and mitigation measures are proposed which would permit the construction and operation of the TKB HAR with the least possible environmental impact to the marine environment.

6.2 EXISTING MARINE ENVIRONMENT

6.2.1 Water Quality

The water in the area has relatively high levels of *E.coli*. This is primarily due to the presence of sewage and storm water outfalls located on the mainland coast between Sham Tseng and Tsuen Wan discharging into the marine environment. The water quality in the area has deteriorated over the last few years. This is believed to be caused by the growth of population in the unsewered areas and the presence of nearby industry located at Sham Tseng, Tsuen Wan and Kwai Chung. Water quality in the area is expected to improve in the future with the gazetting of WBWCZ and the implementation of the Strategic Sewage Disposal Scheme.

6.2.2 Sensitive Receivers

The main SRs include:

- eight gazetted beaches in the locality of TKB (Figure 6.1). They have the following bacteriological water quality ranking as designated by "Bacteriological Water Quality of Bathing Beaches in Hong Kong, 1992" and the new ranking system that commenced 1st March 1992.

Beach	Rank 1992	Rank (May 1993)
Tung Wan (Ma Wan)	fair	fair
Anglers	poor	no data
Gemini	poor	poor
Ho Mei Wan	poor	poor/very poor
Casam	fair	poor
Lido	fair	poor
Ting Kau	poor	very poor
Approach	poor	very poor

There are no non-gazetted beaches in the area.

- Ma Wan Fish Culture Zone, located on the west coast of Ma Wan; and

- aquatic life including fish and the Chinese White Dolphin.

6.2.4 Sea Bed Geology

A geotechnical assessment was undertaken in 1991 of the sea bed strata. The investigation showed that the bedrock is overlain by a mantle of soils varying in thickness between 2 to 50 metres, comprising marine clay, marine sand, alluvium and in-situ decomposed granite and volcanic rock.

6.2.5 Construction Impacts and Mitigation

Contaminated Marine Mud

During the construction of the sea wall and reclamation at the Ting Kau headland there will be the need to dredge and dispose of 110,000m^3 of marine sediment. A detailed description of the nature (Category etc.), the dredging and disposal requirements and the mitigation of the marine sediments has been included in the Route 3 CPS, TKB Environmental Assessment - Technical Report Volume 4A Chapter 6.

The tentative works schedule and activities assumes that the sea wall and the reclamation are constructed at the same time. This has the advantage that it reduces the duration of the construction. However the main potential water quality impact associated with the reclamation is loss of material to the marine environment and subsequent transport to nearby beaches. Construction of the sea wall in advance of the reclamation would help to minimise loss of material into the wider environment and this is recommended. If this is not practicable due to programming constraints then appropriate alternative mitigation must be adopted such as the deployment of 'silt curtains' to prevent the escape of suspended solids to the nearby sensitive receivers.

6.2.6 Operational Impacts and Mitigation

The potential water quality impacts arising from the operation of the TKB will be associated with the imposition of bridge piers (supports) at the bridges northern end, a breakwater/bridge support in the centre of the northern Rambler Channel. The bridge will also require a reclamation at the Ting Kau headland which will act as bridge pier protection and serve the purpose of a barging area and works site.

The likely effects are changes in the hydraulic regime (flows, currents, etc.) and associated changes in water quality (dissolved oxygen, BOD, *E. coli*, SS etc.) A hydraulic and water quality computer modelling study has been undertaken as part of the TKB EIA and the scope and basic study details were agreed upon with EPD. This included the reclamation for the bridge pier and barging area/works site. This study concluded that there would be no significant water quality implications associated with the reclamations, (Ting Kau Bridge WAHMO Modelling Assessment Supplementary Paper).

6.3 FRESH WATER QUALITY

6.3.1 Existing Water Quality

The well vegetated southern facing slopes of Ting Kau are drained by a small water course that enters the northern Rambler Channel at the eastern end of Lido Beach. The stream originates in a catchment area that runs from the north, just above the Tuen Mun Road, southwards in a valley to the east end of Lido Beach. The water in the stream is generally clean and silt free except for times during and after heavy rainfall events. The HAR virtually follows the stream's course, originating just above the Tuen Mun Road and finishing at the reclamation at the Ting Kau Bridge headland. Additionally the TKB will run across the catchment area and the bridge support pylons will be located in part of the catchment.

The current activities that take place in the catchment that may affect the water quality are:

- water gathering via the catchwater above Tuen Mun Road, which has partially dewatered the stream;
- small scale orchard plots situated along part of the upper catchment;
- residential dwellings have been built in the lower catchment area, below the Tuen Mun Road;
- two roads which pass through the catchment area;
- culverts that drain storm water to the water course below the catchwater from various cuttings associated with the Catchwater Road and Tuen Mun Road; and
- the stream mouth is trained in its lower reaches and runs through a nullah at Lido Beach.

6.3.2 Construction Phase Impacts and Mitigation

Sensitive Receivers

Currently there are various freshwater fauna species (Table 10.5) associated with the stream near Ting Kau. Site surveys were carried out during April, May 1993 (Route 3 CPS, TKB Environmental Assessment - Technical Report Volume 4A) and again during September and October 1993 the results of these are given in detail in Chapter 10 of this report. It can be expected that the freshwater biota in the stream already come under the influence of run-off from small scale fruit plots (pesticides and fertilizers), road run-off, and sewage from the residential dwellings located in the catchment. Further stresses resulting from smothering, exposure to toxins or elevated pH levels would therefore be particularly undesirable.

Compounding effects would result from any impacts on the fresh water system as these would be transferred to the marine environment, via the direct input of the catchment.

The current proposed alignment of the HAR will heavily impact upon the stream and its water course. It sites itself amidst the valley and requires a substantial area in the middle and lower sections of the streams catchment. The stream will be bridged at six different points. Retaining walls and embankments will be required for the road to overcome the natural topography of the area.

In the course of construction large areas of cut and fill will be required for the road alignment. The main impacts occurring during construction will be related to the arising of run-off containing high concentrations of suspended solids (SS) from areas of open earth works due to the areas of cut and fill. It is possible that quantities of spoil and fill material from construction site run-off could be carried to fresh waters via the drainage system. Such solids have the potential to cause localised problems such as increases in turbidity, discoloration, increases in biochemical oxygen demand (BOD) and nutrient enrichment. These impacts can have severe detrimental effects on freshwater and marine biota.

The concrete manufactured at the concrete batching plant will be required for the TKB and its ramps. A potential source of impact will be the release to surface waters, via run-off or other routes, of liquors containing significant quantities of cement derived materials.

Discharge or run-off of lime based materials if uncontrolled would be likely to cause the following primary effects:

- localised increases in turbidity and discolouration;
- localised elevations in pH; and
- accretion of high pH solids.

Potential impacts also exist from spillage, leakages and indiscriminate disposal of fuel oils, lubricants and hydraulic fluids used by construction vehicles and plant. These hydrocarbons are potentially toxic to fresh water biota and persist in fresh water sediments.

Mitigation

With the Western Buffer Water Control Zone declared and the schedule in place covering the area of the proposed HAR any discharges from the site will now be subject to the specific Technical Memorandum schedule (Standards for Effluents Discharged into Drainage and Sewage Systems, Inland and Coastal Waters, 1990).

In view of the potential impacts described controls should be applied and site run-off treated wherever practicable. It is considered that clauses should be included in construction contracts requiring these measures to be carried out.

Control and treatment should include the following:

- site compounds should be designed to take account of contaminated surface water. This will involve provision of drainage channels and settlement lagoons to allow interception and reuse (say for concrete batching) or controlled release of settled/treated waters;

- discharges from concrete batching should be settled and if necessary pH adjustment made to the supernatant liquor, reuse is recommended where practicable. In the event of settlement alone being insufficient to settle colloidal materials, consideration should be given to further treatment with settling agents prior to discharge;

- oil interceptors should be provided in site compounds and regularly emptied to prevent release of oils and grease into the surface water drainage systems after accidental spillages. The interceptor should have a by-pass to prevent flushing during periods of heavy rain. Oil and fuel bunkers should be bunded to prevent discharges due to accidental spills or breaching of tanks; and

- any stockpiles of spoil or fill materials should be treated to reduce erosion of the stockpile and sediment release. To avoid direct run-off of fresh water containing SS to the sea stockpiling of spoil should be avoided on the platform of the reclamation. In some cases it may be prudent to provide a separate settlement system for larger stockpiles to collect contaminated surface water prior to release to the site drainage system.

6.3.3 Operational Phase Impacts and Mitigation

Impacts

The main area of potential impact will arise from run-off from the HAR and the reclamation platform and the resultant transport of material to fresh and marine waters.

The main sources of potential contamination are :

- sediment from spoil transportation on the HAR and spoil handling at the reclamation platform. Notably sediment and dust will be derived from wheel tracks. It will be generated from exposed spoil, in moving dumper trucks, and the dumping of spoil to barges;

- accidental spillage of fill during transportation operations;

- concrete wastes accumulated on the HAR and works area platform at the reclamation derived from concrete manufacture and deliveries of concrete and materials to and from the batching plant; and

- drainage and spillage of hydrocarbons and contaminants from vehicles and construction equipment.

Mitigation

In view of the potential impacts described, controls should be applied and site run-off treated wherever practicable. It is considered that clauses should be included in construction contracts requiring these measures to be carried out.

The transport of sediment, contaminants and concrete wastes to fresh water and subsequently the marine water environment can be minimised by following the recommendations below:

- wheel wash facilities to be used prior to vehicles leaving the earthworks sites and running on the sealed HAR;

- the reclamation works site compound should be designed to take account of contaminated surface water. This will involve provision of drainage channels, appropriate sediment traps and oil interceptors to allow the interception and controlled release of treated waters;

- traps and interceptors should be regularly emptied to prevent the release of oils, grease, and sediments to surface waters; the interceptors should have a by-pass to prevent flushing during periods of heavy rain;

- oil, fuel and chemical bunkers should be bunded to prevent discharges due to accidental spills or breaching of storage containers;

- waste water from concrete batching operations should be settled and pH adjustment made to the supernatant liquor. In the event of settlement alone being insufficient to settle colloidal materials, consideration should be given to further treatment with settling agents prior to reuse; and

- any stockpiles of aggregate materials at the reclamation or elsewhere should be treated to reduce erosion of the stockpile and sediment release. It may be prudent to provide a separate settlement system for any large stockpiles to collect contaminated surface water prior to release to the reclamation sites drainage system.

Monitoring

The detailed Monitoring and Audit requirements are given in Chapter 13 of the Route 3 CPS, TKB Environmental Assessment - Technical Report Volume 4A, however, some general requirements include:

- discharges should be monitored and managed to achieve compliance with the Technical Memorandum in respect to the Western Buffer Water Control Zone;

- inspections should be carried out periodically to ensure that good site practice is being observed and that settlement tanks and silt traps are managed and maintained to ensure optimum performance; and

- periodic inspections of oil interceptors should be made to ensure that these are working satisfactorily and that oil derived wastes are collected regularly for appropriate off-site disposal, attention should be given to the Waste Disposal Ordinance and its regulations.

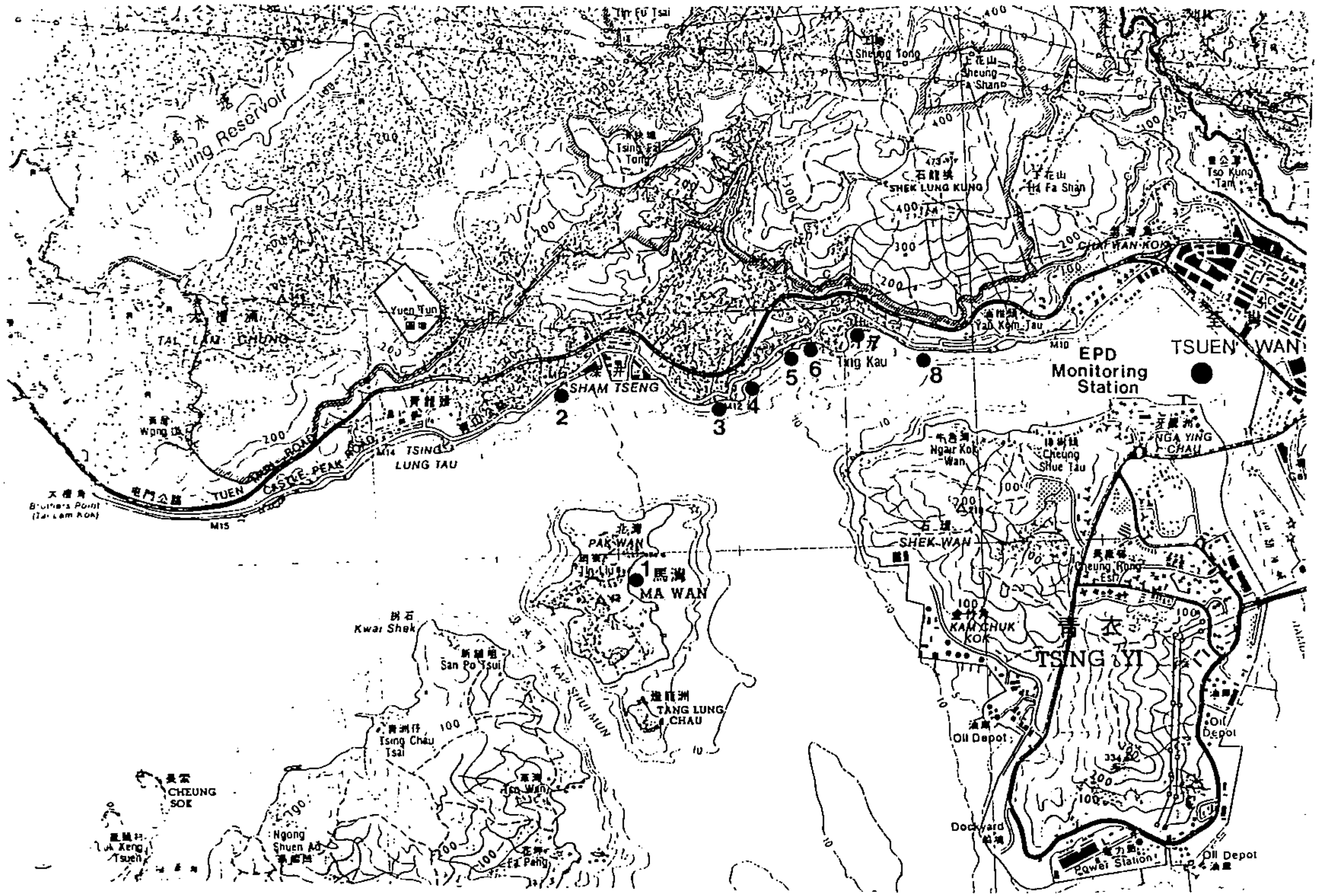
More specific recommendations that are applicable to the HAR site are:

- monitoring for SS/Turbidity and DO at sites along the stream course to gain baseline measurements, plus compliance monitoring during construction and the use of the HAR;
- baseline, compliance and post construction monitoring for SS/Turbidity and DO 150m from the sites where dredging and reclamation will be taking place; and
- for the waste waters arising from the concrete batching plant, periodic checks should be made on the pH values of the liquor held in settling tanks to ensure their suitability for reuse.

6.6 CONCLUSION

During the construction phase the key issues will be the prevention of sediment, waste materials, chemicals, spoil and dust etc., from entering the water course and thus the marine waters; and the dredging and disposal of contaminated sediments as part of the provision for the reclamation sea wall. Suitable clauses must be included in the contract documentation to limit impacts.

During the operational phase the potential impacts will arise from the transportation of spoil and loading of it to barge, operation of the concrete batching plant (including receiving concrete materials and aggregate deliveries by barge), and wastes arising from the production transportation and use of concrete.



Beach

1 Tung Wan (Ma Wan)
2 Anglers
3 Gemini
4 Ho Mei Wan
5 Casam
6 Lido
7 Ting Kau
8 Approach

FREEMAN FOX MAUNSELL	Drg. Title : GAZETTED BEACHES, RAMBLER CHANNEL	Job Title : ROUTE 3 HAUL/ACCESS ROAD SUPPLEMENTARY PAPER
		Scale : N.T.S
		Date Nov. 93
		Job No. 058 007
		Fig No. 6.1

MANAGEMENT OF SPOIL AND FILL

CHAPTER 7

7. MANAGEMENT OF SPOIL AND FILL

7.1 INTRODUCTION

The construction of the HAR will require handling of material from cut and fill activities. Part of the alignment will run along the western valley side, north of Ting Kau, to accommodate access for the heavy vehicles that will use the route. Owing to the steep topography of the area which consists of steep slopes and deeply incised valleys major earthworks cannot be avoided.

Overall it is assumed that quantities of spoil arisings will be in excess of fill requirements. However, the construction of the reclamation at the Ting Kau headland will require large volumes of fill and therefore the surplus could be utilised for this and is therefore not expected to be problem in terms of disposal.

During the operation phase the HAR will function as a haul/access route to the major excavations required for the construction of the TKB ramps G and H and the road widening cuttings alongside Tuen Mun Road (TMRW). Large volumes of spoil will arise from these areas and it is proposed that the material will be hauled out by truck using the HAR.

7.2 CONSTRUCTION OF THE HAUL/ACCESS ROAD

7.2.1 Introduction

The design of the HAR has aimed where practicable, to minimise the cut and fill requirements which will be necessary to accommodate the route.

Structures associated with the HAR and areas of cut and fill are a temporary bridge that will be constructed along the steep slope immediately east of Lido Beach, that at the eastern side of the road, Gabion walls are also used just south of Tuen Mun Road. The use of Gabion walls to support the structure will avoid the use of large volumes of fill, as would be required for an embankment structure. To the north and south of Tuen Mun road there are further small temporary bridges, as shown in Figure 7.1.

7.2.2 Spoil Generation Locations

There are six main areas of construction activity for the HAR where spoil will be generated:

- north of the reclamation, where the TKB section of HAR/Bailey Bridge traverses the steep hillside of the headland, a cutting will be required;
- north of Castle Peak Road a large cutting is needed to provide for the TKB section of road on the steep hillside;
- north of Castle Peak Road, and half way along the shared section of

road a cutting will be formed on the western side of the route, while a Gabion wall has been designed for the eastern side. The Gabion wall will decrease the volume of spoil arising while minimising the area of disturbance and impact on the stream course.

- south of Tuen Mun Road, the western side of the loop that will service the works areas for the TKB ramps G and H;
- north of Tuen Mun Road on both sides above the stream course; and
- spoil will be generated from the dredging for the seawall, the estimated volume of which is estimated to be 110 000m^3 (Figure 2.1). This spoil is likely to be highly contaminated and mitigation procedures will need to be incorporated during the dredging and disposal activities. It is preferable from an environmental standpoint that construction of the reclamation be undertaken leaving as much mud as is possible in-situ. The full implications surrounding marine spoil classification, dredging and disposal are covered in detail in the Route 3 CPS, TKB Environmental Assessment - Technical Report Volume 4A Chapter 4.

7.2.3 Fill Requirements

For the construction of the HAR material will be required to support the road platform as it traverses the western side of the deep stream valley. It is anticipated that this material will be taken from within the HAR project.

7.2.4 Spoil and Fill Volumes

TMRW

For the construction of the HAR for the TMRW works there is an excess of 30,000m^3 of spoil. This will be transported to other sites via the HAR and Castle Peak Road. This will require the use of five trucks per hour. The excess is derived from the volumes in Table 7.1.

Table 7.1 HAR Cut and Fill Volumes for TMRW

TMRW - HAR	
Construction Operation	*Volume of Material (m^3)*
Cutting	40,000
Filling	10,000
Excess Spoil Volume	**30,000**

TKB

For the construction of the HAR sections to provision for the Ting Kau Bridge works (Ramps H & G), there will be a spoil excess of 5,000m^3. This excess will be transported off the site to a barge loading point using six trucks per hour. The excess is derived from the volumes in Table 7.2.

Table 7.2 HAR Cut and Fill Volumes for TKB

TKB - HAR	
Construction Operation	***Volume of Material (m^3)***
Cutting	40,000
Filling	35,000
Excess Spoil Volume	**5,000**

7.2.5 Spoil Disposal

It is understood that the spoil arisings will be used within the project where fill is required, as mentioned above. However a potential surplus could be used for the reclamation as a large quantity will be needed for the seawall and reclamation fill.

7.3 OPERATION OF THE HAUL/ACCESS ROAD

7.3.1 Spoil Generation Locations

The HAR will be used for approximately 4 years serving the TKB, TMRW as well as the TLT and YLA section of Route 3. Apart from providing an access route for construction plant the main purpose of the HAR is to haul spoil from areas of cut. Spoil arising from the TKB works will be hauled down to the barge loading point at the reclamation. Material arising from the TMRW project will be trucked from Tuen Mun Road, along the HAR, to Castle Peak Road and then to sites further a field.

The volumes of spoil arising for these two projects are:

- the major excavations for Ramps G and H for the construction of TKB. It is anticipated that approximately 190,000m^3 will arise from Ramp G and 700,000m^3 from Ramp H. The location of the excavation areas are shown in Figure 2.1.

- north of Tuen Mun Road for the TMRW project spoil arisings in the order of 50,000m^3 are estimated.

7.3.2 Spoil Disposal

The spoil from the TKB works will be hauled down to the reclamation and barge loading point. In the early parts of the construction period, it is anticipated that the material will be used to form the reclamation itself. After this is completed, the spoil will be transported by barge to other sites where there is a need for fill material within or outside the TKB project. Spoil disposal options are discussed in further detail in the TKB Environmental Assessment - Technical Report Volume 4A (Chapter 7).

The spoil from the TMRW excavations will be hauled by truck to Castle Peak Road via the HAR for further transportation to sites further afield.

7.4 SPOIL DISPOSAL IMPACTS

Usually the potential spoil disposal impacts are limited to the construction phase of a project. However, the operation phase of the HAR comprises the construction of the TKB, TMRW, and Route 3 TLT and YLA section, and therefore the impacts of the HAR will extend to cover both its construction and use. Impacts related to the restoration, after-care and long term use of disposal sites needs to be considered further, as it is understood that the HAR will be removed, fill material in the valley is anticipated to be removed and the area restored after use.

7.4.1 Construction Related Impacts

The effects specially related to construction and disposal activities mainly include:

- production and handling of spoil at the construction site;
- temporary stockpiling and storage of spoil and aggregate;
- transport of spoil to disposal location;
- placement and treatment of spoil at a disposal location (if within the Study Area) and
- barge loading procedures.

Each of these activities have the potential to impact the environment. In most cases options are available and it is important to ensure that the option with least environmental impact is chosen, provided it proves practicable/feasible under existing conditions. At the disposal location, a range of specific environmental protection measures are likely to be required including:

- measures aimed at avoiding damage including ensuring transport and access routes bypass sensitive receivers such as residential areas and areas of ecological importance; and

- design and programming of site disposal activities to minimise long term impact and maximise environmental gain.

7.4.2 Transport of Spoil

The transport of spoil consists mainly of two aspects; the movement of material by the means of transport equipment and/or vehicles i.e. road and marine barge and the handling and transport near and within the proposed site, either the works area or the disposal site.

For this particular project the spoil will be transported by road on the HAR and from the proposed reclamation by barge to other, not yet determined, sites.

The main advantages of transport by road are that it is suitable for small quantities of spoil, it gives high flexibility allowing for changes in spoil arising location and disposal sites and there is no need for secondary handling of spoil as lorries are often able to drive up to the disposal site. However it might not be possible for the trucks to dump the spoil straight into the barges, suitable mitigation measures must be applied to act against dust generation and spillage into the waters.

There are also a number of disadvantages with road transport of which the main one is that it potentially creates nuisance due to increase in noise levels, deterioration of air quality and an increase in traffic flow on public road.

Transport of spoil by barges is recommended, providing that the appropriate procedures are adopted during the handling and transport.

7.5 MITIGATION MEASURES

Environmental protection and mitigation measures that may need to be considered during the construction and use of the HAR are anticipated as follows:

- Attenuation of noise, control of dust spread and reduction in visual intrusion by careful selection of stockpiling sites, taking into account the topography, creation of new earth bunds and retaining existing trees.

- Prevention of surface water pollution by bunding and directing run-off to settlement ponds.

- Minimise land take and in particular productive land, by limiting the size of stock piles and associated works areas.

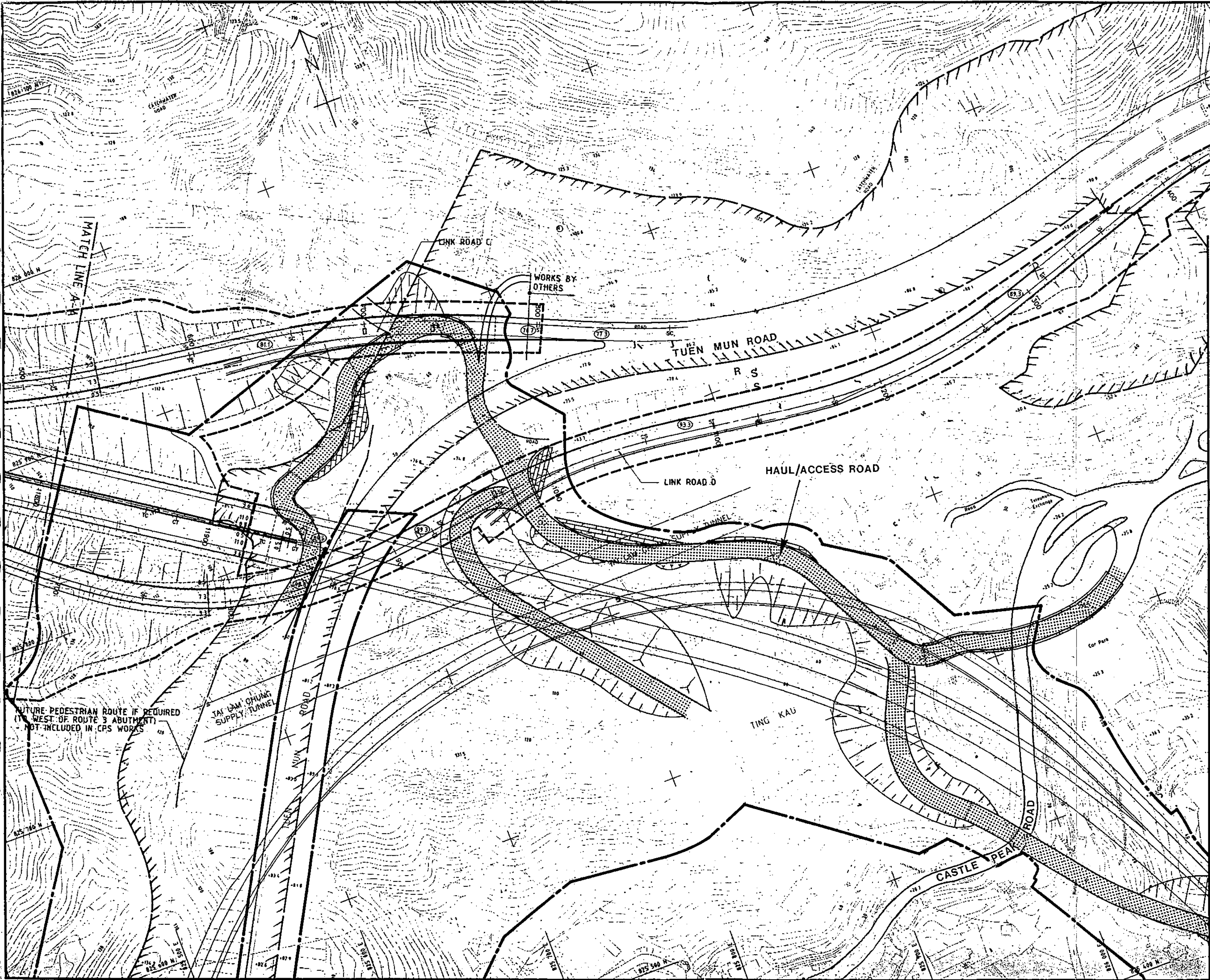
- Protecting productive agricultural, important habitat and landscape features by fencing all the boundaries to keep the stockpiles and works areas contained.

- At the end of stockpiling activity, restore the land to its original use and former quality.

7.6 CONCLUSION

During the construction of the HAR, it is anticipated that there will be a small surplus of spoil material. The volume that is not used to fill in the valley north of Castle Peak Road will be used as fill material for the proposed reclamation at Ting Kau headland.

Considering the operational phase of the haul road (up to 4 years), spoil arisings from TKB works will mainly be used for the reclamation, with surplus requirements being removed by barge. Arisings from the TMRW will be hauled by road to a final disposal destination. Detail of spoil arisings are presented in the Route 3 CPS, TKB Environmental Assessment - Technical Report Volume 4A.



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HIGHWAYS DEPARTMENT

WESTERN HARBOUR LINK OFFICE

ROUTE 3 COUNTRY PARK SECTION AND TING KAU BRIDGE PRELIMINARY DESIGN STAGE 2

Figure 7.1

Areas of Cut and Fill associated with the Haul/Access Road

Drg No 92393 / SK / 261

FREEMAN FOX MAUNSELL

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

CHAPTER 8

8. LANDSCAPE AND VISUAL IMPACT ASSESSMENT

8.1 INTRODUCTION

The major road construction associated with the proposed TKB section of Route 3 will in itself cause significant landscape and visual impacts primarily through the construction and use a temporary haul/access roads (HAR). The impact of these temporary structures must be considered to determine whether they are acceptable in terms of their construction, operational phase and their final restoration.

The landscape and visual impacts resulting from the use and construction of the HAR must be viewed in light of the more significant and permanent road construction associated with TKB itself. As the HAR is a short term project, taking 6-7 months to construct and being in use for up to 4 years, there will be considerable emphasis on effective short term mitigation whilst the HAR is operational and the re-instatement of the land form and vegetation cover once the HAR becomes redundant.

This section of the Supplementary Paper considers the potential landscape and visual impacts resulting from the construction and operation of the proposed HAR and identifies mitigation measures in terms of landscaping and rehabilitation. The detailed Landscape and Visual Impact Assessment for the entire TKB Section of Route 3 may be referred to in the TKB Environmental Assessment - Technical Report Volume 4A. The methodology adopted for the Visual and Landscape Impact Assessment of the HAR is necessarily described in detail within the landscape and visual impact assessment Chapter 9 of the Route 3 CPS, TKB Environmental Assessment - Technical Report Volume 4A.

8.1.1 Objectives

Specific landscape and visual impact assessment objectives include:

- Identification of the broad visual envelope created by the proposed temporary route corridor:

- Identification of the key visual receivers within the visual envelope;

- Assessment of the landscape and visual impact of the route, both during construction and operation;

- Identification and evaluation of effective short term mitigation measures, and final restoration proposals for the route corridor.

8.1.2 Existing Assessment Legislation and Guidelines

There is no legislation in Hong Kong which specifically relates to the landscape and visual impact of development. However, a degree of control is achieved through the requirement to address visual issues as part of the environmental review and assessment process. Whilst these policy objectives were originally related to specific environmental issues of noise, air, water and waste disposal, they may now be regarded as applying equally to the landscape and visual impacts of development.

8.1.3 Project Overview

The HAR comprises a 910m length of concrete road, from the promontory on Lido Beach continuing north, north west along the natural valley landform, to the existing Tuen Mun Expressway. Here the road divides into two branches (see Figure 2.1). The HAR just south of Tuen Mun Road doubles back on itself to access the works at Ramps G and H of the TKB. The northern branch will serve the TMRW project and passes below the Tuen Mun expressway to provide links towards the CPS. To the south this option will provide a link eastwards onto Castle Peak Road.

To achieve the desirable running gradients, there will be areas of cut and fill associated with the majority of the route, plus short temporary bridge structures.

The main features of the Haul road which will be significant in of potential landscape and visual impacts are:

- Areas of cutting,
- Areas of embankment;
- Bridges - temporary Bailey bridges.

The positions of cuttings and embankments are shown on Figure 2.1 and 7.1.

Construction of the HAR will take approximately 6 months, during this time activities will include:

- Construction of the HAR itself, involving cuttings, embankments and formation of running surface;
- Construction of the reclamation at the Ting Kau headland;
- Storage areas equipment and materials;
- Movement of vehicles along the HAR.

These elements may be potentially significant in terms of both their impact on the surrounding landform and vegetation cover, and visual receivers.

The majority of the activity will be localised, contained predominantly within the HAR corridor. Large scale construction will be required for reclamation works and slope regrading, but must be considered in light of the overall impact of the construction works in the area associated with the construction of the TKB section of Route 3.

Temporary visual intrusion may be suffered by receivers throughout the visual envelope. The severity of the intrusion is dependant on the proximity of the construction works and the sensitivity of the visual receptors; residential properties immediately adjacent to the route being subject to the most severe intrusion from construction works in their immediate vicinity.

8.1.4 Study Area

The study area comprises coastland rising into the foothills of the Tai Lam Country Park in the vicinity of the village of Ting Kau Village.

8.2 BASELINE CONDITIONS

The Feasibility study for Route 3 identified the area surrounding Ting Kau Village as a coastal strip with diverse vegetation and some influence from surrounding urban fringe developments, but strongly associated with adjacent coastal waters (character zone 12).

8.2.1 Character Area 12 - Coastal Strip - Ting Kau

The character area encompasses the lower aspects of the hillslopes and coastal areas between the Tuen Mun Road (T2) to the north, Hoi Mei beach to the West and Kan Shui Wan beach to the east on the mainland.

a) Visual Envelope and Existing Views

The visual envelope for landscape character area 12 is restricted by the landform and vegetation cover that encloses and limits views both within, and to the area.

The main zone of visual influence is southwards, views experienced are one of a well wooded enclave scattered with residential properties set against the steeply sloping grassland covered hills to the north. Dominant features within the view are the linear elevated structure, and the shotcrete coated regraded slopes of the Tuen Mun Road and to a lesser extent the alignment and shotcrete regraded slopes associated with the Shek Lunk Kung catchwater.

Views within the area are restricted by the topography but more significantly the mature tree cover and residential properties. More extensive views occur along the coastal margins, across the Rambler Channel to the Island of Tsing Yi, Ma Wan and Lantau in the foreground and smaller islands beyond. The views are heavily influenced by the extensive shipping activities in the surrounding waters, but do not encompass major docking or industrial facilities.

b) Topography Natural Drainage and Vegetation Cover

The landscape comprises steep south facing slopes falling from the Tuen Mun Road in the north to a small natural bay forming a series of small sandy beaches of Hoi Mei, Casam, Lido and Ting Kau interspersed with rocky headlands. The slopes within the character area form the lower aspects (below 100m AOD) of hills rising to a minor ridge of approx 150m in the north west and 400m to the more significant Shek Lung Kung mountain to the north east. Vegetation cover consists predominantly of scrub and stands of mature trees creating enclosed woodland-cover over much of the study area, with limited areas to the north and north west of rough grassland and regenerating scrub.

c) Built Development

The coastal plain comprises a residential enclave, with scattered low rise residential properties and Ting Kau Village. The properties have a strong association with the water margins of the Ramblers Channel, many having direct access to the sandy beaches and rocky promontories. There are no major industrial developments within the character area.

d) Access and Circulation

Ting Kau Village and the scattered residential properties are served by the Castle Peak Road. Traffic is primarily local, serving the local settlements between Sham Tseng and Tsuen Wan, through the traffic utilising the Tuen Mun expressway.

Although no direct access is achievable from the Tuen Mun expressway (the nearest access points being at Sham Tseng and Tsuen Wan), the highway is a major circulation structure within the wider area and its scale, location and volume of traffic exerts a significant influence on the landscape character of the area.

The footpath network within the area is limited, however there are a number of areas that enable direct access to the beaches and headlands from the vehicular road network.

Water traffic includes recreational facilities associated with the beaches along the coastal margins and industrial shipping lanes towards the centre of the channel.

e) Landscape Character

The resultant landscape character of this area is one of a pleasant well vegetated south facing coastal land with a well developed infrastructure and settlement pattern of scattered low rise properties with a quiet introspective disposition set within the natural bay. The area is of good quality and one that would be sensitive to change.

f) Visual Receivers

Visual Receivers in the study area comprise of the following receivers:

Visual Receivers within Study Area

- residential properties surrounding Lido Beach;
- isolated residential properties to the north of the Castle Peak Road,

above Ting Kau village centre;
- isolated properties to the north of the Tuen Mun Expressway;
- the village of Ting Kau;
- visitors to the Lido Beach area;
- visitors to the Tai Lam Country Park (Views from coastal facing slopes only);
- Traffic on the Tuen Mun Expressway and the Castle Peak Road;
- Marine traffic on the surrounding coastal waters.

Potentially the most sensitive visual receivers, those of residential properties, together with the less sensitive receivers using the local road and footpath network lie within the immediate vicinity of the route corridor.

Scattered residential properties and footpath users would create the main receiver groups within the country park to the north and island groups to the south. The high volume of waterborne and vehicular traffic in the vicinity create a further transient receiver group.

8.3 IMPACT ASSESSMENT

8.3.1 Visual Impacts

The visual envelope as detailed in Figure 8.1 identifies two broad types of visual intrusion, namely:

- Areas in close proximity suffering visual intrusion/obstruction (a);

- Long distance views from positions outside the study area, where the intrusion will not constitute a major intrusion into the overall view (b).

a) Immediate Surroundings

The most significant visual impact would be on receivers within areas with direct views, and in close proximity to the proposed route, as identified in 8.2.1 and Table 8.1.

Table 8.1 Visual Impact

Visual Receivers within Study Area	Impact	Comments
Residential properties surrounding Lido Beach	M/L	Oblique views of lower aspects of HAR in vicinity of temporary bridge
Isolated residential properties to the North of Castle Peak Road, above Ting Kau village	S	Direct views into existing natural valley mitigation measures limited effectiveness due to elevated nature of properties

Isolated residential properties to the north of the Tuen Mun Expressway	S O	Severely effected by northern extension of HAR spur (including a number of properties that will be demolished.
Ting Kau Village	-	Not effected due to the orientation of buildings and intervening landform and vegetation
Visitors to Lido Beach	S	Direct views from beach to temporary bridge structure Lido Beach promontory.
Visitors to Tai Lam Country Park	L	Views from Coastal hill slopes in the vicinity of Ting Kau. HAR would not be significant element in overall visual quality of area.
Traffic on Tuen Mun Expressway and Castle Peak Road	M	Traffic in both directions would look down onto proposed HAR corridor set within valley.
Marine traffic on the surrounding coastal waters	L	Views from Lido Beach and area to south, would encompass lower aspects of HAR corridor, but would not significantly effect the quality of the overall view.

Key:
S Severe
M Moderate
L Low
O Visual obstruction
Not affected

Residential properties in close proximity to the proposed HAR within the Ting Kau area will be severely affected in terms of visual intrusion, and in some cases visual obstruction (where the route structures will physical obstruct the view from a property). At present views from these properties are not affected by major artificial structures, and the introduction of cuttings, embankments and road bridges will have a significant impact during the construction and operational phase of the HAR. Once the operational phase of the haul road is completed, and the TKB and associated route corridor is constructed, the TKB corridor itself will form the dominant element within the overall view, and the impact of the HAR will be significantly reduced in relation to these new permanent structures.

It should be noted that the majority of the properties within Ting Kau village itself will not be affected by the proposed route corridor due to the position of the proposed HAR corridor and intervening landform and vegetation.

b) Distant Views

Further from the HAR corridor isolated residential settlements; passive recreation users, within Ting Kau Bay, adjacent coastal slopes (Tai Lam

Country Park, north and west sections of Tsing Yi Island of Ma Wan. Tang Lung Chau and Lantau); users of the local circulation network may all incur visual intrusion, the severity reducing with the distance from the structures and intervening topography.

Generally these more distant views contain intrusive visual elements such as major industrial, residential and infrastructure developments. The introduction of a further temporary man made feature would not significantly alter the perception of the existing visual quality of the area.

8.3.2 Landscape Impacts

Landscape impacts, through the creation of cuttings and embankments would cause a significant impact in the local landscape. The most significant impact in the short term would be the breaching of the natural ridge between Lido Beach and Ting Kau Beach and the embankments that cross the minor valley (unnamed stream) in close proximity to the Tuen Mun Road. It is envisaged that these earthworks will be established before the bulk of the construction works are commenced and they will therefore constitute the initial source of impact within the area. Their impact will however become less significant as the major construction associated with the TKB route corridor, get underway causing landscape and visual impacts.

8.4 MITIGATION MEASURES

Broad principles for the landscape mitigation/restoration proposals were established in the Route 3 CPS, TKB Environmental Assessment - Technical Report Volume 4A Chapter 9 and summarised in below:

General Mitigation Measures

- Treatment of the interface between man made and natural landforms;
- Position and design of associated buildings;
- Specific attention to the visual quality of the structures associated with the route;
- Landscape treatment within, and immediately outside, the route corridor;
- Colour and materials used for structures should reflect the colours and materials of the surrounding landscape. As a general principle strong contrast in colour should be avoided and muted colours related to the natural environment should be used with darker colour concentrated to the base of the structure to create a sense of stability.
- Detailed attention to the gradients and the profile of regraded slopes, and earth modelling to ensure they reflect the gradients of the natural slopes in the vicinity including the use of extended slopes and

undulating slope profiles.

- The use of chunam or shotcrete treatment of regraded slopes should be avoided.

- Screen planting within the curtilage of residential properties to screen the view at source.

Specific mitigation proposals based on these broad principles will not only reduce the impact of the temporary HAR during is operational life, but may also improve the overall quality of the landscape character of the area by the re-introduction of tree and shrub species.

8.3.4 Construction and Operational Phases

The following measures are recommended to reduce the impact during construction:

- Restrict the volume of construction traffic;

- Restrict the construction working areas to a minimum, siting them if possible in visually isolated positions;

- Enclose the working areas with hoardings to define boundary edge and screen low level construction activities from surrounding receptors;

- Restrict heights of storage materials, stock piles and spoil heaps to low levels;

- Minimise night time working and lighting.

Specific mitigation measures associated with the operational phase of the temporary haul road would consist primarily of the following two elements.

Temporary Mitigation Planting

The planting of fast growing shrubs and trees that will quickly establish a screen to reduce the impact of the new embankment and cut slopes; to aid slope stability and to reduce dust pollution on the surrounding landscape. Suitable species would be established by evaluating the existing vegetation cover (as identified within the ecological Chapter of this report).

Off-site Mitigation Measures

The construction of temporary screen hoardings and/or vegetation planting within the curtilage of visually sensitive residential properties, to screen the view at source. This should be undertaken through liaison with the property owners concerned to establish the preferred option (screen fence, vegetation planting or to keep the view open).

8.5 FINAL RESTORATION OF HAR

The most important part of the mitigation proposals would be the restoration of the HAR road once its operational phase is completed. The final objective of the restoration would be to at least reinstate the quality, and where possible enhance the structure, of the existing vegetation cover (see Figure 8.2), as identified in the landscape restoration proposals philosophy in the TKB EIA. In this case this would involve:

- the removal of all man made features associated with the temporary haul road such as the concrete road surface, associated drainage ditches, bridges, lighting columns etc. These structures should be removed from the area and disposed of in an appropriate tipping area:
- the man-made slopes (cuttings/embankments) and road alignment should be graded out to form a continuous more natural slope. This may involve the loss of sections of the fast growing shrubs planted to screen the operation phase, but is desirable to ensure a more natural final landform is formed.
- the re-grade slopes should be planted with the woodland Mix B identified in the TKB EIA;

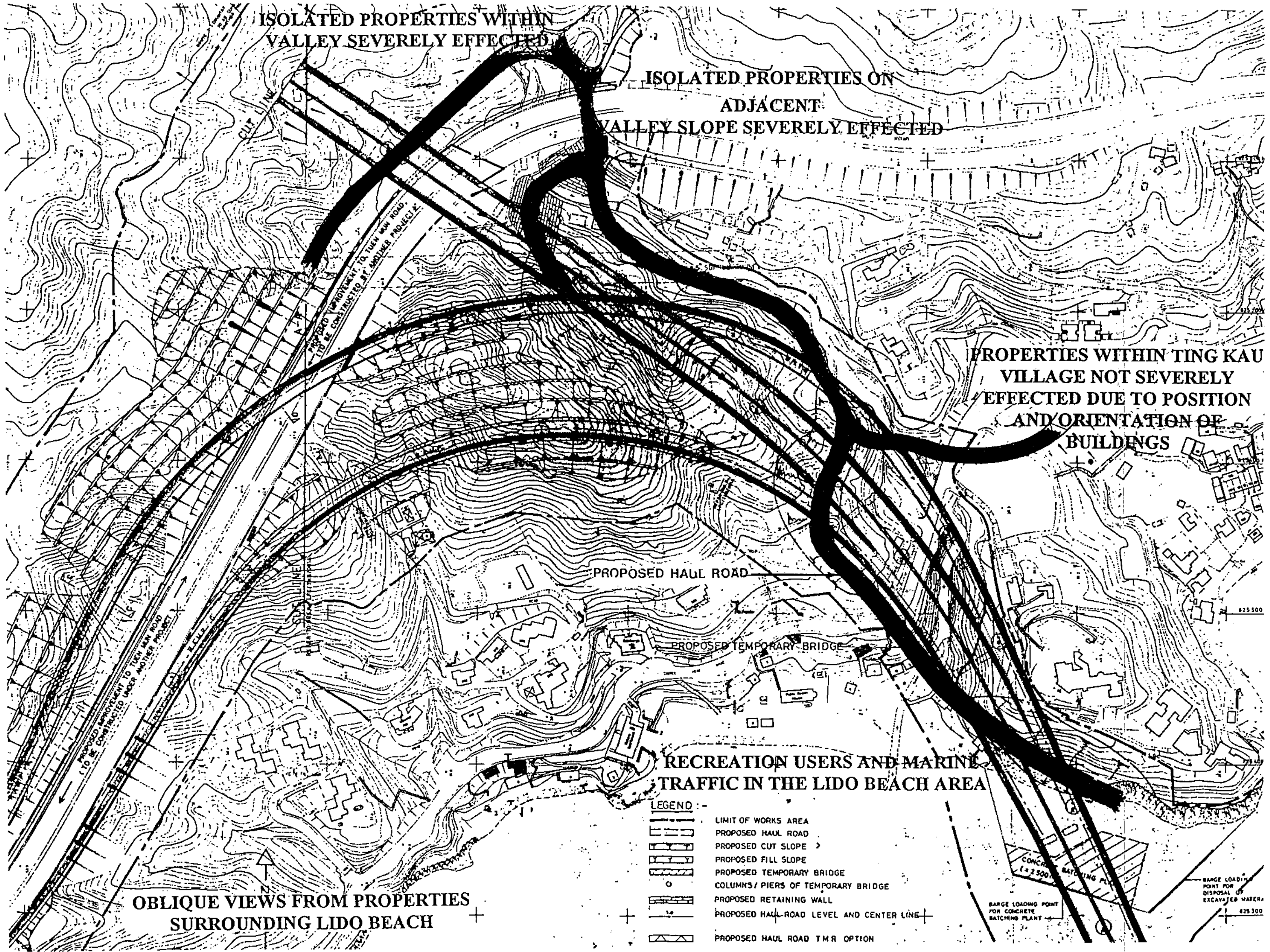
Woodland Mix B-Description

Hydroseed with grass and tree seed
Plant trees on 100% of area
Pit plant 75% tree/shrub whips, 25% light standard trees
Density: 1.5m staggered centres

The composition of the tree species would be established by a detailed site investigation to determine the existing trees present in the area, together with an appraisal of effective tree species in comparable road planting schemes.

Long Term Residual Effects

The adoption of a sympathetic landscape restoration programme should minimise the long term residual effects of the temporary haul road, which should in time return to its semi-natural well vegetated state.



FREEMAN FOX MAUNSELL

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Scale : N.T.S

Date Dec. 93

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Fig No. 8.1

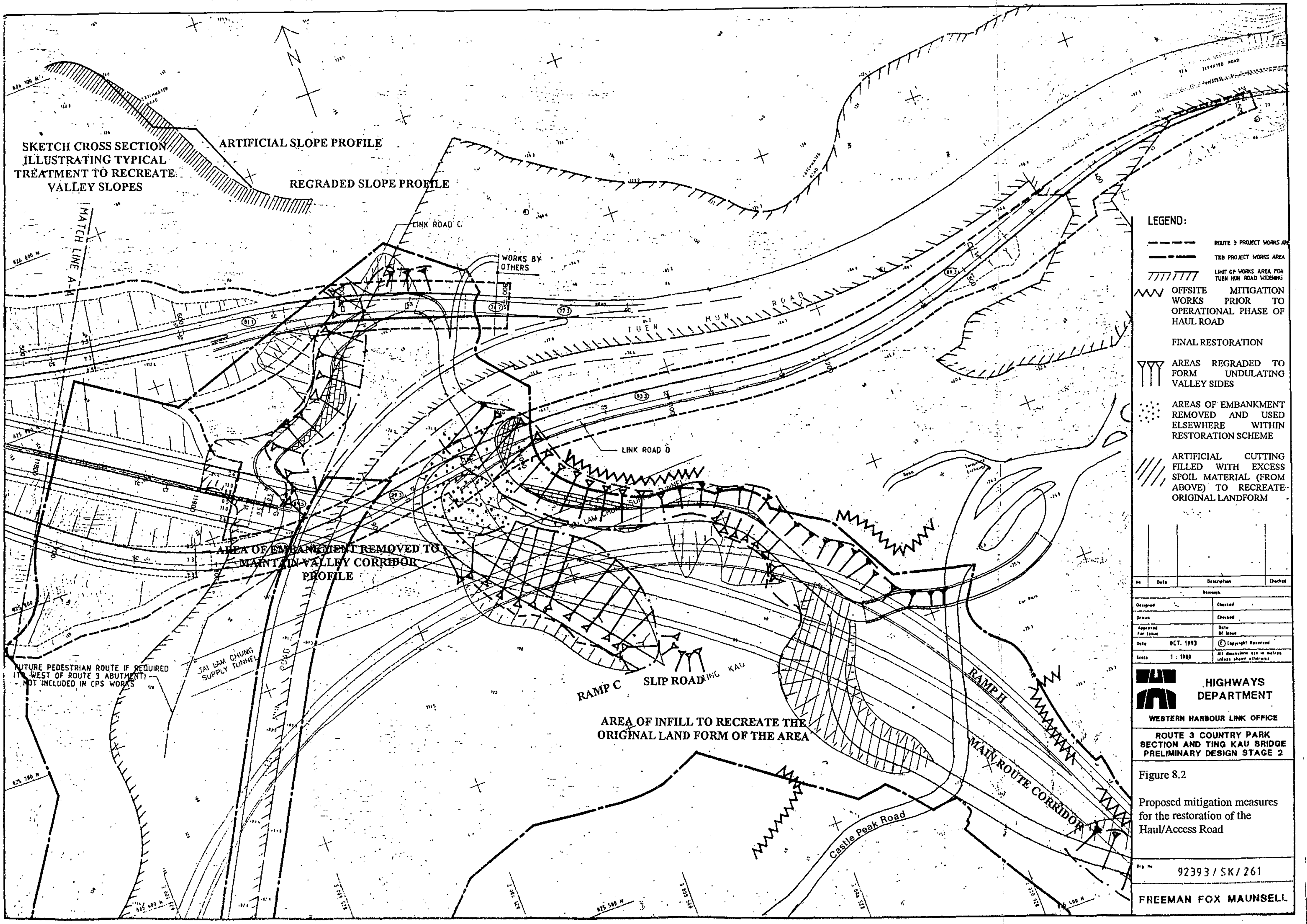

Figure 8.2

Proposed mitigation measures for the restoration of the Haul/Access Road

COMMUNITY ISSUES

CHAPTER 9

9. COMMUNITY ISSUES

9.1 INTRODUCTION

Potential community issues have been identified and assessed in terms of both the construction and use of the HAR. Community issues in relation to the TKB Section whole have been considered in greater detail in the Route 3 CPS, TKB Environmental Assessment - Technical Report Volume 4A (Chapter 10).

Government landuse zoning and planning policies were used to identify where landuse may be a constraining factor on the development of the HAR, and impacts have been assessed in relation to the degree and nature of disturbance to both the local community and visitors to the Study Area, and the importance of the affected areas in terms of their resource value. The significance of potential impacts has been assessed in relation to the nature and extent of SRs affected.

Sites of archaeological and historic interest were identified through consultation with the Antiquities and Monuments Office (AMO).

9.2 IDENTIFICATION OF KEY COMMUNITY ISSUES

9.2.1 Introduction

A review of 1:20 000 scale maps, Outline Zoning Plans (OZP) for Tsuen Wan west, non metropolitan landuse plans, the Territory Development Strategy (TDS) and site visits, established the existing and proposed landuse in the Study Area.

In general terms, the HAR passes through unprotected woodland interspersed with scattered low rise residential premises. Little planned and committed development has been identified, consequently community issues associated with these areas has focused on the existing landuse.

9.2.2 Existing Landuse and Sensitive Receivers

The existing landuse and SRs potentially affected by the HAR comprise:

- Communities at Ting Kau.

  Existing development in the vicinity of the northern landfall (Ting Kau) comprising low density residential dwellings scattered in the hillside between Tsuen Mun road and Castle Peak road.

  Ting Kau itself is a recognised village, and residential dwellings are typically low rise (2-3 storeys), and of high quality are situated in a superior position with substantial views across the Rambler Channel. Consequently these communities are extremely sensitive to both the long and short term impacts resulting from the construction and operation of a haul/access road located in such close proximity.

- Lido Beach

Situated next to the proposed reclamation at the Ting Kau headland, Lido Beach is a gazetted beach comprising a 200m stretch of sand with a waterfront heavily used for recreational activities. Towards the eastern end of the beach a nullah outfall is located which discharges directly into the sea. While the beach is heavily used for 'water based' recreation, the area directly to the north of the beach is used for such activities as picnics and weekend barbecues. It is estimated that approximately 9,600 people visit the area on a typical weekend reaching a maximum of 47,000 during peak season*.

Facilities available to the public include food and drink outlets, toilets, barbecue fixtures and a life guard station for bathing. Regional Services Department (RSD) have expressed an intention for upgrading and improvement of the area.

At Lido Beach's eastern most waterfront is a small, well used and maintained temple which is situated immediately behind the proposed reclamation.

In 1992, despite the water quality being downgraded from *fair** (1992), to *poor*, Lido Beach remains popular for water based recreational activities.

- Ting Kau Beach

Ting Kau Beach is situated to the east of the coastline reclamation. Of the order of 100m in length, the beach had a *poor* water quality rating in 1992, which has since deteriorated to *very poor*. The beach is used for recreational purposes to a limited extent such that on a typical weekend only approximately 100 people will visit the beach area.

- Casam Beach

Casam Beach is located west of Lido Beach. It has a stretch of beach 70m long. The water quality of the beach water is *fair*. The beach is used for recreation. Its calculated attendance rates are 1,164 people on a typical weekend with 8,000 people estimated for peak season*.

- Mainland Wooded Areas

The wooded hillsides provide an aesthetically pleasing backdrop to the beaches and are therefore important in terms of the landscape character of the area. Details of the woodland are described in the

* *(Bacteriological Water Quality of Bathing Beaches in Hong Kong, EPD, 1992).*

Ecology and Landscape and Visual Impact Chapter (Chapters 11 and 8 respectively) of this Report. In terms of local amenity and recreation the wooded areas are of relatively little significance, with a few minor footpaths, mainly used by the local community.

9.3 CONSTRUCTION AND OPERATIONAL PHASE IMPACTS

9.3.1 Introduction

Impacts from the construction and operation of the HAR will primarily affect sensitive receivers in the settlement at Ting Kau, surrounding properties that are located in the Study Area, and users of recreational areas along the coast and in the wooded hillside to the north. Although impacts resulting from the construction and use of the HAR will be temporary in nature, they are potentially significant as they may extend as for up to 4 years. The restoration of disturbed areas is therefore of upmost importance in mitigating potentially longer term impacts.

9.3.2 Severance

Severance impacts during the construction and operation of the road will be experienced by the communities in the region of Ting Kau as a result of the establishment earthworks; embankments and cuttings. The construction of temporary bridges, particularly those affecting Castle Peak Road, will affect the movement of vehicular and pedestrian traffic. During the operational phase there will be severance and blockage of access roads to properties especially in areas north of Ting Kau above Castle Peak Road.

9.3.3 Disruption and Disturbance

The settlement at Ting Kau is likely to be severely disrupted during the construction and operational phase. Construction traffic will potentially create disruption and disturbance through local traffic diversions, temporary blockage of access roads and general nuisance. Traffic flow on Castle Peak Road is likely to be disrupted due to movements of heavy plant and the volume of construction related traffic. This will adversely affect both residents mobility (disrupting daily activities) and also through-traffic on what is an important strategic traffic route serving the area between Tsuen Wan and Sham Tseng.

Deterioration in air quality due to dust and the increase in noise levels are a likely impact of such large scale construction activities.

9.3.4 Loss of Amenity/Recreation

There are two main types of landuse resource in the Study Area with recreational/amenity value:-

- the beach areas; and
- the mainland woodland.

Beaches - The recreational and amenity value of Lido, Ting Kau and Casam Beaches will be significantly affected by construction and operation activities.

The reclamation activities at the Ting Kau headland and the construction of the HAR will detract from the currently pleasant environment of the beaches and the natural amphitheatre of woodland to their rear. The effect will be the loss of a large area of the beach and the surrounding recreational area due to the landtake requirement. This will cause the direct loss of a section of the beach and also a large area of woodland behind it. The most significant impact will be to the eastern end of Lido Beach where the proposed reclamation/barge point for the bridge pier, concrete batching plant and construction area for the bridge pylons are located. However, due to the presence of the nullah outfall at this location this section of the beach is not as heavily used for water-based recreational purposes as the remainder of the beach.

Movement of construction materials and vehicles along the HAR, noise and dust nuisance, disruption of accessibility will contribute to deterioration of this recreational resource. Dredging activities associated with the reclamation will potentially cause a visible deterioration of water quality through increased suspended solid loadings which may be contaminated with heavy metals, reducing the value of the beaches for bathing and other water related activities. Activities associated with the construction and use of the HAR may have to be curtailed during weekends and public holidays that fall amidst the bathing season (i.e. March to October).

Mainland Woodland - the wooded slopes rising from the coastline are important more in terms of their ecology and their aesthetic appeal as a backdrop to the beaches, rather than for their recreational value. There are only a few footpaths in this area, the land is quite steep and therefore access is limited. However, maintenance or relocation of footpath access should be considered where practicable to maintain existing recreational value.

Detrimental impacts to the woodland area will arise from the construction related landtake which will include the road alignment and its foundation areas of fill, plus all of the supporting structures that will be placed to facilitate the roads use, including areas of cut, supporting walls and temporary bridges.

9.3.5 Landtake

Landtake during construction of the TKB comprises the temporary and permanent use of areas of land. There is no realistic mitigation for the landtake impacts associated with the period of use of the roadway foundations, temporary bridges, drainage channels etc. It is intended that the HAR will be restored after its 4 years of construction/use. This will require post-operational phase specialist landscaping and replanting works (see Chapter 8).

9.3.6 Land Value

Land value and development potential can be affected by the general quality of the surrounding urban environment. It should be noted that it is anticipated that the permanent presence of Route 3 and the Ting Kau Bridge will change the existing environment such that future non industrial development may be limited in scope. The HAR is temporary (up to 4 years) and will be removed and the affected area restored on completion of the operational phase. At present, however, the OZPs show no specific development plans for the Study Area.

The most sensitive receivers in the vicinity of the HAR are the high quality residential premises located on the hillsides. The superior location of the premises contributes significantly to their current value, consequently the inevitable short term changes to landscape quality, air quality, visual outlook and ambient noise may affect land and property values. However in the light of the TKB being constructed, the HAR will not add to the impacts on landvalue and development potential in the longer term.

9.4 MITIGATION MEASURES

9.4.1 Construction

The scope for mitigation of landuse impacts during the 6 month construction period of the HAR is limited. The most effective mitigation is to avoid siting construction activities and particularly work sites in close proximity to sensitive receivers. Care should also be taken in setting out work areas and during daily practice to ensure that associated impacts are minimised.

Timing of works can be important in reducing disruption due to traffic congestion etc., avoiding using roads for heavy plant and equipment during busy traffic periods.

In all instances where practicable, temporary revegetation/restoration works should be undertaken on completion of the construction works. Reinstatement of access to existing properties particularly those north of the beaches and for areas with high recreational and amenity value should be required and made a contractual condition.

9.4.2 Operation

Mitigation of community impacts during the four year period of use of the HAR will to a certain extent be achieved as a result of noise, air quality and landscape mitigation measures recommended in the preceding chapters.

Additional mitigation can be provided through detailed design and management measures. Where practicable a positive commitment to the management and maintenance of temporary roadside landscape works should be undertaken to maintain both the recreational and amenity value of the affected areas development potential and land values. In all instances where practicable reinstatement should be undertaken once the road has served its intended purpose and design life.

9.5 CONCLUSION

The impacts arising due to the 6 month construction period and four year use of the HAR will be temporary. The impacts to the Ting Kau community and the surrounding areas are, however, potentially significant. They will be in the form of: severance to access and the traffic routes; general disruption affecting residents mobility; disturbance due to air quality deterioration and noise level increases; loss of amenity and recreation at Lido Beach due to the construction activities located there; temporary land take will occur and the cumulative effects of the development will create a negative effect on land value.

ECOLOGY

CHAPTER 10

10 ECOLOGY

10.1 INTRODUCTION

Potential ecological impacts of the proposed haul/access road (HAR) and associated areas of embankment and cutting were assessed based on surveys of the site during September and October 1993, and on previous surveys conducted during April and May 1993 for the Ting Kau Bridge section of the Route 3 EIA. Information from both surveys are included in this report, as both are current and the information is applicable to both types of disturbance.

Non-systematic surveys were used to identify plants or animals protected by Hong Kong regulation or international convention, or which are of conservation significance for other reasons such as local rarity.

There were no gazetted or proposed sites of special scientific interest or special areas within the study area. The nearest gazetted conservation area was Tai Lam Country Park, which will be unaffected by construction of the HAR.

The study area consists of an unnamed stream valley oriented roughly from northwest to southeast through the proposed disturbance area together with upland slopes west of the stream valley which are the location of the proposed cut slopes associated with the Ting Kau Bridge ramps G and H. The stream is permanent, and it drains the southwest flank of Shek Lung Kung mountain (474m elevation) which is within Tai Lam Country Park approximately 1.2km north of the village of Yau Kom Tau. The topography adjacent to the stream is steeply incised, ranging from 131.5m to sea level. Within the study area the stream ranges from roughly 30m elevation beneath Tuen Mun Road to sea level in elevation.

10.2 TERRESTRIAL FLORA

Flora in the study area was classified into five habitats, including secondary woodland, tall shrub woodland, tall shrub, low shrub, and low shrub-grassland (Figure 10.1). The habitats were fragmented by roads and parking sites, houses, recreation areas, and agricultural areas. Some portions of the site above Castle Peak Road on the west side of the valley had been burned by wildfire during autumn or winter 1992-1993. No plants listed on the Agriculture and Fisheries Department list of protected plants in Hong Kong were recorded.

Below Castle Peak Road the level of historic disturbance from building and road construction was higher than in the upper section from Castle Peak Road to Tuen Mun Road. However, wild fire had apparently not affected the area below Castle Peak Road for approximately 60 years (S.T. Chan, pers. comm.). Vegetative cover of the site consisted generally of a maturing woodland into which some cultivated species were encroaching. Species diversity was relatively high in each ecological layer of this woodland, and individual trees were tall and large in girth. Species recorded in this portion of the study area are listed by ecological layer in Table 10.1.

The woodland on the southwest facing slope north of the stream and below Castle Peak Road was of particular note. Specimens of *Delonix regia* and *Cinnamomum camphora* were conspicuous due to the numbers of trees and the girth and height of individual plants. Such mature stands of native tree species are not common in this area.

Table 10.1 Plant species identified between Lido Beach and Castle Peak Road on the Ting Kau Bridge section of the study area.

Trees and Overstory Vegetation	
Aleurites spp.	*Ficus microcarpa*
Bamboo	*Crewia spp.*
Bauninia spp.	*Liquidambar styraciflus*
Bombax malabaricum	*Litsea glutinosa*
Bridella monoica	*Macaranga tenuifolia*
Celtis sinensis	*Melaleuca leucademdron*
Cinnamomum camphora	*Melia azedarach*
Cratoxylum ligustrinum	*Sapium spp.*
Delonix regia	*Schefflera octophylla*
Ficus elastica	*Sterculia lanceolata*
Ficus hispida	*Tristania conferta*
Understory shrubs, small trees, climbers	
Brucea javanica	*Ilex rotunda*
Cerbera magghas	*Ligustrum sinensis*
Dalberhia spp.	*Mucuna spp.*
Ficus hirta	*Phoenix hanciana*
Ficus hispida	*Psychotria rubra*
Gardenia jasminoides	*Raphiolepis indica*
Gnetum montanum	*Rhus spp.*
Ilex pubescens	*Vitex negundo*
Herbs	
Asparagus cochinchinensis	*Oxalis corymbosa*
Christella parasitica	*Paederia scandens*
Hedyotis acutangula	*Pteris semipinnata*
Ipomoea spp.	*Rubus spp.*
Liriope spicvata	*Sida acutifolia*
Lygodium japonicum	*Youngia japonica*

From Castle Peak Road to Tuen Mun Road, the area was vegetated by small patches of woodland interspersed with tall shrubland maturing to woodland. In combination with these secondary native habitats the area was a mixture of re-vegetation, horticulture, housing, and burned areas.

The area burned by wildfire (apparently in autumn or winter 1992) was a pine-acacia plantation and low shrubland to the east of the hilltop proposed for an area of cutting for the Ting Kau Bridge ramps. The stream valley and slopes draining into it were unaffected by the fire. Species recorded on the burned area are listed below in Table 10.2.

The northern side of the stream valley in this area is largely cultivated. It consists of orchards of lychee, *Prunus* spp., wampei, *Anona* spp., *Michelia* spp., oranges, *Artocarpus*, loquat, banana, and others.

The relatively undisturbed tall shrubland on the south side of the valley provides a diversity of habitats. It is maturing toward a woodland climax habitat. Although it provides habitats useful to wildlife, it is surrounded by highways, and is not continuous with less disturbed woodlands or shrublands to the west toward Tai Lam Country Park.

Species encountered in this portion of the study area are listed by ecological layer in Table 10.3 below. Two uncommon species were recorded. These were *Evodia meliaefolia* and *Carallia brachiata*. No protected species were recorded.

Table 10.2 Plant species recorded in the burned area between Castle Peak Road and Tuen Mun Highway.

<u>Planted species</u>
Acacia confusa
Pinus massoniana
<u>Others</u>
Dicranopteris linearis
Rhus spp.
Rhodomyrtus tomentosa
Baeckia frutescens
Schefflera octophylla
Pandanus tectorius

Table 10.3 Plant species recorded between Castle Peak Road and Tuen Mun Highway.

Trees	Herbs
Acronychia pedunculata	*Cassytha filiformia*
Aleurites moluccana	*Dicranopteris linearis*
Bauhinia blakeana	*Elephantopus spp.*
Gordonia axillaris	*Miscanthus sinensis*
Litsea rotundifolia	*Morinda umbellata*
Palmyra rubra	*Neyraudia neyraudiana*
Pinus massoniana	*Smilax china*
Sapium spp.	
Schefflera octophylla	
Sterculia lanceolata	
Bamboo	
Shrubs & Woody Climbers	
Adina pilulifera	
Clerodendrum frutescens	
Dalbergia spp.	
Embelia laeta	
Eurya chinensis	
Ficus variolosa	
Ilex aspera	
Ilex pubescens	
Lantana camara	
Melastoma spp.	
Pandanus tectorius	
Rhodomyrtus tomentosa	
Rhus sinensis	
Strophanthus divaricatus	
Tetracera asiatica	

10.3 TERRESTRIAL FAUNA

Because this portion of the study area is small in extent and has been inhabited for many years, it is unlikely that mammalian species of conservation significance occur. None was recorded during field surveys. However, evidence of burrowing by rodents was observed in the burned areas, indicating that some small mammals probably occupy the site. Burrows were small (5-7cm diameter), and most showed no sign of recent use.

Bird use of the Ting Kau portion of the study area reflected the diversity of habitat types available and the successional nature of the shrubland. Bird species seen are listed below in Table 10.4. Birds were surveyed during spring and summer 1993. It is inevitable that additional species occupy the site during other seasons of the year. The Hong Kong Bird Watching Society was consulted regarding the importance of this area for avifauna on a year-round basis with the result that there was no knowledge of occurrence of any species or bird community of special significance.

Table 10.4 Bird species recorded from Ting Kau beach to Tuen Mun Road.

Black kite	*Black-naped oriole*
Moorhen	*Black-necked starling*
Spotted dove	*Crested myna*
Koel	*Magpie*
Large hawk cuckoo	*Crested bulbul*
Indian cuckoo	*Chinese bulbul*
Collared crow	*Black-faced laughing thrush*
Crow pheasant	*Long-tailed tailor bird*
Swallow	*White eye*
Rufous-backed shrike	*Magpie robin*
Black drongo	*Great tit*
	Tree sparrow

10.4 FRESHWATER FAUNA

The stream channel is largely natural between Tuen Mun and Castle Peak Roads. The stream bed consists of small to medium size stones, with some larger boulders. Immediately beneath Tuen Mun Road, and from Castle Peak Road to the sea, the stream has been channeled into an open culvert. Along the entire length of the stream there are several waterfalls emptying into large, deep pools. The stream gradient is roughly 30m over 560m in length, or 5.4%.

The freshwater species in the stream were recorded through direct sighting, or capture/release using a hand net. All species recorded are listed in Table 10.5.

Although water levels in the stream were quite low except during major storm events, fish were observed in pools in the middle reaches of the stream between Castle Peak and Tuen Mun Roads. Five species of freshwater fish were observed, all of which are common in Hong Kong streams. Two species of crab and two (possibly three) of freshwater shrimp were also found.

The insect life associated with the stream was very rich, including many dragon and damsel flies, abundant grouse locusts (*Tetrix* spp.) and aquatic species such as waterboatmen (*Corixidae* spp.) and pond-skaters (*Gerris* spp.). Neither butterfly (M. Bascombe, unpub. data) nor dragonfly (K. Wilson, pers. comm.) populations in the area are known to be unusual or noteworthy.

Table 10.5 Freshwater and associated fauna recorded during October 1993 on the Ting Kau study area.

Pisces *Puntius semifasciolatus* (six-banded barb) *Gambusia patruelis* (mosquito fish) *Rhinogobius* spp. (freshwater goby) *Lebistes reticulatus* (guppy) *Barbatula hingi* (stream loach)
Crustacea *Machrobrachium hainanense* (small long-armed shrimp, and possibly *M.nipponense,* the large long-armed shrimp) *Palaemontes* spp. (common freshwater shrimp - very abundant) *Potamon hongkongensis* (Hong Kong freshwater crab) *Potamon anacoluthon* (mountain freshwater crab - remains only; commonly inhabits mountain streams)
Insecta. *Corixa* spp. (waterboatman) *Gerris* spp. (pond-skater) *Tetrix* spp. (possibly *T.subulutus*) (grouse locust) *Neochauloides bowringi* (alder-fly larvae) dragon and damsel flies. butterflies.

The Indian skink (*Lygosoma indicum*) was recorded during autumn 1993. No amphibians were recorded using the stream.

10.5 POTENTIAL IMPACTS

The proposed project calls for construction of a HAR in the stream valley for access to two large areas which are designated to be large cuttings on the hills in the western portion of the study area and smaller areas of cut in the central and southeastern portions of the study area. The HAR and associated slope works will primarily affect the valley bottom and stream, while the areas of cut associated with the HAR will affect upland sites.

Because the HAR will follow the southwest bank of the stream between Castle Peak Road and Tuen Mun Road, this 210m section of the stream bank will be affected by road embankment structures (Gabion walls), cutting and filling operations. For the purpose of this assessment it is assumed that this area will be completely disturbed during construction, and will require some channel reconstruction, removal of all fill material and restoration of areas of cut, followed by re-seeding or transplanting after completion of the project.

North of Tuen Mun Road the main stream catchment and two of its tributaries will be bridged (20m, 30m and 40m bridges) to allow access to areas of cutting. It is assumed that vegetation in this section of stream will also be removed and will require re-planting following completion of road construction.

10.5.1 Terrestrial Ecology

Because the site has historically been subjected to a high level of disturbance due to road and housing construction, wildfire, and horticulture, available habitats are highly fragmented. There are only a few isolated patches of largely undisturbed habitat, and these have matured into closed canopy woodland or tall shrubland. These sites provide a diverse range of micro-habitats due to the maturity and diversity of vegetation and nearby availability of fresh water.

The area between Lido beach and Castle Peak Road supports a mature woodland representative of a habitat type which has been dramatically reduced in extent throughout Hong Kong. Although this woodland does not include protected species, it is of conservation significance because it resulted from many years of protection from wild fire and timber harvest, and it is associated with a permanent stream. The woodland is dissected by roads, recreation areas, and building sites, yet it supports a diverse flora and bird fauna. Occurrence of mature, native tree species in close proximity to intensive human use areas is unusual in that it offers a natural park within a suburban setting. In addition to providing wildlife habitats, this wooded area stabilises a steep slope and provides an attractive green belt through a low density sub-urban area.

The southeast portion of this woodland would be destroyed by slope works required to create clearance for the haul road and temporary bridge nearest the concrete batching plant. The remaining portion of the woodland would probably be severely affected or possibly lost due to subsequent construction of the Route 3 Ting Kau Bridge Section.

From Castle Peak Road to Tuen Mun Highway the proposed haul road and associated slope works will necessitate disturbance of the western bank of the stream and complete loss of riparian woodlands and shrublands. Above the upper stream bridges there would be no further impact to the riparian vegetation. The cumulative impact of the HAR and the Route 3 alignment would result in severe disturbance of the stream and loss of adjacent habitats throughout the course of the construction project from just above Tuen Mun Road to the sea. All terrestrial and avian wildlife associated with these habitats will be severely adversely impacted by the construction process. Because there is little evidence of mammalian use of the study area, it is predicted that bird life would suffer the greatest impact due to loss of nesting, perching, and feeding habitats. The insect fauna appeared to be abundant and diverse, suggesting that insectivorous birds would suffer loss of feeding habitat due to destruction of the woodlands.

The upland sites which are to serve as areas for cutting are vegetated with secondary low shrubland and some tall shrubland. They support vegetation which is widely distributed throughout the Territory, consequently it is of no particular conservation interest. The area along the west side of Tuen Mun

Road is a dry site on relatively steep slopes, and portions of it were incorporated into cut slopes for construction of Tuen Mun Road. Although this area is near Tai Lam Country Park, there is predicted to be little impact on the Country Park due to the relatively common vegetative cover in this area.

The hilltop east of Tuen Mun Road is largely low shrub habitat which has been subjected to repeated hill fire. The north facing slope of this hill supports some tall shrub habitat on the lower elevations. Portions of this slope will not be affected, and the disturbed sites will be relatively easy to restore due to the reduced slope gradients which will result following the cutting operation. Retention of seed trees and shrubs in this area will facilitate rapid revegetation of regraded slopes.

10.5.2 Freshwater Fauna

Aquatic fauna will be severely impacted by the project. The stream segments that will be affected, in particular the stream banks, comprise over third of the total stream length within the study area (approximately 210m of 560m total stream length). The stream segments to be affected are historically the least disturbed portions of the stream and are flowing in a relatively natural channel (with the exception of the small reservoir immediately above Castle Peak Road). The two stream sections currently flowing in an open concrete nullah lack a natural substrate, and provide less habitat diversity. These areas had fast flowing, shallow water, and did not support aquatic fauna.

The construction of the HAR will require diversions of the stream along the edge of the fill slope while the HAR platform is constructed and supporting Gabion walls are built. This will result in partial disturbance of the natural channel. Channel encroachment, and cut and fill operations necessary for the HAR are likely to cause the stream to become uninhabitable from the commencement of construction till the period of time when construction of the haul road is finished and temporary road planting is established.

The section of stream south of Tuen Mun Road will be adversely affected by heavy sediment loading during construction of the proposed haul road. This will alter the nature of the stream bed, particularly in pools were sediments will accumulate. This will have a severe effect on the fauna through alteration of habitat and increased input of organic material. The latter impact will lead to decreased dissolved oxygen in the water.

10.6 IMPACT MITIGATION

10.6.1 Terrestrial Ecology

Impacts on terrestrial ecology would be difficult to mitigate because the haul roads and associated slope works would be constructed in areas of the greatest floristic diversity on the study site, namely, the riparian and mature woodlands. This would result in nearly complete removal of vegetation in the stream valley. The only feasible option to reduce impacts of the haul roads and slope works is to relocate the haul road away from the valley floor.

This option should be considered in the detailed design stage of the project.

Whereas the Route 3 Ting Kau Bridge would be constructed on vertical pylons above the valley floor (thereby offering some prospect of avoiding damage to terrestrial habitats), the earth moving operation associated with the HAR project would require substantial surface disturbance and removal of vegetation. Construction of the Route 3 alignment following the cut and fill operation associated with the Ting Kau Bridge ramps G and H, would compound the difficulty of mitigating impacts on terrestrial ecology because some of the Route 3 Ting Kau Bridge Section construction would take place in areas unaffected by earth moving. Examples of such areas are: 1)below Castle Peak Road on the east side of the valley; and 2)above Castle Peak Road on the southwest of the valley.

Although construction phase impacts of earth moving would be difficult to mitigate, long-term impacts can be reduced by careful selection of revegetation species to maximize native plant species representation and optimize potential wildlife attractiveness. Plant species which meet these criteria are listed in Table 10.6 following Corlett (1992). Although some of these species may not be available from nurseries at the time of this writing, they can be grown on order by the Agriculture and Fisheries Department nursery staff (L. Chau, pers. comm.). Use of revegetation species listed in Table 10.6 in a successful re-vegetation programme will ensure that long term impacts of the loss of woodland and shrubland vegetation are mitigated to the extent possible.

10.6.2 Aquatic Ecology

The primary impact on aquatic ecology will result from radical alteration of the stream habitat over short sections of the streams banks. This impact could be avoided to some extent by movement of the HAR alignment away from the stream banks, however, even this measure may be of little use due to the frequency of haul road traffic, the long duration of the project, and the likelihood of dust generation or accidental spillage of fill or other contaminant into the stream.

Impacts on aquatic ecology will result from removal of riparian vegetation and from sedimentation during construction. Due to the requirement for embankment works and stream bank alteration, it is expected that sedimentation would be a severe impact on aquatic fauna. This impact could be mitigated through use of a temporary cover over the stream channel during major earth moving operations.

10.7 RESIDUAL IMPACTS

10.7.1 Terrestrial Ecology

The primary residual impact on terrestrial ecology would be loss of riparian and adjacent woodlands and the habitats they provide. Although these habitats are fragmented by suburban residential, horticultural, and recreational land uses, the same land uses provide a degree of protection. As a result, these woodlands provide diverse and complex habitats made more important by their proximity to a freshwater stream. Loss of the unusually large, native trees due to slope works near Lido Beach could only be mitigated by regrowth over a time span of several decades.

Because of the cumulative impacts of the haul road construction and operation followed by construction of the Route 3 Ting Kau Bridge Section it is assumed that much of the existing woodland habitat will be lost. Due to the scope of the project it is not likely that large patches of mature woodland or tall shrubland will be retained near the disturbance areas. Therefore, nearby seed sources will be few, and the success of the habitat restoration programme will depend primarily on the success of replanting. It will require 10 to 20 years for the existing mature woodland areas to be revegetated from bare ground. Restoration of the existing floral community diversity will also require a number of decades, during which much of the value of the area for birds and invertebrate wildlife will be lost.

10.7.2 Aquatic Ecology

Construction and operation of the HAR and associated slope works will cause severe residual impacts to aquatic ecological resources. Embankment works affecting 210m of stream length would initially cause sedimentation of the downstream channel in addition to loss of the riparian portions directly affected by embankment works. The construction process would require loss of virtually all riparian vegetation which is critical to the aquatic ecology of the stream. It is probable that the adverse impacts could not be mitigated without removing the proposed disturbance areas from the immediate vicinity of the stream channel.

Because stream channel restoration technology is sophisticated, it is possible that following project completion the re-created stream course could achieve pre-disturbance levels of biological productivity. This process would require many years due to the time required for regrowth of mature riparian vegetation. Also, implementation of a sophisticated restoration programme may not be desirable for a publicly funded project due to excessive expense.

Table 10.6 Native plants attractive to frugivorous birds in Hong Kong (Corlett 1992)

SPECIES	HABIT	BIRDS	ATTRACT	PERIOD
Aralia chinensis	small tree	3	x	Dec-Jan
Berchemia racemosa	climber	3	xx	Mar-Apr
Bridelia tomentosa	small tree	4	xxx	Dec-Mar
Cassytha filiformis	parasitse	3	x	Oct-Mar
Celtis sinensis	tree	2	xxx	Jun-Aug
Cinnamomum camphora	large tree	5	xxx	Nov-Jan
Diospyros morrisiana	tree	2	xx	Dec-Jan
Elaeocarpus sylvestris	tree	2	xx	Oct-Nov
Eurya chinensis	shrub	17	xxxx	Oct-Nov
Eurya japonica	shrub	5	xxx	Nov-Jan
Evodia lepta	small tree	14	xxxx	Oct-Nov
Evodia meliaefolia	tree	4	xxx	Nov-Dec
Ficus microcarpa	tree	3	xx	irregular
Ficus superba	tree	3	xx	irregular
Ficus virens	tree	5	xx	irregular
Ilex pubescens	shrub	4	x	Nov-Feb
Litsea rotundifolia	shrub	8	xxx	Oct-Dec
Macaranga tanarius	tree	5	xxx	Jun-Jul
Machilus breviflora	tree	1	x	Oct-Jan
Machilus oreophila	tree	2	xx	April
Machilus thunbergii	tree	2	xx	Jun-Jul
Machilus velutina	tree	1	x	Jan-Feb
Maesa perlarius	shrub	2	xx	Dec-Jan
Mallotus paniculatus	small tree	3	xxx	Dec-Jan
melastoma candidum	shrub	4	xx	Nov-Jan
melastoma sanguineum	shrub	8	xxx	Nov-Jan
Microcos paniculata	small tree	5	x	Oct-Mar
Morinda umbellata	climber	3	xxx	Aug-Sep
paederia scandens	climber	4	xxx	Nov-Mar
psychotria rubra	shrub	8	x	Oct-Jan
Psychotria serpens	climber	7	x	Oct-Mar
Rhaphiolepis indica	shrub	2	xxx	Dec-Jan
Rhodomyrtus tomentosa	shrub	6	xxx	Aug-Nov
Rhus chinensis	small tree	8	x	Nov-Dec
Rhus hypoleuca	small tree	5	x	Nov-Dec
Sapium discolor	tree	12	xxxx	Oct-Dec
Sapium sebiferum	tree	3	xx	Nov-Jan
Schefflera octophylla	tree	7	xxxx	Jan-Mar
Scolopia saeva	tree	2	xx	Dec-Jan
Sterculia lanceolata	tree	4	xxxx	Jul-Sep

Note : BIRDS = number of bird species known to eat the fruit;
ATTRACT = relative attractiveness to birds;
PERIOD = main fruiting period.

Plantnames follow Anon (1978), except *Bridelia tomeniosa* B1. (= *B. monoica*).

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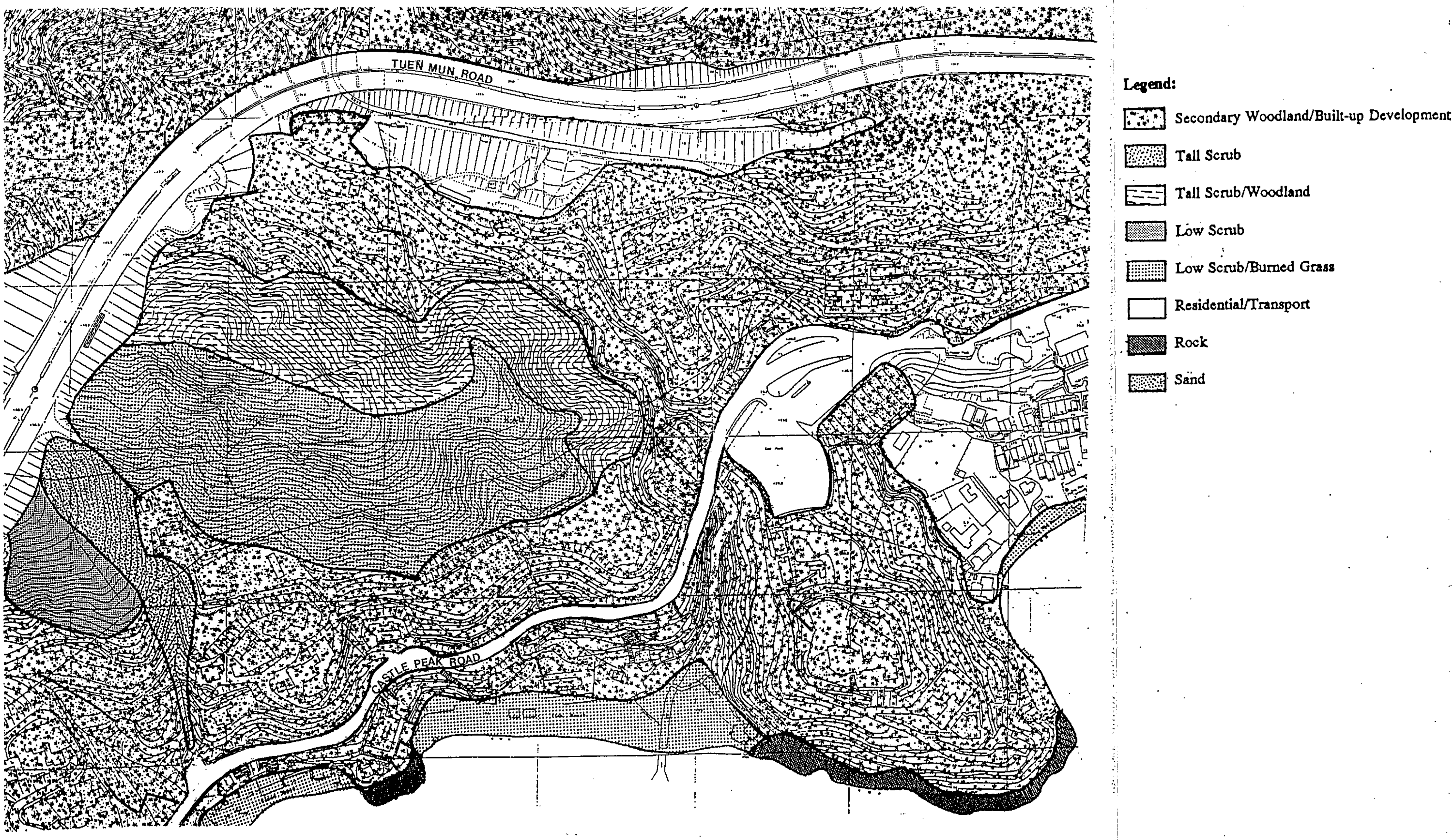

FREEMAN FOX MAUNSELL	Drg. Title : HABITAT MAP - TING KAU	Job Title : ROUTE 3 HAUL/ACCESS ROAD SUPPLEMENTARY PAPER		
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ENVIRONMENTAL MONITORING AND AUDIT

CHAPTER 11

11. ENVIRONMENTAL MONITORING AND AUDIT (EM&A)

11.1 INTRODUCTION

Environmental monitoring schedules and audit procedures are essential to ensure:-

- environmental impacts resulting from construction and operation of the HAR are acceptable;
- mitigation measures have been applied when necessary;
- compliance with environmental objectives.

Background and general information concerning the requirements, objectives and technical details of EM & A are discussed in detail in chapter 13 of Route 3 Ting Kau Bridge EIA. As such, this information is not duplicated in this Chapter.

The timing of the construction and operation of the HAR will coincide with the two much larger scale construction activities of TMRW and TKB. As such,the following should be noted with regard to the EM & A of the HAR:

- Environmental monitoring requirements of the HAR may co-incide in many cases with monitoring for TMRW and TKB. As such, monitoring in many cases should not be duplicated, but the data used for overall assessment of cumulative impacts.
- Owing to the larger size and scale of TMRW and TKB construction it is proposed that the assessment criteria to be used during audit of both the construction and operation of the HAR is construction criteria.

11.2 ENVIRONMENTAL MONITORING & AUDIT SCHEUDLES AND ACTION PLANS

Noise, air quality and fresh water quality impacts are the areas of main concern for the construction and operation of the HAR. Outline Monitoring Schedules and Action Plans are detailed in Tables 11.1 to 11.6.

TABLE 11.1

AIR QUALITY - MONITORING SCHEDULE

PARAMETER	OBJECTIVE	TRIGGER LEVEL	ACTION LEVEL	TARGET LEVEL	LOCATION	FREQUENCY/TIMING
Particulates	Baseline assessment	N/A	N/A	N/A	At selected SRs*	For a period of at least two consecutive weeks prior to commencing construction activities. 24hr monitoring continuously, and 1-hr sample 3 times daily to coincide with periods when the highest dust impact is expected.
Particulates	Compliance monitoring	1hr TSP, 24hr TSP ≥ baseline + 30%	Average of Trigger and Target Levels	$500\mu g/m^3$ 1hr average $260\mu g/m^3$ 24hr average	At selected SRs*	At least one 24hr sample every 6 days, 3 one hour samples every 6 days.
**Wind speed	Assessment parameter/ compliance monitoring	N/A	N/A	N/A	Air Quality Monitoring Station and where necessary to account for wind direction with respect to SRs	Continuous
**Wind direction	Assessment parameter/ compliance monitoring	N/A	N/A	N/A	Air Quality Monitoring Station and where necessary to account for wind direction with respect to SRs	Continuous

Note :
- * If possible, environmental monitoring should be conducted at same SRs for TMRW and Route 3 construction, to avoid unnecessary duplication of monitoring.
- ** No values recommended, potential impacts are dependant on the nature of the construction activity. High wind speeds during dusty activities and/or wind direction towards an SR should act as a trigger
- SRs Sensitive Receivers
- N/A Not Applicable

TABLE 11.2

NOISE - OUTLINE MONITORING SCHEDULE

PARAMETER	OBJECTIVE	TRIGGER LEVEL	ACTION LEVEL	TARGET LEVEL	LOCATION	FREQUENCY/TIMING
L_{10}, L_{50}, L_{90}, $L_{Aeq\ (30\ min)}$	Baseline Assessment	N/A	N/A	N/A	NSRs*	24hr monitoring period for one week
L_{10}, L_{50}, L_{90}, $L_{Aeq\ (30\ min)}$	Check Baseline	N/A	N/A	N/A	NSRs*	One 24hr period every 3 months or as near as possible for a typical 24hr period. When construction activities are not taking place
$L_{Aeq\ (30\ min)}$	Spot Check	Background + 5dB(A)	Background + 10dB(A)	Background + 15dB(A)	NSRs*	Minimum of once per week for each NSR during construction activities
$L_{Aeq\ (30\ min)}$	Compliance monitoring (non-restricted daytime hours)	Background + 5dB(A)	Background + 10dB(A)	Background + 15dB(A)	NSRs*	Minimum of 3 times per week between 0700 and 1900hrs, (2300) during general construction work; as appropriate during noisy activities
$L_{Aeq\ (30\ min)}$	Response to complaints (non-restricted daytime hours)	Background + 5dB(A)	Background + 10dB(A)	Background + 15d B(A)	Complainant	As appropriate

Note : NSRs - Noise Sensitive Receivers
N/A - Not Applicable
* If possible, environmental monitoring should be conducted at the same SRs for TMRW and Route 3 construction, to avoid unnecessary duplication of monitoring.

TABLE 11.3

FRESH WATER QUALITY - OUTLINE MONITORING SCHEDULE

PARAMETER	OBJECTIVE	TRIGGER LEVEL	ACTION LEVEL	TARGET LEVEL	LOCATION	FREQUENCY/TIMING
Dissolved oxygen (mg/l and %) Turbidity Suspended solids	Baseline assessment Baseline checking	N/A	N/A	N/A	Selected Monitoring Stations in stream	Prior to commencing construction for a period of 2 months. Check baseline at all the monitoring stations every 3 months.
Dissolved oxygen Suspended solids/ Turbidity	Compliance monitoring	20% deterioration in running background levels	Average of Trigger and Target Levels	30% deterioration in running background levels	Selected Monitoring Stations in stream	During the course of construction daily at each monitoring station
Dissolved Oxygen Suspended Solids/ Turbidity	Compliance monitoring	80% Target Level	Average of Target and Trigger Level	Technical Memorandum Discharge Standard	Main Discharge Points into stream	During the course of construction, twice per week at each main discharge point.

Note : N/A Not applicable

* In the event that the running background level is below the WQO, the Target Level = a level 30% below the running background, or 2mg/l, whichever is greater

TABLE 11.4

AIR QUALITY ACTION PLAN - SUSPENDED PARTICULATES

EVENT	FREQUENCY	ACTION	
		Site Manager	*Contracter*
Breach of Trigger Value	**One sample**	Inform Contractor & RSE	Check working practices
	Two consecutive samples	Inform EPD, contractor and RSE; resample to confirm result	Check working methods/practices to identify any immediate causes; take appropriate remedial action if necessary
Breach of Action Level	**One sample**	Inform EPD, contractor and RSE; resample to confirm result	Check working methods/practices to identify any immediate causes; take appropriate remedial action if necessary
	Two consecutive samples	Inform EPD, contractor and RSE; resample to confirm result Increase frequency of monitoring to daily Propose remedial action to contractor and RSE Continue monitoring after completion of remedial action to confirm action is effective Record events in monitoring report for submission to the contractor and EPD	Review dust sources: plant, equipment and working procedures, impose necessary mitigation measures Ensure implementation of remedial action Inform EPD of remedial action Amend method statement, if appropriate
Breach of Target Level	**One sample**	Inform EPD, contractor and RSE; Confirm result & increase monitoring frequency to daily Propose remedial action to contractor and RSE Undertake monitoring at nearest SR Continue monitoring after completion of remedial action to confirm action is effective Complete Monitoring Report and submit to contractor and EPD	Undertake immediate check of activities plant and equipment and employ any appropriate mitigation. In extreme cases cease activities Ensure corrective action has been undertaken as proposed by (monitoring team) and is effective Amend method statement, if appropriate Inform EPD of remedial action

TABLE 11.5

NOISE ACTION PLAN

EVENT	ACTION	
	Site Manager	*Contractor*
Breach of: daytime (unrestricted hours) **Trigger value**	Inform contractor, RSE	Investigate complaint***
Breach of: daytime (unrestricted hours) **Action Value;** 1 complaint	Inform contractor, EPD, RSE; resample at NSR to confirm monitoring result ($L_{Aeq\ (5\ min)}$) within restricted hours, $L_{Aeq\ (30\ min)}$ outside restricted hours) **Submit report to EPD within two weeks of receipt of complaint should the measured noise level exceed the Target, proposals to reduce noise should be recommended in the report	Check working methods, practices, to identify causes, take appropriate remedial action if necessary Inform EPD of remedial action taken
* 2 complaints	Inform contractor, EPD, RSE; resample to confirm monitoring result ($L_{Aeq\ (5\ min)}$ within restricted hours, $L_{Aeq\ (30\ min)}$ outside restricted hours) Increase frequency of monitoring at affected NSRs to at least two measurements per time period or daily as appropriate Propose remedial action Continue monitoring after completion of remedial action to confirm was effective, - **until no further complaint is received within two weeks of the last complaint **Submit report to EPD within two weeks of receipt of complaint should the measured noise level exceed the target, proposal to reduce noise should be recommended in report. Confirm corrective action has been undertaken and is effective in monitoring and audit report	Undertake detailed check of working methods and practices. Investigate complaint and increase impact monitoring*** Undertake appropriate remedial action and provide evidence of having done so Ensure corrective action has been undertaken and is effective Amend method statement if appropriate Inform EPD of remedial Action

Note: * In the event of creeping ambient levels, Trigger Level = 1 complaint, Action Level = 2 complaints

** Action associated with response to complaints

*** The action plan for the target level should be adopted and implemented whenever the noise levels measured during any complaint investigation exceed the appropriate target level.

TABLE 11.5 (continued)

NOISE ACTION PLAN

EVENT		ACTION
	Site Manager	*Contractor*
Breach of:	Inform contractor RSE, EPD	Review noise sources and working procedures and methods
daytime (unrestricted hours)/**Target Value,**	Confirm monitoring result and repeat measurement for a further 15 minutes (3x5 min) and 30 minutes respectively for exceedence of Target level within and outside restricted hours following the implementation of noise reduction measures	In extreme cases cease activities
	Increase frequency of monitoring	Undertake immediate check of construction activities and employ appropriate mitigation.
	Propose remedial action	Ensure implementation of immediate remedial action as proposed by monitoring personnel
		Inform EPD of remedial Action
	Confirm corrective action has been undertaken and is effective in monitoring and audit report	

Note: * In the event of creeping ambient levels, Trigger Level = 1 complaint, Action Level = 2 complaints
** Action associated with response to complaints

TABLE 11.6

FRESH WATER QUALITY ACTION PLAN - SUSPENDED SOLIDS AND DISSOLVED OXYGEN

EVENT	FREQUENCY	ACTION		
		Monitoring Team	*RSE/Site Manager*	*Contractor*
Breach of Trigger Value	One sample	Inform contractor & RSE		
	Two consecutive samples	Inform EPD, contractor and RSE; resample to confirm result	Check working methods/practices to identify any immediate causes; take appropriate remedial action if necessary	
Breach of Action Level	One sample	Inform EPD, contractor and RSE; resample to confirm result	Check working methods/practices to identify any immediate causes; take appropriate remedial action if necessary	
	Two consecutive samples	Inform EPD, contractor and RSE; resample to confirm result	Undertake detailed check of working methods and practices	Review plant, equipment and working procedures
		Increase frequency of monitoring		
		Propose remedial action	Carry out appropriate remedial action as recommended by environmental monitoring team	Ensure implementation of remedial action
		Continue monitoring after completion of remedial action to confirm action is effective	Ensure corrective action has been undertaken and is effective	Inform EPD of remedial action
		Record event in monitoring report for submission to contractor and EPD	Amend method statement, if appropriate	
Breach of Target Level	One sample	Inform EPD, contractor and RSE;	Under take immediate check of activities and employ any appropriate mitigation.	Review plant, equipment and working procedures
		Confirm result & increase monitoring frequency	In extreme cases cease activities	Ensure immediate implementation of remedial action
		Propose remedial action	Ensure corrective action has been undertaken as proposed by (monitoring team) and is effective	
		Undertake monitoring at nearest water quality SR	Amend method statement, if appropriate	Inform EPD of remedial action
		Continue monitoring after completion of remedial action to confirm action is effective		
		Complete Monitoring Report and submit to contractor and EPD		

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 12

12. CONCLUSIONS AND RECOMMENDATIONS

12.1 INTRODUCTION

An environmental assessment of the proposed haul/access road (HAR) has been carried out, and the key environmental issues are addressed in preceding chapters. Appropriate mitigation measures have also been recommended for incorporation, wherever possible, into the contract documents; with specific measures to be agreed with EPD. This Chapter summarises the findings and recommendations of the impact assessment, and discusses the feasibility of the proposed HAR in an environmental context.

12.2 KEY ENVIRONMENTAL ISSUES

12.2.1 Air Quality

Dust levels in the area next to the HAR have been predicted based on a set of concurrent works, including the construction of Ting Kau Bridge (TKB), the construction and operation of the HAR, and the widening of Tuen Mun Road. The results indicate that the majority of sensitive receivers in the vicinity of the area will be exposed to TSP levels exceeding both the 1-hour average and 24-hour average criteria. However, the TKB construction is expected to be the major contributor with an associated dust emission rate of 55.7 g/s; construction of the HAR and its potential traffic flow have relatively lower dust emission rates of 1.56 g/s and 18.5 g/s respectively.

Dust suppression measures have been discussed in Chapter 4. Reductions in dust levels were estimated to be about 50% for water spraying on exposed earth surfaces, and up to 80% with the use of chemical stabilisers on inactive or completed cuts and fills. Dust control measures should be incorporated in the contract documents and the contractor should follow the "Guidelines on Dust Suppression Measures for Construction Sites, March 1992". However, due to the concurrent nature of the various projects, the mitigation measures proposed may be inadequate to bring dust levels within acceptable limits particularly if dry and windy conditions prevail.

12.2.2 Noise

In the areas adjacent to the HAR, 31 representative noise sensitive receivers (NSRs) have been selected for the noise assessment. Noise levels due to the HAR construction were estimated based on a schedule of construction equipment with the equipment sound power levels (SWL) as outlined in the "Technical Memorandum on Noise from Construction Work other than Percussive Piling". A daytime assessment criterion of 75 dB(A) L_{eq} (30min) was adopted. Due to the proximity of the receivers, it is estimated that 94% of the selected NSRs will be exposed to noise levels exceeding the noise limit.

The assessment also included an alternate set of modelling results based on a lower SWL for dumptrucks according to BS 5228: Part 1: 1984. Although the resulting facade noise levels are reduced, with the percentage of affected NSRs reduced to 70%, the results show that the calculated levels still significantly exceed 75 dB(A) L_{eq} at the facades of the selected NSRs close to the HAR alignment.

A significant impact is therefore anticipated and reduction in noise levels can be achieved with silenced equipment (5-10 dB(A)), partial or full enclosures of noise generating equipment (10 and 25 dB(A) respectively), and the use of barriers (5-10 dB(A)). The noise mitigation measures discussed in Chapter 5 would need to be adopted where practicable in order to reduce noise levels at the NSRs.

In the assessment of HAR operation noise, the noise impact due to other construction activities (associated with the TKB project) was included to obtain the cumulative noise levels at the selected NSRs. Without the HAR, it is found that most receivers will be exposed to high construction noise levels well over the 75 dB(A) L_{eq}(30min) criterion, with the exception of two NSRs where the predicted noise levels are 74 dB(A). On average, the HAR operation will lead to an increase of 1.3 dB(A) over the above noise levels.

The two NSRs where the predicted noise levels without the HAR are 74 dB(A), would have their combined noise levels increased by 2 - 3 dB(A) due to the HAR operation. Mitigation measures at the receivers, as recommended in the previous *TKB Section EIA* report, such as double glazing and air conditioning are also deemed appropriate for these two NSRs.

12.2.3 Water Quality

During the construction phase of the HAR, compounding effects would result from any impacts on the fresh water system being transferred to the marine environment via direct input from the catchment. The main potential impacts will arise from run-off with high concentrations of suspended solids (SS) from open earthworks areas, release of liquors from the concrete batching plant, and spillage, leakages and disposal of fuel oils, lubricants, etc. used by construction plant.

The main potential marine water impacts would be associated with loss of material during the reclamation process. It is recommended that loss of material in the form of suspended solids in prevented either by the environmentally preferred method of constructing the sea wall first or by alternative mitigation measures such as silt curtains. Effective mitigation to prevent impacts to the nearby sensitive receivers must be applied.

In view of the above potential for impacts, prevention and control measures as discussed in Chapter 6 should be applied wherever practicable. In addition, suitable clauses should be included in contract documentation requiring the implementation of such measures.

The main sources of potential contamination in the HAR operational phase will be the transportation and handling of spoil, and wastes derived from the batching plant and its associated operations (including transportation of concrete and materials and aggregate deliveries by barge). Potential resultant run-off and transfer of material to fresh and marine waters will need to controlled by measures recommended in Chapter 6 wherever practicable. It is also recommended that clauses be included in contracts to again necessitate such prevention measures.

12.2.4 Spoil and Fill

Due to the steep topography of the area, the construction of the HAR will involve cut and fill activities to accomodate the route. The spoil arisings are estimated to be in excess of fill requirements, and surplus of spoil material could be used for the construction of the proposed reclamation at the Ting Kau headland, which requires a large quantity of spoil for seawall and reclamation fill. There are, therefore, not expected to be problems associated with disposal. However, some of the construction activities, such as production and handling of spoil on-site, temporary stockpiling, and barge loading procedures, have the potential to impact the environment. In most cases, options are available and is important that the most practical/feasible options (with least environmental impact) should be considered for selection.

In its operational phase, the HAR will function as a route to the major excavation works for the TKB project, and road widening cuttings along Tuen Mun Road (TMRW project). The transport of spoil may also cause potential impacts during the movement of material (i.e. by road and marine barge), and handling and transport activities (at the works area or disposal site). Some specific environmental protection and mitigation measures have been proposed in Chapter 7 to minimise potential impacts during construction and use of the HAR.

12.2.5 Landscape and Visual Impacts

Landscape and visual impact assessment was carried out in order to identify visual impacts imposed by the HAR during construction and operation. The main features of the HAR that would cause significant landscape impacts are from areas of cutting, embankment and bridges. Severe visual impact was anticipated at receivers with direct views including residential properties north of Tuen Mun Expressway and Castle Peak Road (above Ting Kau village), and Lido Beach visitors. Since the HAR is a short term project (about 4 years in total for construction and operation), mitigation measures were recommended with emphasis on treatment of short term visual impacts. The major part of the mitigation proposal would be the restoration of the HAR once its operational phase is completed, and this is detailed in Chapter 8.

Landscape and visual impact of the HAR will become less significant as the major construction associated with the TKB route corridor progresses, and forms the dominant element within the overall view.

12.2.6 Community Issues

The impacts arising during the 6 month construction period and four year use of the HAR will be temporary. The impacts to the Ting Kau community and the surrounding areas are, however, potentially significant. They will be in the form of: severance to access and traffic routes; general disruption affecting residents mobility; disturbance due to air quality deterioration and noise level increases; loss of amenity and recreation at Lido Beach due to the construction activities located there; temporary landtake and the cumulative effects on land value. In view of the TKB being constructed, the HAR is not anticipated to impact on land value and development potential of the area in the long term.

The scope for mitigation of landuse impacts will be limited during the HAR construction period. Various recommendations have been discussed in Chapter 9, in particular attention should be paid to the siting of construction activities as far as practicable from sensitive receivers, and to the temporary restoration works on completion of construction. The latter should also be considered as a contractual requirement. A majority of operational impacts would have been mitigated to an extent by recommended measures for noise and air pollution control, and landscape considerations in preceding Chapters. However, to maintain both recreational and amenity value of the affected areas, measures should be taken where practicable in temporary restoration and also the ultimate reinstatement.

12.2.7 Ecology

Terrestrial Ecology

The primary residual impact on terrestrial ecology would be loss of riparian and adjacent woodlands and the habitats they provide. These woodlands provide diverse and complex habitats made more important by their proximity to a freshwater stream. Because of the cumulative impacts of the HAR construction and operation, followed by construction of the Route 3 Ting Kau Bridge Section, it is assumed that much of the existing woodland habitat will be lost, and that undisturbed, nearby seed sources will be few.

Therefore, the success of the habitat restoration programme will depend primarily on the success of replanting as opposed to natural re-colonisation. Restoration of the existing floral community diversity would require ten or more years, during which much of the value of the area for birds and invertebrate wildlife will be lost. It is therefore important that the re-vegetation programme include native species of trees and shrubs which are represented in the baseline surveys.

Aquatic Ecology

Construction and operation of the HAR and associated slope works will cause severe residual impacts to aquatic ecological resources. Embankment works would cause sedimentation of the downstream channel in addition to loss of the riparian habitats directly affected by embankment works. It is probable that the adverse impacts could not be mitigated in the near term without removing the proposed disturbance areas from the immediate vicinity of the stream channel.

Following project completion, a re-created stream course could achieve pre-disturbance levels of biological productivity. This process would require substantial capital investment over many years due to the time required for regrowth of mature riparian vegetation.