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 -
Tai Lam Tunnel and Yuen Long Approach Road

Environmental Assessment - Supplementary Paper

Conveyor System

FREEMAN FOX MAUNSELL

EIA-033.5/BC

ROUTE 3

COUNTRY PARK SECTION

AND TING KAU BRIDGE

PRELIMINARY DESIGN STAGE 2

Country Park Section - Tai Lam Tunnel & Yuen Long Approach

Environmental Assessment - Supplementary Paper

Conveyor System

March 1994

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

CS	Conveyor System
CPS	Country Park Section
TLT & YLA	Tai Lam Tunnel and Yuen Long Approach Road
HKAQO	Hong Kong Air Quality Objectives
NSR	Noise Sensitive Receiver
TSP	Total Suspended Particulates
FDM	Fugitive Dust Model
USEPA	United States Environmental Protection Agency
WBWCZ	Western Buffer Water Control Zone
SS	Suspended Solid
BOD	Biochemical Oxygen Demand
SSSI	Site of Special Scientific Interest
AFD	Agriculture and Fisheries Department
WC	Works Checker

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

CHAPTER 1

1. INTRODUCTION

1.1 BACKGROUND

The Route 3 Country Park Section (CPS) project has been divided into two sub sections; the Tai Lam Tunnel and Yuen Long Approach Road (TLT & YLA) and the Ting Kau Bridge (TKB). This Supplementary Paper is part of the EIA for the TLT & YLA Section.

The Preliminary Design process has identified the need to remove about 6Mm^3 of excavated spoil material from an area to the south of the Southern Tai Lam Tunnel Portal. The possibility of disposal by haulage using trucks was considered impractical and environmentally unacceptable. The need for a conveyor system to transport the spoil to a barge loading area at the Rambler Channel was identified.

The excavation work is expected to take more than two years starting from January 1995. After excavation work is completed. The conveyor will be removed and the route will be reinstated to replace any disturbed vegetation.

This report is a supplementary paper as a part of the Environmental Impact Assessment for Route 3 (CPS - TLT & YLA) to assess the environmental implications related to both construction and operation of such a Conveyor System (CS).

Consideration of possible conveyor system routes and locations for a barge loading facility along the northern coastline of the Rambler Channel led to four possible alignments being identified during this Preliminary Design stage. Factors taken into account in this selection included the need to identify suitable crossing points over Tuen Mun Road and Castle Peak Road, the topography and gradients, impacts on residential areas and the need for a suitable barge loading area at the shore/sea level. The four alignments are shown in Figure 1.1 and briefly described below:

- Alignment A represents the shortest route for excavated material to reach the sea shore from the construction site (locations where spoil will arise). However, this route would bring disturbance to local residences and require the barge loading point to be set up at Lido Beach and involve temporary closure of at least part, and possibly all of this very popular beach.

- Alignment B will require the barge loading point to be erected at the seashore between Casam Beach and Hoi Mei Beach both of which are gazetted beaches. In addition the surrounding area includes residential accomodation.

- Alignment C leads to a barge loading point off the Gemini Headland which is located between the two Gemini Beaches. This alignment appeared to be the best option of the other possible alignments. Since the small headland at Gemini Beaches provides a platform slanting gently to the sea, which therefore appears to be the most suitable

location for the barge loading point. The route is also some distance from significantly populated areas and major gazetted beaches in the vicinity. This alignment will be discussed in detail in the following chapters in relation to key environmental implications.

- Alignment D would require the barge loading facilities to be accommodated along the seashore between the Gemini Beaches and Sham Tseng. The steep slopes in these areas will require a massive structure intruding over a great distance off the shore thereby causing unacceptable interference with the marine traffic using the Ma Wan Channel. For this reason and also due to the proximity of residential areas north of Tuen Mun Road this is not a viable option.

Alignments A, B and D were rejected as not viable on feasibility and practicality grounds and alignment C was identified for further study. The proposed alignment of the Conveyor System (Alignment C) is presented in Figure 1.2.

1.2 SCOPE OF THE STUDY

The scope of the study draws broadly upon the Route 3 - CPS Stage 2 Preliminary Design, Environmental Impact Assessment, Study Brief No. CE27/92. A draft scope for the Study was prepared and forwarded to EPD and Highways department for comments. The draft scope and EPD's comments are included as Appendices A1 and A2 respectively. In common with the overall study, a number of environmental issues have been addressed including :

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

1.3 STUDY AREA

The Study Area is bounded by the Rambler Channel to the south, and the Tai Lam Country Park to the north and includes the area shown in Figure 1.1.

1.4 EXISTING ENVIRONMENT

1.4.1 General

The Study Area encompasses the hillsides and coastal area between Tuen Mun Road in the north and the Rambler Channel to the south. Between Castle Peak Road and Tuen Mun Road there is an undeveloped area with a slow rising hillside towards a peak at approximately 130m. In this area there are a few footpaths crossing over the hill, which are mainly used for

recreation.

The settlement pattern is dispersed, with a mixture of high-rise and low-rise development along the coast. The development at present is not dense, but new residential blocks are being built along Castle Peak Road towards Tsuen Wan. There is no major industrial development within this part of the Study Area.

The traffic in the area includes some from the local residential developments. The road network consists of Tuen Mun Road (between Tsuen Wan and Tuen Mun) and Castle Peak Road, being the original link between the settlements along the coast.

The details of the existing environment of the Study Area are described in Chapter 3 of each of the Final Reports for Route 3 Country Park Section EIA, TKB and TLT & YLA. The key aspects of the existing environmental quality are briefly described below:

1.4.1 Air Quality

Baseline air quality monitoring was carried out as part of the Stage 1 studies in 1990, 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).

1.4.2 Noise

A baseline noise survey was carried out during April and May 1993 to determine background noise levels in the area. A Stage 1 survey has been reviewed to supplement the measured data and to establish an overall picture of the noise levels in the area. The area is characterized by it's 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.

1.4.3 Water Quality

Discharges from Tsing Yi and in the north into Rambler Channel and the sea from small watercourses are generally clean and silt free. There is usually little flow in these streams with the exception of extraordinary weather conditions and they do not run through any heavy industrial areas. However, there are outfalls into Rambler Channel that are polluted by squatter areas and unsewered development.

There are a number of gazetted beaches along Rambler Channel and one on Ma Wan that are within or adjacent to the Study Area.

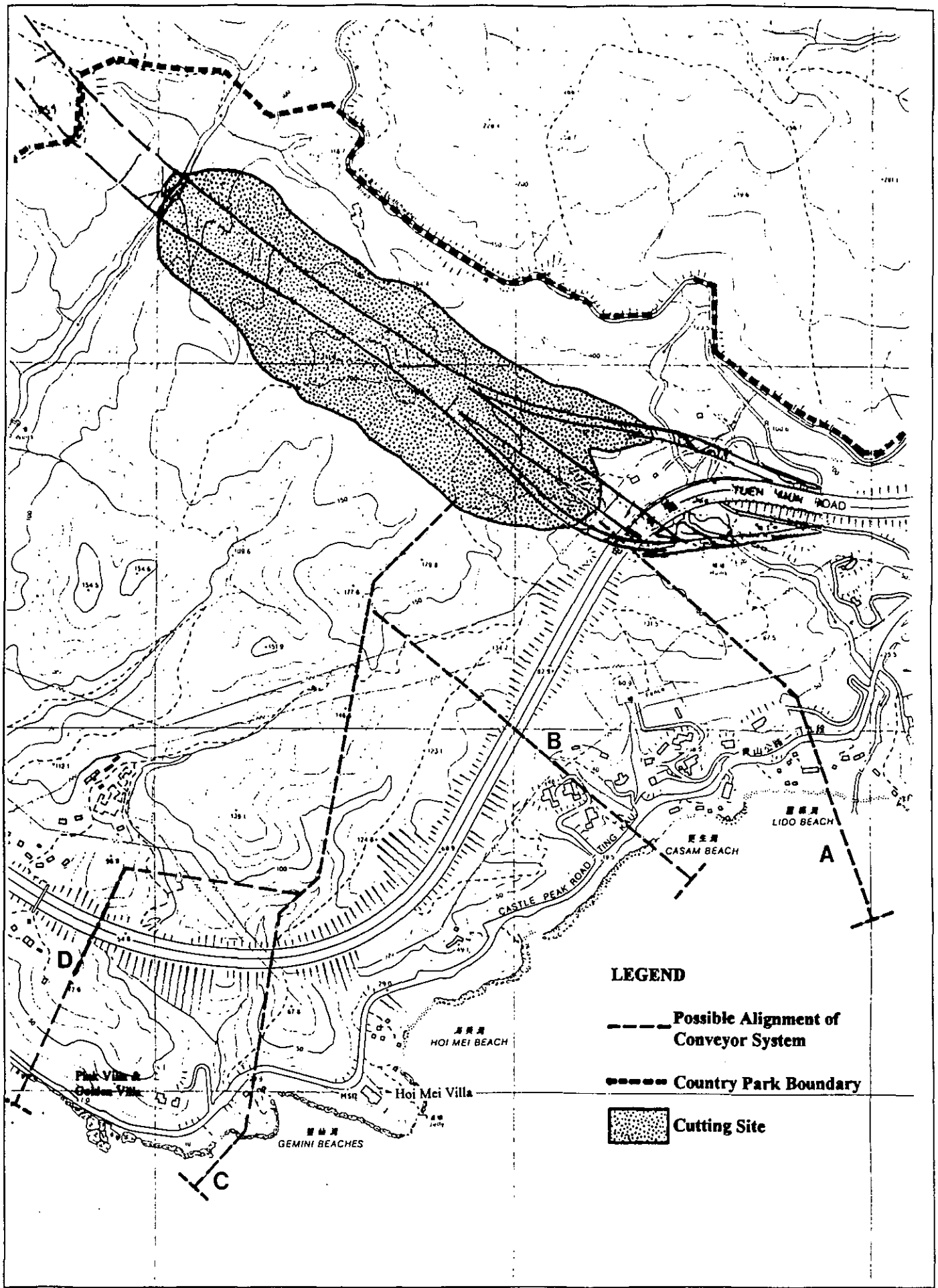
In the government publication "Bacteriological Water Quality of the Bathing Beaches in Hong Kong"(EPD,1991, 1992) beaches are ranked "good", "fair", "poor" or "very poor" depending on *E. coli* level in the water. No beaches in the area are ranked "good" in the report for 1992, but Casam and Lido

beaches on the mainland and Tung Wan on Ma Wan are ranked as " fair", Gemini beach has been downgraded from being "fair" (1992) to "poor" (1993). Further, Approach, Ho Mei Wan, Angler's and Ting Kau beaches are ranked as "poor" and are unsuitable for swimming.

1.5 STRUCTURE OF THE REPORT

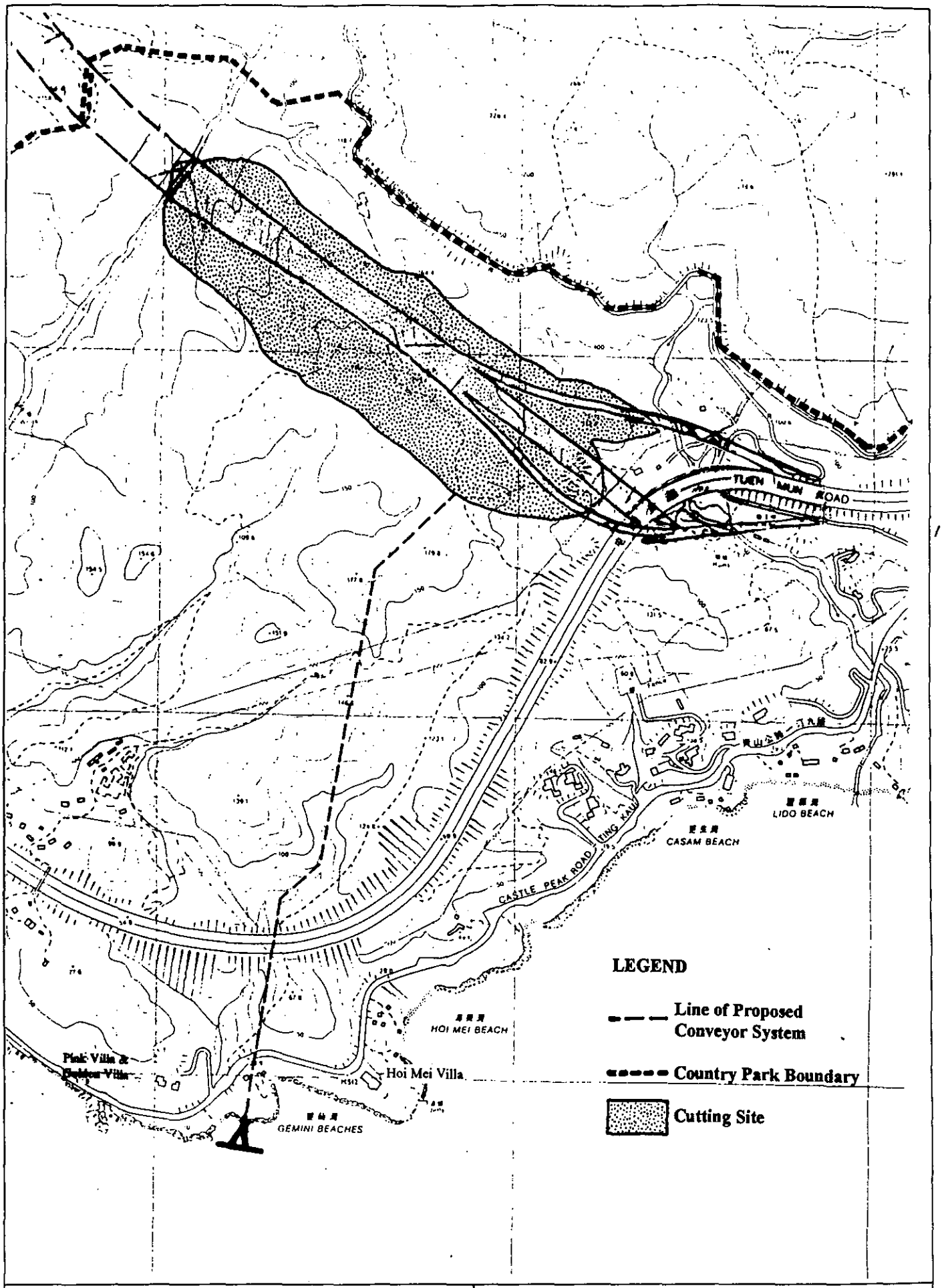
In addition to this introductory chapter, this Supplementary Paper comprises nine further chapters and appendices as follows:

- **Chapter 2** details the project in terms of the structural requirements, construction activities and operational phase.
- **Chapter 3 - 9** details the environmental implications, involving the assessment of the alignment: air, noise and water quality, spoil management, landscape and visual assessment, ecology, and environmental monitoring and audit.
- **Chapter 10** provides the overall conclusion resulting from the environmental assessment of the Conveyor System and recommendations.



FREEMAN FOX MAUNSELL

Job Title	ROUTE 3 CPS - TLT&YLA CONVEYOR SYSTEM SUPPLEMENTARY PAPER	
Dwg. Title	FOUR POSSIBLE ALIGNMENTS OF THE CONVEYOR SYSTEM	
Date: JAN , 94	Scale : N.T.S.	Figure No.: 1.1



FREEMAN FOX MAUNSELL

Job Title	ROUTE 3 CPS - TLT&YLA CONVEYOR SYSTEM SUPPLEMENTARY PAPER	
Dwg. Title	PROPOSED CONVEYOR SYSTEM ALIGNMENT	
Date: JAN , 94	Scale : N.T.S.	Figure No.: 1.2

PROJECT DESCRIPTION

CHAPTER 2

2. PROJECT DESCRIPTION

2.1 GENERAL

The proposed Conveyor System alignment is shown in Figure 1.2. It runs across the hill contours and ridges from the southern tunnel portal, and leads to a barge loading point off the Gemini headland; the headland between the Gemini Beaches. The Conveyor System will run at grade, and will only be elevated in the stretch which passes over Tuen Mun Road and Castle Peak Road.

A typical Conveyor System has been assumed to enable the feasibility of this spoil disposal method to be assessed. The actual disposal system will be chosen and designed by the Contractor.

A 30m wide corridor will be set aside to enable provision of the conveyor alignment and an access road (5 to 6m wide) plus the Conveyor Systems transfer points. The access road will be temporary structure that will approximately follow the conveyor system alignment. It shall be partially sealed and will not entail any large cut or fill requirements. Not all of the corridor will be used all of the time.

The Conveyor System will need to transfer approximately 1,000 m^3/hour. This would be required to operate for 10 hours a day, for a 600 day period, to move the 6 Mm^3 of material. The width of the conveyor might typically be about 1.5 metres and an operating speed of about 2 to 2.3 metres per second has been assumed. Such conveyors are often limited to operating at a maximum angle of 18 degrees, or about 1 in 3. It is assumed that gentle change of gradient can be achieved within a straight length of conveyor. The total length of the conveyor is approximately 1000m.

2.2 STRUCTURAL CONSIDERATION

The main features of the Conveyor System comprises:

- Crushing plant - the conveyor would be fed by a crusher which would reduce the rock to a maximum size of 250mm. The crusher in turn would be fed by dump trucks operating between the excavation site and the crusher, and a series of haul roads would need to be established as the cutting is formed.

- Conveyor corridor - an assumed 1.5 metres width of conveyor belt will be constructed and an assumed maximum band width of 30 metres will be directly affected by the conveyor.

- Transfer points - When a change in direction is required there would be a need for a surge bin/hopper; for this proposed route up to five surge bins/hoppers would be required between the sections of conveyor.

- The conveyor is elevated when it crosses the Tuen Mun Road and Castle Peak Road.

- Barge loading system - The Conveyor System would feed onto a barge loading system at the headland of Gemini Beach. It is envisaged that two separate conveyors with means of directing the flow from one to the other will be used. In this way the main flow on the conveyor could be maintained while the loading of the subsequent barge commences. The barge loading jetty would therefore accommodate at least two barges at any one time.

2.3 CONSTRUCTION PHASE

2.3.1 Construction programme

It is understood that the construction works of the TLT & YLA are anticipated to start in January 1995 and an overall period of approximately 2 ½ years is required. The Conveyor System will take between 3 to 6 months to construct and it would then operate for about 2 years until the excavation is completed.

2.3.2 Construction Activities

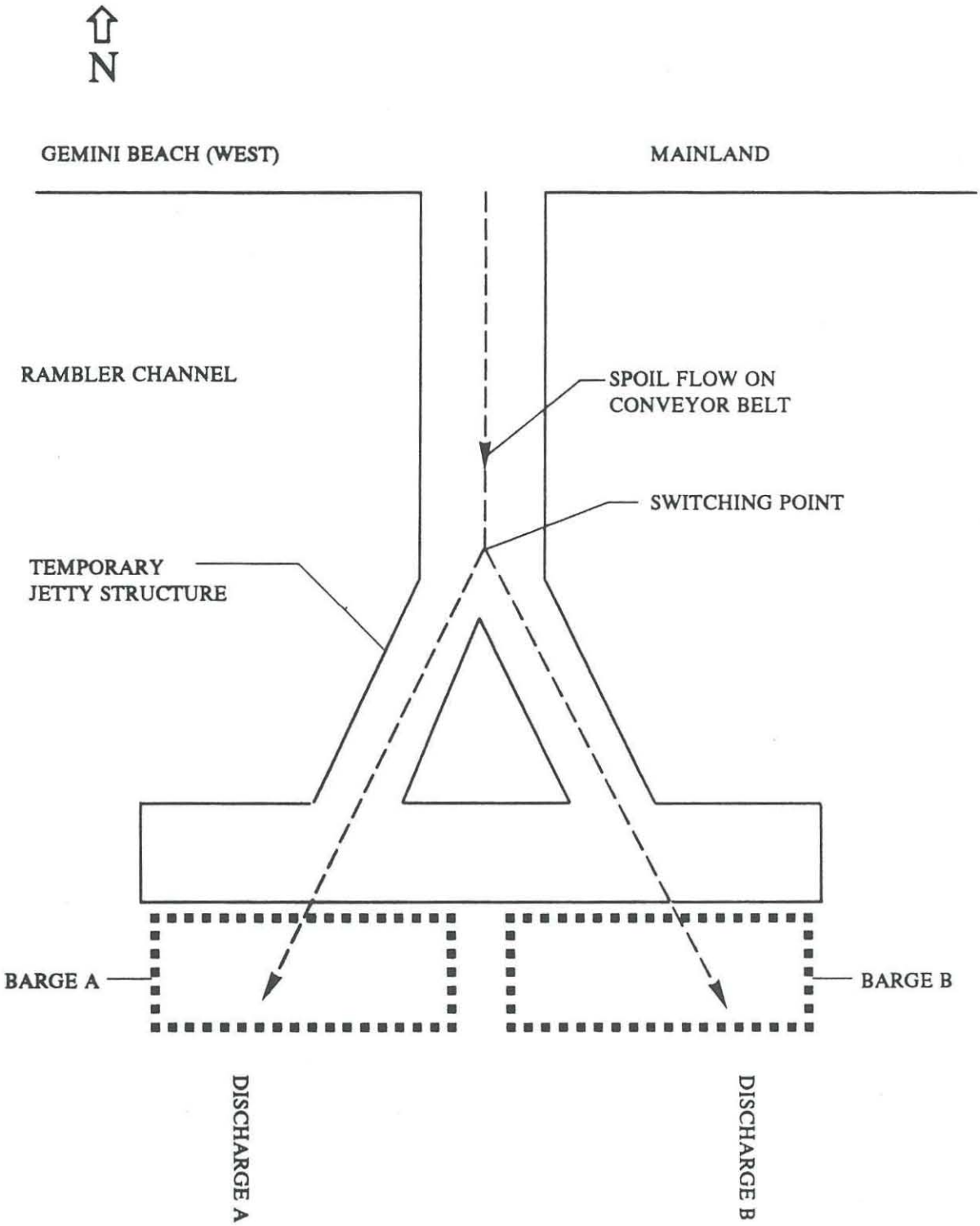
- No major earthworks along the conveyor corridor will be required and cuttings will be to depths of 1-2m at most.

- It is envisaged that a piled jetty will be constructed and therefore no reclamation and dredging is required for the construction of the barge loading jetty . The jetty will be a temporary structure to be removed after use. Bored piling may be preferred provided that it is feasible in this location. This will partly depend on sea bed geology. If marine sands are present piling is possible. However if bed rock is present then concrete foundation support blocks will need to be positioned to allow concrete piers to be constructed upon them.

2.4 OPERATIONAL PHASE

The Conveyor System will be in use for about 2 years with the actual design being determined by the Contractor during the detailed design stage. The operational system is therefore unknown at this stage and the assessment of the impacts arising from the operation phase had been carried out on the basis of the outline design parameters.

Again there is no detailed design for the barge loading system at this stage. The outline design of the barge loading system is shown in Figure 2.1. It is proposed that the Conveyor System should have a 'Y' shaped feeding point arrangement on the jetty which will permit switching of the flow of material from one barge to another. During the operation period the eastern Gemini beach could remain open to the public, only the western beach and part of the headland including the access road to the beach would have to be temporarily closed.



PLAN VIEW

FREEMAN FOX MAUNSELL	Job Title: ROUTE 3 CPS - TLT&YLA CONVEYOR SYSTEM SUPPLEMENTARY PAPER		
	Dwg. Title: OUTLINE DESIGN OF THE BARGE LOADING SYSTEM		
	Date: JAN , 94	Scale : N.T.S	Figure No.: 2.1

NOISE

CHAPTER 3

3. NOISE

3.1 INTRODUCTION

During the construction of the TLT & YLA sections of Route 3, a massive excavation between the Tai Lam Tunnel South Portal and Tuen Mun Road is expected and will result in a large volume of spoil. A conveyor system is proposed to transport and dispose the spoil from the construction site to the seashore. The spoil will then be sent for reuse to sites by sea transport such as barges. The system will be operated for about 10 hours a day (during daytime).

Piling may be required for the construction of the barge loading area. At the moment, details and feasibility of the construction method have not been confirmed. However, any works related to percussive piling will be controlled by the EPD's "Technical Memorandum on Noise from Percussive Piling".

Since no major earthworks will be involved and the construction period of the conveyor system is expected to be short, the associated construction noise impact will not be further investigated. This Chapter presents the operational noise impact assessment of the conveyor system and recommends mitigation measures, if necessary.

3.2 NOISE SENSITIVE RECEIVERS

Within the Study Area, most of the noise sensitive receivers (NSRs) are located either at a significant distance from the conveyor system or are screened by the local topography. Two noise sensitive areas have been identified as critical to this study and are shown in Figure 1.2. These include Pink Villa and Golden Villa to the west of the conveyor system and Hoi Mei Villa to the east of it and have direct line of sight of the barge loading point.

Table 3.1 shows the estimated distances of the NSRs from the conveyor system.

Table 3.1 Shortest Distances between the NSRs and the Conveyor System

NSRs	Shortest Distance from the Conveyor System (m)
Pink Villa and Golden Villa	90
Hoi Mei Villa	150

Pink Villa and Golden Villa

These 3-storey buildings are adjacent to and overlook the Castle Peak Road. They have lines of sight to the Tuen Mun Road and the proposed conveyor system.

Hoi Mei Villa

The house is located at the headland of Hoi Mei Beach and is adjacent to the Castle Peak Road. This one-storey government property is unoccupied at the moment but might be changed to a museum or a viewing platform for the PADS project. It will overlook the proposed jetty to the its south-west.

3.3 OPERATIONAL NOISE ASSESSMENT

3.3.1 Existing Background Noise

The ambient noise in the Study Area is dominated by the traffic along Castle Peak Road with minor contribution from the Tuen Mun Road to the south. Spot noise measurements have been carried out at the road side of Castle Peak Road and opposite to the Pink Villa during daytime. The results are summarised as follows:

Table 3.2 Ambient Noise Measurement

Noise Level, dB(A), 5 min			
L_{10}	L_{50}	L_{90}	L_{eq}
75	61	56	71

The measured L_{90} is only 56 dB(A) which indicates a general low background noise level. However, the traffic noise dominates the existing noise environment with the measured L_{10} attending 75 dB(A).

3.3.2 Noise Characteristic

The operational noises will be characterized by the engine noise as well as the impact noise generated during the spoil transfer system's operation. Engine noise will be contributed mainly from the vehicles at the excavation site, drives of the conveyor systems and tug boats at the loading jetty. Impact noise will originate from the continuous stream of excavated materials transferring over the conveyors or falling into the hoppers.

It is expected that the above will be the key activities that would affect the noise environment in this area besides the road traffic noise.

3.3.3 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) $_{Leq\ (30\ min)}$ for construction work in urban areas. For the purpose of this assessment, this limit has been taken as the daytime assessment criterion.

3.3.4 Methodology

Noise data as measured from an overland conveyor system in the UK is used for the assessment. These include:

(i) Noise level at 10m from an enclosed drive house is around 62 dB(A); and

(ii) Noise level at 20m from the covered conveyor along its general run is 49 dB(A).

Sound power levels of the other equipment are based on EPD's "Technical Memorandum on Noise from Construction Work other than Percussive Piling". The noise data is summarised in Table 3.3.

Table 3.3 Noisy Activities/Equipment and Associated Sound Power Levels

Activities/Equipment	Sound Power Level, dB(A)
Tug Boats at the Jetty (two)	113
Conveyor (covered)	67
Drive House (enclosed)	90

The location of the drive house is not yet determined. The worst-case scenario is assumed with a drive house located at the headland of Gemini Beach and therefore close to the NSRs. Dump truck movements are likely to be limited at the excavation site which is far away from the NSRs, and is therefore not taken into consideration.

In the assessment, the conveyor line is treated as a line source while the other activities/equipment are regarded as discrete point sources. Noise levels at the worst-affected facades of NSRs are predicted using standard acoustic principles.

3.3.5 Impact Assessment

The results of the noise modelling are summarised in Table 3.4. The predicted noise levels at the NSRs are found to be well below the 75 dB(A) criterion. NSRs at Pink Villa and Golden Villa (69 dB(A)) will be exposed

to a relatively high noise level when compared to that at Hoi Mei Villa (65 dB(A)).

Table 3.4 Predicted Noise Levels

Noise Sensitive Receiver	Predicted Facade Noise Level, dB(A)
Pink Villa and Golden Villa	69
Hoi Mei Villa	65

3.3.6 Recommendation

The operational noise impact of the proposed conveyor system is predicted to be insignificant with enclosed drive houses and conveyor belts. The following measures are proposed, however, to further minimize and monitor the probable noise nuisance:

(i) Noisy installations such as the drive house should be sited away from the NSRs as far as possible and should be properly enclosed;

(ii) Regular maintenance and checking of the system and enclosures should be carried out to ensure its effectiveness; and

(iii) Parallel operation of noisy activities should be avoided.

(iv) monitoring and audit programmes need to be implemented during operation of the CS.

AIR QUALITY

CHAPTER 4

4. AIR QUALITY

4.1 INTRODUCTION

Massive cuttings will be required near the southern portal of the Tai Lam Tunnel and will result in a large volume of excavated materials. The proposed conveyor system will be used to transport the spoil to barges which will remove it to the reuse site.

No major earthworks will be required for the construction of the conveyor system. The associated dust impact is therefore expected to be insignificant. Hence, only the operational dust impact is discussed in the following sections.

4.2 AIR SENSITIVE RECEIVERS

The northern section of the conveyor system aligns with the hill slopes and is isolated from the sensitive receivers. At the southern end next to the barge loading jetty, two groups of receivers have been identified. The 3 storey residential buildings, Pink Villa and Golden Villa, are located at about 90m to the west of the conveyor. The Hoi Mei Villa is located at about 150m to the east of the conveyor and is unoccupied at the moment. The above receivers are shown in Figure 1.2.

4.3 OPERATIONAL DUST ASSESSMENT

4.3.1 Background Air Quality

The ambient air quality information is based on the short-term air quality monitoring which was conducted from 14 September to 11 October 1990 on Tsing Yi Island (Ching Pak House in Cheung Ching Estate). The mean Total Suspended Particulates (TSP) concentration was 72 $\mu g/m^3$ (from "Route 3 Technical Report No. 13: Environmental Impact Assessment (Draft)", SPHW, November 1990). It is used to represent the background pollutant levels in the Study Area and is included in the results as shown in Section 4.3.6.

4.3.2 Assessment Criteria

For construction dust, EPD's maximum acceptable TSP level in air over a one-hour period is 500 $\mu g/m^3$. According to the Hong Kong Air Quality Objectives (HKAQOs), the maximum acceptable TSP concentration averaged over a 24-hour period is 260 $\mu g/m^3$.

4.3.3 Model

The Fugitive Dust Model (FDM) was used to assess the operational phase dust (TSP) emissions. This model is designed to calculate dust concentration

and deposition from point, line, or area dust sources.

4.3.4 Dust Sources and Emission Factors

The major dust sources include the transfer points, discharge locations and the conveyor belts etc. Five activities have been identified as the key fugitive dust sources. These include:

(i) Transfer of material into the crusher at the northern end of the conveyor belt;
(ii) Crusher operation location at the northern end of the conveyor belt;
(iii) Material transfer over conveyor belts;
(iv) Material transfer into barges; and
(v) Wind erosion of stockpiles on barges.

The dust emission rates of the above activities have been estimated by using the United States Environmental Protection Agency (USEPA) "Compilation of Air Pollutant Emission Factors". The details are shown in Appendix A3.

4.3.5 Meteorological Data

The 1992 meteorological data as monitored by the Royal Observatory's Tuen Mun Station has been used as the model input. These include the wind speed, wind direction, temperature, stability class and mixing height.

4.3.6 Impact Assessment

Using the above information, the highest 1-hr and 24-hr averaged TSP levels have been calculated. The results of the dust modelling are summarised in Table 4.1.

Table 4.1 Predicted TSP Levels

Air Sensitive Receiver	TSP Concentrations ($\mu g/m^3$)	
	1-hr	24-hr
Pink Villa and Golden Villa	126	82
Hoi Mei Villa	152	95

Material transfer at the jetty is the dominant dust source because of its proximity to the receivers and the relatively high dust emission rate. The results indicate that the maximum predicted 1-hr averaged TSP concentrations at Pink Villa/Golden Villa and Hoi Mei Villa are 126 $\mu g/m^3$ and 152 $\mu g/m^3$ respectively and are far below the 500 $\mu g/m^3$ criterion. The corresponding wind direction for the former case is from south-east while the latter one is from south-west. The predicted 24-hr averaged TSP concentrations are less than 100 $\mu g/m^3$ and are well within the HKAQOs limit (260 $\mu g/m^3$).

The other large construction projects in the area could further degrade the air quality. However, with the above safety margins between the predicted concentration and the corresponding limits and the remoteness of the receivers from the other construction sites, the resultant TSP concentrations are unlikely to exceed the limits.

4.3.7 Recommendations

The operational phase dust impact can be further minimized through the following means:

(i) Dust control measures should be included in the contract documents and the contractor should follow EPD's "Guidelines on Dust Suppression Measures for Construction Sites 1992".

(ii) A specified process licence in pursuant to the Air Pollution Control Ordinance will be needed for use of the proposed crushing plant. Best practical means must be used to ensure no AQOs are exceeded or health hazards will result due to its operation.

(iii) Conveyors should be totally enclosed.

(iv) Receiving hopper of the crusher should be enclosed on top and 3 sides and its outlet should be enclosed and ducted to a dust extraction/collection system.

(v) Wet suppression techniques such as spraying water on the materials may be employed at appropriate locations e.g. conveyor feed, transfer points, crusher intakes, discharge points, etc. An efficient spray system is estimated to reduce emissions by 70 to 95 percent.

(vi) At the point of discharge the dropping height should be minimised, this would reduce the dust emissions. Also, the discharge point should be enclosed with chutes and water sprays.

(vii) Full barges employed should be taken for dumping as soon as possible, otherwise the surface of stockpile should be kept sufficiently wet by water spraying.

(viii) Monitoring and audit programmes need to be implemented during operation of the conveyor system.

WATER QUALITY

CHAPTER 5

5. WATER QUALITY

5.1 INTRODUCTION

The construction and operation of the proposed Conveyor System (CS) 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 CS with the least possible environmental impact to the marine environment.

5.2 MARINE WATER QUALITY

5.2.1 Existing 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 Western Buffer Water Control Zone (WBWCZ) and the implementation of the Strategic Sewage Disposal Scheme.

5.2.2 Sensitive Receivers

The main SRs include:

- eight gazetted beaches in the locality of the barge jetty associated with the CS (Figure 5.1). 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.

- aquatic life including fish and the Chinese White Dolphin.
- Ma Wan Fish Culture Zone, which is located on the west coast of Ma Wan is not considered as a sensitive receiver due to it's distance from the proposed barge loading points.

5.2.3 Construction Impacts and Mitigation

It is understood that a piled structure will be required and no dredging (and therefore disposal of marine sediments) or reclamation will be neccessary for construction of the jetty. However should there be any mud from piling work required to be disposed of in the marine dumping ground, the project proponent should follow the procedures in the Works Technical Circular No.22/92.

The construction method to be used on the barge jetty is dependant on the geology of the sea bed. If marine sands are present then piling may occur which will cause minor localised disturbance. If the sea bed is scoured and marine sediments are not available to receive support piles for the structure then concrete foundation blocks could be lowered onto the sea floor to act as foundations.

In either case the extent of disturbance of the sea bed is considered to be minor and temporary (as the structure is to be removed after use).

5.2.4 Operational Impacts and Mitigation

The potential water quality impacts arising from the operation of the CS will be associated with the imposition of piers (supports) beneath the barge jetty and the possible spillage of spoil and dust to the waters surrounding the facility. The likely effects are minor changes in the hydraulic regime (flows, currents, etc.) and associated changes in water quality (dissolved oxygen, BOD, *E. coli*, SS etc.) in the immediate vicinity of the structure.

The transport of sediment to the marine water environment can be minimised by the following recommendations:

- stock piling of spoil should be limited to north of Tuen Mun Road;
- enclose all moving sections of the CS where possible to suppress dust and deter spillages;
- use water sprays to suppress dust at the point of barge loading; and
- the use of an enclosure/chute at the CS barge loading point.

The use of silt curtains would reduce the escape of any spillage at the barge loading area to the wider marine environment and their use should be considered. If the monitoring programme identifies a problem with SS at this location then silt curtains should be utilised unless effective alternative measures can be identified and enforced.

5.3 FRESH WATER QUALITY

5.3.1 Existing Water Quality

The well vegetated southern facing slopes that form the backdrop to Gemini Beach are drained by a small unnamed water course that enters the Ma Wan Channel at the western end of Gemini 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 west end of Gemini Beach. The water in the stream is generally clean and silt free except for times during and after heavy rainfall. The CS follows the stream's course, lying amidst its catchment area over certain sections of its route.

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

- ridge top restoration plantings consisting of plantation areas;
- 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 from various cuttings associated with Tuen Mun Road; and
- the stream is dammed and diverted.

5.3.2 Construction Phase Impacts and Mitigation

Sensitive Receivers

Generally the flow in the stream during winter months is very low. The steep gradient of the stream and highly seasonal nature of the stream may preclude development of noteworthy aquatic faunal communities. No fish or crustacean life was recorded during a survey of the stream. Neither were amphibians or reptiles recorded. Some Alderfly larvae (*Neuchauliodes bowringi*) were observed on the undersides of stones, as were litter cockroaches, (*Opisthoplatia orientalis*).

Stresses resulting from smothering due to direct run-off of sediment or settled dust are particularly undesirable. Compounding effects would result from any impacts on the fresh water system as these would be transferred to the marine environment, via direct input from the catchment.

The proposed route of the CS will impact upon the stream along two stretches; the lower most section, below Castle Peak Road and the valley immediately above Tuen Mun Road. The route runs through the valley and uses areas in the middle and lower sections of the streams catchment.

In the course of construction small areas of cut will be required for the route. The main impacts occurring during construction will be related to the works

area run-off which may contain high concentrations of suspended solids (SS). It is possible that sediments from construction activity run-off could be carried to fresh waters via the catchment. Suspended 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.

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 WBWCZ declared and the schedule in place covering the area of the proposed HAR, any discharges from the site will be subject to the specific Technical Memorandum schedule (Standards for Effluents Discharged into Drainage and Sewage Systems, Inland and Coastal Waters, 1991).

In view of the potential impacts described above it is considered that clauses should be included in construction contracts requiring the implementation of certain mitigation measures.

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 controlled release of settled waters;

- 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 (at least 110% of maximum storage volume) 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 marine waters stockpiling of excavated spoil derived from the CS corridor should be avoided.

5.3.3 Operational Phase Impacts and Mitigation

Impacts

The main area of potential impact will arise from run-off from the vehicular access road, CS corridor, CS transfer points and barge loading area.

The main sources of potential contamination are :

- sediment and dust derived from the wheel tracks of vehicles used to service the CS;
- sediment from spoil transportation on the CS, this will take the form of dust due to movement of spoil along the conveyor and transfer at the surge bins;
- accidental spillage of spoil during transportation operations.

Mitigation

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

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

- the access road should be designed to take account of contaminated surface water. This will involve provision of drainage channels and appropriate sediment traps to allow the interception and controlled release of treated waters;
- traps and interceptors should be regularly emptied to prevent the release of 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, the bunds should be able to hold at least 110% of the maximum storage volume;
- any stockpiles of excavated materials in the area of the area of the cutting 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 main drainage system.
- limit the use of the CS access road to service traffic only;
- partially seal the service road to enable dust retention during use; and
- house the surge bins/transfer point in sealed enclosures.

Monitoring

Detailed Monitoring and Audit objectives, methods and requirements are given in Chapter 9 of the Route 3 CPS, TLT & YLA Road EIA Technical

Report Volume 3A, however, some general requirements include:

- discharges should be monitored and managed to achieve compliance with the Technical Memorandum and the Water Pollution Control Ordinance 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 CS site are:

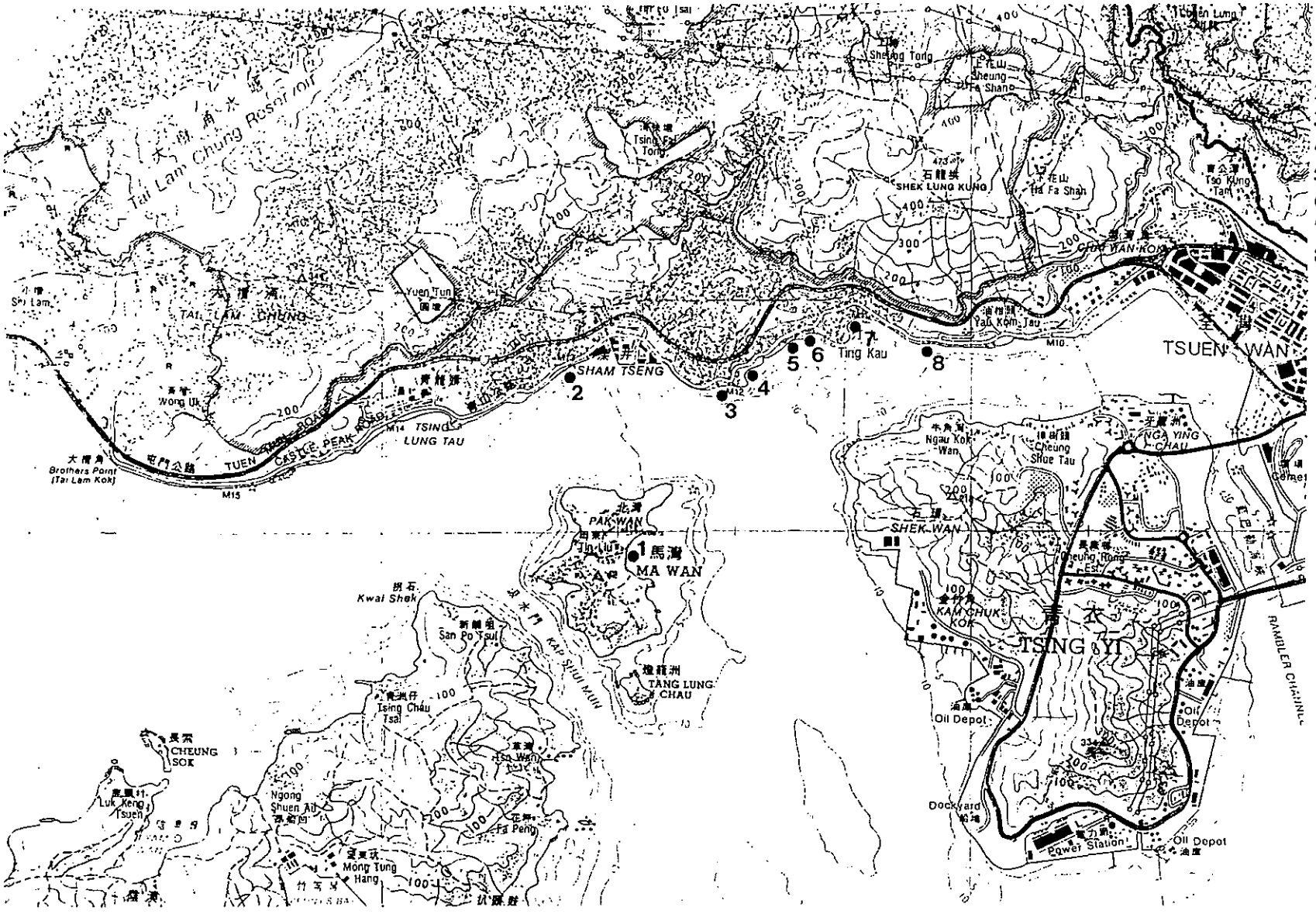
- monitoring for SS/Turbidity and DO at sites along the stream course to gain baseline measurements, plus compliance monitoring during construction and the use of the CS;
- baseline, compliance and post construction monitoring for SS/Turbidity and DO at a distance of 150m from the sites of jetty construction should be carried out. Also compliance monitoring should be carried out whilst the jetty is in use.

5.4 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 through its catchment and also marine waters due to the activities associated with the construction of the barge loading jetty. In view of the potential impacts, prevention and control measures as discussed above should be applied wherever practicable. Suitable clauses must be included in the contract documentation to limit impacts.

During the operational phase the potential impacts will arise from the use of the access road, transportation of spoil and spoil handling, particularly during the loading of it to barge. Special consideration should be given to design of all spoil handling facilities to deter the loss of spoil in any form to the surrounding environment.

The use of silt curtains should be considered and if problems with spillage at the barge loading area persist then they should be installed. With the inclusion of measures such as those described previously e.g. enclosed loading point chutes the potential for impacts on the local marine water quality will be significantly reduced. The programme of water quality monitoring and auditing will show if impacts from the operation of the CS are occurring. If impacts are occurring then action plans would be implemented to reduce impacts to acceptable levels. The monitoring and audit schedules proposed for the CS are discussed in detail in Chapter 9 of this Report.



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

Dwg. Title

GAZETTED BEACHES, RAMBLER CHANNEL

Job Title

ROUTE 3 CPS - TLT&YLA
CONVEYOR SYSTEM SUPPLEMENTARY PAPER

Scale : 1:50 000	Job No. 058 009	Fig No. 5.1
Date : JAN, 94		

SPOIL MANAGEMENT

CHAPTER 6

6. SPOIL MANAGEMENT

6.1 INTRODUCTION

The extremely large quantity of spoil material which will arise cannot be utilised within the Route 3 CPS project and requires disposal to another project for reuse. It has already been accepted by Highways Department that it is impractical as well as environmentally unacceptable to remove the spoil by truck haulage. A conveyor system has therefore been proposed to remove the spoil and given good design this will be able to significantly reduce the impacts which would otherwise be associated with disposal of such a large quantity of spoil. The proposed route of the Conveyor System is shown in Figure 1.2 and assumptions have been made as to the likely design of the conveyor system.

6.2 SPOIL ARISINGS

The spoil to be transported by the conveyor system will arise from major construction activities, notably:

- Ting Kau - where a major excavation/cutting is required to prepare the formation for the Ting Kau Interchange and the approach to the southern tunnel portal. This will generate in the region of 5.5Mm^3 and the cutting is shown in Figure 1.2.

- Tai Lam Tunnel - where the estimated volume of tunnel spoil arising from the southern half of the tunnel is 0.5Mm^3.

This spoil will be brought to the loading area at the beginning of the conveyor for pretreatment (if required) and loading onto the conveyor.

This total volume of approximately 6Mm^3 is extremely large and will inevitably involve use of major plant and equipment over an extended period. It is anticipated that the spoil will arise on a fairly continual and steady rate basis however it may be that spoil will arise on a 24hour basis (for example from the tunnel) and be accumulated at the loading location where it can be crushed and then loaded during conveyor operating hours at an agreed rate and duration.

It may be prudent to have an agreed period (say 30 minutes) during the day when spoil is not loaded and an opportunity for clean up or running repairs could be effected. Alternatively spoil could be loaded intermittently in batches of an agreed volume with short (say 5 minute) breaks. This could make the switching procedure at the barge loading facility easier to accomplish.

6.3 SPOIL TREATMENT AND HANDLING

The spoil is likely to require pretreatment in the form of crushing and screening to ensure its suitability for reuse. This process will have the

advantage of making the material more consistent and easier to handle and should facilitate the loading process.

6.3.1 General Requirements

In general once the initial pretreatment has occurred the less handling of the spoil the better. Thus if the route of the conveyor system is kept relatively straight with minimal turning and changes of direction the number of transfer points (where the conveyor changes direction) can be minimised.

The Conveyor System alignment should be covered to prevent exposure to wind and thus dust generation.

It is recommended that the detailed design of the conveyor system route is designed to minimise the number of transfer points as far as is practicable.

All handling and transfer points should be weatherproofed or otherwise designed to prevent ingress of water from rainfall and therefore loss/discharge of material through flushing or being carried by run-off.

It is recommended that any required stockpiling of spoil is limited to north of Tuen Mun Road.

6.3.2 Specific Requirements

The proposed route at present contains several sections with upto 5 transfer points (see Figure 1.2). It will be essential to design these transfer points and associated containers such as surge bins to prevent loss of material either by windblow or water flushing.

Notwithstanding this requirement it may be necessary to use 'fine mist' water sprays to control dust emissions. Care must be taken to prevent over watering and creation of high suspended solid run-off waters from this spraying. To be successful this process requires adjustable automatic sprays to ensure regular and consistent use, coupled with frequent manual checking and servicing (providing adjustment of the volume sprayed if necessary) to ensure that:

- the sprays are working;
- they are appropriate to the material being transferred;
- that the material is neither over nor under wetted; and
- the sprays are appropriate for the weather conditions.

The nature of the material can rapidly be determined by on site visual and physical checking. This could be carried out at the northern loading location at the start of each day and the information passed on to the site checkers.

The handling and loading system at the barge loading facility should be designed to minimise handling requirements and opportunity for dust and

noise generation. For instance by use of a hopper/feeder arrangement which permits material to be fed to the barges on a continuous basis. A mechanism to prevent and/or quickly clear blockages will be required as well as a system which prevents material being discharged unless a receiving barge is in position.

The actual design of the barge loading facility is unknown and will be designed by the Contractor. A possible design has been assumed and is shown in Figure 2.1 and this assessment is based on this layout.

6.4 SPOIL DISPOSAL

Surplus excavated materials from the project represent a valuable fill resource, and unproductive disposal at sea is not acceptable to the Secretary of Fill Management Committee. Potential receiver sites for surplus materials can be identified from the "FMC Database of Fill Requirements and Surpluses".

Of the disposal options the favoured is disposal to a reuse location, possibly a marine reclamation project such as Tseung Kwan O or the Lantau Container Port (CT10 and CT11). This would involve barge transportation of the spoil. Several disposal fallback options should exist as marine disposal of valuable surplus material should not be considered a fallback.

The main environmental requirements for this process are that good practice is enforced for the filling and movement of the barges. It is essential that the barges are not overfilled and dust covers are used in dry, windy weather.

These precautions will prevent loss of spoil due to windblow or overflow. The practise of 'short dumping' is unlikely as the barge will be expected at the reuse site however an accounting system will be required to ensure this does not occur.

The control of the disposal operation at the reuse site will be the responsibility of the project office for that site. The specification for the "control of disposal operation" will first have to be agreed with EPD.

6.5 IMPACTS AND MITIGATION

Some of the major potential impacts are related to air quality (dust), noise, fresh and marine water quality, and general nuisance. The main potential occurrence of these will be at the various handling, storage, transfer and loading locations along the spoil disposal 'chain'. Other important potential impacts are visual (including effects on the landscape) and ecological. These impacts have already been discussed and assessed in the respective chapters of this Report.

The general spoil related impacts will be associated with loss of spoil from the spoil management system at any location and particular care will be required to minimise this loss of material during the operations.

In recognition of the very large quantity of spoil involved and the lengthy period of spoil disposal it is considered necessary for regular and frequent checking of the system at all key locations on at least a daily basis.

The checker should be able to make minor repairs and on encountering large spillages should be able to:

- stop the loading of spoil and the running of the conveyor by remote means (such as mobile telephone communication)
- invoke pre-arranged 'clean-up' procedures
- call on contractor's staff to quickly clear the spillage and resolve the problem/repair equipment.

The conveyor should not be permitted to continue to operate while a significant problem or spillage is occurring and a system/mechanism must be designed to prevent this.

6.6 CONCLUSION

The Route 3 CPS project is going ahead and involves the need to dispose of this extremely large volume of spoil ($6Mm^3$). The use of a conveyor system is the preferred method of moving the material to a location where it can be transferred to large containers (barges) for further transport and disposal.

Apart from impacts related to the construction and physical presence of the conveyor system, good spoil management procedures are the key to the systems' environmental acceptability.

It is considered practicable to minimise impacts at the various potential weak points i.e. conveyor loading, handling, transfer and barge loading locations. This can be achieved by careful design, imposition of identified control measures and strict enforcement of these measures as well as simple practical checks on basic good site practise.

It is essential that the detailed design incorporates control and mitigation measures to prevent spillages and therefore consequent impacts.

LANDSCAPE AND VISUAL IMPACT ASSESSMENT

CHAPTER 7

7. LANDSCAPE AND VISUAL ASSESSMENT

7.1 INTRODUCTION

A temporary conveyor system has been proposed to transport spoil arisings from the Tai Lam Tunnel portal and material from cuttings to the south west of the portal associated with Route 3 - CPS section.

As the conveyor system is a short term project, taking 3 to 6 months to construct and being in use for approximately two years, attention will be paid to establishing effective short term mitigation whilst the conveyor system is operational and the re-instatement of the land form and vegetation cover once it becomes redundant.

This section of the EIA considers the potential landscape and visual impacts resulting from the construction and operation of the proposed conveyor system and identifies landscape mitigation measures. The detailed description of the methodology adopted for the Visual and Landscape Impact Assessment of the conveyor system is included within the landscape and visual impact assessment Chapter 8 and 9 of the Route 3 CPS EIA.

7.1.1. 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 once operational;
- Identification and evaluation of effective short term mitigation measures, and final restoration proposals for the conveyor belt corridor.

7.1.2 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.

7.1.3 Project Overview

The temporary conveyor system comprises a 1000 m length, 1.5m wide belt that will operate for 10 hours a day for a 600 day period. The approximate alignment is indicated on Figure 8.1a and Figure 8.1b. In addition on the conveyor belt itself, surge bins/hoppers will be required where there is a change in direction (up to in 3 number); temporary haul roads between the excavating face and the conveyor belt, and a barge loading jetty off the Gemini beach promontory capable of accommodating two barges at any one time. At present the details of the size and form of the surge bins are not known and therefore not considered in detail in this report.

The alignment of the conveyor belt is dictated by its operating requirements and the topography it must traverse (operating at an angle of 18 degrees or about 1 in 3). It initiates in the vicinity of the tunnel portal (connected by a series of temporary haul roads), from where it broadly follows the top of the existing ridge line southwards across the Tuen Mun Road and Castle Peak Road to form a jetty at Gemini Beaches.

The main elements of the conveyor system which will be significant in terms of potential landscape and visual impacts are;

- Surge bins;
- Temporary bridging structures over the existing roads;
- Barge loading jetty off the Gemini Beach promontory.

The majority of the activity will be localised, contained within the conveyor belt corridor. Larger scale construction will be required for piling and construction works associated with the barge loading jetty.

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.

7.2 BASELINE CONDITIONS

7.2.1 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, as shown in Figure 1.2.

The Preliminary Design Stage 1 study for Route 3 identified two types of landscape character within the Study Area, as identified on Figure 7.1. 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), and the higher ground to the north, as an area of steep uninhabited hill slopes supporting a vegetation of sparse scrub and grassland (character area 13).

7.2.2 Character Area 12 - Coastal Strip - Ting Kau

The character area encompasses the lower aspects of the hill slopes and coastal areas between the Tuen Mun Road to the north, Hoi Mei Beach to the west and Approach Beach to the east on the mainland.

a) Visual Envelope and Existing Views

The visual envelope for landscape character 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 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 approximately 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 an area scattered with low rise residential properties and small villages such as Ting Kau. The properties have a strong association with the water margins of the Rambler 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 Castle Peak Road. Traffic is primarily local apart from Tuen Mun Road, serving

the local settlements between Sham Tseng and Tsuen Wan.

Although no direct access is achievable from the Tuen Mun Road (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 to 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. The area is of good quality and one that would be sensitive to change.

f) Visual Receivers

Visual Receivers within this section of the study area comprise of the following receivers:

- 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 Road;
- 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 Road and Castle Peak Road;
- Marine traffic on the surrounding coastal waters.

7.2.3 Character Area 13 - Steep hill slope

The character area encompasses the rising ground with a coastal aspect above the Tuen Mun Road.

a) Visual envelope and Existing views

Due to the abrupt nature of the topography, the visual envelope is distinct, limited by the sharp ridge lines of the surrounding hillsides. Views from the character area, due to its elevated nature, are extensive, across the busy Rambler Channel, to the Islands to the south, such as Tsing Yi and Lantau, as well as oblique views along the hill slopes to either side of the study area. These extensive views are mirrored by the slopes visibility from a wide area, of predominantly transient visual receivers. The initial coastal ridge line

forms an important barrier, screening views to the character area from the heart of the Tai Lam Country Park.

b) Topography, Natural Drainage and Vegetation Cover

The natural topography of the character area consists of steep slopes rising abruptly from the Coastal strip of the mainland, to a high point of 200m. Local variation of the predominantly flat sided slopes of the mainland creates a localised area of undulating landform. A significant 'V' shaped river valley (unnamed) bounds the study area to the north-west and forms a distinct character area of its own; elsewhere within the character area, water courses include the Water catchment channel and a number of seasonal watercourses. The vegetation cover is typically sparse grassland with occasional scrub species on the higher ground, with some scrub and tree establishment on the lower slopes.

c) Built Development

The character area does not contain residential or industrial properties. It is however visible from adjacent residential areas.

d) Access and Circulation

Access to the area is at present extremely restricted, limited to footpath access and vehicular access via the water catchment service road.

e) Landscape Character

The resultant landscape character of Area 13 is one of remote, uninhabited steeply sloping hillside slopes facing the busy coastal waters, with an open aspect and extensive views. Human influence within the heart of the area is limited, however the lower aspects of the slopes are heavily influenced by the existing Tuen Mun Road corridor. The denuded nature of the landscape quality results in a landscape capable of absorbing change, but the elevated nature of much of the character area renders it visually prominent over a wide area, to a potentially large number of visual receivers.

f) Visual Receivers

Visual receivers within the character area are limited to transient receivers using the existing footpath network. Views from the outskirts of the residential area of Sham Tseng (to the west), scattered residential properties and footpath users, both on the mainland and from islands to the south, would form the main receiver groups from outside the study area. The high volume of waterborne and vehicular traffic in the vicinity create a further transient receiver group.

7.3 IMPACT ASSESSMENT

7.3.1 Landscape Impacts

Along the ridgelines and most northern section of the conveyor system the landscape impacts created by the conveyor belt, comprising small sections of shallow cuttings, and disturbance to the existing grassland, would not create a significant landscape impact. However the southern section of the conveyor system which lies north of Tuen Mun Road will cause a major impact on the existing high quality landscape character of the small stream valley associated with the conveyor systems corridor. The impact will arise due to the loss of woodland consisting of closed canopy mature trees. As well significant, localised impact will be created in areas associated with the surge bins, the temporary bridge structures and the jetty. It is envisaged that the impact created by these further elements will be minor and final restoration of the scheme would reinstate the former landform.

7.3.2 Visual Impacts

The visual envelope as detailed in Figure 7.2 identifies two broad types of visual intrusion, namely:

- Areas in close proximity suffering visual intrusion/obstruction from the conveyor belt and/or its associated structures(a);
- Long distant views from positions outside the study area, where the intrusion will not constitute a major intrusion into the overall view(b).

a) Immediate Surroundings

Due to the restricted access to the area through which the majority of the conveyor system is positioned, visual intrusion to receivers within its immediate vicinity are limited. Receivers would include:

- Hoi Mei Villa
- Golden Villa and Pink Villa to the north of Castle Peak Road.
- Footpath users on the coastal slopes within the study area
- Transient traffic on the Tuen Mun Road and Castle Peak Road
- Visitors to Gemini Beach
- Marine traffic in the immediate vicinity of the Gemini Beach promontory

The most severely effected receivers within the study area comprise the permanent residents within the properties surrounding the Gemini Beaches. The impact would be particularly significant should operations be undertaken at night or in poor light, necessitating the need for artificial illumination.

It should be noted that the properties within the village area to the north west of the study area would not be significantly effected by the position of the conveyor belt as it is screened by the intervening landform.

b) Distant Views

Further from the conveyor system the outskirts of Sham Tseng, isolated residential settlements; passive recreation users, along the coastal margins; adjacent coastal slopes (Tai Lam Country Park, north and west sections of Tsing Yi Island of Ma Wan, Tang Lung Chau and Lantau), and 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 already contain intrusive visual elements such as major industrial, residential and infrastructure developments. The conveyor system and its associated structures would be seen as an intrusive element as it follows the ridge line consequently breaking the existing skyline, but would not be considered significant in light of the existing views from these areas which are already affected by intrusive human elements. The introduction of a further temporary man made feature would not significantly alter the perception of the existing visual quality of the area to these more distant receivers.

7.4 LANDSCAPE MITIGATION MEASURES

Broad principles for the landscape mitigation/restoration proposals were established in the CPS EIA Chapter 9 and summarised as general mitigation measures below:

- Treatment of the interface between man made and natural landform;
- Specific attention to the visual quality of the associated structures/buildings;
- Colour and materials used for structures/buildings 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 not be allowed;
- 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 conveyor system during it operational life, but may also improve the overall quality of the landscape character of the overall area by the re-introduction of tree and shrub species.

7.4.1 Mitigation during Construction and Operational Phases

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

- Restrict the volume of construction traffic along the conveyor route (including service vehicles);
- 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 conveyor belt system would consist of the following elements.

Alignment of conveyor belt and position of Surge bins

Detailed consideration of the alignment of the conveyor belt and the position of the surge bins should be undertaken to minimise breaking the existing ridge lines and impacting upon sensitive landscape features such as woodland, thereby minimising the consequent visual intrusion caused by these man made elements positioned within an otherwise natural landscape. In addition where deemed appropriate at the detailed design stage, the surge bins may be screened within blocks of fast growing trees and shrubs. This must however be considered in the light of the specific position of the structures, the surrounding vegetation type, and the appropriateness of introducing trees and scrub into the landscape at this point.

Temporary Mitigation Planting

The planting of fast growing shrubs and trees that will quickly establish a screen to reduce the impact of the temporary bridges and barge jetty. In addition this tree/shrub planting will aid slope stability and reduce dust pollution on the surrounding landscape. Suitable species would be established by evaluating the existing vegetation cover (as identified with the ecological section of this report). It should be noted that tree planting should be restricted to the lower aspects of the hill slopes, extending the existing areas of tree and scrub cover. Tree planting in a linear belt along the existing ridge lines would not be recommended as it would be out of context with the

existing landscape character of the area.

Offsite Mitigation Measures

The construction of temporary screen hoardings and/or vegetation planting within the curtilage of visually severely effected residential properties, to screen the view at source (residential properties surrounding Gemini Beach). 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).

7.4.2 Final Restoration of Conveyor System

The most important part of the mitigation proposals would be the restoration of the conveyor system 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, as identified in the landscape restoration proposals philosophy in the Route 3 CPS EIA. In this case this would involve:

- the removal of all man made features associated with the temporary conveyor system
- artificial slopes (cuttings/embankments) should be graded out to form a continuous more natural slope.
- the re-graded slopes should be planted with the woodland Mix B identified in the Route 3 CPS 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 maximum

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.

- Elsewhere, on the higher slopes a suitable grass/scrub planting seed mix should be used to reinstate the grass sward destroyed by the conveyor belt corridor and surge bin locations.

7.4.3 Long Term Residual Effects

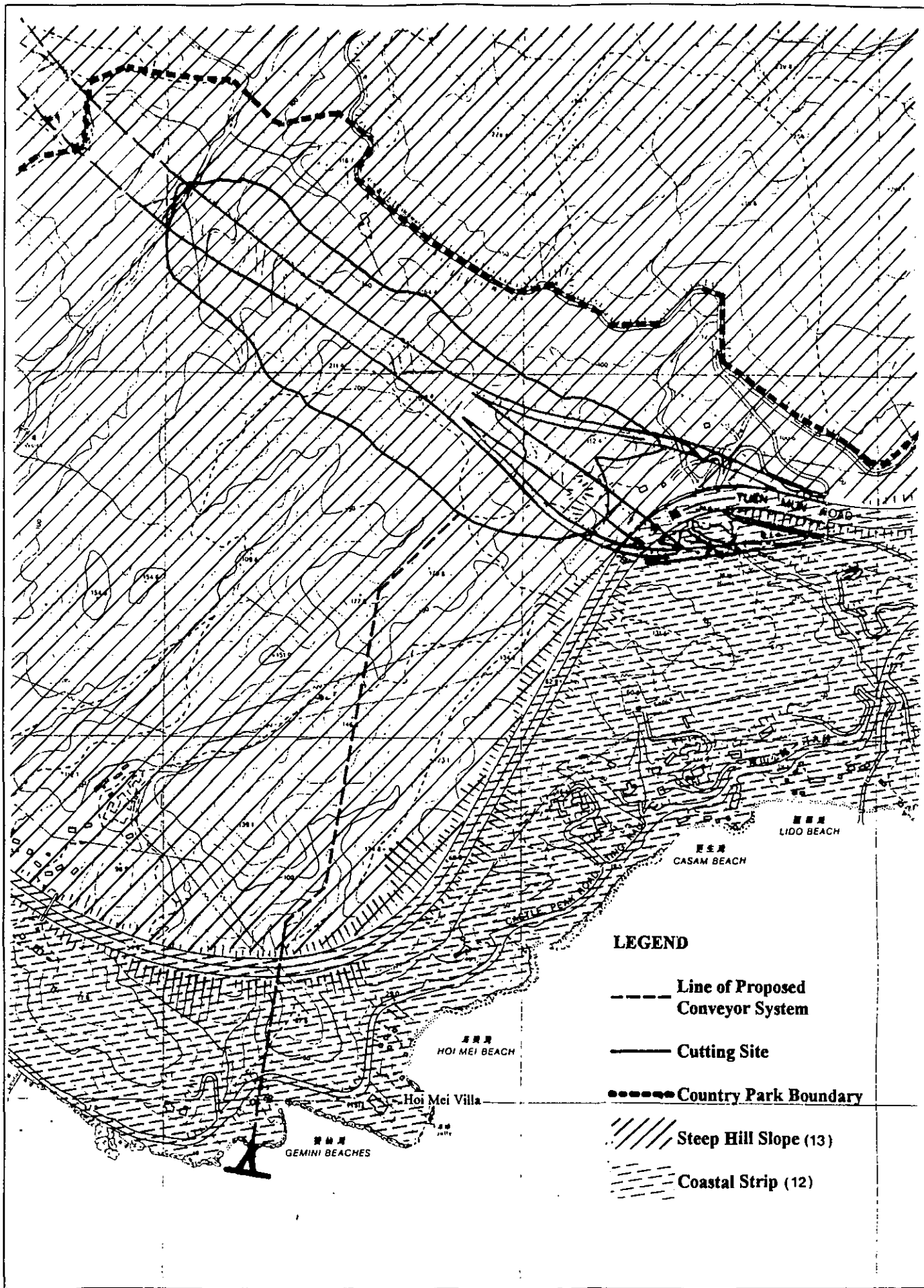
The adoption of a sympathetic landscape restoration programme should minimise the long term residual effects of the temporary conveyor system, which should in time return to its semi-natural state.

7.5 CONCLUSION

Table 7.1 summarises the potential landscape and visual impacts created by the conveyor system through time. It summarises the impact it will have on the elements identified within the baseline conditions. Analysis of the table shows that although the conveyor system would cause a number of locally significant impacts, the final restoration of the scheme may in fact provide positive benefit to the character of certain parts of the area through which it passes.

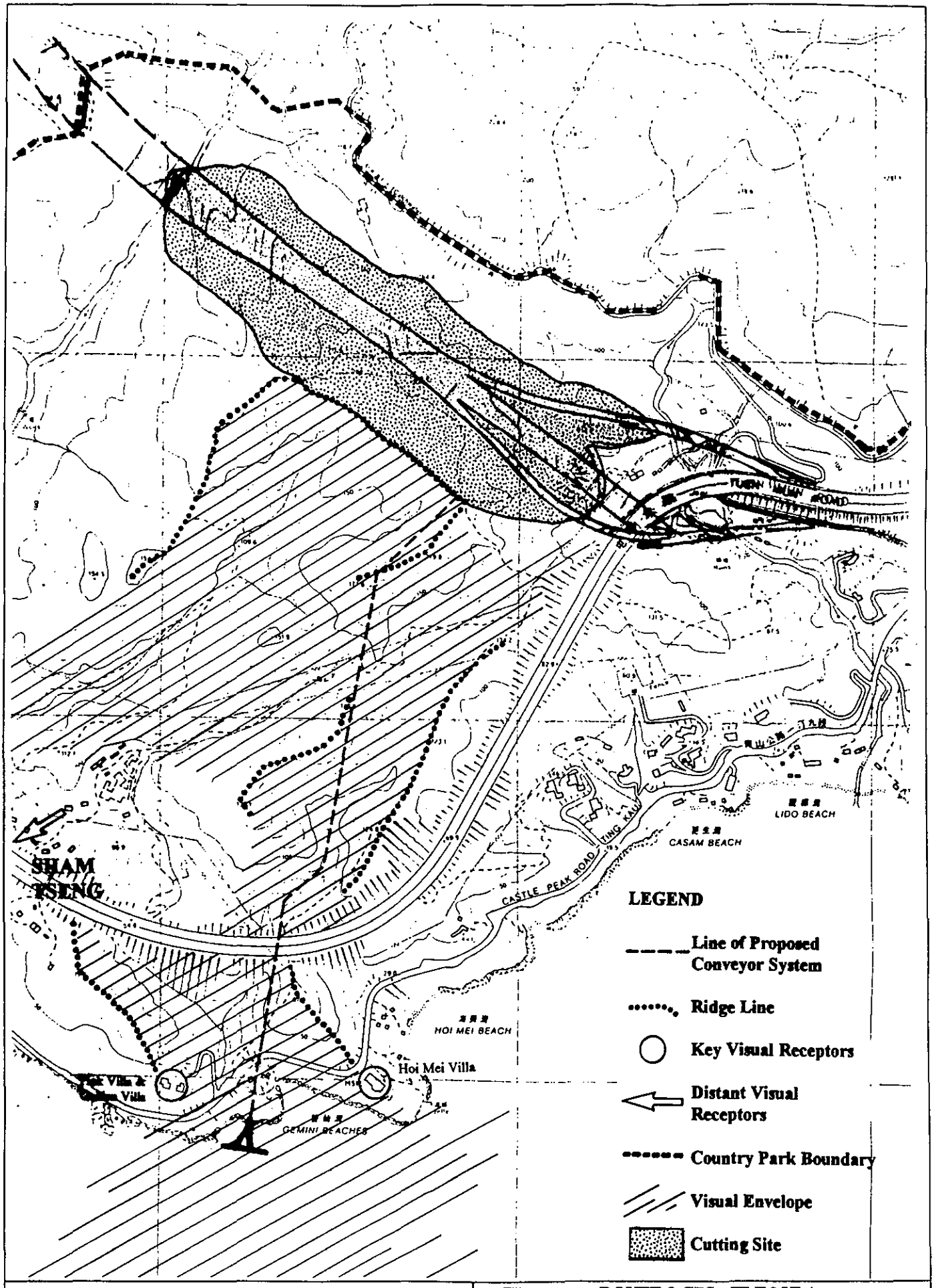
Table 7.1 Summary of Potential Landscape and Visual Impacts

Element	Construction	Operational	Residual
Landform	Low (Locally Mod)	Low (Locally Mod)	Low
Built Development	Low (Locally severe)	Low (Locally severe)	-
Access/circulation	Low (Locally severe)	Low (Locally severe)	-
L'dscape character	Moderate	Moderate	Positive
Visual receivers	Low (Locally severe)	Low (Locally severe)	-



FREEMAN FOX MAUNSELL

Job Title	ROUTE 3 CPS - TLT&YLA CONVEYOR SYSTEM SUPPLEMENTARY PAPER
Dwg. Title	CHARACTER AREAS
Date: JAN . 94	Scale : N.T.S — Figure No.: 7.1



FREEMAN FOX MAUNSELL

Job Title	ROUTE 3 CPS - TLT&YLA CONVEYOR SYSTEM SUPPLEMENTARY PAPER		
Dwg. Title	VISUAL ENVELOPE		
Date: JAN , 94	Scale : N.T.S.	Figure No.: 7.2	

ECOLOGY

CHAPTER 8

8. ECOLOGY

8.1 ECOLOGY SURVEY METHODS

Field surveys were conducted on the proposed conveyor alignment and cutting area (studied area) from 13 March through 1 June 1993, and between 3 and 15 January 1994. Surveys were intended to determine the conservation significance of the disturbance area in terms of habitats or flora and fauna resources, and to determine whether species of plants and animals which are protected by local regulation or international convention occurred in the or near to the disturbance area.

The proposed cutting area (from Tuen Mun Road north to the south tunnel portal) was surveyed non-systematically during daylight hours on 13 March, 15 April, 27 May and 30 May, and at night on 31 May and 1 June. The daytime survey was to assess the overall conservation value of the area, including the dominant species of flora and the suitability of the habitat for wildlife. The night survey focused on the stream, with particular emphasis on amphibians. The conveyor alignment from the cutting area to the terminus at the Gemini Beaches was surveyed on 3, 14, and 15 January 1994 to assess the conservation importance of the proposed alignment separate from the cutting area. The flora and fauna surveys are not considered comprehensive because they did not cover all seasons of the year. However, they did allow a determination of potential impacts based on the information gathered.

8.2 SURVEY RESULTS

The proposed conveyor alignment crosses an area which slopes generally southward toward Gemini Beaches. The terrain is rough and broken, with stream valleys typically running from north to south or southwest. Maximum elevation is 211.9 m in the cutting area at the north end of the alignment. Minimum elevation is sea level where the conveyor terminates at the barge loading pier.

Within the studied area there were no Sites of Special Scientific Interest (SSSIs), Special Areas, Country Parks, or other types of areas designated for nature conservation.

Adjacent features of significance from the standpoint of enhancing flora and fauna resources are Tai Lam Country Park and the large valley which runs from the Country Park southwestward in a nearly straight path toward Sham Tseng. These features border the studied area on the west, and provide a corridor between the two. Both areas are remote, and access is difficult. Therefore, use of these areas by humans is not as frequent as in other, better developed portions of the Country Park perimeter. This may contribute to the richness of the plant and animal communities on the studied area.

Tai Lam Country Park also lies along the north border of the studied area, but the potential link between the two areas is severed to some extent by the water catchment channel which lies at the Country Park boundary. This channel would serve as a boundary to movements of terrestrial wildlife unable to negotiate the concrete paved channel.

The east and south boundaries of the studied area are formed by Tuen Mun and Castle Peak Roads. Because of the extremely high traffic volume on Tuen Mun Road, it would also serve as a barrier to movements of terrestrial wildlife. The area between the two roads is developed for low-density residential use, so it is not suited to consistent use by terrestrial wildlife. This area is, however, protected from fire, so it does support well-developed stands of trees and tall shrubs.

8.2.1 Flora

The area was composed of six different habitats: shrub/grassland, shrub/woodland, open woodland/shrub, plantation, eroded areas, and marsh habitat (Figure 8.1). There was a marked distinction between the relatively xeric vegetation types found on ridges versus the mesic types in the valley bottoms or in the area south of Tuen Mun Road where protection from fire and natural weather or climate factors is greater.

The mosaic habitat of grass and low shrubs is typical of granite hill-slopes in Hong Kong, and is well-represented in the western New Territories, particularly on exposed, south facing slopes or on ridges. The shrub/woodland habitat was found primarily in the valleys, and in some areas appeared to have been undisturbed by fire for quite a long time. Vegetative cover in some of the woodland areas in the valley bottoms was unusually thick, with a closed canopy of mature trees. The open woodland/shrub habitat was confined to an area surrounding habitation on the southwest portion of the studied area north of Tuen Mun Road near Sham Tseng. This habitat is the result of extensive human use of the former woodland.

The plantation habitat consisted of stands of trees and shrubs planted (presumably by Agriculture and Fisheries Department [AFD]) to restore eroded ridge lines. These plantations were effective in restoring vegetation to many of the eroded portions of the studied area, and appeared to be well established. Eroded habitats were also recorded where recent fires, washouts, or land slips had removed vegetation and/or topsoil from the ridges or hill tops. Most of the eroded areas had little or no plant cover from natural revegetation.

Marsh habitat was recorded between Tuen Mun Road and Castle Peak Road above a small, concrete check dam.

8.2.2 Shrub-Grassland Habitat

The shrub-grassland mosaic was found on the central portion of the cutting area and on the higher elevations and exposed slopes of the studied area. This habitat included patches of both grassland and shrubland habitats, neither of which was adequately large or continuous in coverage to be designated a

separate habitat. Most shrubs were below 1.5 m in height.

The grassland was dominated by common grass species of Hong Kong hillsides. These included *Ischaemum spp.*, *Arundinella setosa*, *Eulalia* spp., and *Cymbopogon* spp. Interspersed shrubs included *Baeckea frutescens*, *Rhodomyrtus tomentosa*, *Raphiolepis indica* and *Eurya japonica*. Climbers recorded throughout the area included *Cassytha filiformis*, *Gnetum montanum* and *Smilax glabra*.

The shrubland patches were varied in species composition. The commonest species, in addition to those listed above, were *Litsea rotundifolia*, *Diploprora dubia*, *Melastoma sanguineum*, *Cratoxylum ligustrinum* and *Sterculia lanceolata*.

8.2.3 Shrub/Woodland Habitat

Shrub/woodland habitat was mainly located on the north and east facing slopes in the cutting area and in the valley bottoms and somewhat protected areas along the conveyor alignment. In the southern half of the studied area a predominant shrub was *Gordonia axillaris*. This habitat contained a dense growth of common native woodland species, such as *Sapium discolor*, *Artocarpus hypargyrea*, *Celtis sinensis*, *Schefflera octophylla*, *Quercus glauca*, and *Quercus myrsinaefolia*. On the higher elevation reaches of this habitat *Pinus massoniana* was also common. In the under-storey climbers like *Gnetum montanum*, *Jasminum lanceolatum* and *Alyxia sinensis* were quite common. In the valley immediately north of Tuen Mun Road which is proposed for the conveyor alignment there is a particularly dense stand of woodland habitat which is virtually impenetrable alongside a small stream. The understory of *Phoenix hanceana* in this area is particularly well developed.

8.2.4 Open Woodland/Shrub Habitat

Former woodland habitats on the western extent of the studied area were degraded by human habitation to produce an open woodland shrub habitat. None of this habitat lies within the proposed works area of the conveyor alignment, so it is not considered further.

8.2.5 Plantation Habitat

The plantation areas were confined to the ridge tops, and were assumed to be habitat restoration planting by AFD. In most areas the plantations appeared to have suffered little mortality. Stands of *Acacia confusa* in the central portion of the alignment appeared to have established particularly well.

8.2.6 Eroded Areas

These areas supported only a sparse cover of grasses, or widely scattered shrub seedlings. Most eroded areas were on steep hill slopes or on exposed ridges. Patches of bare soil were visible throughout most of the area mapped as shrub/grassland, but only the larger of these areas was mapped as a separate habitat.

8.2.7 Marsh

This is a man-made habitat in an area impounded behind a small concrete dam near the Golden Villa residential development near Castle Peak Road. Sedges and grasses had colonized the marsh area, and the periphery was vegetated by tall riparian shrubs and trees.

8.2.8 Rare and Protected Plant Species

No species of plant recorded on the proposed cutting and conveyor disturbance area is listed as rare or endangered in Hong Kong. However, one recorded species is protected by Hong Kong legislation. *Enkianthus quinqueflorus* is protected under the Forestry Regulation, (Cap.96, section 3).

Recorded species are listed below in Table 8.1.

TABLE 8.1 PLANT SPECIES RECORDED ON THE PROPOSED CUTTING AREA AND CONVEYOR ALIGNMENT

Abarema lucida	*Dianella ensifolia*	*Melastoma sanguineum*
Acacia confusa	*Dicranopteris linearis*	*Millettia reticula*
Acronychia pedunculata	*Dioscorea spp.*	*Millettia speciosa*
Adinandra millettii	*Diospyros vaccinoides*	*Millettia nitida*
Adiantum caudatum	*Diploprora dubia*	*Miscanthus floridulus*
Albizia corniculata	*Embelia laeta*	*Morinda umbellata*
Alymia hypargyrea	*Embelia ribes*	*Mussaenda pubescens*
Alyxia sinensis	*Enkianthus quinqueflorus*	*Neyraudia reynaudiana*
Ampelopsis cantoniensis	*Eulalia spp.*	*Ormosia emarginata*
Antidesma bunius	*Euonymus chinensis*	*Pandanus spp.*
Antirrhea chinensis	*Eurya japonica*	*Phoenix hanceana*
Alymia hypargyrea	*Ficus superba*	*Phyllanthus cochinchiensis*
Alyxia sinensis	*Ficus variolosa*	*Phyllanthus emblica*
Ampelopsis cantoniensis	*Ficus hispida*	*Phyllanthus reticulatus*
Antidesma bunius	*Gahnia tristis*	*Pinus massoniana*
Antirrhea chinensis	*Garcinia oblongifolia*	*Plumeria rubra*
Aporusa chinensis	*Gardenia jasminoides*	*Psychotria rubra*
Ardisia crenata	*Gnetum montanum*	*Psychotria serpens*
Artocarpus hypargyrea	*Glochidion wrightii*	*Pteridium aquilinum*
Arundinella setosa	*Glochidion eriocarpus*	*Quercus glauca*
Aster spp.	*Gordonia axillaris*	*Quercus myrsinaefolia*
Atalantia buxifolia	*Grewia hirsuta*	*Rava microphylla*
Baeckea frutescens	*Hedyotis acutangula*	*Rhaphiolepis indica*
	Helieteres angustifolia	*Rhodomyrtus tomentosa*
	Heterosmilax gaudichaudiana	
Bauhinia championii	*Homalium cochinchinensis*	*Rhus chinensis*
Blechnum orientale	*Hypserpa nitida*	*Rhus succedanea*
Bridelia monoica	*Ilex asperella*	*Rhynchospora rubra*
Broussonetia papyrifera	*Ilex pubescens*	*Rubus reflexus*
Brucea japonica	*Ilex viridis*	*Sapium discolor*
Caesalpinia vernalis	*Inula cappa*	*Sapium suberiferum*
Carallia brachiata	*Ishaemum spp.*	*Schefflera octophylla*
Casuarina spp.	*Itea cainea*	*Schima superba*
Cassytha filiformis	*Itea chinensis*	*Schinia spp.*
Celtis sinensis	*Jasminum lanceolatum*	*Schizoloma ensifolia*
Cinnamomum camphora	*Lantana camara*	*Scleria chinensis*
Citrus microcarpa	*Liriope spicata*	*Smilax china*
Clausena lansium	*Litsea rotundifolia*	*Smilax glabra*
Clerodendrum fortunatum	*Lithocarpus glabra*	*Sterculia lanceolata*
Cratoxylum ligustrinum	*Litsea cubeba*	*Strophanthus divaticula*
Croton lachnocarpus	*Litsea glutinosa*	*Styrax suberifolius*
Cyclea racemosa	*Lophatherum gracile*	*Symplocos laurina*
Cymbopogon spp.	*Lygodium japonicum*	*Ternstroemia gymnanthera*
Dalbergia benthamii	*Macaranga tanarius*	*Tetracera asiatica*
Dalbergia hancei	*Machilus chinensis*	*Uvaria microcarpa*
Dendrotrophe frutescens	*Melaleuca leucodendron*	*Zanthoxyllum avicennae*
	Melastoma dodecandum	

8.2.9 Invertebrate Fauna

The conveyor alignment is largely upland habitat which is unlikely to support invertebrate wildlife communities of local conservation importance. More mesic habitats south of Castle Peak Road may support butterfly communities of interest, but the limited extent of this area and high levels of disturbance due to residences and heavy vehicle traffic suggest that the invertebrate community would be typical of urbanized green belts throughout Hong Kong.

8.2.10 Amphibians and Reptiles

Amphibians and reptiles recorded during summer surveys on the cutting area are the following. Changeable lizards (*Calotes versicolor*) were seen near the catchment trail. Asiatic common toads (*Bufo melanostictus*) were foraging in the woodland, shrubland, and grassland in the site during the survey nights. Lesser spiny frogs (*Rana exilispinosa*) were quite common and were breeding in both the main stream and the side streams. One brown tree frog (*Polypedates leucomystax*) was also found calling near a stream pool. Paddy frogs (*Rana limnocharis*) also were recorded as breeders in rainwater pools near the catchment road.

During the winter 1994 surveys no amphibians or reptiles were observed in the studied area.

8.2.11 Birds

Bird species recorded when seen or heard during summer 1993 and winter 1994 surveys are listed in Table 8.2. Only two recorded species seen are considered to be uncommon to rare in Hong Kong. These are the red-winged crested cuckoo and the crested goshawk. All other recorded species are widespread or locally common in Hong Kong. Additional winter visiting birds such as flycatchers and other thrushes would also be expected to use this type of habitat.

Due to the large size, relative seclusion, and location of the proposed impact area in relation to Tai Lam Country Park, it is likely that additional bird species not recorded during surveys are using this site. The proximity of Tai Lam Country Park and the open nature of the shrub/grassland habitats on the upland slopes makes it a favourable location for birds of prey which typically forage over large, undeveloped areas. Numerous black kites (10-15) were seen simultaneously circling over the cutting area and the northern end of the conveyor alignment during the winter 1994 survey.

TABLE 8.2 LIST OF BIRDS RECORDED ON THE CUTTING AND CONVEYOR AREAS (MAY 1993, JANUARY 1994)

COMMON NAME (Latin Name)	STATUS
Little egret (*Egretta garzetta*)	R
Black eared kite (*Milvus migrans*)	R
Crested goshawk (*Accipiter trivirgatus*)	R
Chinese francolin (*Francolinus pintadeanus*)	R
Spotted dove (*Streptopelia chinensis*)	R
Collared scops owl (*Otus bakkamoena*)	R
Red-winged crested cuckoo (*Clamator coromandus*)	SV
Large hawk cuckoo (*Cuculus sparverioides*)	SV
Indian cuckoo (*Cuculus micropterus*)	SV
Koel (*Eudynamis scolopacea*)	R
Greater coucal (*Centropus sinensis*)	R
White breasted kingfisher (*Halcyon smyrnensis*)	R
House swift (*Apus affinis*)	R
Swallow (*Hirundo rustica*)	SV
Magpie (*Pica pica*)	R
Jungle crow (*Corvus macrorhynchus*)	R
Crested mynah (*Acridotheres cristatellus*)	R
Hwamei (*Garrulax canorus*)	R
Violet whistling thrush (*Myiophoneus caeruleus*)	R
Black-faced laughing thrush (*Garrulax perspicillatus*)	R
Crested bulbul (*Pycnonotus jocusus*)	R
Chinese bulbul (*Pycnonotus sinensis*)	R
Great tit (*Parus major*)	R
Long-tailed tailor bird (*Orthotomus sutorius*)	R
Yellow-browed warbler (*Phylloscopus inornatus*)	WV
Yellow-bellied wren warbler (*Prinia flaviventris*)	R
White eye (*Zosterops japonica*)	R
White wagtail (*Motacilla alba*)	WV
Yellow wagtail (*Motacilla flava*)	WV
Blue rock thrush (*monticolla solitaria*)	WV
Key to symbols: R = resident	
SV = summer visitor	
WV = winter visitor	

All bird species are protected under the Wild Animals Protection Ordinance (revised edition 1980, Chapter 170).

8.2.10 Mammals

A scat of a civet, probably either the masked palm civet (*Paguma larvata*) or the small Indian civet (Viverricula indica), was found during the summer 1993 survey in the cutting area near the catchment trail on a grave overlooking the ravine. Occurrence of civets would be expected on this site because the woodlands and shrublands provide suitable habitat for these and

other mid-sized mammals.

A barking deer was heard during summer 1993 surveys near the cutting area. Because of their characteristically high mobility, it is likely that barking deer forage in the study site. The seclusion and lack of human habitation along the conveyor alignment, combined with the proximity of Tai Lam Country Park would enhance the suitability of the area as barking deer habitat.

Quills of a Chinese porcupine (*Hystrix hodgesoni*) were located in the plantation habitat in the centre of the studied area. There was no apparent damage to nearby trees suggesting intensive use of the area by feeding porcupines. However, the dense shrub/woodland cover in the ravines immediately below the plantation habitat provides secluded and inaccessible habitat which would be suitable for porcupine habitation.

No burrows or heavily used trails were located, and it is not thought that burrowing mammal use of the site is intense.

8.2.11 Aquatic ecology

Marine

Gemini Beaches East and West.

The two Gemini beaches lie in small coves either side of Gemini headland. They consist of short stretches of sand bordered by rock outcrops. A small stream runs to the sea down one side of the western beach.

No marine fauna was observed on the intertidal sandy portions of the beaches, and no infaunal species were retained on a 1mm mesh sieve. High-zoned on the rocks and boulders between and to either side of the beaches is a sparse distribution of Littorinid snails such as *Nodolittorina millegrana* and *N. pyrimidalis*. Very few individuals were recorded.

In the upper eulittoral were good numbers of the limpet *Patelloidea pygmaea* and a few limpet-like *Siphonaria japonica*. The stalked barnacle *Pollicipes mitella* inhabited cracks in the boulders. Lower down was a band of barnacles, which consisted mostly of *Tetraclita squamosa*. A few *Balanus tintinnabulum volcano* were also present.

Freshwater

A small stream drains onto Gemini Beach west. The stream flows through a deep, steep-sided valley above the Tuen Mun road and through a tunnel under the road, then into a marshy area of grass and reeds that has developed behind a concrete retaining wall in the valley between Tuen Mun and Castle Peak Roads. The water draining from this marsh flows over or around the retaining wall and through a tunnel beneath Castle Peak Road down to the beach. Only two stretches of the stream fall within the work limits for the proposed conveyor; the lowermost section, below Castle Peak Road and the valley immediately above Tuen Mun Road. Flow in the stream during winter months is very low. The steep gradient of the stream and highly seasonal

flow rates may preclude development of noteworthy aquatic faunal communities.

No fish or crustacean life was recorded during a survey of the stream. Neither were amphibians or reptiles recorded. Some Alderfly larvae (*Neuchauliodes bowringi*) were observed on the undersides of stones, as were litter cockroaches, (*Opisthoplatia orientalis*).

8.2.12 Summary

No officially gazetted (apart from Gemini Beach) or other conservation areas occurred in the studied area.

The habitats in the studied area were shrub/grassland, shrub/woodland, open shrub/woodland, plantation, eroded area, and marsh. Mature, shrub/ woodland habitats are of greatest interest from the point of view of floral and faunal diversity and relative rarity in Hong Kong. In the lower valleys the woodland cover was unusually dense, and the canopy cover was complete.

The conservation value is diminished by the severe boundary effect of Tuen Mun and Castle Peak Roads on the east and south, and by the encroachment of human habitation on the southwest extent of the studied area. However, conservation value is enhanced by the presence of Tai Lam Country Park and undisturbed neighbouring woodland habitats adjacent to the studied area on the west.

The stream is not an important aquatic habitat because of the steep gradient, small catchment, and resulting highly seasonal flows.

8.3 POTENTIAL IMPACTS AND MITIGATION MEASURES

8.3.1 Construction Phase

The studied area is characterized by shrub-grassland and secondary forest near the cutting area which grades to more mature, closed-canopy shrub/woodland in the valleys along the conveyor alignment.

The area to be impacted by construction of the conveyor is narrow (30 m), and in the northern 460 m of its length, is confined to the ridges where vegetation cover is least developed. Habitats on the ridges are typically plantation, shrub/grassland, or eroded area. On these sites the potential impacts of construction would be confined to temporary (2 years) loss of habitats which are of limited conservation value. Potential impacts may occur due to malpractise by the works crew such as setting of fires, dumping of debris unnecessary chopping of vegitation etc. This will need to be monitored and controlled by the Works Checker. Potential long-term impacts of habitat loss can be avoided through effective re-vegetation measures immediately following removal of the conveyor and regrading of the site.

In the southern 540 m of the conveyor alignment, and particularly in that portion from Tuen Mun Road northward for 230 m (deep stream valley with

dense woodland cover), loss of shrub/woodland and woodland habitat would be a severe long-term impact. It would require 10 years or more for carefully selected, re-planted trees and shrubs to achieve the height of the existing tree canopy. Restoration of the understory would also require careful planning and many years of undisturbed growth. Remoteness and difficulty of access have contributed to conservation of this woodland through suppression of timber harvest and wildfire. The floristic diversity of this type of mature forest habitat, although once common, is now unusual in Hong Kong, and is therefore important from a conservation perspective. Loss of this stand of unusual woodland would reduce the wildlife habitat value of the valley. Although the area used for erection of the conveyor is small, some of the valley would likely be lost due to possible requirement for grading to construct access roads and construction platforms. Although the territory-wide impacts would be moderate to slight due to the limited extent of woodland involved, an important stand of native trees shrubs and climbers would be lost should the conveyor alignment pass through this valley.

Shrub/grassland and shrub/woodland habitats below Tuen Mun Road would also be lost due to construction of the conveyor. These habitats have been disturbed by prior road construction, residential, and recreational land uses. Many of the trees and shrubs in this area have been planted in revegetation exercises following past disturbances (*Acacia* spp., *Cassia* spp., *Casuarina* spp.). Therefore, loss of these habitats is likely to be a short-term impact which will be mitigated through effective restoration of the area.

Although bird use of these areas is intense, the bird species recorded were common in Hong Kong (white eye, long-tailed tailor-bird, bulbuls, common warblers, common doves). Habitat loss is not predicted to cause impacts on avian species of particular conservation significance in Hong Kong. Further, by selecting, the most preferred tree and shrub species for revegetation, these habitats may be improved over a period of 10 years following completion of construction.

The main impact of the proposed conveyor on aquatic life will be to the intertidal communities on the rocks and boulders of east and west Gemini Beach. The construction of facilities for the loading of barges from the proposed conveyor would potentially cause adverse impacts to the intertidal habitat in the form of sea bed disturbance due to localised piling, provision of concrete pier foundations or resulting sedimentation. However, the abundance and species diversity within these communities is low, and it is expected that recolonization of dockside structures will occur following completion of construction.

The lack of freshwater fauna inhabiting the stream means that in this respect the impacts of the project will be small. Steps taken to mitigate the impact of the conveyor on the vegetation of the valley will also serve to mitigate disturbance to the stream itself.

8.3.2 Operation Phase

The greatest impact during the operation phase of the conveyor system will be the increase in human activity in the area over a two year period. It is

probable that service and maintenance crew visits to the area will be frequent, and that human disturbance levels will be high. Therefore, it is expected that the conveyor route will not be used to any extent by terrestrial wildlife during the operation phase. Animals may pass under the conveyor in elevated sections, but intense use of the route is unlikely.

Operation of the proposed conveyor may lead to increased levels of sediment in the waters off Gemini Beach through spillage of material during loading of barges and disturbance of the bottom sediments by the barges themselves. If suitable mitigation measures are not agreed and enforced then this could have a negative impact on the water quality of the sensitive receivers, this is dealt with under Water Quality - Chapter 6.

8.3.3 Mitigation of Construction Impacts

A survey should be carried out at Detailed Design Stage of the conveyor system to enable the choice of a route to avoid woodland and habitats of significance.

Re-routing of the conveyor away from the valley immediately north of Tuen Mun Road would preclude the need to remove somewhere between approximately 0.2 and 0.7 ha (depending on the amount of the 30m wide, corridor actually used) of woodland habitat. In the northern half of the alignment the conveyor is to be constructed on the ridges, thereby avoiding the more densely vegetated valleys and lower slopes. The preference would be for such a ridge line routing to be continued southwards to Tuen Mun Road thereby avoiding the severe impacts of native woodlands in the lowland valleys, however the ridge lines in the southern section do not lend themselves to such a conveyor routing.

To reduce the impact the southern portion of the conveyor (immediately north of Tuen Mun Road) should be moved westward to align with the conveyor routing to the south of Tuen Mun Road, the short length of conveyor connecting the northern run to the southern run would be moved north by some 170 metres. This measure would greatly reduce the nett ecological impacts of the construction phase of the project and in terms of disturbance to woodland this is a preferred alignment, however there are engineering constraints associated with this. [It is understood that the southern section of the conveyor would have to have an "ascending" section with increased capital, running and maintenance costs, including power costs. The conveyor system on which this environmental assessment has been based avoids these added complications].

Mitigation of loss of upland shrub/grassland and shrub/woodland habitats can be accomplished over a longer term (10-15 years) through revegetation using native species endemic to the proposed disturbance site. Species potentially useful for replanting are listed in Appendix A12 of the Route 3 - Country Park Section Preliminary Design Stage 2 TLT & YLA EIA Report and in previous reports on this project. A useful supplement to these lists appears in Corlett (1992) which lists plants attractive to fruit-eating birds in Hong Kong.

One species of protected plant was recorded in the proposed disturbance area (*Enkianthus qinqueflorus*). *Enkianthus qinqueflorus* is a shrub which was recorded on both the south and north areas of the proposed alignment. It is likely to occur at other sites in the immediate vicinity which will not be disturbed by construction, and therefore will not be eliminated from Hong Kong's flora due to construction of the project. Because of its status as a protected plant, it should be included in the seed mix for revegetation, or individual plants should be transplanted from disturbance areas to nurseries for cultivation and later re-planting on re-contoured areas.

8.3.4 Mitigation of Operation Impacts

Operation impacts on terrestrial or avian flora and fauna will result from increased levels of human disturbance for maintenance and servicing of the conveyor. The most effective means of reducing this type of impact is to shorten the length of the earth moving operation. This could be accomplished by extending hours of operation of the conveyor on a daily basis. This could have adverse consequences for noise and/or dust sensitive residents of the area affected by the conveyor. However, it would speed the earth moving process, thereby shortening the time span over which wild plants and animals would be affected.

To mitigate operational impacts on marine resources steps should be taken to prevent the accidental spillage of material into the sea. Also, the loading area should be adequately deep to allow loading of barges without disturbance of the sea bed.

8.4 MONITORING MEASURES

Prior to onset of construction a reliable supply of revegetation seed and seedling stock should be secured. If necessary, government plant nurseries should initiate programmes to cultivate plants for revegetation of disturbance areas. Use of introduced species should be avoided in revegetation seed mixes, and in species to be transplanted to the site rather native species should be used to the limits of available technoligy (It should be noted that a longer lead time is reqüired to prepare native stocks). Prior to the CS route formation all important woodlands should be marked as "no go" areas. Monitoring should be undertaken to ensure equipment operators do not stray into the "no go" areas.

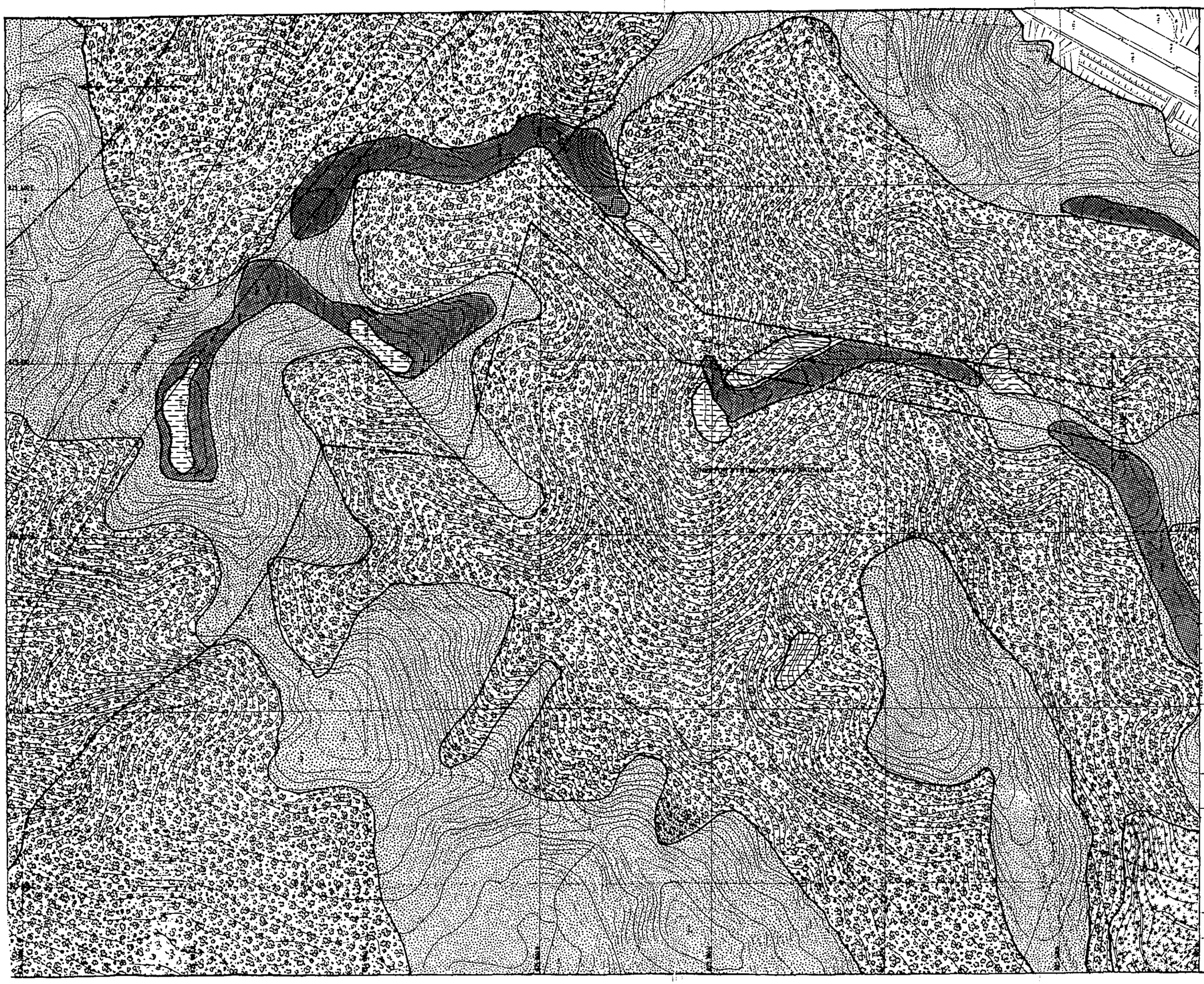
Should the initially proposed conveyor alignment be chosen (in the wooded valley bottom), further study should be undertaken to determine which of the affected plants could be transplanted to a nursery for cultivation in preparation for later use in re-vegetation. Removal of those plants should precede construction on the site.

Revegetation and erosion control on upland sites should be monitored during and following construction by a qualified environmental supervisor. The environmental supervisor should report to the Works Checker, and should have authority to direct revegetation or erosion control works to achieve minimal adverse impacts. Success of revegetation and requirements for

further planting or cultivation should be monitored during the first five years following completion of construction. Areas where plantings have failed to establish or where excessive erosion has occurred should receive immediate corrective action. The use of humus or other organic soil amendments should be investigated to compensate for the poor soil quality which is typical of the site.

Literature Cited

Corlett, R. 1992. Plants attractive to frugivorous birds in Hong Kong. Mem. H.K. Nat. Hist. Soc. 19:115-116.



LEGEND :

LIMIT OF WORKS AREA

Marsh

Eroded

Plantation

Tall Shrub/ Woodland

Open Shrub/ Woodland

Shrub/ Grassland

No	Date	Description	Checked
		Revision	

Designed		Checked	
Drawn		Checked	
Approved For Issue		Date Of Issue	
Date	7.11.1995	© Copyright Reserved	
Scale	1:1000		

HIGHWAYS DEPARTMENT

WESTERN HARBOUR LINK OFFICE

Route 3 CPS - TLT & YLA
Conveyor System Supplementary Paper

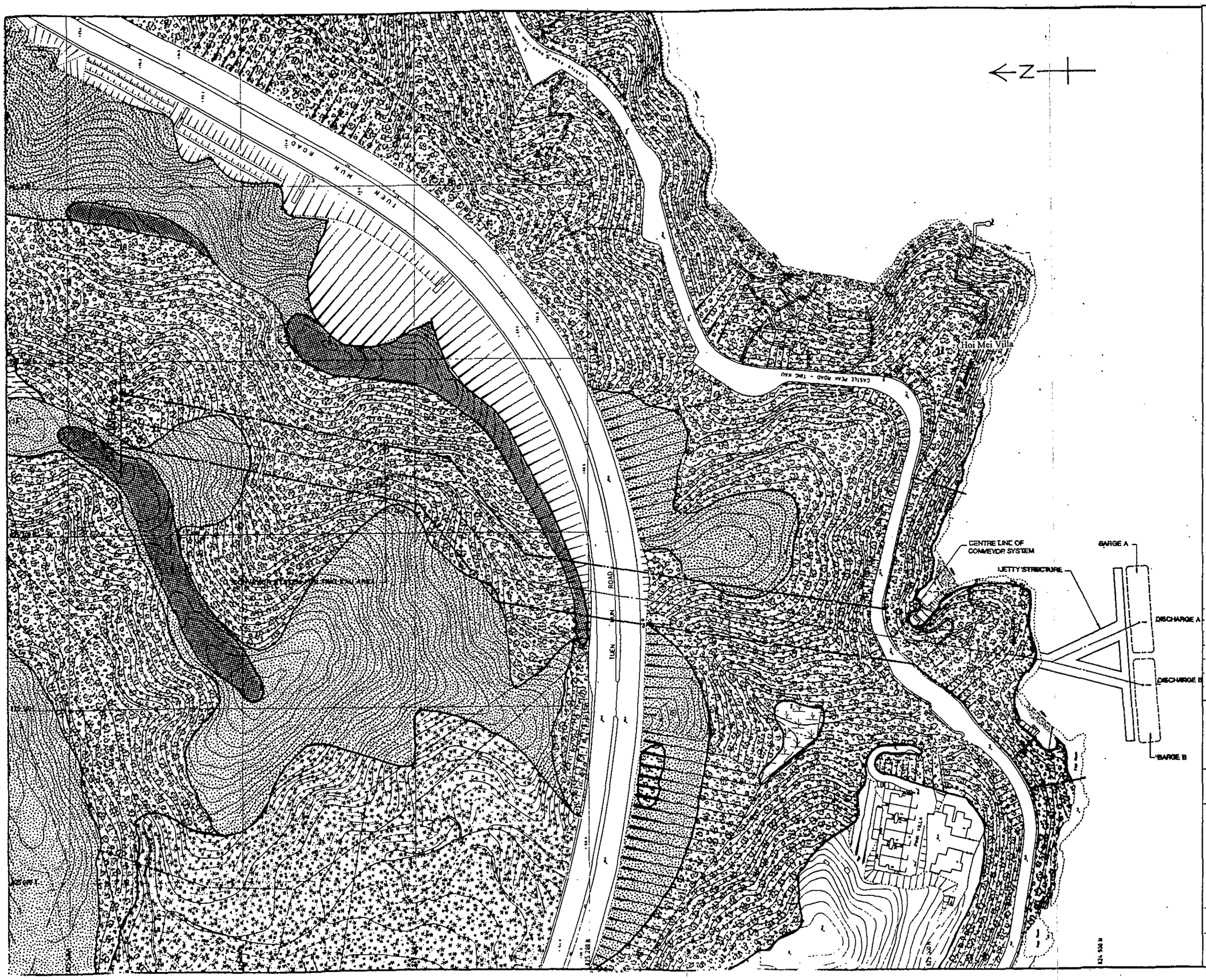
Figure No. 8.1a

HABITAT MAP

SHEET 1 OF 2

Drg No 92393/SK/265

FREEMAN FOX MAUNSELL



LEGEND :

LIMIT OF WORKS AREA

- Marsh
- Eroded
- Plantation
- Tall Shrub/ Woodland
- Open Shrub/ Woodland
- Shrub/ Grassland

No	Date	Description	Checked
		Revisions	

Designed — Checked
Drawn — Checked
Approved For Issue — Date Of Issue
Date
Scale

HIGHWAYS DEPARTMENT

WESTERN HARBOUR LINK OFFICE

Route 3 CPS - TLT & YLA
Conveyor System Supplementary Paper

Figure No. 8.1b

HABITAT MAP

SHEET 2 OF 2

Drg No 92 393 / SK / 266

FREEMAN FOX MAUNSELL

ENVIRONMENTAL MONITORING AND AUDIT

CHAPTER 9

9. ENVIRONMENTAL MONITORING AND AUDIT (EM&A)

9.1 INTRODUCTION

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

- environmental impacts resulting from construction and operation of the Conveyor System (CS) 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 Country Park Section - TLT & YLA EIA. As such, this information is not duplicated in this Chapter.

As the Conveyor System is part of the TLT & YLA Road BOT contract the representative on site (or at least responsible for the site) will be a Works Checker (WC). There will also be an environmental team employed to undertake the monitoring and audit. It is recommended that the duties, responsibilities and resources are extended to include the CS into the overall Monitoring and Audit programme for the whole Project.

9.2 ENVIRONMENTAL MONITORING & AUDIT SCHEUDLES AND ACTION PLANS

Noise, air quality and fresh and marine water quality impacts are the areas of main concern for the construction and operation of the CS. Outline Monitoring Schedules and Action Plans are detailed in Tables 9.1 to 9.7.

The finalised monitoring and audit schedules, methodology and procedures should be agreed with EPD before the programme is implemented.

TABLE 9.1

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 : SRs Sensitive Receivers - Golden Villa/Pink Villa and Hoi Mei Villa
N/A Not Applicable
** 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

TABLE 9.2

NOISE - OUTLINE MONITORING SCHEDULE

PARAMETER	OBJECTIVE	NOISE EXCEEDANCE LIMIT	LOCATION	FREQUENCY/TIMING
L_{10}, L_{50}, L_{90}, $L_{Aeq\ (30\ min)}$	Baseline Assessment	N/A	NSRs	24hr monitoring period for one week
L_{10}, L_{50}, L_{90}, $L_{Aeq\ (30\ min)}$	Check Baseline	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	75 dB(A) * between 0700 - 1900hrs on normal weekdays	NSRs	Minimum of once per week for each NSR during construction activities
$L_{Aeq\ (30\ min)}$	Compliance monitoring (non-restricted daytime hours)	75 dB(A) * between 0700 - 1900hrs on normal weekdays	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)	75 dB(A) * between 0700 - 1900hrs on normal weekdays	Complainant	As appropriate

Note : NSRs - Noise Sensitive Receivers - Golden Villa/Pink Villa and Hoi Mei Villa
N/A - Not Applicable
* Reduce to 70 dB(A) for schools and 65 dB(A) during school examination periods

TABLE 9.3

FRESH WATER QUALITY - OUTLINE MONITORING SCHEDULE

PARAMETER	OBJECTIVE	TRIGGER LEVEL	ACTION LEVEL	TARGET LEVEL	LOCATION	FREQUENCY/TIMING
Dissolved Oxygen Suspended Solids/ Turbidity	Compliance monitoring	80% Target Level	Average of Target and Trigger Level	TM *	Main Discharge Points into stream	During the course of construction, twice per week at each main discharge point.
Dissolved Oxygen Suspended Solids/ Turbidity	Baseline monitoring	80% Target Level	Average of Target and Trigger Level	WQO *	Appropriate locations in stream	During the course of construction, twice per week at each main discharge point.
Dissolved Oxygen Suspended Solids/ Turbidity	Compliance monitoring	80% Target Level	Average of Target and Trigger Level	WQO *	Appropriate locations in stream	During the course of construction, twice per week at each main discharge point.

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

TABLE 9.4

MARINE WATER QUALITY MONITORING SCHEDULE

PARAMETER	OBJECTIVE	TRIGGER LEVEL	ACTION LEVEL	TARGET LEVEL	LOCATION	FREQUENCY/TIMING
Dissolved oxygen	Baseline assessment	N/A	N/A	N/A	2 monitoring stations close to barge loading point - 1m below surface - mid level - 1m above sea bed	Prior to commencing construction for a period of at least 4 weeks, 2 samples per monitoring station, 4 times per week
Suspended solids/ Turbidity	Baseline assessment	N/A	N/A	N/A	2 monitoring stations close to barge loading point - 1m below surface - mid level - 1m above sea bed	Prior to commencing construction for a period of at least 4 weeks, 2 samples per monitoring station, 4 times per week
Dissolved oxygen	Compliance monitoring	20% below running background levels	Average of Trigger and Target Levels	*WQO	2 Designated monitoring stations 1 Control Station - 1m below surface - mid level - 1m above sea bed	During the operation period of the barge loading facilities - 3 times per week, 2 samples per monitoring station
Suspended solids/ Turbidity	Compliance monitoring	20% above running background levels	Average of Trigger and Target Levels	WQO	2 Designated monitoring stations 1 Control Station - 1m below surface - mid level - 1m above sea bed	During the operation period of the barge loading facilities - 3 times per week, 2 samples per monitoring station
Dissolved Oxygen	Post construction period compliance monitoring	20% below running background levels	Average of Trigger and Target Levels	*WQO	2 Designated monitoring stations 1 Control Station - 1m below surface - mid level - 1m above sea bed	After completion of barge loading activities for a period of 4-6 weeks continuously
Suspended solids/ Turbidity	Post construction period compliance monitoring	20% above running background levels	Average of Trigger and Target Levels	WQO	2 Designated monitoring stations 1 Control Station - 1m below surface - mid level - 1m above sea bed	After completion of barge loading activities for a period of 4-6 weeks continuously

Note : N/A Not applicable

WQO Water Quality Objective for Western Buffer Water Control Zone = dissolved oxygen - 4mg/l (depth average) 2mg/l (bottom); suspended solids - waste discharge not to raise the natural ambient level by 30%, nor accumulation of suspended solids.

* 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

Turbidity should also be measured to give an instantaneous indication of the water quality and the frequency and related action should be agreed with EPD

Sampling should be carried out at mid-flood and mid-ebb tides.

Table 9.4

MARINE WATER QUALITY MONITORING SCHEDULE (Continued)

PARAMETER	OBJECTIVE	TRIGGER LEVEL	ACTION LEVEL	TARGET LEVEL	LOCATION	FREQUENCY/ TIMING
Eschericha coli	Baseline assessment	N/A	N/A	N/A	2 monitoring stations one close to the bathing heaches and one close to the barge loading point - approximately 20cm below surface	Prior to commencing construction for a period of 4 weeks, 2 samples per monitoring station; 2 times per week
Eschericha coli	Compliance monitoring	20% above running background levels	Average of Trigger and Target levels	WQO*	1 Designated monitoring stations close to the barge loading point, 1 control station close to the bathing beaches - approximately 20cm below surface	During the operation period of the barge loading facilities once per week 2 samples per monitoring station.
Eschericha coli	Post construction period compliance monitoring	20% above running background levels	Average of Trigger and Target levels	WQO*	1 Designated monitoring station close to the barge loading point, 1 control station close to tbe bathing beaches. - approximately 20cm below	After completion of barge loading activaties for a period of 4-6 weeks.

Note: N/A Not Applicable

* WQO for the Western Buffer Water Control Zone = annual geometric mean not to exceed 610/100ml (secondary contact recreation surface subzones)

NB: Running Background levels refer to data collected during preconstruction monitoring which represents natural seasonal changes which will occur during the normal life of an aquactic environment. This data can then be used as a comparison to gauge if any unnatural impacts have occured to the aquatic environment during the period of construction or operation of the project.

TABLE 9.5

AIR QUALITY ACTION PLAN - SUSPENDED PARTICULATES

EVENT	FREQUENCY	ACTION	
		Site Manager	*Contractor*
Breach of **Trigger Value**	**One** sample	Inform Contractor & WC	Check working practices
	Two consecutive samples	Inform EPD, contractor and WC; 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 WC; 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 WC; resample to confirm result Increase frequency of monitoring to daily Propose remedial action to contractor and WC 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 WC; Confirm result & increase monitoring frequency to daily Propose remedial action to contractor and WC 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 check its effectiveness Amend method statement, if appropriate Inform EPD of remedial action

TABLE 9.6

NOISE ACTION PLAN

EVENT	ACTION	
	Site Manager	*Contractor*
Breach of: daytime (unrestricted hours) **Noise Exceedance Limit**	Inform contractor, WC	Investigate complaint***
Breach of: daytime (unrestricted hours) **Noise Exceedance Limit** 1 complaint	Inform contractor, EPD, WC; 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, WC; 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: ** Action associated with response to complaints

*** The action plan for the Noise Exceedance Limit should be adopted and implemented whenever the noise levels measured during any complaint investigation exceed the Noise Exceedance Limit.

TABLE 9.7

FRESH AND MARINE WATER QUALITY ACTION PLAN - SUSPENDED SOLIDS AND DISSOLVED OXYGEN

EVENT	FREQUENCY	ACTION		
		Monitoring Team	*WC/Site Manager*	*Contractor*
Breach of **Trigger Value**	**One sample**	Inform contractor & WC		
	Two consecutive samples	Inform EPD, contractor and WC; 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 WC; 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 WC; 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 WC;	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 10

10. CONCLUSIONS AND RECOMMENDATIONS

10.1 INTRODUCTION

An environmental assessment of the proposed Conveyor System (CS) has been carried out, and the key environmental issues are addressed in the preceding chapters. It should be noted that there is no confirmed design of the proposed CS as yet, and the assessment was based on assumptions of what is considered to be practicable and likely. Appropriate mitigation measures have also been recommended for incorporation whenever possible, into the contract documents for the detailed design stage, 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 CS in an environmental context.

10.2 KEY ENVIRONMENTAL ISSUES

10.2.1 Noise

Within the Study Area most of the noise sensitive receivers (NSRs) are located either at a significant distance from the conveyor system or are screened by the local topography. The noise modelling predicted noise levels at the selected representative receivers to be well below the 75 dB(A) criterion. The operational noise impact of the proposed conveyor system is predicted to be insignificant if the enclosed drive houses and conveyor belts are used.

Piling may be required for the construction of the barge loading area. At the moment details and feasibility of the construction method have not been confirmed. However any works related percussive piling will be controlled by the EPDs " Technical Memorandum on Noise from Percussive Piling ".

10.2.2 Air Quality

The northern section of the conveyor system is isolated from the sensitive receivers. At the southern end next to the barge loading jetty, two groups of sensitive receivers exist. The first group is located at Pink Villas and Golden Villa, the second consists of Hoi Mei Villa.

The Fugitive Dust Model (FDM) was used to assess the impact of operational phase dust (TSP) emissions upon the receivers. The results indicated that the maximum predicted 1-hr averaged TSP concentrations are far below the 500$\mu g/m^3$ criterion and the predicted 24-hr averaged TSP concentrations are well within the Hong Kong Air Quality Objectives (HKAQOs) limit.

10.2.3 Water Quality

During the construction phase of the conveyor system the key issues will be centred on the potential contamination of the stream catchment and the

marine environment, through provision of the conveyor system, its access road and the barge loading jetty. Impacts may arise due to sediment or waste materials entering the stream course and thus the marine environment or through direct input into the marine waters due to construction activities associated with the barge loading jetty.

In view of the potential impacts prevention and control measures are suggested and it is recommended that these should be applied wherever practicable. Suitable clauses must be included in the contract documentation to limit impacts.

The section of the alignment which affects the small stream valley should be re-routed away from the catchment area which would otherwise be affected. It is recommended that this is considered during the detailed design.

During the operational phase the potential impacts will arise from use of the access road, transportation and handling of spoil, particularly during barge loading activities. Special consideration needs to be given to all spoil handling facilities to deter loss of spoil in any form to the surrounding environment. Use of the access road should be limited to maintenance vehicles.

10.2.4 Spoil

The use of a conveyor system is the preferred method of moving the material to a location where it can be transferred to large containers (barges) for further transport and disposal.

Apart from impacts related to the construction and physical presence of the conveyor system, good spoil management procedures are the key to the systems' environmental acceptability.

It is considered practicable to minimise impacts at the various potential weak points i.e. conveyor loading, handling, transfer and barge loading locations. This can be achieved by careful design, imposition of identified control measures and strict enforcement of there measures as well as simple practical checks on basic good site practise.

It is essential that the detailed design incorporates control and mitigation measures to prevent spillages and therefore consequent impacts.

10.2.5 Landscape and Visual Assessment

The main features of the CS that would cause significant landscape impacts, result from the alignment of the southern section of the conveyor system which lies north of the Tuen Mun Road. This section will cause a major impact to the small stream valley. The impact will arise due to the loss of woodland. Further minor localised impact will be created in areas associated with the surge bins, the temporary bridge structures and the barge loading jetty. These impacts will be amended once the conveyor system is removed and the restoration and reinstatement takes place.

Temporary visual intrusion may be suffered by receivers throughout the visual envelope. The most severely affected receivers within the study area comprise the permanent residents within the properties surrounding the Gemini Beaches. The impact would be particularly significant should operations be undertaken at night or in poor light necessitating the need for artificial illumination.

It should be noted that the properties within the village area to the north west of the study area would not be significantly affected by the position of the conveyor system as it is screened by the intervening landform.

Although the conveyor system would cause a number of locally significant impacts the structure and its affects will be temporary, the final restoration of the scheme could in fact provide positive benefit to the character of certain areas through which it passes.

10.2.6 Ecology

No officially gazetted or other conservation areas occurred in the studied area. However one species of protected plant was recorded in the proposed disturbance area; New Year flower (*Enkianthus qinqueflorus*). *Enkianthus qinqueflorus* is a shrub which was recorded on both the south and north areas of the proposed alignment.

In the southern 540m of the conveyor system there is a 230m portion that lies northward from Tuen Mun Road where a deep stream valley with dense woodland cover will be affected. Loss of shrub/woodland and woodland habitat would be a severe long term impact. The floristic diversity of this type of mature forest habitat, although once common, is now unusual in Hong Kong and is therefore important from a conservation perspective. It would require 10 years or more for carefully selected, re-planting trees and shrubs to achieve the height of the existing tree canopy.

Re-routing of the conveyor away from the valley immediately north of Tuen Mun road would preclude the need to remove somewhere between approximately 0.2 and 0.7 ha (depending on the amount of the 30m corridor actually used) of woodland habitat thereby avoiding the severe impact on native woodland in the lowland valleys.

The construction of facilities for the loading of barges from the proposed conveyor system would potentially cause adverse impacts to the intertidal habitat in the form of sea bed disturbance due to piling or resulting sedimentation. However, the abundance and species diversity within these communities is low, and it is expected that recolonisation of dockside structures will occur following completion of construction. The lack of freshwater fauna inhabiting the stream means that impacts of the project will be small.

The greatest impact during the operational phase of the system will be the increase in human activity in the area over a two year period due to maintenance, checking and servicing requirements. The most effective means of reducing the impact is to speed up the earth moving operation, or increase

the number of hours the conveyor system is operated for, thereby shortening the time span over which wild plants and animals would be affected.

10.3 RECOMMENDATIONS

It is recommended that the identified monitoring and audit procedures are carried out and the associated action plans are enforced.

It is recommended that the alignment of the conveyor system route is modified by diversion to the west to avoid mature woodland and its associated stream valley and therefore reduce ecological impacts. This diversion would involve a 50 metre westerly movement of the 230 metres of conveyor immediately to the north of Tuen Mun Road. This would not involve a movement to the west in the section of conveyor south of Tuen Mun Road as this would bring the alignment closer to the SRs at Pink and Golden Villas which might be unacceptable, particularly if night-time working is required.

The alignment which has been assessed is feasible and if this proposed diversion is not practicable due to engineering or other constraints then this alignment could be used. In this case extremely careful design and construction to minimise loss of trees will be required. This should include detailed mapping of habitats and flora and preparation of a tree felling plan as well as involvement of an ecologist and/or other appropriate specialist(s) in the detailed route selection, design and restoration processes.

APPENDICES

SCOPE OF WORK

APPENDIX A1

Route 3 Country Park Section - Supplementary Paper on Conveyor System

Scope of Works

1. Noise Assessment

No major earthworks will be involved and the construction period of the conveyor system is expected to be short. Hence the associated construction noise impact will not be further investigated.

The conveyor system's operational noise which might sustain during the Route 3 project will be assessed. The Noise Sensitive Receivers (NSRs) identified are:

(i) Pink Villa - residential; and

(ii) Homi Villa - vacant at present, might be changed to a museum or a viewing point for the PADS project.

Noise levels at the above NSRs will be predicted using the available sound information from the engineer. They will be compared against the Hong Kong noise standards or guidelines. Noise mitigation measures and appropriate site practice will be recommended if necessary.

2. Air Quality Assessment

As mentioned in the noise section, construction of the conveyor system is not expected to bring along significant dust impact since no major earthworks will be required.

The operational phase dust impact will be assessed using the modelling software FDM. The Sensitive Receivers identified are:

(i) Pink Villa - residential; and

(ii) Homi Villa - vacant at present, might be changed to a museum or a viewing point for the PADS project.

The emission factors will be estimated using USEPA 'Compilation of Air Pollutant Emission Factors (AP-42, 1985)'. Typical worst case meterological data will be assumed. They include:

Wind Speed	=	2 m/s
Wind Direction	=	Worst-case
Wind Direction Variation	=	11.5°
Mixing Height	=	1000 m
Ambient Temperature	=	25 °C
Stability Class	=	D

The results will be compared to Hong Kong Air Quality Objectives (HKAQO) and other Hong Kong guidelines and mitigation will be proposed if necessary.

3. Water Quality Impact

Marine water quality impacts from the construction of the barge loading point are not expected to be significant, as it is intended that the loading point be located in water sufficiently deep enough for access and egress by barges without the need for dredging work. The loading facility would be a piled structure which will be removed after completion of Route 3. Location of the loading point and its construction method will be assessed with mitigation measures proposed for identified impacts.

The operational stage will last some 2 years and the potential for marine water quality impacts will have to be assessed. A number of beaches are located in close vicinity of the facility with Gemini Beaches being less than 100m from the site. The potential impacts will be assessed with a review of the operational procedures. Where impacts or shortfalls in the operational procedures are identified, mitigation measures and recommendations on the operation of the loading facility will be made.

4. Spoil and Fill

The quantity, quality and timing of the excavated material arisings from the construction of the conveyor system will be identified. Suitable waste handling and disposal measures will be recommended, including considerations for the reuse of surplus excavated materials and construction wastes for construction purpose so as to minimise the amount of wastes to be disposed of at landfills. Potential environmental impacts during both the construction and operation (particularly at the barge loading point) of the system will also be identified and appropriate mitigation measures will be proposed to minimise these impacts.

5. Landscape and Visual Assessment

An appraisal of baseline conditions will be carried out. In order that the subsequent impact assessment can be evaluated objectively, the existing landscape context will first be established. Landscape and visual impacts will subsequently be predicted based on the order of change to these baseline conditions. The severity of the impacts is categorised into severe, moderate, low and insignificant. Appropriate short-term mitigation measures will be identified, with final restoration proposals outlined for the conveyor corridor.

6. Ecological Impact

The proposed alignment will be surveyed non-systematically during January 1994 to record flora and fauna. Flora will be recorded according to life form, and a habitat map will be prepared. Particular attention will be paid to species protected by local regulation. Locations of any recorded protected plants will be identified on the habitat map.

Fauna will be surveyed to record presence or sign of animals which are of special significance in the Territory or throughout the region. Special attention will be paid to documenting presence of animals protected by local ordinances. Intensive use areas such as nest sites, burrows, trails, or perches will be identified on the habitat map. Species recorded on the site will be listed with special reference to those considered to be of conservation significance.

EPD COMMENTS ON SCOPE OF WORK

APPENDIX A2

From Director of Environmental Protection
To GE/WHL, HyD (Attn: Mr. Y.S. HEUNG)
Ref. In EP2/N6/14 Annex (1)
Tel. No. 835 1106 (Fax : 591 0558)
Your Ref. 50 EHL 17/4/08 III
Date 14 January 1994
dated 31.12.93

Route 3 - Country Park Section and Ting Kau Bridge
EIA - Preliminary Design Stage 2
Haul/Access Road, WAHMO Assessment and S.Section Spoil Disposal
Supplementary papers

Further to your captioned memorandum and the recent telephone discussions Cox/HEUNG, please be advised of the following:

* comments on the Haul/Access Road paper will be submitted shortly

* confirmation of this departments satisfaction with the WAHMO revised assessment was sent to you under cover of my fax dated 11.1.94.

* I understand that the tunnel air quality guidelines endorsed by EPCOM and adopted by HyD will not require changes to the Tai Lam Tunnel ventilation design, hence there is no requirement from this department for changes to the EIA report in this respect.

* the proposed scope of works for the spoil disposal from the Southern portal of the Tai Lam Tunnel had not been received by this department until 11.1.94 p.m. Comments on the scope are given below:

1. The use of FDM is acceptable. However, to be consistent with the assessment for the construction dust impacts assessment for TKB and CPS, the Consultant should use 1992 weather data from the Royal Observatory's Tuen Mun Station instead of the proposed worst case meterological data.

2. I am not sure whether the Pink Villa and Homi (Hoi Mei ?) Villa are the only sensitive receivers in that area, your consultant should confirm this.

3. The Consultant should also assess the cumulative, including background, dust impacts in these sensitive receivers. Appropriate measures should be recommended.

4. On the noise assessment aspect, I have no objection to the suggestion that the associated construction noise impact of the conveyor system will not be investigated on the condition that the noise control clauses covered under the construction contract for the road scheme will also be adopted here.

5. As mentioned in 2. above, I presume that the 2 NSRs identified in the paper will represent the full picture of the potential noise impact arising from the conveyor system. It is the responsibility of your consultant to confirm the adequacy of the assessment points. The design and maintenances of the conveyor system should also be

addressed in the supplementary paper.

(David Cox)
Senior Environmental Protection Officer (Atg.)
for Director of Environmental Protection

c.c.

		fax
PD/LFC, HyD	(Attn: Mr. C. S.WAI/E. Roblin)	8276566
Freeman Fox Maunsell	(Attn: Mr. R. Taylor)	3756399
Axis Environmental	(Attn: Mr. T. Chapman)	8272891

c:\wp\projects\memo.94\TKB-EIA1.add

CALCULATION OF EMISSION RATES

APPENDIX A3

APPENDIX A3 CALCULATION OF EMISSION RATES

The dust emission rates have been calculated in accordance with the empirical equations quoted in the USEPA document "Compilation of Air Pollutant Emission Factors, AP-42".

Assumption

Hours of Operation:	10 hrs/day
Removal Rate of Spoil:	1000 m^3/hr x 2500 kg/m^3
	= 0.69 Mg/s

1. Transfer of Material into Crusher

The quantity of particulate emissions generated by the batch drop operation is estimated using the following empirical expression:

$$E = k(0.0009)\frac{(s/5)(U/2.2)(H/1.5)}{(M/2)^2(Y/4.6)^{0.33}} \text{ (kg/Mg)}$$

assuming:

k	=	particle size multiplier
	=	0.73
s	=	material silt content
	=	2 %
U	=	wind speed
H	=	drop height
	=	3 m
M	=	material moisture content
	=	0.7 %
Y	=	dumping device capacity
	=	5.4 m^3

Hence, the uncontrolled emission factor, E = 0.00185*U kg/Mg or 1.283*U g/s.

2. Crusher Operation

The emission factor for primary crushing operation is 0.009 kg/Mg or 6.25 g/s.

3. Material Transfer over Conveyor

The emission factor for conveying materials with covered conveyor belts is 0.17 g/Mg or 0.000118 g/s/m (one-tenth of the uncovered system) .

4. Material Transfer into Barges

The quantity of particulate emissions generated by the continuous operation is estimated using the following empirical expression:

$$E = k(0.0009)\ \frac{(s/5)(U/2.2)(H/3.0)}{(M/2)^2}\ (kg/Mg)$$

assuming:

- k = particle size multiplier = 0.77
- s = material silt content = 2 %
- U = wind speed
- H = drop height = 3 m
- M = material moisture content = 0.7 %

Hence, the uncontrolled emission factor, E = 0.00103*U kg/Mg or 0.71*U g/s.

5. Wind Erosion of Stockpiles on Barges

For wind erosion of active storage piles, the following emission equation is used:

$$E = 1.9\left(\frac{s}{1.5}\right)\left(\frac{365-p}{235}\right)\left(\frac{f}{15}\right)\ (kg/day/hectare)$$

assuming:

- s = material silt content = 2 %
- p = number of days with more than 0.25 mm of precipitation per year = 137
- f = % of time that the unobstructed wind speed exceeds 5.4 m/s at the mean pile height = 3.26 %
- A = stockpile area = 625 m^2

Hence, the uncontrolled emission factor, E = 0.0334 kg/day or 6.2×10^{-7} g/s/m^2.