Scott Wilson

Ping Ha Road Improvement
Ha Tsuen Section
EIA & DIA Studies

Environmental Impact Assessment Report
(Final)

March 1998

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PREPARED BY

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in association with

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Enpac Limited

SWK Atria

FOR

New Territories North Development Office

Territory Development Department

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6 Tung Lo Wan Hill Road, Sha Tin,

New Territories

Agreement No. CE 3/94

Ping Ha Road Improvement
Ha Tsuen Section
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1. Introduction

1.1 Introduction

This Final Environmental Impact Assessment (Final EIA) has been prepared as part of the Ping Ha Road Improvement - Ha Tsuen Section EIA and DIA Studies, awarded by the Territory Development Department (NT North Development Office) under Consultancy Agreement No. CE 3/94. Details of the brief for the EIA are summarised in Section 1.3 below.

The Final EIA provides a quantitative assessment of the key environmental impacts identified in the Brief and Inception Report and incorporates responses to comments made by Government departments. Where necessary recommendations have also been made for incorporation of mitigation measures into the design and implementation of the works, in order to control and minimise the potential impacts on nearby sensitive receivers. Assessment of cumulative impacts is also provided with respect to each of the key environmental issues. Recommendations for environmental monitoring and audit of the baseline, construction, operational and post completion phases of the project, are augmented in a Draft Environmental Monitoring and Audit Manual submitted in Appendix C of this report.

This Final EIA has been prepared by Aspinwall Clouston Limited. The preparation, assessment and analysis of the noise impacts has been undertaken by ENPAC Limited.

1.2 Background

Under the Territorial Development Strategy (TDS), the NWNT is targeted for major growth and urban development. Ping Ha Road and Tin Ha Road are the major access roads to the area and traffic pressure on the road is increasing as Tin Shui Wai develops. The Tin Shui Wai new town development (approximately 4 km^2) is located in the Tin Shui Wai drainage basin which covers an area of approximately 23 km^2 with major sub catchments, relevant to the study area, at Ha Tsuen and Lo Uk Tsuen. Until recently the basin was susceptible to regional flooding and drainage improvement works have been undertaken with construction of channels, poldering of villages, including Lo Uk Tsuen, Sik Kong Tsuen and Sik Kong Wai, and the damming and use of storm retention ponds. However, local flooding still occurs.

According to the TELADFLOCOSS 2, Basin Management Planning Report for Basin No. 8 - Tin Shui Wai (1993) and the Draft Ha Tsuen Outline Zoning Plan, there has been widespread conversion of agricultural land into uses such as open storage yards for containers, vehicle repairing and maintenance workshops, and open storage areas for construction machinery and materials. Much of this development has been undertaken without the provision of any stormwater drainage systems or other infrastructure such as proper access and sewerage and has led to the rapid degradation of the existing rural environment, reduction in flood storage capacity, increased run off, traffic congestion and visual blight, particularly along Ping Ha Road and Tin Ha Road.

The area most susceptible to flooding in the Tin Shui Wai drainage basin is Ping Ha Road between Lo Uk Tsuen and Sha Kong Wai, immediately to the north of the study area limit. Reclamation either side of the road has resulted in the road now being the lowest point in the area with modification of the local drainage paths so that a greater area now drains into the basin. Highways Department has implemented some interim improvements to the road drainage which has provided some relief, but flooding can still occur after significant rainfall and will remain a problem until the original drainage path has been reinstated and Ping Ha road reconstructed at a higher level. Works are currently being undertaken at Fung Kong Tsuen to the north west of the Study Area.

In addition the reclamation of a large proportion of Ha Tsuen Marsh at Ha Tsuen Shi, for container and vehicle storage, has increased flooding west of Tin Ha Road, immediately south-west of the study area. This is now being rectified by construction of new drainage channels at Kau Lee Uk Tsuen and Ha Tsuen Shi.

In response to the increasing traffic pressure on Ping Ha Road and access roads, and the drainage problems, TDD are implementing the realignment, widening and raising of the road to accommodate increased traffic flows and cope with periods of flooding.

1.3 Scope and Objectives of the EIA

The scope and objectives of the EIA for Ping Ha Road - Ha Tsuen Section, have been based on the requirements of the Brief and the key environmental issues identified in the Final Inception Report (July 1996).

Scope

The environmental issues that need to be addressed in the Final EIA include the following:

- air quality impacts during construction and operation of the road improvement scheme;
- noise levels during construction and operation of the road improvement scheme;
- water quality of the nullah and adjacent fish pond areas during construction;
- impacts from liquid waste and road run off;
- management of wastes generated during construction and operation;
- visual impact assessment and landscape mitigation for the road;
- impacts on ecology;
- land use issues such as existing and future uses, severance, antiquities and monuments;
- mitigation of adverse impacts and assessment of residual impacts and their acceptability; and
- environmental monitoring and audit requirements.

Objectives

The objectives of the Brief with respect to the EIA Study are as follows :

(a) to describe the proposed project and associated works together with the requirements for carrying out the proposed project;
(b) to identify and describe the elements of the community and environment likely to be affected by the proposed project, and/or likely to cause adverse impacts upon the proposed project, including both the natural and man-made environment;
(c) to identify and quantify emission sources and determine the significance of impacts on sensitive receivers and potential affected uses;
(d) to identify and quantify any potential losses or damage to flora, fauna and natural habitats;
(e) to propose the provision of infrastructure or mitigation measures so as to minimise pollution, environmental disturbance and nuisance during construction and operation of the project;
(f) to identify, predict and evaluate the residual (i.e. after practicable mitigation) environmental impacts and cumulative effects expected to arise during the construction and operation phases of the project in relation to the sensitive receivers and potential affected uses;
(g) to identify, assess and specify methods, measures and standards, to be included in the detailed design, construction and operation of the project which are necessary to mitigate these impacts and reduce them to acceptable levels;
(h) to design and specify the environmental monitoring and audit requirements necessary to ensure the implementation and the effectiveness of the environmental protection and pollution control measures adopted;
(i) to investigate the extent of side-effects of proposed mitigation measures that may lead to other forms of impacts;
(j) to identify constraints associated with the mitigation measures recommended in the study; and
(k) to identify any additional studies necessary to fulfil the objectives to the requirements of this EIA Study.

The Final EIA is presented in the following chapters :

- Chapter 2 Project Description and Activities;
- Chapter 3 Existing Environment;
- Chapter 4 Air Quality Impact Assessment;
- Chapter 5 Noise Impact Assessment;
- Chapter 6 Water Quality Impact Assessment;
- Chapter 7 Waste Management;
- Chapter 8 Landscape Improvements;
- Chapter 9 Planning and Land Use Impact Assessment;
- Chapter 10 Ecological Impact Assessment;
- Chapter 11 Identification of Environmental Monitoring and Audit Requirements; and
- Chapter 12 Summary and Recommendations.

1.4. Limit of the Study Area

The Study Area for this project includes the two km stretch of the Ha Tsuen section of the Ping Ha Road, extending from Sha Chau Lei Tsuen in the south to the junction with Lau Fau Shan Road in the north. For assessment of direct impacts the boundary of the Study Area extends approximately 300 metres either side of the road to incorporate existing and future land uses to the east and west (air quality, noise, water quality). Where appropriate indirect impacts are considered in a more regional context. The location of the Study Area is shown on Figure 1.1.

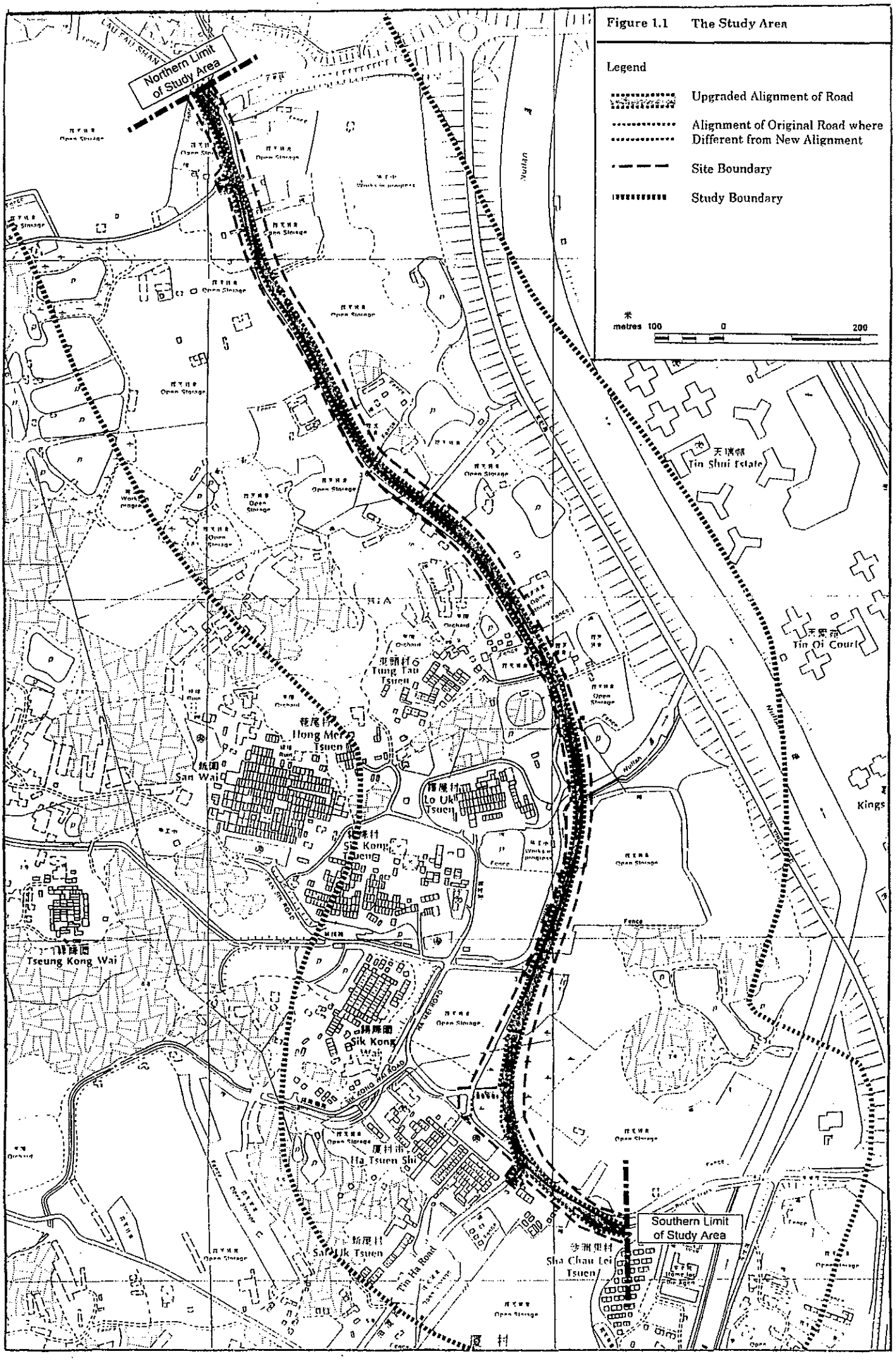


Figure 1.1 The Study Area
Legend
Upgraded Alignment of Road
Alignment of Original Road where Different from New Alignment
Site Boundary
Study Boundary
metres 100 0 200
Northern Limit of Study Area
Southern Limit of Study Area
Tin Shui Estate
Tin Oi Court
Tung Tau Tsuen
Hong Mei Tsuen
San Wai
Lo Uk Tsuen
Sik Kong Tsuen
Tseung Kong Wai
Sik Kong Wai
Ha Tsuen Shi
San Uk Tsuen
Sha Chau Lei Tsuen
Tin Ha Road
Sik Kong Ha Road
Yuen Long Highway
Yuen Long Kau Hui Road
Kings
Yuen Long

2. Project Description and Activities

2.1 Project Description

Ping Ha Road (Ha Tsuen Section) is a narrow two lane district distributor with speed limit of 50 km/hr. The road is located in a semi-rural area and connects a number of villages set back off the road 80 metres or more to the west :

- Sha Chau Lei Tsuen;
- San Uk Tsuen;
- Ha Tsuen Shi;
- Sik Kong Wai;
- Sik Kong Tsuen;
- San Wai;
- Hong Mei Tsuen;
- Lo Uk Tsuen; and
- Tung Tau Tsuen.

According to the draft Ha Tsuen OZP the villages are located in "village type development" land use zones.

Heavy freight traffic and lorries appear to be the main road users. In the dry season, the road is dusty and in the wet season flooding occurs.

The proposed road improvement scheme is to include the following components :

- construction of two km of a single carriageway, 10.3 metres wide, with realignment of the road section to the east, straightening of the southern section at Ha Tsuen, and elevation of the road on embankment to above flood level;
- construction of junctions with side roads;
- bridge construction works over the nullah at Lo Uk Tsuen;
- construction of a cycle track, three metres wide, along the western edge of the road. A buffer strip, 0.9 metres wide, will separate the road from the cycle track;
- construction of footpaths, 2.75 metres wide, along the western edge of the cycle track, the eastern edge of the road and associated junctions and side roads;
- construction of road drainage, sewers and associated works; and
- landscaping and environmental impact abatement works.

A typical schematic cross section of a road is included in Figure 2.1.

2.2 Construction and Operational Activities

Construction Phase

In the absence of details being available from the project proponent, the consultant has drawn up preliminary construction details for the purposes of this assessment. Typical construction activities likely to be undertaken for this road improvement scheme include the following :

- preliminary earthworks, site clearance and mobilization;
- excavation, breaking of existing road surfaces;
- formation of the new alignment near Ha Tsuen Shi;
- backfilling, grading and laying of an elevated sub-base;
- laying of drainage and utilities;
- laying of kerbing, road paving and installation of road signs;
- laying of the footpath and restorative works; and
- landscaping and environmental abatement works.

The construction plant likely to be employed for these construction activities, together with the sound power levels (SWL) for the individual items of powered mechanical equipment (PME), are included below in Table 2.1. Further detailed equipment requirements are included in Table 5.2. Construction is likely to be based on the phasing of activities for the entire section of the road as opposed to individual sections as this will enable each stage of works to be completed quickly. There will be some overlapping of activities particularly between breaking of existing road surfaces, site preparation and laying of sub-base material.

Table 2.1: Sound Power Levels for Construction Equipment

Construction Activity	PME/Noise Sources	TM CNP No.	SWL dB(A)	No. of Plant
Earthworks	bulldozer	030	115	2
	excavator	081	112	2
	dumper	066	106	2
	dump truck	067	117	2
	lorry	141	112	2
				Total SWL = 124 dB(A)
Road Paving	dump trucks	067	117	2
	grader	104	113	2
	hot mix applicator	004	109	1
	mini backhoe	081	112	2
	road roller	185	108	2
				Total SWL = 123 dB(A)

Operational Phase

In environmental terms, the main operational characteristics of the road improvement scheme, are likely to be increased traffic volumes and flows resulting in noise and air quality impacts. The provision of bicycle and foot paths is likely to encourage an increase in the use of the road for recreational and pedestrian traffic.

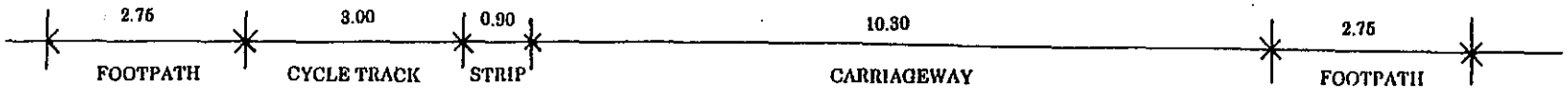
Predicted traffic flows for the year 2011 have been supplied by the project proponent and are shown on Figure 4.1.

2.3 Project Implementation

The road improvement works are currently expected to be completed in a 24 month period commencing in July 1998. A tentative schedule is included in Table 2.2

Table 2.2: Preliminary Project Construction Schedule

Project Activity	Monthly Timetable											
	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	23-24
Preliminary earthworks, site clearance, mobilisation												
Excavation/ breaking of existing road surface												
Formation of new alignment near Ha Tsuen Shi												
Backfilling grading and laying of elevated sub-base												
Drainage and utilities												
Kerbing, road paving, road sign												
Footpath												
Landscaping & Environmental abatement work												



TYPICAL ROAD CROSS SECTION

Scale 1:100

Figure 2.1	**Typical Schematic Cross-Section of a Road**
Note	Supplied by SWK Scale 1:100

3. Existing Environment

3.1 General Description of the Study Area

The Ha Tsuen section of Ping Ha Road is located in the Tin Shui Wai drainage basin, in flat, low lying, near coastal terrain at less than ten metres above sea level. Traditionally the area was rural and agricultural with farming of fish ponds, some vegetable farming, and rice paddies. Much of this has disappeared, particularly along Ping Ha Road where many of the fish ponds and paddies have been converted into uses such as open storage yards for containers, vehicle repair and maintenance workshops, and open storage areas for construction machinery and materials. To the west, behind the villages some limited farming and agricultural practices continue and fish ponds are used for irrigation of plants and the retention of storm waters. The area is now semi-rural with a number of established growing village developments to the west and Tin Shui Wai new town with it's multi storey blocks of flats, dominating the horizon to the east.

3.2 Existing and Planned Sensitive Receptors

Potential sensitive receptors have been identified during site visits and following reference to the draft Ha Tsuen Outline Zoning Plan (OZP) No. S/YL-HT/1 and aerial photographs of the site on 19 July 1995. Sensitive receivers are shown in Figure 3.1.

Existing Sensitive Receptors

Ping Ha Road (Ha Tsuen Section) is a narrow two lane road, just wide enough for two container lorries to pass. The road is located in a semi-rural area and connects a number of villages set back off the road 80 metres or more to the west :

- Sha Chau Lei Tsuen;
- San Uk Tsuen;
- Ha Tsuen Shi;
- Sik Kong Wai;
- Sik Kong Tsuen;
- San Wai;
- Hong Mei Tsuen;
- Lo Uk Tsuen; and
- Tung Tau Tsuen.

According to the draft Ha Tsuen OZP the villages are located in "village type development" land use zones.

Heavy freight traffic and lorries appear to be the main road users. In the dry season, the road is dusty and in the wet season flooding occurs.

A number of container storage yards, open storage areas and vehicle maintenance workshops/storage yards appear to be the main land uses located immediately along both sides of the road. There is no designated "Open Storage"

use in the northern section of the study area, whereas an area to the south of Ping Ha Road, opposite the Home for the Aged, is zoned 'Open Storage" in the draft Ha Tsuen OZP. Large container storage yards in the northern section of the study area appear to be better managed than some of the storage areas to the south. North of the villages, the land use is zoned 'Comprehensive Development Area" in the draft Ha Tsuen OZP to facilitate the phasing out of sporadic open storage areas and other industrial activities such as car repair workshops and temporary structures which have become incompatible with the adjoining developments. To the east of Lo Uk Tsuen the land use is classified as 'Open space".

Individual land use along Ping Ha Road includes :

- upon approval of a planning application for the 'Undetermined Use" zone to the east of Ping Ha Road, the area currently unreclaimed and remained as agricultural land would be developed for open storage use;
- the Tang Ancestral Hall at Ha Tsuen Shi, built in 1793 (grade 1 monument);
- Ha Tsuen Old Market from the 19th century. Not graded. Not in existence as a building;
- homes for the aged at Sha Chau Lei Tsuen (Government/institution/community land use) and Tung Tau Tsuen;
- irrigation and fish ponds south and north of Lo Uk Tsuen and Tung Tau Tsuen, on both sides of the road, and to the north of Tung Tau Tsuen. Fish ponds are also located to the east of the road behind the container storage areas;
- new village houses at Lo Uk Tsuen;
- two storm drainage nullahs which run between Ha Tsuen Shi, Sik Kong Wai and Sik Kong Tsuen, converge at Lo Uk Tsuen, and flow east into the Tin Shui Wai main drainage nullah;
- Yeung Hau Temple at Tung Tau Tsuen, built in the 18th century (declared monument);
- archaeological sites at Ha Tsuen and Tung Tau Tsuen;
- unused derelict fresh water marshy plots (reclaimed fish ponds) north of Tung Tau Tsuen;
- a small fruit orchard (with lychee trees) north of Tung Tau Tsuen; and
- a small marsh at the northern end of the road at the junction with Lau Fau Shan Road.

Agricultural and gardening activities adjacent to the road appear to be limited, possibly due to the conversion of land to storage and vehicle maintenance uses.

Two storm drain nullahs run along the north and south of Sik Kong Wai to converge at Ha Mei Road, west of Ping Ha Road. The nullah then flows north along Ping Ha Road to Lo Uk Tsuen and north-east into the main Tin Shui Wai nullah to finally discharge into Deep Bay. The main nullah runs north between Tin Shui Wai and Tin Ying Road which is on embankment and east of Ping Ha Road. In the dry season, the nullahs are virtually dry with very little water flow and sediment and debris on the bottom when egrets can be a common sight. During monsoon rains, the nullahs are likely to be very full and fast flowing.

Some drainage laying works are currently being carried out alongside the Ping Ha Road at Ha Tsuen Shi.

Future Sensitive Receptors

The south-east area which includes Ha Tsuen Marsh is currently classified as an "Undetermined" (U) land use zone pending the finalization of the KCRC West Rail alignment. However, during preparation of the Draft Final EIA (December 1996) for this study, a planning application was approved for conversion of the Ha Tsuen Marsh area into Open Storage land use. This area may therefore be no longer regarded as a sensitive receptor.

According to Planning Department, a number of small house applications have been approved by DLO/YL for location along the west side of Ping Ha Road opposite the Ha Tsuen Marsh. Some of this land is to be released for village development following the eastwards realignment of the road across the remaining section of the marsh.

The land use along Tin Ha Road, south west from the junction with Ping Ha Road has been designated for village development.

3.3 Ongoing Construction Works

According to information made available by the Rural Planning and Improvement Strategy (RPIS) the following two RPIS minor works projects are currently being implemented in the Study Area.

- Project YL-109 is being undertaken by Highways Department and involves reconstruction of the access road to Fung Kong Tsuen in the northern section of the Study Area. Works include raising of the existing access and provision of a drainage channel along the access road. Works are to be completed by April 1997 and will not affect the proposed Ping Ha Road improvement works.

- Project YL-148 is being undertaken by the Drainage Services Department and involves drainage improvement works at Ha Tsuen Shi in the southern section of the Study Area. The works include the construction of two 1.5 metre wide covered slotted drainage channels, with a total length of 330 metres, to collect run off from Ha Tsuen Shi for discharge into the Sik Kong Wai Channel. The works are to be completed by June 1996 and will not affect the proposed Ping Ha Road improvement works.

Details of both of these projects are included in Appendix A.

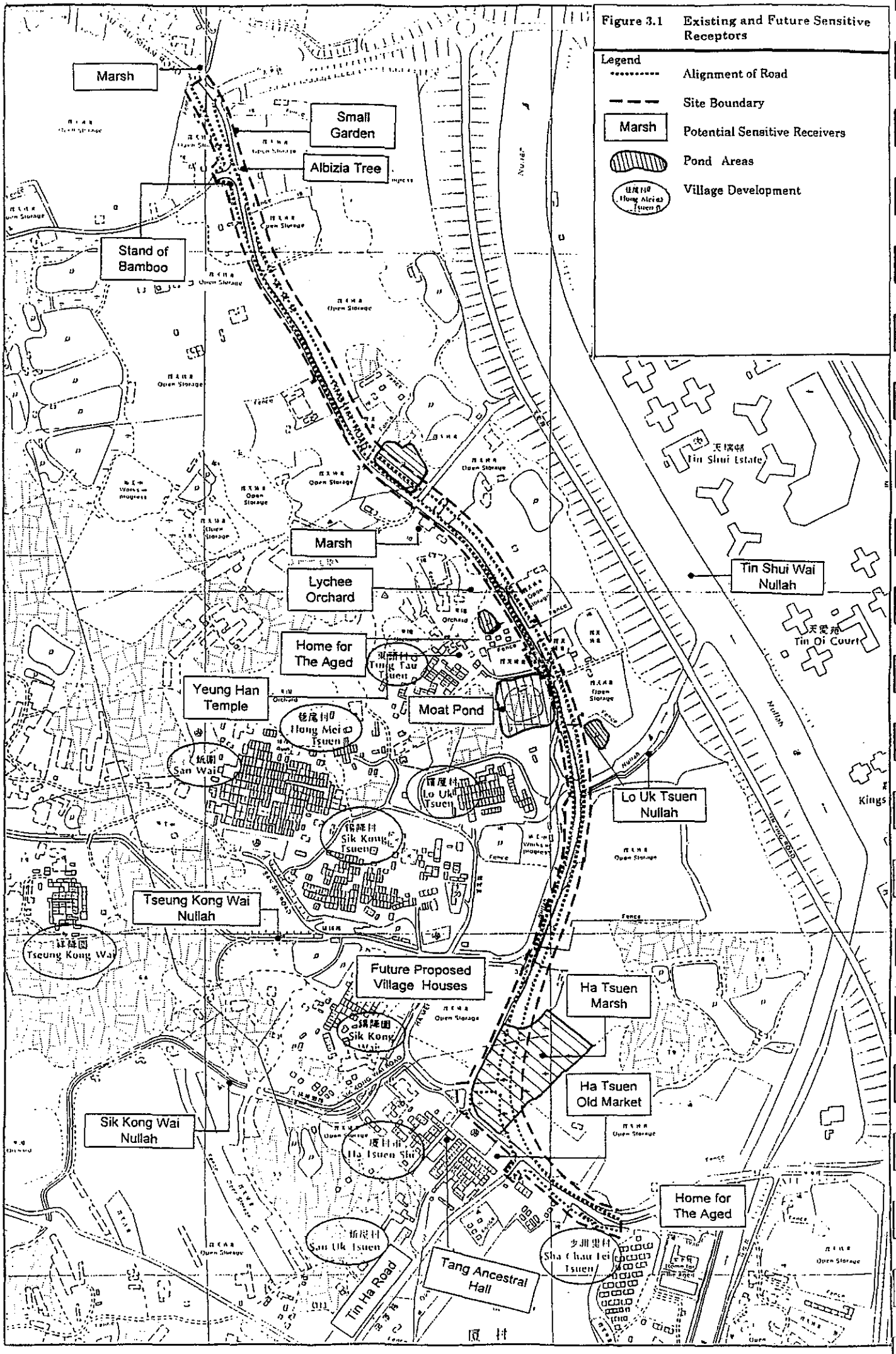


Figure 3.1 Existing and Future Sensitive Receptors
Legend
Alignment of Road
Site Boundary
Marsh
Potential Sensitive Receivers
Pond Areas
Village Development
Marsh
Small Garden
Albizia Tree
Stand of Bamboo
Marsh
Lychee Orchard
Home for The Aged
Yeung Han Temple
Moat Pond
Tseung Kong Wai Nullah
Future Proposed Village Houses
Sik Kong Wai Nullah
Tin Ha Road
Tang Ancestral Hall
Tin Shui Wai Nullah
Lo Uk Tsuen Nullah
Ha Tsuen Marsh
Ha Tsuen Old Market
Home for The Aged
Tin Shui Estate
Tin Oi Court
Kings
Nullah

4. Air Quality Impact Assessment

4.1 Introduction

This section includes an assessment of the air quality impacts predicted to occur during the construction and operational phases of the Ping Ha Road improvement works. The key issues identified include the generation of dust in the form of total suspended particulates during construction; and future traffic emissions (carbon monoxide, nitrogen dioxide and respirable suspended particulates) during operation. Reference has been made to existing air quality legislation (air quality objectives defined under the Air Pollution Control Ordinance and in the Hong Kong Planning Standards and Guidelines), representative sensitive receptors and potential sources of air pollutants. Assessment has been undertaken to include for the worst case 24 hour and one-hour impacts, including cumulative impacts from other overlapping projects and activities. Practical mitigation measures have also been recommended for the control of adverse environmental impacts and assessment has been undertaken of any residual impacts and their acceptability.

4.2 Assessment Criteria

The Air Pollution Control Ordinance (APCO) provides the statutory authority for controlling air pollutants from a variety of stationary and mobile sources, including fugitive dust emissions from construction sites. It encompasses a number of Air Quality Objectives (AQOs) which stipulate concentrations for a range of pollutants including sulphur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), respirable suspended particulates (RSP) and total suspended particulates (TSP). The AQOs are listed in Table 4.1.

Table 4.1 Hong Kong Air Quality Objectives

Pollutant	Average Concentration μg m^{-3}			
	1-Hour*	8-Hour	24-Hour**	Annual
SO_2	800	-	350	80
CO	30000	10000	-	-
NO_2	300	-	150	80
TSP	500***	-	260	80
RSP	-	-	180	55

Note: * *Not to be exceeded more than three times per year*
** *Not to be exceeded more than once per year*
*** *In addition to the above established legislative controls, it is generally accepted that an hourly average TSP concentration of 500 μg m^{-3} should not be exceeded. Such a control limit is normally applied to construction work*

4.3 Assessment Methodology

Construction Dust

The Fugitive Dust Model (FDM) has been used to predict the potential dust concentrations generated from the construction activities on the proposed site for the worst case average 24 hour and one-hour scenarios. For the purposes of this assessment the following assumptions have been made :

Construction Activities and Dust Particulates

- construction activities will be undertaken in sections along the road;
- dust is likely to be generated during material handling (preliminary earthworks, site clearance, breaking of existing road surfaces, backfilling and laying of the sub-base) and vehicle/plant movements on unpaved roads;
- some excavation will need to be undertaken of wet areas and reclamation, infilling and grading works will be required to elevate the road platform above the current level;
- there will be no concrete batching plant within the work site;
- the model used the default particle size distribution in FDM, i.e. the fraction in each of 0-2.5, 2.5-5, 5-10, 10-15 and >15 micrometer diameter is 0.0262, 0.0678, 0.1704, 0.1536 and 0.5820 respectively;
- average dust density = 2500 kg m^{-3};
- mean vehicle speed on unpaved road = 20 km hr^{-1} ;
- average no. of trucks moving on site per day = 50 trucks/day;
- average trip distance = 1.5 km;
- silt content = 5.0 %;
- moisture content = 0.7 %;

Meteorology

- wind speed = 1 ms^{-1}
- wind direction = worst case wind direction
- stability class = D
- mixing height = 500 metres
- temperature = 25° C
- standard wind deviation angle = 20°

Particulate emissions rates for the identified potential dusty sources were determined based on the *US EPA* publication *Compilation of Air Pollution Emission Factors (AP-42-1995).* Table 4.2 presents the predicted dust emissions for each major construction activity expected to be undertaken on site. Detailed calculations are provided in Appendix B.

Table 4.2 Assumed Modelling Parameters for Dust Emissions

Activity	Dust (TSP) Level (Kg day^{-1})
Vehicle movements on unpaved road	115.0
Material handling	1.0

Vehicular Emissions

The main traffic air pollutants are carbon monoxide (CO), nitrogen dioxide (NO_2) and Respirable Suspended Particulates (RSP). Maximum hourly concentrations of NO_2 and CO and 24-hours RSP concentration are modelled using the CALINE4 dispersion model to check potential compliance of future traffic flows along Ping Ha Road with the AQOs. The assessment was carried out based on the predicted 2011 traffic flow figures as shown in Figure 4.1. Figure 4.1 also indicates the percentage of heavy goods vehicles with an unladen weight exceeding 1525kg. Traffic figures for the year 2011 were supplied by the Client.

Emission factors of CO, NO_x and RSP for each vehicular type in 2011 were provided by EPD and compound emission factors were calculated to represent average emission rates for the traffic within the study area.

As recommended by EPD the levels for NO_2 were taken as 20% of the total NO_x emission.

The following worst case meteorological conditions were assumed for the typical input parameters for the emissions modelling :

- wind speed = 1 ms^{-1}
- wind direction = worst case wind direction
- stability class = D
- mixing height = 500 metres
- temperature = 25° C
- standard wind deviation angle = 20°

Currently, there is no hourly criteria for RSP. The hourly results were converted to daily average to check the compliance of the daily criteria of 180 $\mu g/m^3$. A conversion factor of 0.64, as agreed with EPD, was used to convert hourly RSP to daily RSP based on the 24 hours traffic flow pattern within the study area.

4.4 Existing Environment and Background Data

No baseline air quality data are currently available for the study area. However, the air quality monitoring programme carried out by the Environmental Protection Department (EPD) at the Yuen Long Air Quality Monitoring Station has provided an acceptable indication of the existing conditions. Table 4.3 shows the measured pollutant concentrations of NO_2 , TSP and RSP for 1996. No CO data is available from the Yuen Long Air Quality Monitoring Station. Average values of pollutants appear to be below the AQO but the maximum 24 hour TSP value just exceeds the AQO.

Table 4.3 Monitoring data obtained from Yuen Long Air Quality Monitoring Station (1996)

Pollutant	Concentration ($\mu g\ m^{-3}$)		
	Average Background	Maximum Background	AQO
NO_2 (1 hour)	52	229	300
TSP (24 hour)	163	262*	260
TSP (1 year)@	114	262	80
RSP (24 hour)	64	152	180

Note : * *Concentration level exceeds AQO*
\# *EPD's guidelines only*
@ *24 hour TSP background concentrations were between Dec 95 - Feb 96*

4.5 Air Sensitive Receptors

Representative existing and future air sensitive receptors (ASRs) have been identified in accordance with the HKPSG and are the same for both the construction and operational phases. Twelve existing receptors have been identified and include a number of dwellings and buildings, located in the proximity of Ping Ha Road, and the recreational area at Ha Tsuen Shi.

Two representative future sensitive receivers have been identified following review of information made available by the Planning Department. A number of small house applications have been approved along the west side of Ping Ha Road opposite Ha Tsuen Marsh and, according to the draft Ha Tsuen OZP, an area to the south west of the road, along Tin Ha Road, has been zoned for village type development.

Identification and location of the ASRs are shown in Figure 4.2 and listed in Table 4.4.

Because most of the dwellings are three storey village houses, assessments were made at ground level as well as the highest level, i.e. ten metres above ground. The highest levels of emissions occur at ground level and dissipate with height and distance. Ten metres above ground level is equivalent to the top floor occupants of village houses.

Table 4.4 : Grid Co-ordinates of Air Quality Sensitive Receptors

Identification of ASR	Location of the ASRs	Grid Co-ordinate (East)	Grid Co-ordinate (North)
ASR1	Home for the Aged, Sha Chau Lei	817683	834038
ASR2	Village house, Sha Chau Lei	817629	834057
ASR3	Dwelling, between Sha Chau Lei and Tin Ha Road	817505	834107
ASR4	Dwelling, Junction of Tin Ha Road	817462	834125
ASR5	Recreational area, Ha Tsuen Shi	817400	834215
ASR6	Dwelling, Sik Kong Wai	817282	834473
ASR7	Dwelling, Sik Kong Tsuen	817248	834525
ASR8	Dwelling, Sik Kong Tsuen	817367	834585
ASR9	Dwelling, Lo Uk Tsuen	817478	834682
ASR10	Dwelling, Lo Uk Tsuen	817483	834763
ASR11	Home for the Aged, Tung Tau Tsuen	817441	834955
ASR12	Dwelling, Northern Section	817149	835289
ASR13	Future Dwelling, Sik Kong Wai	817385	834310
ASR14	Future Dwelling, Sik Kong Wai	817425	834390

4.6 Construction Phase Impact Assessment

The major potential air quality impact during the construction phase will be dust and the worst case one-hour and 24 hour levels have thus been predicted. Vehicle and plant exhaust emissions from the site are not considered to constitute a significant source of air pollutants and have not been assessed.

According to the information provided by the Yuen Long District Land Office, the proposed future village houses, at ASR13 and ASR14, may be constructed before the commencement of the Ping Ha Road improvement works. These two ASRs have therefore been included in the construction phase impact assessment.

Since the road within the study area is quite uniform in its alignment and topography, the likely construction activities have been assumed to be similar for each section of the road. For each ASR the worst case one-hour average TSP concentrations at ground level and ten metres above ground were modelled and the results are presented in Table 4.4 which also include the annual average background levels (114 μgm^{-3}) to give a total prediction. Figures 4.4 to 4.6 show the peak one-hour and 24-hour average TSP concentration contours at ground level and ten metres above ground respectively.

It is expected that construction work will be undertaken for a ten hour day with no working during the restricted night time hours (1900 - 0700 hours). Therefore, the worst case 24-hour average TSP will be equal to 10/24 of the worst case one-hour average TSP. The predicted worst case 24-hour average TSP values are presented in Table 4.5 and include the average background levels (163 μgm^{-3}) to give a total prediction.

Table 4.5 Predicted Worst Case Average TSP Concentrations at Air Sensitive Receptors (μgm^{-3})

Sensitive Receptor	TSP Concentration (μgm^{-3})			
	Ground level		10 m above ground	
	1-hr** average	24-hr** average	1-hr** average	24-hr** average
ASR1	279.9	232.1	192.3	195.6
ASR2	476.7	314.1*	205.6	201.2
ASR3	559.8*	348.7*	217.8	206.3
ASR4	555.3*	346.9*	235.4	213.6
ASR5	770.0*	436.4*	227.6	210.3
ASR6	226.5	209.9	193.2	196.0
ASR7	197.2	197.5	179.5	190.3
ASR8	210.6	203.2	186.2	193.1
ASR9	281.7	232.9	197.0	197.6
ASR10	282.2	233.1	186.2	193. 1
ASR11	257.2	222.7	206.2	201.4
ASR12	408.3	285.6*	233.0	212.6

Sensitive Receptor	TSP Concentration (μgm^{-3})			
	Ground level		10 m above ground	
	1-hr** average	24-hr** average	1-hr** average	24-hr** average
ASR13	667.2*	393.5*	187.5	193.6
ASR14	661.0*	390.9*	202.8	200.0
AQOs	500***	260	500***	260

Note : * *Predicted levels exceeds AQO for 24- hour average TSP (260 $\mu g\ m^{-3}$) or the EPD's guidelines for 1- hour average TSP (500 $\mu g\ m^{-3}$)*

** *Background levels of 114 $\mu g\ m^{-3}$ and 163 $\mu g\ m^{-3}$ were included in the one hour and 24-hours average TSP prediction results respectively.*

*** *EPD Guideline only*

The data indicate that the 24-hour average TSP levels at ground level for ASRs 2, 3, 4, 5, 12, 13 and 14 will exceed the AQO of 260 $\mu g\ m^{-3}$ when the average background level of 163 $\mu g\ m^{-3}$ is included. The EPD's recommended guideline of 500 $\mu g\ m^{-3}$ for one-hour average TSP will also be exceeded at ASRs 3, 4, 5, 13 and 14 on including the average background level of 114 $\mu g\ m^{-3}$. These ASRs are located close to the roadside and will be susceptible to adverse impacts. The TSP and RSP levels measured in Yuen Long town centre are regarded as being typical of an urban area and high compared to the levels that would be expected along the Ping Ha Road. Consequently, the levels calculated are likely to be conservative.

However, based on this assessment dust suppression measures are therefore required during the construction phase for the worst affected ASRs. Following implementation of mitigation measures the residual impacts will need to be assessed for their acceptability.

During construction of the road improvement works there should be no other projects or works being undertaken in or near the study area and so cumulative impacts are not expected.

4.7 Operational Phase Impact Assessment

Air quality impacts during the operational phase have been assessed for emissions from traffic on the Ping Ha Road and associated access roads, for a design year of 2011. These are the only traffic flow figures available for this study.

For each ASR, the assessment has been carried out at ground level and ten metres above ground. The worst-case one hour concentrations predicted for CO, NO_2 (with background levels) and 24 hour concentration for RSP (with background levels) are shown in Table 4.6 and indicate compliance with the statutory AQOs (NO_2, CO and RSP) at all ASRs. The predicted levels are also well below the average and maximum baseline levels (NO_2 one-hour and RSP 24-hour) obtained from the Yuen Long Air Quality Monitoring Station. The peak average pollution contours for one-hour NO_2 and CO and 24-hours RSP concentrations at ground level are shown in Figures 4.7, 4.8 and 4.9 respectively.

The noise impact assessment has proposed the installation of a combination of noise barriers along the upgraded Ping Ha Road for amelioration of noise levels in excess of the NCO criteria. Air quality levels as indicated in Table 4.6 may be affected by the barriers. However, the CALINE4 model is not appropriate for quantitative assessment of the impacts of noise barriers on air quality and adjacent sensitive receivers. For this study a qualitative assessment has been carried out based on the consultants experience and understanding of the distribution of particulates, knowledge of the study area and current practise in Hong Kong.

It is expected that if the barriers are higher than the ASRs, they will provide a shielding effect and the pollution levels will thus be lower than those predicted in Table 4.6. Conversely, if the barriers are lower, the ASRs will receive higher levels of pollution.

Table 4.6 Worst-Case One Hour (NO_2 and CO) and 24-Hours (RSP) Pollutants Concentration at ASRs ($\mu g\ m^{-3}$) for 2011

ASR	Ground level			10 metres above ground		
	NO_2*	CO	RSP	NO_2*	CO	RSP
1	101.6	430.0	78.7	94.3	371.5	76.7
2	132.1	688.7	87.9	108.4	493.9	81.0
3	130.0	653.0	85.4	113.5	518.5	80.8
4	139.2	787.9	87.7	121.0	607.1	82.4
5	112.6	524.2	81.5	100.6	428.5	78.3
6	142.5	761.8	92.4	91.9	338.8	76.3
7	105.6	436.4	79.8	93.9	344.1	76.4
8	92.3	323.8	75.0	88.9	298.0	74.1
9	83.6	279.5	72.4	81.7	262.2	72.0
10	77.6	231.3	70.9	76.5	220.2	70.6
11	84.4	380.4	73.0	73.1	250.4	70.0
12	90.8	440.9	74.5	78.5	306.0	71.5
13	109.7	451.7	78.8	98.6	373.4	73.3
14	138.9	663.6	85.4	114.2	489.6	79.7
AQOs	300	30000	180	300	30000	180

Note : * *Background level of 52 and 64 $\mu g\ m^{-3}$ are included in the one-hour average NO_2 and 24 hour RSP levels respectively.*

It is noted that even at the lowest level of each ASR as presented in Table 4.6, the pollution levels should remain within the limits. Therefore, it is expected that the proposed noise barriers will not cause breaches of the AQOs or EPD guidelines and consequently mitigation measures are not considered necessary for reduction of vehicle emission impacts.

4.8 Mitigation Measures and Residual Impacts

Construction Phase

The results of the air quality modelling exercise indicates that without mitigation the AQOs could be breached during construction at ASRs (2, 3, 4, 5, 12, 13, 14) if the background one hour and 24-hour average TSP levels are included. It is reiterated that the modelling has been undertaken for construction activities carried out in sequence continually progressing from one section of the road to the next.

High dust levels generated on site can be easily and effectively controlled, in terms of effort, cost and environmental acceptability. Either the reduction of vehicle speeds on unpaved site roads from 20 km hr^{-1} to 10 km hr^{-1} or watering of unpaved site roads twice daily as necessary can achieve up to 50% reduction thereby reducing construction dust to within acceptable levels. The watering of unpaved site roads has been proven to be one of the most effective ways of controlling TSP levels to within the AQOs and the hourly guideline limits in many previous construction projects and should therefore be considered. The effects of 50% dust suppression has therefore been incorporated into the calculation of mitigated construction dust levels and the results show that with basic mitigation both the one hour and the 24-hour average TSP concentrations at all ASRs can be reduced to comply with the one hour and 24-hour guideline of 500 and 260 $\mu g\ m^{-3}$ respectively. The results of the analysis are included in Table 4.7 and the respective peak 24-hour average dust concentration contours at ground level with 50% mitigation are shown in Figure 4.10.

In addition, it is recommended that provision is made for watering of exposed stockpiles and unpaved road areas during dry and windy conditions to prevent the generation of dust plumes on site and adverse impacts on nearby ASRs. This is a simple and effective way of controlling unforeseen dust on site and should be carried out as part of the contractors best working practices. It will be up to the contractor to implement the measures necessary to control and reduce unacceptable dust levels to comply with the AQOs or EPD guidelines.

Table 4.7 Predicted Worst-Case Average TSP Concentrations on Air Sensitive Receptors (μg m^{-3}) (with mitigation for 50% suppression)

Sensitive Receptor	TSP Concentration (μgm^{-3})			
	Ground level		10 m above ground	
	1-hr average	24-hr* average	1-hr average	24-hr* average
ASR1	155.4	180.3	133.7	171.2
ASR2	204.7	200.8	136.9	172.5
ASR3	225.4	209.4	140.0	173.8
ASR4	224.3	209.0	144.3	175.6
ASR5	278.0	231.3	142.4	174.8
ASR6	142.1	174.7	133.8	171.2
ASR7	134.8	171.7	130.4	169.8
ASR8	138.1	173.1	132.1	170.5
ASR9	155.9	180.5	134.7	171.6
ASR10	156.1	180.5	132	170.5
ASR11	149.8	177.9	137.1	172.6
ASR12	187.7	193.4	143.8	175.4
ASR13	252.3	220.6	132.4	170.7
ASR14	250.7	220.0	136.2	172.3
AQOs	500**	260	500**	260

Note : * *Background levels of 114 μg m^{-3} and 163 μg m^{-3} was included in the one hour and 24-hour average TSP prediction results respectively.*
** *EPD Guideline only*

For the control and minimisation of construction dust, the Environmental Protection and Pollution Control Requirements of the contract specification will need to specify dust suppression measures to be implemented by the Contractor. These incorporate best working practice by the Contractor and could include, but not be limited to the following :

- restriction of vehicle speeds on unpaved site roads from 20 km/hr^{-1} to 10 km/hr^{-1};
- watering of all unpaved site roads twice daily as necessary;
- use of effective water sprays to dampen stockpiles (raw materials and reclaimed spoil), when dust is likely to be created during dry and windy weather;
- covering of stockpiles with tarpaulins during periods of high winds;
- areas of reclamation should be completed with final compaction as quickly as possible, consistent with good practise, to limit the creation of wind blown dust;
- covering of dusty vehicle loads transported to, from and between site locations with tarpaulin;

- prevent earth, mud debris and dust from being deposited on public roads; and
- vehicle wheel washing stations should be established at the exit point of the site to prevent mud being transferred onto the public highways.

Operational Phase

The vehicular emission impact assessment indicates that the worst case levels for CO and NO_2 will comply with the AQOs and as such mitigation will not be required. There are unlikely to be any overlapping activities in the area and cumulative impacts are not expected.

4.9 Conclusions

The air quality assessment has addressed two main potential sources of emissions:

- dust from construction activities; and
- vehicular emissions during operation of the improved road.

14 representative air quality sensitive receptors were selected for the worst case assessment of potential impacts. Predictive modelling has indicated that during construction there should be no breach of the statutory or required limits at the facades of the existing and future ASRs provided that mitigation for 50% dust suppression is carried out. This could include either imposing a speed limit of 10 km hr^{-1} for construction vehicles using unpaved site roads, or watering of unpaved site roads twice daily as necessary. In addition, during dry and windy weather water spraying should be carried out to prevent generation of wind blown dust on stockpiles and unpaved areas.

Additional measures to ensure best working practice should be included in the contract specification as part of the Environmental Protection and Pollution Control Requirements to ensure that generation of dust is controlled and minimised.

Traffic emission levels for CO, NO_2 and RSP generated during operation of Ping Ha Road, for the design year of 2011, are expected to comply with the AQOs.

Population areas further away from the Study Area (e.g. Kiu Tau Wai) are not expected to be affected by the proposed Ping Ha Road Improvements.

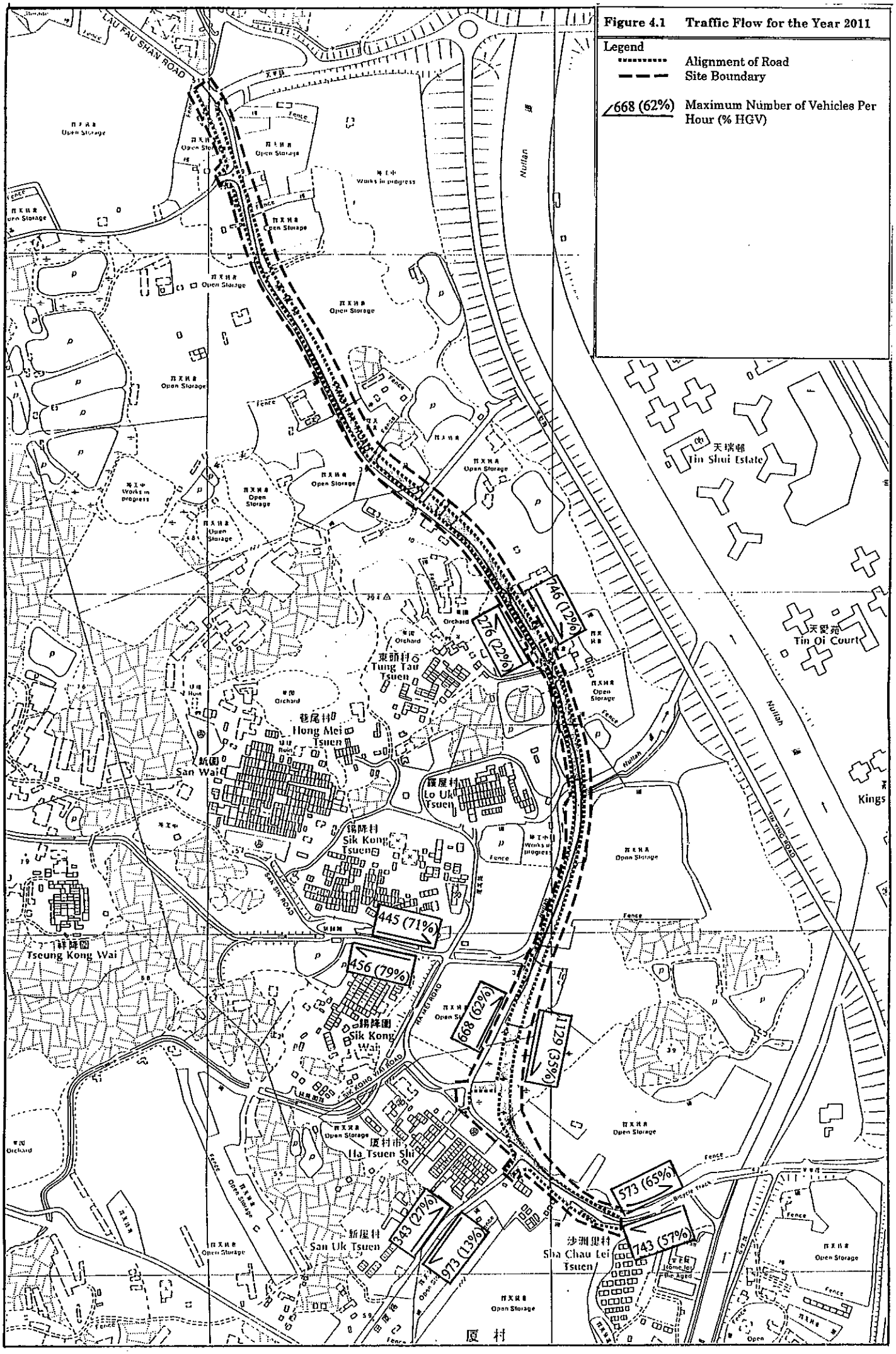


Figure 4.1 Traffic Flow for the Year 2011
Legend
Alignment of Road
Site Boundary
668 (62%) Maximum Number of Vehicles Per Hour (% HGV)
LAU FAU SHAN ROAD
Nullah
Tin Shui Estate
天瑞邨
Tin Oi Court
天愛苑
Kings
146 (12%)
276 (22%)
Tung Tau Tsuen
東頭村
Hong Mei Tsuen
巷尾村
San Wai
新圍
Lo Uk Tsuen
鑼屋村
Sik Kong Tsuen
錫降村
445 (71%)
456 (79%)
668 (62%)
129 (35%)
Tseung Kong Wai
錫降圍
Sik Kong Wai
SIK KONG WAI ROAD
Ha Tsuen Shi
厦村市
573 (65%)
345 (27%)
973 (13%)
743 (57%)
San Uk Tsuen
新屋村
Sha Chau Lei Tsuen
沙洲里村
厦村
Works in progress
Open Storage
Orchard
Fence
Bicycle Track

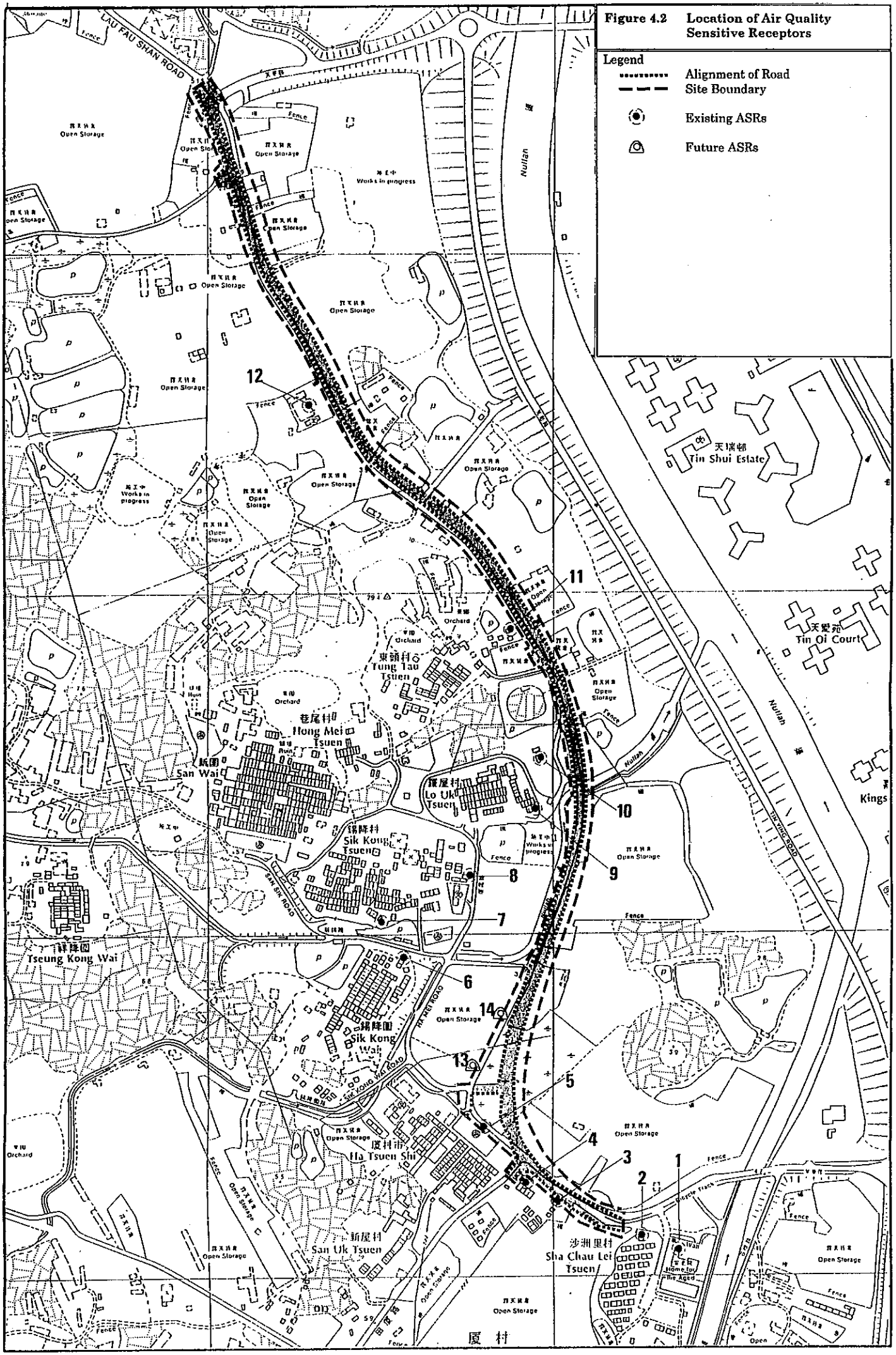


Figure 4.2 Location of Air Quality Sensitive Receptors
Legend
Alignment of Road
Site Boundary
Existing ASRs
Future ASRs
LAU FAU SHAN ROAD
Nullah
Tin Shui Estate
天瑞邨
Tin Oi Court
天愛苑
Kings
Tung Tau Tsuen
東頭村
Hong Mei Tsuen
巷尾村
San Wai
新圍
Lo Uk Tsuen
窿屋村
Sik Kong Tsuen
錫降村
Tseung Kong Wai
錫降圍
Sik Kong Wai
錫降圍
Ha Tsuen Shi
厦村市
San Uk Tsuen
新屋村
Sha Chau Lei Tsuen
沙洲里村
厦村
Works in progress
Orchard
Open Storage
Fence
SAN SIK ROAD
SIK KONG WAI ROAD
TIN YIU ROAD
1
2
3
4
5
6
7
8
9
10
11
12
13
14

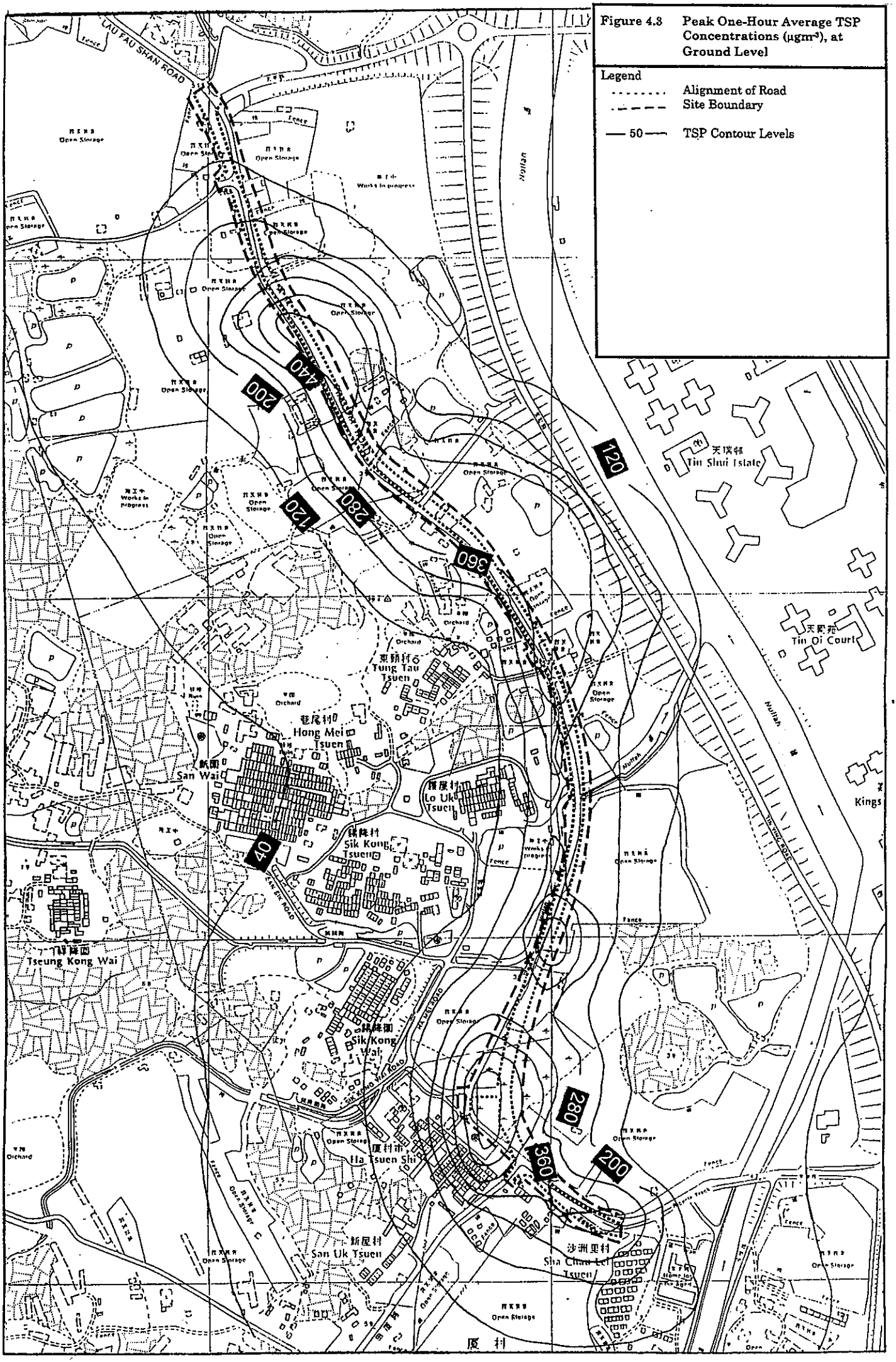
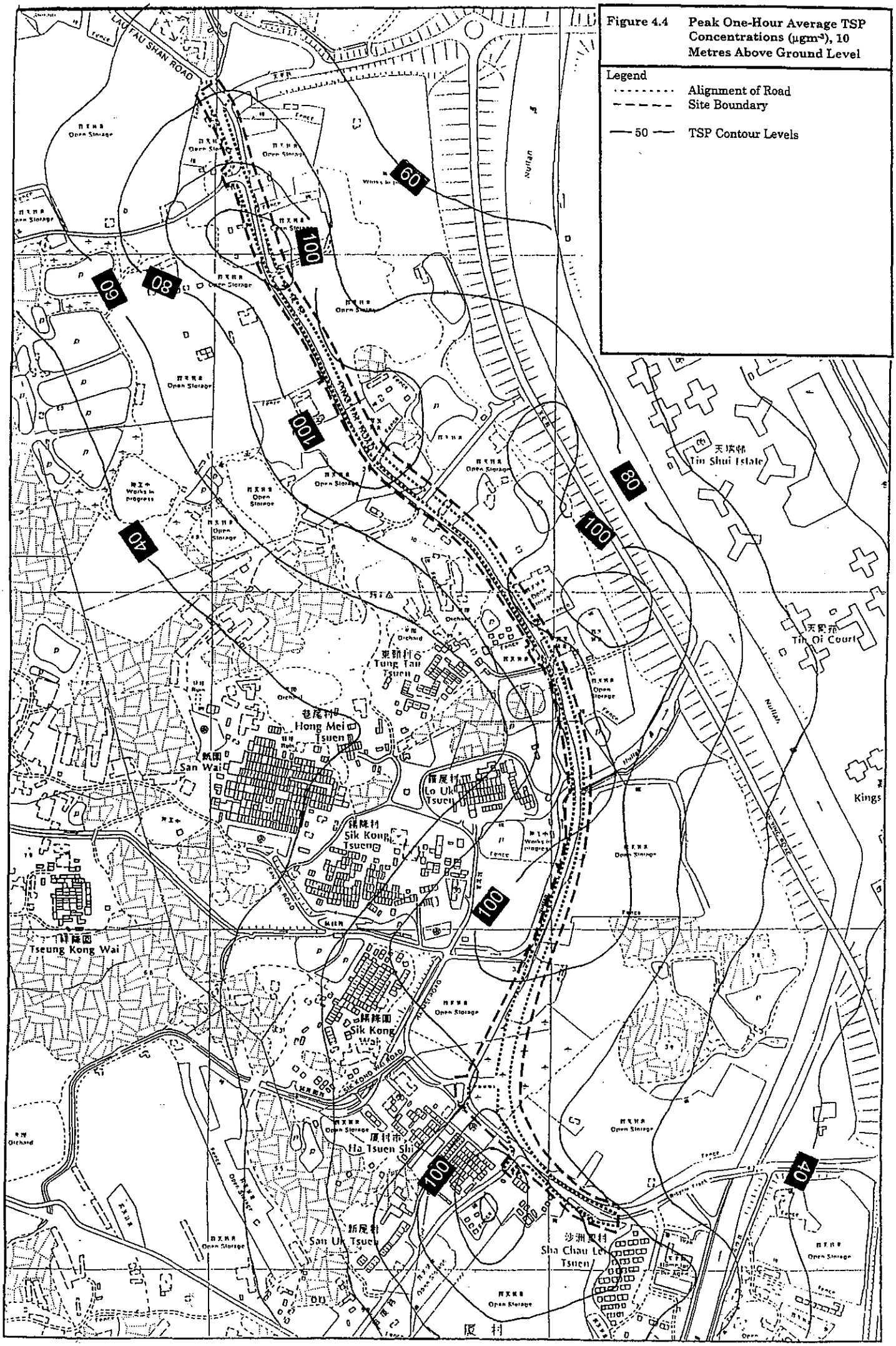


Figure 4.3 Peak One-Hour Average TSP Concentrations (μgm⁻³), at Ground Level
Legend
Alignment of Road
Site Boundary
50 TSP Contour Levels
LAU FAU SHAN ROAD
Nullah
Tin Shui Estate
Tin Oi Court
Kings
Tung Tau Tsuen
Hong Mei Tsuen
San Wai
Lo Uk Tsuen
Sik Kong Tsuen
Tseung Kong Wai
Sik Kong Wai
Ha Tsuen Shi
San Uk Tsuen
Sha Chau Lei Tsuen
TIN SHUI ROAD
YUEN LONG BYPASS
200
240
120
280
360
40
120
280
360
200


LAU FAU SHAN ROAD
Nullah
60
100
09
08
100
40
80
100
100
100
40
Tin Shui Estate
Tin Oi Court
Kings
Tung Tau Tsuen
Hong Mei Tsuen
San Wai
Lo Uk Tsuen
Sik Kong Tsuen
Tseung Kong Wai
Sik Kong Wai
Ha Tsuen Shi
San Uk Tsuen
Sha Chau Lei Tsuen
Open Storage
Works in progress
Orchard
Fence
厦村
Figure 4.4 Peak One-Hour Average TSP Concentrations (μgm⁻³), 10 Metres Above Ground Level
Legend
Alignment of Road
Site Boundary
50 TSP Contour Levels

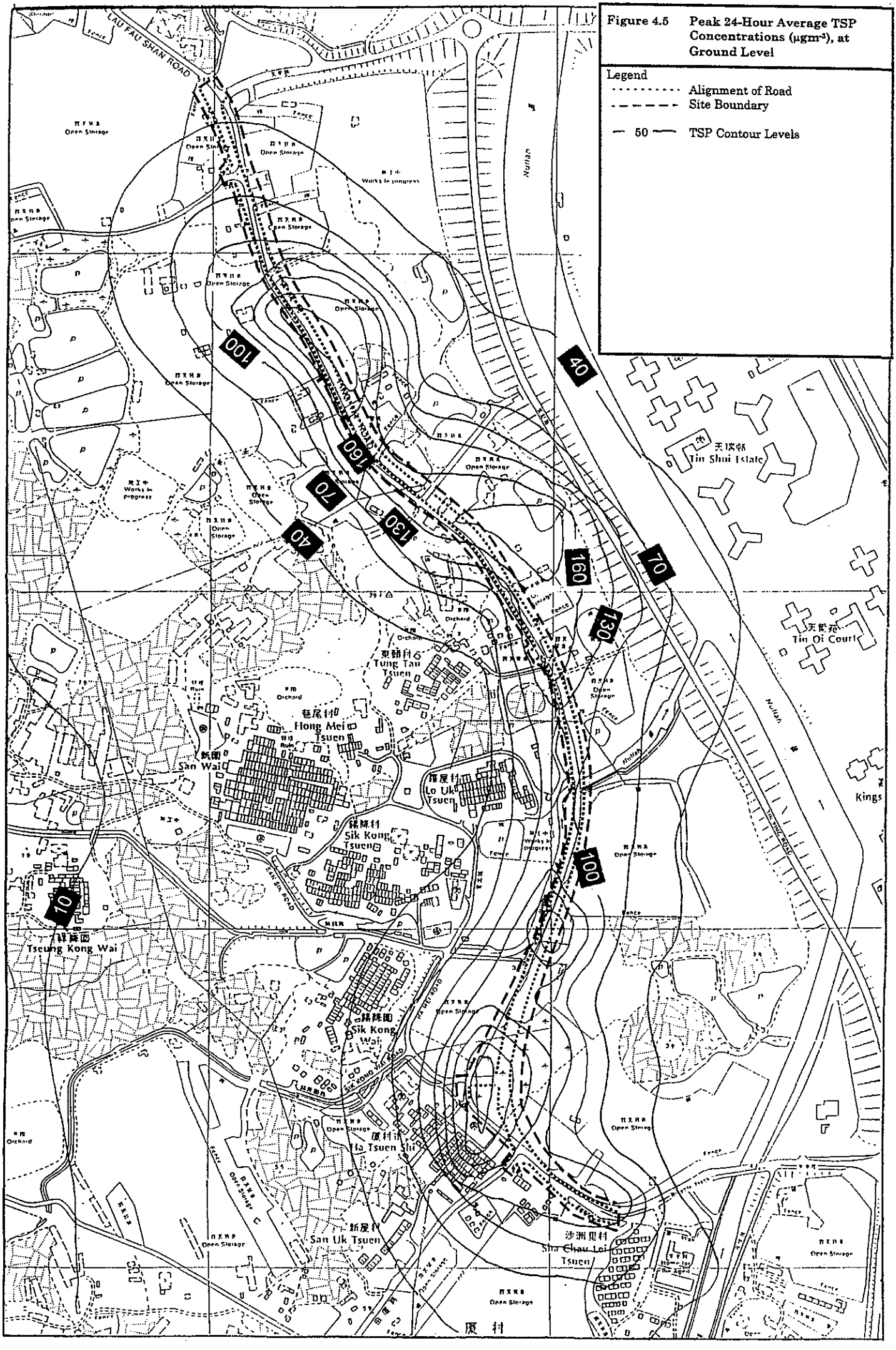


Figure 4.5 Peak 24-Hour Average TSP Concentrations (μgm^{-3}), at Ground Level

Legend

- Alignment of Road
- Site Boundary
- 50 TSP Contour Levels

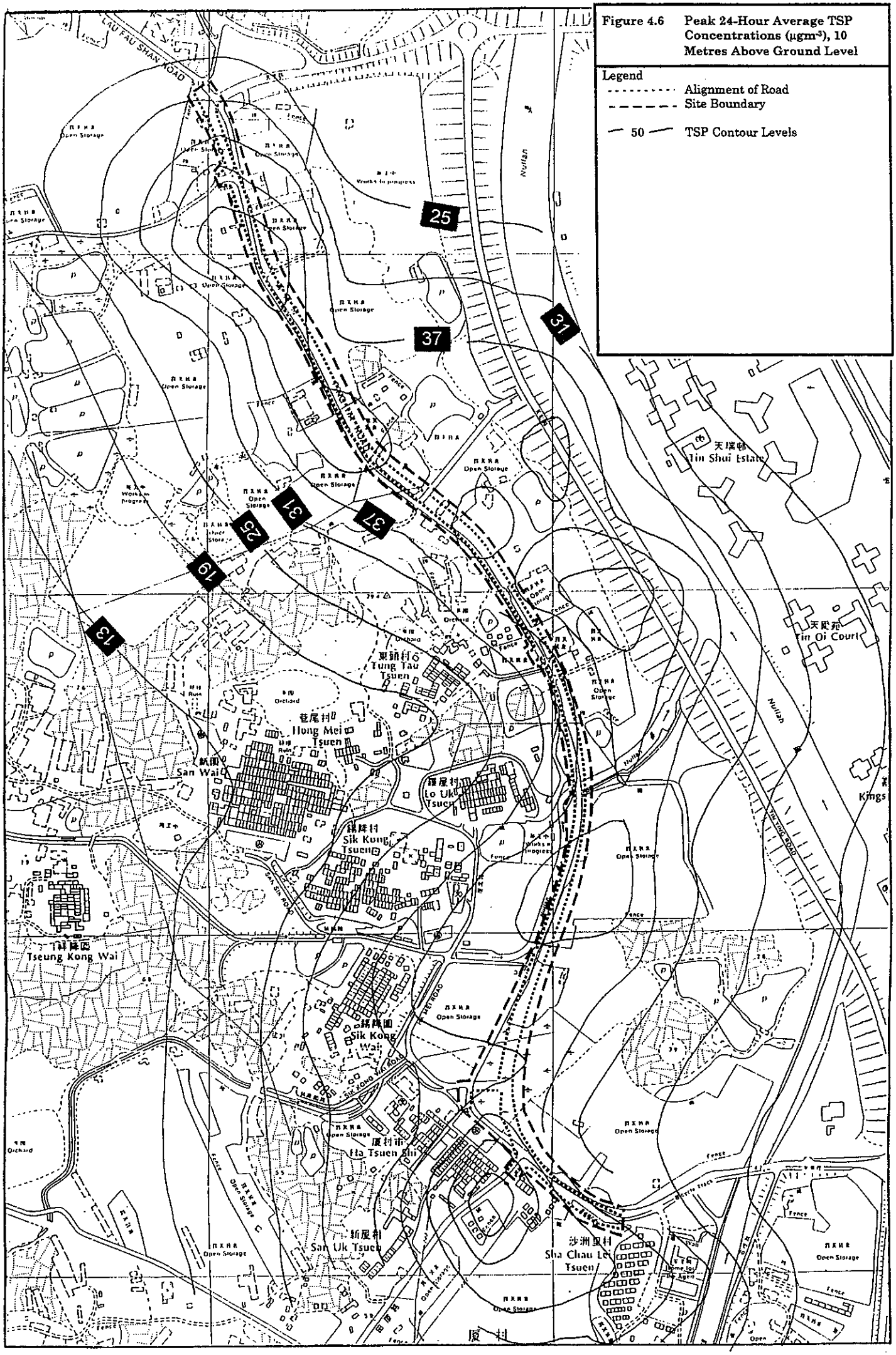


Figure 4.6 Peak 24-Hour Average TSP Concentrations (μgm-3), 10 Metres Above Ground Level
Legend
Alignment of Road
Site Boundary
50 TSP Contour Levels
LAU FAU SHAN ROAD
Nullah
25
37
31
37
25
37
19
13
天瑞邨
Tin Shui Estate
天慶苑
Tin Oi Court
東頭村
Tung Tau Tsuen
Hong Mei Tsuen
San Wai
Lo Uk Tsuen
Sik Kong Tsuen
Tseung Kong Wai
Sik Kong Wai
Ha Tsuen Shi
新屋村
San Uk Tsuen
沙洲里村
Sha Chau Lei Tsuen
TIN YIU ROAD
SIK KONG WAI ROAD
Kings
Open Storage
Orchard
Works in progress

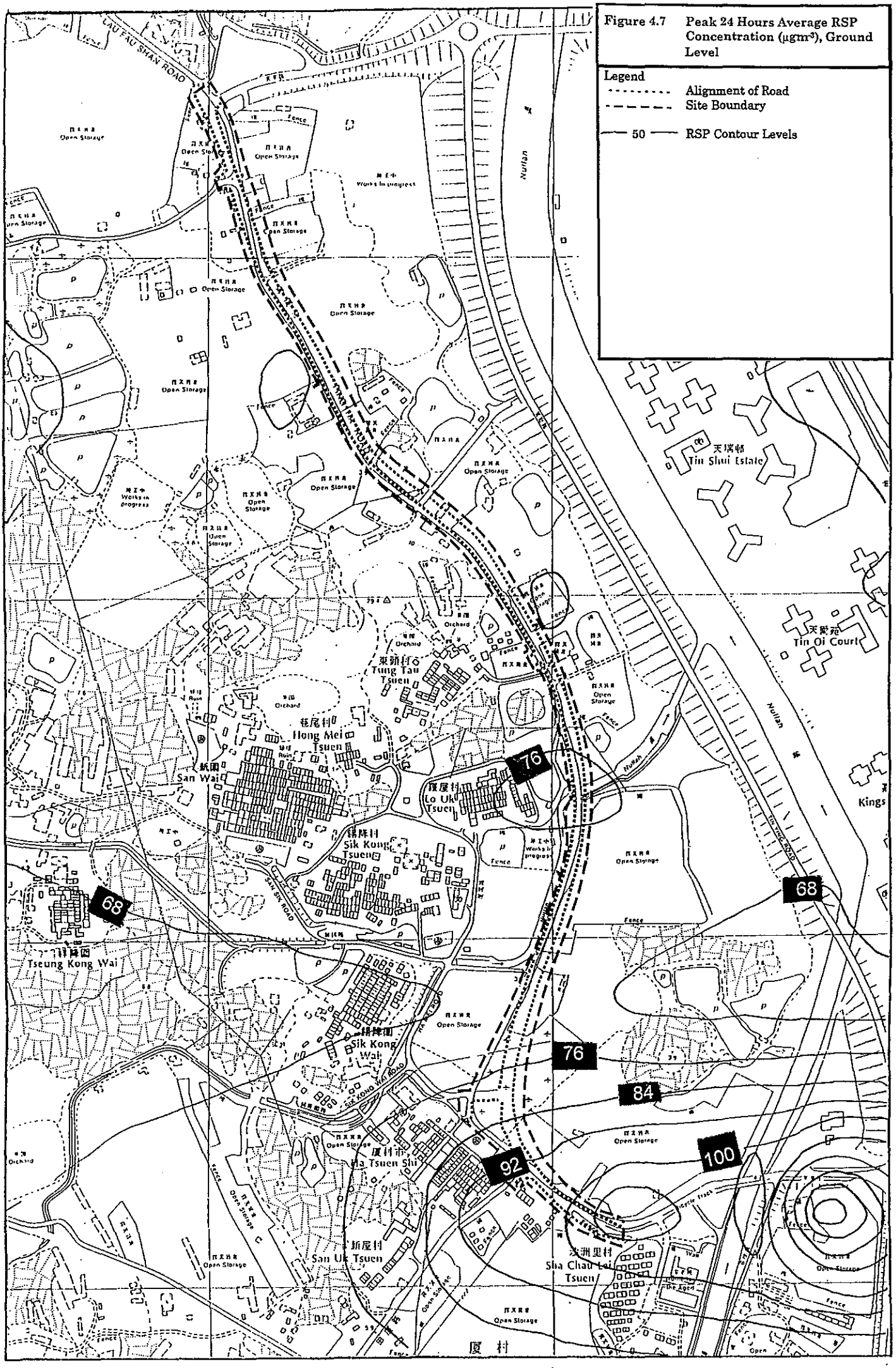


Figure 4.7 Peak 24 Hours Average RSP Concentration (μgm³), Ground Level
Legend
Alignment of Road
Site Boundary
50 RSP Contour Levels
LAU FAU SHAN ROAD
Nullah
Tin Shui Estate
天瑞邨
Tin Oi Court
天愛苑
Kings
Tung Tau Tsuen
東頭村
Hong Mei Tsuen
康美村
San Wai
新圍
To Uk Tsuen
陡屋村
Sik Kong Tsuen
錫崗村
Tseung Kong Wai
Sik Kong Wai
San Uk Tsuen
新屋村
Sha Chau Lei Tsuen
Ha Tsuen Shui
厦村
厦村
SIK KONG WAI ROAD
SAN SIK ROAD
TIN YUEN ROAD
Works in progress
Open Storage
Orchard
Fence
Circle Track
68
76
84
92
100

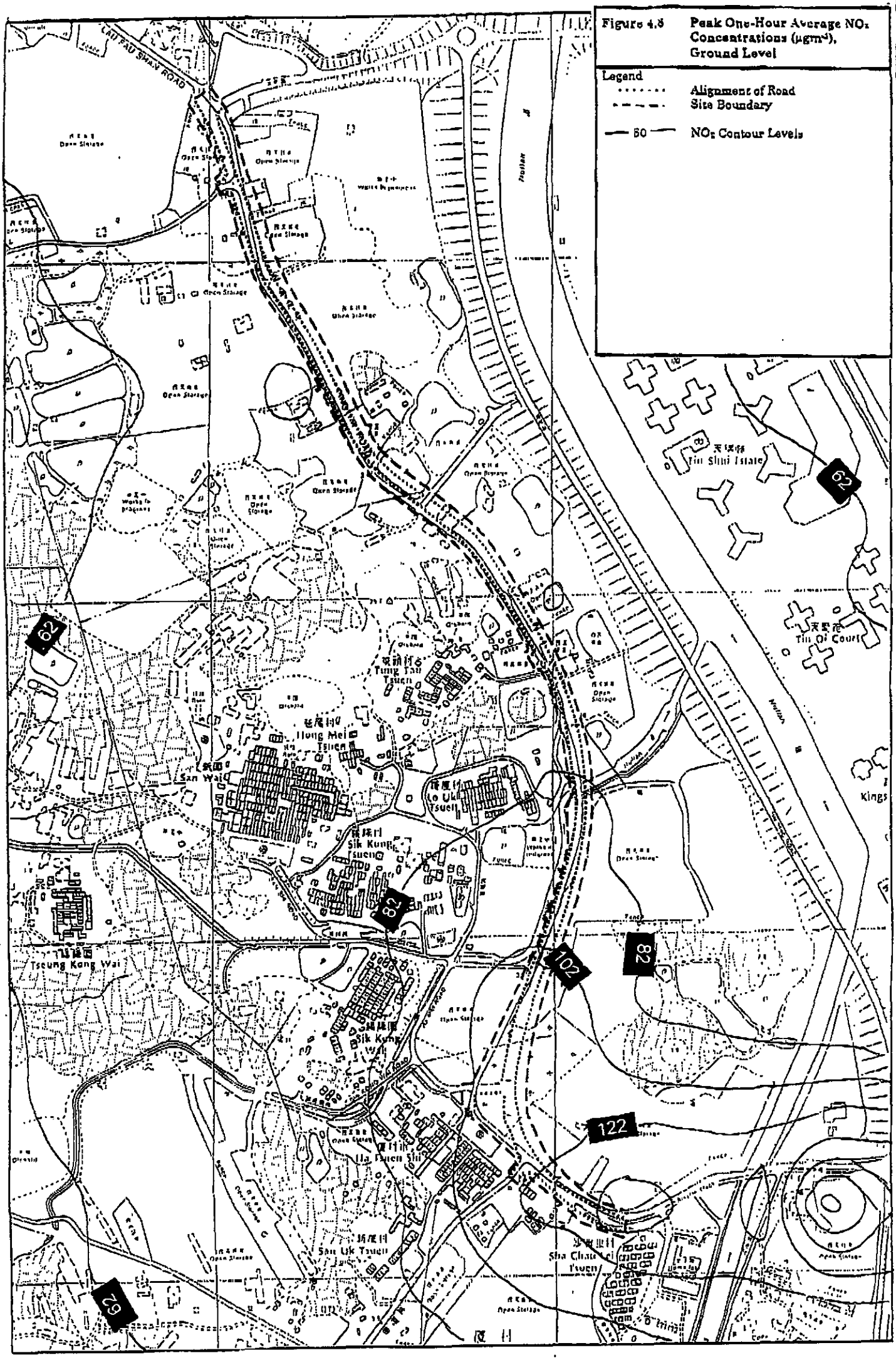


Figure 4.8 Peak One-Hour Average NO_2 Concentrations (μgm^{-3}), Ground Level
Legend
Alignment of Road
Site Boundary
80 NO_2 Contour Levels
LAU FAU SHAN ROAD
Tin Shui Estate
Tin Oi Court
Tung Tau Tsuen
Hong Mei Tsuen
San Wai
To Uk Tsuen
Sik Kung Tsuen
Tseung Kong Wai
Sik Kung Wai
Ha Tsuen Shi
San Uk Tsuen
Shu Chuen Tsuen
62
62
82
102
122
29

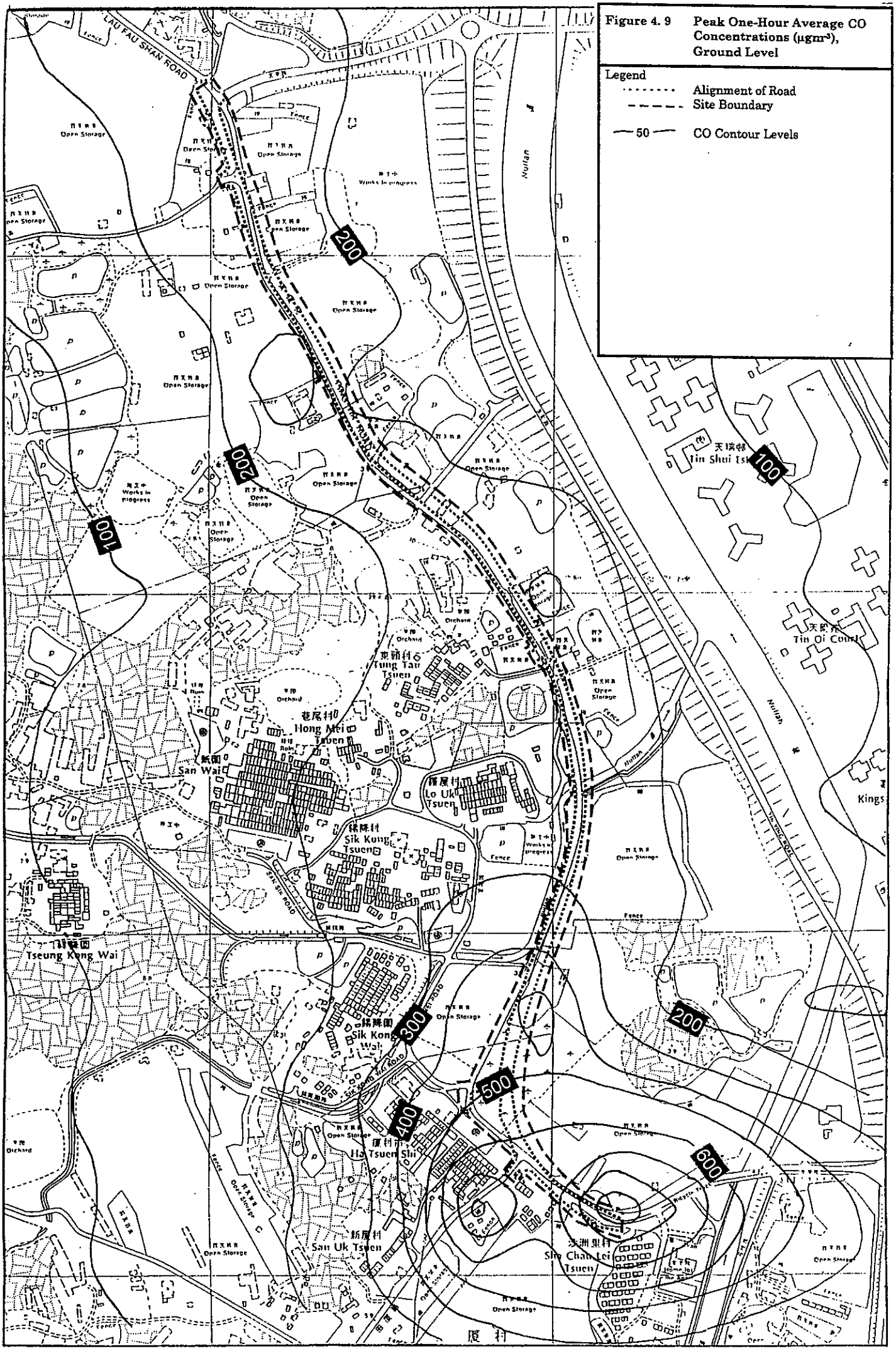


Figure 4. 9 Peak One-Hour Average CO Concentrations (μgm⁻³), Ground Level
Legend
Alignment of Road
Site Boundary
50 CO Contour Levels
LAU FAU SHAN ROAD
TSUEN WAN ROAD
Nullah
Tin Shui Estate
Tin Oi Court
Kings
Tung Tau Tsuen
Hong Mei Tsuen
San Wai
Lo Uk Tsuen
Sik Kong Tsuen
PEAK SIK ROAD
Tseung Kong Wai
Sik Kong Wai
SIK KONG WAI ROAD
Hai Tsuen Shu
San Uk Tsuen
Sha Chau Lei Tsuen
100
200
300
400
500
600

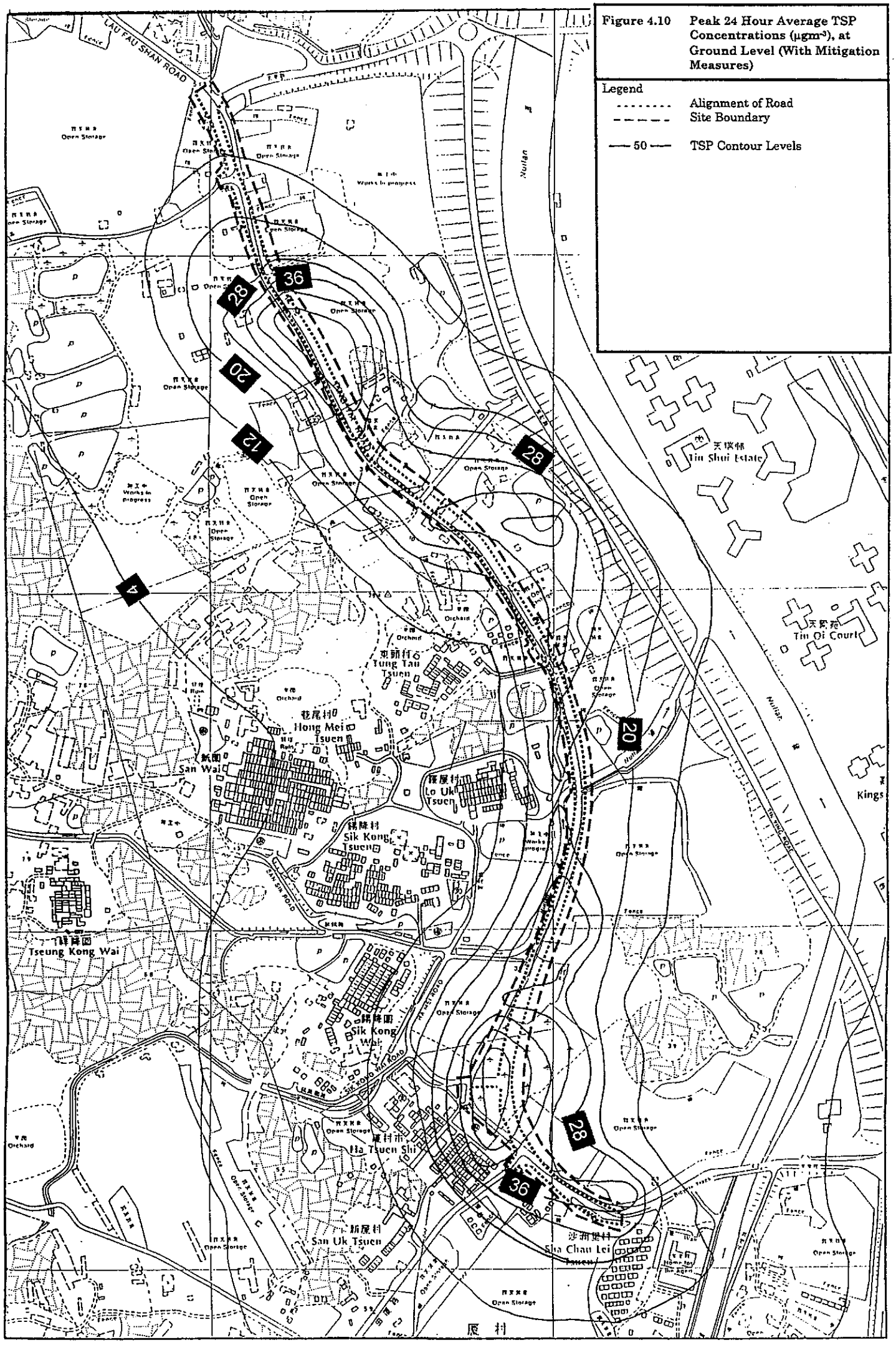


Figure 4.10 **Peak 24 Hour Average TSP Concentrations (μgm^{-3}), at Ground Level (With Mitigation Measures)**

Legend

- Alignment of Road
- Site Boundary
- 50 — TSP Contour Levels

5. NOISE IMPACT ASSESSMENT

5.1 Introduction

This section presents an assessment of the short- and long-term noise impacts associated with the Project. The purpose of the study is to provide information on the nature and extent of the potential noise impacts on the environment arising from the construction and operation of the Project and all concurrent activities in the area.

The noise assessment results will be used as the basis for the evaluation of the noise impacts of the proposed road improvement works on both existing and planned communities, as well as for the identification of locations where the acceptable noise level criteria are exceeded and appropriate noise mitigation measures may be required.

5.2 Construction Programme and Activities

A preliminary construction programme for the road improvement works is scheduled as shown in Table 5.1 (also see Figure 5.1).

Table 5.1 Preliminary Construction Programme

Month	Construction Activity	
	No.	Description
1 - 2	1	Site clearance, preliminaries and mobilisation
3 - 10	2	Excavation, breaking of existing road surfaces
3 - 6	3	Formation of new alignment near Ha Tsuen Shi
5 - 12	4	Backfilling and subbase construction
10 - 18	5	Drainage and utilities
12 - 20	6	Kerbing
18 - 23	7	Road paving
22 - 24	8	Footpath, road signs and road markings

Equipment requirements for each activity are provided in Table 5.2, along with sound power levels (SWLs) for individual and groups of equipment. Most of the equipment SWLs employed for this assessment are based on those contained in Table 3 of the Technical Memorandum on Noise from Construction Work other than Percussive Piling and Table 11 of BS 5228: Part 1: 1984.

Perciussive Pilings are required for nullah bridge widening over the nullah at Lo Uk Tsuen and equipment SWL at this location is obtained from Table 2 of Technical Memorandum on Noise from Percussive Piling.

5.3 Project Site

5.3.1 Existing Noise Environment

The existing noise environment in the vicinity of the Project site is dominated by road traffic noise from Ping Ha Road. According to the traffic study carried out under Agreement No. CE10/95 for the Tin Shui Wai Further Development, the highest traffic volume on the section of Ping Ha Road inside the Study Area occurs at AM peak hours.

Table 5.2 Typical Equipment Requirements

Construction Activity	Equipment and Quantity		CNP Code	SWL, dB(A)	
				Per piece	Total
Site clearance, preliminaries and mobilisation	Truck with crane	1	048	112	112
Excavation, breaking of existing road surfaces	Air compressor(1)	1	002	100	121
	Driller	1	064	103	
	Backhoe (Excavator)	2	081	112	
	Bulldozer	1	030	115	
	Lorry(2)	10	141	112	
	Road roller	1	185	108	
	Hydraulic breaker	1	024	110	
	Dump truck	2	067	117	
Formation of new alignment near Ha Tsuen Shi	Air compressor(1)	1	002	100	120
	Driller	1	064	103	
	Backhoe (Excavator)	2	081	112	
	Bulldozer	1	030	115	
	Lorry(2)	10	141	112	
	Road roller	1	185	108	
Backfilling and subbase construction	Backhoe (Excavator)	3	081	112	119
	Bulldozer	1	030	115	
	Road roller	1	185	108	
Drainage and utilities	Truck with crane	1	048	112	119
	Dump truck(2)	1	067	117	
	Backhoe (Excavator)	1	081	112	
	Vibrator	2	170	113	
	Concrete mixer	1	046	96	
	Road roller	1	185	108	
Kerbing	Concrete mixer	1	046	96	117
	Vibrator	2	170	113	
	Dump truck(2)	1	067	117	
Road paving	Asphalt truck	4	-(3)	110	117
	Paver	1	004	109	
	Road roller	1	185	108	
Footpath, road signs and road markings	Concrete mixer	1	046	96	120
	Vibrator	2	170	113	
	Asphalt truck	4	-(3)	110	
	Paver	1	004	109	
	Road roller	1	185	108	
	Truck with crane	1	048	112	

Notes: (1) Silenced type air compressor.
(2) A 20% on-time with an adjustment of -7 dB(A) is applied to lorry and dump truck operations.
(3) SWL based on Table 11 of BS 5228: Part 1: 1984.

Based on the best available information on recent traffic count as shown in Table 5.3, prevailing road traffic noise levels at the existing NSRs are in the range of 54 to 77 dB(A). It is apparent that the existing noise sensitive developments located adjacent to Ping Ha Road (e.g. Ha Tsuen Shi) are being suffered from high traffic noise. NSRs situated further away from Ping Ha Road (e.g. Sik Kong Wai and Sik Kong Tsuen), however, are enjoying a quieter noise environment. Calculated prevailing noise levels at all existing NSRs in the Study Area are given in Table 5.8.

Table 5.3 Existing (1996) AM Peak Traffic Flows

Road Section	2-way Traffic Flow (vehicle/hour)	% of Heavy Vehicle (1)	Road Speed (kph)
Ping Ha Road (Tin Wah Road - Tung Tau Tsuen)	220	63.4	50
Ping Ha Road (Tung Tau Tsuen - Tin Ha Road)	402	63.5	50
Ping Ha Road (Tin Ha Road - Sha Chau Lee Tsuen)	698	74.1	50
Ping Ha Road (Sha Chau Lee Tsuen - Tin Ying Road)	942	72.0	50
Lau Fau Shan Road	421	72.7	50
Tin Ha Road	446	78.7	50
Tin Wah Road	434	83.4	50

Note: (1) All vehicles with an unladen weight exceeding 1525 kg.

Source: Traffic study carried out under Agreement No. CE 10/95 for the Tin Shui Wai Further Development.

5.3.2 Existing Noise Sensitive Receivers

Noise sensitive receivers in the immediate vicinity of the Project site are likely to be adversely affected by the proposed road works. A site survey undertaken in July 1996 reveals that existing NSRs in the Study Area are low-rise developments, including village houses, educational institutions, a temple and homes for the aged. It should be noted that Yau Kung Branch School at Sik Kong Tsuen was closed in 1996 and hence is excluded from the impact assessment.

Representative NSRs have been selected for construction and operational noise impact assessments and these are presented in Table 5.4 and Figure 5.2.

5.3.3 Future and Planned Sensitive Uses

Information on future/planned sensitive uses has been obtained from the latest Outline Zoning Plan (Ha Tsuen) prepared by the Planning Department, and is presented in Figure 5.3. The areas to the east and north of Tung Tau Tsuen

alongside the improved Ping Ha Road, which are currently occupied by fish ponds and open storage, have been zoned for CDA (i.e. Comprehensive Development Area). Besides, the areas to the east of Sik Kong Tsuen and Sik Kong Wai have been zoned for Village Type Development (V).

Having considered a large piece of land zoned for CDA, instead of using discrete receptor points, the traffic noise impacts on these planned CDA are presented in a noise contour map so as to provide a broad picture of the future noise environment. According to the Explanatory Statement of the Draft Ha Tsuen OZP No. S/YL-HT/1, a maximum building height for CDA is 3 storeys including carport. As such, an assessment level at 7.5m above ground at 180° angle of view has been adopted for CDA. With respect to "V" zone, representative receptor points (i.e. P1 to P12) at the zone boundary as shown in Figure 5.3 have been chosen for impact assessment. Other areas zoned village type development and G/IC can duly be represented by the existing NSRs identified there.

Table 5.4 Representative Noise Sensitive Receivers

NSR	Designation		No. of Storey	No. of Dwellings/ Classrooms Represented	Noise Impact Assessed	
	Location	Building Type			Construction	Operational
HA-1	Sha Chau Lei Tsuen	Home for the Aged	3	-		•
HA-2		Home for the Aged	3	-	• (1)	•
HA-3		Home for the Aged	2	-		•
HA-4		Home for the Aged	2	-		•
SCL-1	Sha Chau Lei Tsuen	Village house	3	18	• (1)	•
SCL-2		Village house	3	9		•
HTS-1	Ha Tsuen Shi	Village house	3	9	• (1)	•
HTS-2		Village house	3	9		•
HTS-1A		Village house	3	3		•
HTS-2A		Village house	3	3		•
HTS-3		Village house	2	16	• (1)	•
HTS-4		Village house	2	10		•
HTS-5		Village house	1	6	• (1)	•
SCH-1	Ha Tsuen Shi	Kindergarten	1	6	•	•
SKW-1	Sik Kong Wai	Village house	2	4		•
SKW-2		Village house	3	12		•
SKW-3		Village house	3	16	• (1)	•
SKW-4		Village house	3	7		•
SK-1	Sik Kong Tsuen	Village house	3	9	• (1)	•
SK-2		Village house	3	18	• (1)	•
SK-3		Village house	3	6		•
LUT-1	Lo Uk Tsuen	Village house	3	14		•
LUT-2		Village house	3	13		•
LUT-3		Village house	3	6	• (1)	•
TTT-1	Tung Tau Tsuen	Village house	3	3		•
TTT-2		Village house	3	16	• (1)	•

Table 5.4 (Cont'd)

NSR	Designation		No. of Storey	No. of Dwellings/ Classrooms Represented	Noise Impact Assessed	
	Location	Building Type			Construction	Operational
TTT-3	Tung Tau Tsuen	Village house	1	3	• (1)	•
TTT-4		Village house	3	9		•
HA-5	Tung Tau Tsuen	Home for the Aged	3	-		•
HA-6		Home for the Aged	3	-	• (1)	•
TEMP	Tung Tau Tsuen	Temple	1	-		•
SKWT-1	Sha Kong Wai Tsai	Village house	2	10		•
SKWT-2		Village house	3	9		•
SKWT-3		Village house	2	3		•
SKWT-4		Village house	3	12		•
SKWT-5		Village house	2	14		•
SKWT-6		Village house	3	9		•
SKWT-7		Village house	3	3	• (1)	•
SCH-2	Sha Kong Wai Tsai	Primary School	1	10	•	•
P1	Village Type Development	Village house	3	-		•
P2		Village house	3	-		•
P3		Village house	3	-		•
P4		Village house	3	-		•
P5		Village house	3	-		•
P6		Village house	3	-		•
P7		Village house	3	-		•
P8		Village house	3	-		•
P9		Village house	3	-		•
P10		Village house	3	-		•
P11		Village house	3	-		•
P12		Village house	3	-		•

Notes: (1) The worst construction noise impacted NSR.
P1-P12 Representative receptor points for Village Type Development ("V").

5.4 METHODOLOGY

5.4.1 Environmental Standards and Guidelines

Construction Noise

Non-restricted Hours

Under the existing provisions, there is no legal restriction on noise generated by construction activities (other than percussive piling) between the hours of 07:00 and 19:00 on normal weekdays. However, EPD's Practice Note for Professional Persons ProPECC PN 2/93 sets a non-statutory daytime noise limit of 75 dB(A) L_{eq}(30 min) at the facades of dwellings, and 70 and 65 dB(A) at the facades of schools during normal school hours and examination period respectively. These criteria have been adopted for the assessment of construction noise during non-restricted hours.

Restricted Hours

It is expected that night works will not be required and therefore the criteria stipulated in the Technical Memorandum on Noise from Construction Work other than Percussive Piling, as well as in the Technical Memorandum on Noise from Construction Work in Designated Areas, issued under the Noise Control Ordinance (NCO) are not applicable to this Project.

Percussive Piling

Percussive piling is anticipated during the construction phase and therefore the criteria stipulated in the Technical Memorandum on Noise from Percussive Piling issued under the NCO are applicable to this Project.

Operational Noise

The impact of operational noise has been assessed with reference to the Hong Kong Planning Standards and Guidelines (HKPSG) which stipulates maximum L_{10} (1 hour) road traffic noise levels of 70 dB(A) for domestic premises and 65 dB(A) for educational institutions and places of public worship. Unless the homes for the aged is used for convalescent purpose, the noise standard as for domestic premises, i.e. 70 dB(A), is normally adopted.

5.4.2 Noise Assessment Methodologies

Construction Noise

The methodology outlined in the Technical Memorandum on Noise from Construction Work other than Percussive Piling has been used for the assessment of construction noise. A 20% on-time with an adjustments of -7 dB(A) has been applied to lorry and dump truck operations, according to Figure 3.4 of BS 5228: Part 1: 1984.

Additionally, for the purpose of this EIA, construction noise impact assessment has been undertaken based on the followings:

- Construction of the Project is assumed to be carried out in about 650 m segments, and only a single activity is conducted on each segment at any one time.
- All items of powered mechanical equipment (PME) required for a particular construction activity are located at the notional source position of the segment where such activity is performed.
- The highest total sound power level arising from concurrent construction activities conducted at different segments is used.

Operational Noise

Road traffic noise levels have been predicted using ENPAC's in-house noise model which is based on the procedures described in the CRTN. The projected worst case morning peak hour traffic flows for the design year 2011, the best available information (refer to the footnote in table 5.7), have been employed for operational noise assessment.

5.5 NOISE IMPACT ASSESSMENT

5.5.1 Construction Phase

As illustrated by the construction programme (see Figure 5.1), construction activities will, during a particular period, be undertaken on individual basis or simultaneously. A set of construction noise assessment scenarios has been determined in accordance with the preliminary construction sequence and activities, and is summarised in Table 5.6 below. The assessment scenarios describe broadly individual activities and groups of overlapping activities.

As shown in Table 5.5, the total SWLs for the identified scenarios vary from 112 to 125 dB(A). It is clear that assessment scenario C is the noisiest operation, and therefore this scenario has been adopted for impact assessment.

Table 5.5 Construction Noise Assessment Scenarios

Scenario	Activity[1]	Total SWL[2] dB(A)
A	1	112
B	2,3	124
C	2,3,4	125
D	2,4	123
E	2,4,5	125
F	4,5	122
G	4,5,6	123
H	5,6	121
I	5,6,7	123
J	6,7	120
K	7	117
L	7,8	122
M	8	120

Notes: (1) See Table 5.1 for activity numbers.
(2) A 20% on-time with an adjustment of -7 dB(A) has been allowed for lorry and dump truck operations.

With reference to Table 5.4, 15 NSRs which are likely to be worst affected by construction noise were selected for construction noise impact assessment. Of them, SCL-1, HTS-1, HTS-3, LUT-3 and HA-6 are likely to be exposed to noise levels above 75 dB(A). The maximum anticipated construction noise level at the most affected NSR (HTS-1) exceeds the noise limit by 9 dB(A). With respect to educational institutions, while NSR SCH-2 would comply with the noise criterion during both normal school hours and examination period, NSR SCH-1 is likely to be exposed to unacceptable noise levels during examination period. To alleviate the construction noise impacts, mitigation measures are required.

For the piling activity, NSR LUT-1 (i.e. Lo Uk Tsuen) is the most affected house and has been selected for the worst scenerio assessment. To minimize the potential impacts, appropriate piling methods for percussive piling are recommended. If percussive piling (hydraulic hammer) is used, the contractor is still required to apply a Construction Noise Permit (CNP) to carry out the piling works.

Table 5.6 Construction Noise Levels for the Worst Case Scenario (Unmitigated)

NSR	Breaking of Existing Road		Formation of New Alignment near Ha Tsuen Shi		Backfilling and Subbase Construction		Total Noise Level dB(A)
	Intervening Distance (m)	Noise Level dB(A)	Intervening Distance (m)	Noise Level dB(A)	Intervening Distance (m)	Noise Level dB(A)	
HA-2	128	71	648	56	1288	49	71
SCL-1	46	80	630	56	1234	50	80
HTS-1	28	84	562	57	1134	50	84
HTS-3	56	78	526	58	1067	50	78
HTS-5	80	75	476	58	987	51	75
SCH-1 (1)	180	68	516	58	985	51	68
SKW-3	151	69	360	61	804	53	70
SK-1	176	68	250	64	690	54	70
SK-2	142	70	186	66	655	55	72
LUT-3	214	66	54	77	510	57	77
TTT-2	306	63	102	72	414	59	73
TTT-3	332	63	270	63	446	58	66
HA-6	384	61	32	82	351	60	82
SCH-2 (1)	1496	50	868	53	254	63	64
SKWT-7	1376	50	729	55	118	70	70

Note: (1) Construction noise criteria for school are 70 and 65 dB(A) during normal school hours and examination period respectively.

5.5.2 Operational Phase

The traffic noise levels at the sensitive facades of the representative NSRs have been calculated using the UK DOT procedures. The traffic flows used in the computer simulation are those presented in Tables 5.3 previously and 5.7 below.

The results of the noise analysis are presented in Table 5.8.

Table 5.8 shows that current (1996) traffic noise levels already exceed the HKPSG maxima at a number of NSRs residing close to and facing Ping Ha Road. The L10(1-hr) noise levels are in the range of 54 dB(A) and 77 dB(A) .These

significantly impacted NSRs include the village houses at the front row of Sha Chau Lei Tsuen and Ha Tsuen Shi.

According to the 2011 modelling results, most of the existing NSRs along the Project alignment are subject to adverse operational noise impacts. The predicted L_{10} noise levels range from 53 to 77 dB(A), representing a maximum noise exceedance of 7 dB(A) and 3 dB(A) for domestic premises and homes for the aged respectively. Such adverse impacts are mainly due to: (1) limited source-receiver buffer distances, (2) high percentage of heavy vehicles, and (3) lack of topographical barriers (e.g. hill slopes and large non-sensitive buildings) in the Project area.

Noise predictions for planned CDA for the design year 2011 have been performed and the results are displayed in a noise contour map (see Figure 5.4). As shown in Figure 5.4, the 70 dB(A) noise contours are about 40m away from the kerb of both sides of the improved carriageway. Regarding planned "V" zone (i.e. P1 to P12), the predicted noise levels are in the range of 72 to 80 dB(A).

Given that the predicted noise levels at the identified NSRs are well in excess of the HKPSG criteria, appropriate noise mitigation measures should be provided to remedy the adverse noise environment.

Table 5.7 Predicted 2011 AM Peak Traffic Flows

Road	Nature		2-way Traffic Flow (veh/hr)	% of Heavy Vehicles	Road Speed (kph)
	Improved	Existing			
Improved Ping Ha Road (Section between Tin Wah Road and Access Road to Sik Kong Tsuen)	•		1022	14.7	50
Improved Ping Ha Road (Section between Access Road to Sik Kong Tsuen and Tin Ha Road)	•		1797	45.0	50
Existing Ping Ha Road		•	1316	60.5	50
Tin Ha Road		•	1316	16.6	50
Access Road to Sik Kong Tsuen		•	901	75.0	50
Access Road to Fung Kong Tsuen		•	539	54.5	50
Tin Wah Road		•	1642	28.1	50
Lau Fau Shan Road		•	543	43.0	50

Note: (1) All vehicles with an unladen weight exceeding 1525 kg.
(2) All road surfaces are of flexible paving.
Source: Letter Reference (9) in NTN/RU 2/10/67 from Territory Development Department.

Table 5.8 Current and 2011 Traffic Noise Levels (Unmitigated)

NSR	Assessment Point (Storey)	Assessment Point (mPD)	Assessment Criterion L_{10} dB(A)	Current Noise Level, dB(A)		2011 Noise Level, dB(A)		
				L_{10}	Exceedance over Criterion	Improved Ping Ha Road	Other Roads	Overall
HA-1	1	6.1	70	70	-	61	70	71
	3	11.7	70	70	-	61	70	71
HA-2	1	6.1	70	71	1	68	71	73
	3	11.7	70	71	1	68	71	73
HA-3	1	5.4	70	63	-	-(1)	64	64
	2	8.2	70	63	-	-(1)	64	64
HA-4	1	6.0	70	64	-	46	65	65
	2	8.8	70	64	-	46	65	65
SCL-1	1	6.1	70	73	3	72	72	75
	3	11.7	70	73	3	72	72	75
SCL-2	1	5.9	70	65	-	66	59	67
	3	11.5	70	65	-	66	59	67
HTS-1	1	5.8	70	77	7	78	67	78
	3	11.4	70	76	6	77	66	77
HTS-2	1	5.9	70	69	-	70	-(1)	70
	3	11.5	70	69	-	70	-(1)	70
HTS-1A	1	5.9	70	76	6	77	66	77
	3	11.5	70	76	6	77	66	77
HTS-2A	1	5.9	70	75	5	75	67	76
	3	11.5	70	75	5	75	66	76
HTS-3	1	5.9	70	73	3	73	67	74
	2	8.7	70	73	3	73	67	74
HTS-4	1	5.7	70	71	1	71	63	72
	2	8.5	70	71	1	72	63	73
HTS-5	1	5.6	70	70	-	70	62	71
SCH-1	1	5.2	65	60	-	62	55	63

Note: (1) Traffic noise generated from the road is completely screened by buildings nearby.

Table 5.8 (Cont'd)

NSR	Assessment Point (Storey)	Assessment Point (mPD)	Assessment Criterion L_{10} dB(A)	Current Noise Level, dB(A)		2011 Noise Level, dB(A)		
				L_{10}	Exceedance over Criterion	Improved Ping Ha Road	Other Roads	Overall
SKW-1	1	6.2	70	64	-	66	61	67
	2	9.0	70	64	-	66	60	67
SKW-2	1	6.1	70	63	-	65	58	66
	3	11.7	70	63	-	65	58	66
SKW-3	1	6.2	70	65	-	67	65	69
	3	11.8	70	65	-	67	65	69
SKW-4	1	5.9	70	64	-	66	73	74
	3	11.5	70	64	-	66	73	74
SK-1	1	5.6	70	64	-	65	71	72
	3	11.2	70	64	-	65	71	72
SK-2	1	5.5	70	66	-	66	61	67
	3	11.1	70	66	-	66	61	67
SK-3	1	5.5	70	65	-	65	57	66
	3	11.1	70	64	-	65	57	66
LUT-1	1	4.7	70	68	-	68	59	69
	3	10.3	70	68	-	68	59	69
LUT-2	1	6.5	70	62	-	61	46	61
	3	12.1	70	62	-	61	46	61
LUT-3	1	4.4	70	71	1	69	55	69
	3	10.0	70	71	1	69	55	69
TTT-1	1	7.8	70	64	-	63	51	63
	3	13.4	70	64	-	63	52	63
TTT-2	1	6.8	70	66	-	65	49	65
	3	12.4	70	66	-	65	50	65
TTT-3	1	10.0	70	54	-	53	-(1)	53
TTT-4	1	7.5	70	55	-	54	-(1)	54
	3	13.1	70	55	-	54	-(1)	54

Note: (1) Traffic noise generated from the road is completely screened by buildings nearby.

Table 5.8 (Cont'd)

NSR	Assessment Point (Storey)	Assessment Point (mPD)	Assessment Criterion L_{10} dB(A)	Current Noise Level, dB(A)		2011 Noise Level, dB(A)		
				L_{10}	Exceedance over Criterion	Improved Ping Ha Road	Other Roads	Overall
HA-5	1	5.7	70	72	2	72	56	72
	3	11.3	70	72	2	72	56	72
HA-6	1	6.2	70	65	-	66	52	66
	3	11.8	70	65	-	66	52	66
TEMP	1	10.2	65	61	-	63	50	63
SKWT-1	1	8.2	70	62	-	53	63	63
	2	11.0	70	62	-	54	63	63
SKWT-2	1	8.5	70	65	-	59	66	67
	3	14.1	70	65	-	59	66	67
SKWT-3	1	13.2	70	62	-	50	63	63
	2	16.0	70	62	-	50	63	63
SKWT-4	1	8.4	70	72	2	55	72	72
	3	14.0	70	72	2	55	72	72
SKWT-5	1	7.9	70	61	-	53	63	63
	2	10.7	70	62	-	53	63	63
SKWT-6	1	5.2	70	65	-	55	67	66
	3	10.8	70	65	-	56	66	66
SKWT-7	1	8.2	70	68	-	60	70	70
	3	13.8	70	68	-	60	70	70
SCH-2	1	9.3	65	64	-	55	65	65
P1	1	5.6	70	-	-	80	65	80
	3	11.2	70	-	-	79	65	80
P2	1	5.6	70	-	-	80	64	80
	3	11.2	70	-	-	79	64	79
P3	1	5.3	70	-	-	79	62	79
	3	10.9	70	-	-	78	62	78

Note: (1) Traffic noise generated from the road is completely screened by buildings nearby.

Table 5.8 (Cont'd)

NSR	Assessment Point (Storey)	Assessment Point (mPD)	Assessment Criterion L_{10} dB(A)	Current Noise Level, dB(A)		2011 Noise Level, dB(A)		
				L_{10}	Exceedance over Criterion	Improved Ping Ha Road	Other Roads	Overall
P4	1	5.3	70	-	-	75	62	75
	3	10.9	70	-	-	75	61	75
P5	1	5.3	70	-	-	78	60	78
	3	10.9	70	-	-	78	60	78
P6	1	5.3	70	-	-	78	61	78
	3	10.9	70	-	-	78	60	78
P7	1	5.1	70	-	-	78	60	73
	3	10.7	70	-	-	73	60	73
P8	1	5.1	70	-	-	73	59	73
	3	10.7	70	-	-	73	59	73
P9	1	5.1	70	-	-	73	59	73
	3	10.7	70	-	-	73	59	73
P10	1	5.1	70	-	-	71	57	71
	3	10.7	70	-	-	71	57	71
P11	1	5.0	70	-	-	72	54	72
	3	10.6	70	-	-	72	54	72
P12	1	5.0	70	-	-	74	53	74
	3	10.6	70	-	-	74	53	74

Note: (1) Traffic noise generated from the road is completely screened by buildings nearby.

5.6 NOISE MITIGATION MEASURES

5.6.1 Construction Phase

As discussed in Section 5.5.1, some of the NSRs are likely to be exposed to significant construction noise impacts. Suitable noise mitigation measures should be provided to protect the affected NSRs throughout the construction period.

For mitigation of construction noise at the Project site, the most effective measure is to control noise at source. In the case of PME, this involves either selecting silenced equipment, or reducing transmission of noise using mufflers, silencers, or acoustic enclosures. As the NSRs are low-rise, erecting temporary noise barriers at the site boundary or around the noisy equipment is an effective mitigation options. Table 5.9 demonstrates how construction noise could be mitigated at the adversely affected NSRs by installing noise barriers.

In addition to the provision of temporary noise barriers, the following alternative/additional noise reduction measures should be implemented by the Contractor to reduce noise levels from project activities:

- Noisy equipment and activities shall be sited as far from sensitive receivers as is practical.
- Noisy plant or processes shall be replaced by quieter alternatives where possible. For example, pneumatic concrete breakers can be silenced with mufflers and bit dampers. Silenced diesel and gasoline generators and power units, as well as silenced and super-silenced air compressors, can be readily obtained. Manual operations are generally quietest, but may require long periods of time.
- Idle equipment shall be turned off or throttled down. Noisy equipment should be properly maintained and used no more often than is necessary.
- The power units of non-electric stationary plant and earth-moving plant may be quietened by vibration isolation and partial or full acoustic enclosures for individual noise-generating components.
- Construction activities shall be planned so that parallel operation of several sets of equipment close to a given receiver is avoided.
- If possible, the numbers of operating items of powered mechanical equipment should be reduced.
- Construction plant should be properly maintained and operated. Construction equipment often has silencing measures built in or added on, e.g., bulldozer silencers, compressor panels, and mufflers. Silencing measures should be properly maintained and utilised.
- Temporary noise reducing measures other than noise barriers (e.g. earth embankment) may be used to screen specific receivers. Enclosures for noisy

activities such as concrete breaking should be applied where the noise impact is potentially severe.

While it is not feasible to dictate the methods of construction to be employed by the Contractor, noise control requirements can be incorporated in the tender/contract documents, specifying the noise standards to be met and requirements for noise monitoring on the site.

Environmental Monitoring and Audit will be implemented to ensure that all mitigation measures are effectively applied and noise impact arising from the construction meet the established guideline.

Table 5.9 Construction Noise Levels for the Worst Case Scenario (Mitigated)

NSR	Breaking of Existing Road		Formation of New Alignment near Ha Tsuen Shi		Backfilling and Subbase Construction		Total Noise Level dB(A)
	Intervening Distance (m)	Noise Level dB(A)	Intervening Distance (m)	Noise Level dB(A)	Intervening Distance (m)	Noise Level dB(A)	
HA-2	128	71	648	56	1288	49	71
SCL-1	46	70 (1)	630	56	1234	50	70
HTS-1	28	74 (1)	562	57	1134	50	74
HTS-3	56	68 (1)	526	58	1067	50	68
HTS-5	80	75	476	58	987	51	75
SCH-1	180	58 (2)	516	58	985	51	61
SKW-3	151	69	360	61	804	53	70
SK-1	176	68	250	64	690	54	70
SK-2	142	70	186	66	655	55	72
LUT-3	214	66	54	67 (1)	510	57	70
TTT-2	306	63	102	72	414	59	73
TTT-3	332	63	270	63	446	58	66
HA-6	384	61	32	72 (1)	351	60	72
SCH-2	1496	50	868	53	254	63	64
SKWT-7	1376	50	729	55	118	70	70

Note: (1) A noise reduction of -10 dB(A) has been allowed for the provision of temporary noise barriers.
(2) A noise reduction of -10 dB(A) has been allowed for the provision of temporary noise barriers during examination period only.

The establishment of good community relations can be of great assistance to both the Contractor and local communities. Residents and school administrations should be notified in advance of planned operations and informed of progress. If necessary, a liaison body can be established to bring together representatives of the affected communities, the Government and the Contractor. In addition, residents and school administrations should be provided with a telephone number for the Resident Engineer's office, where they may register complaints concerning excessive noise.

5.6.2 Operational Phase

Potential Noise Mitigation Options

Traffic noise may be controlled at source, along its path, or at NSR facades. The various options available for mitigating traffic noise have been reviewed, and their suitability for use in this Project are presented below.

Control at Source

Controlling traffic noise at its source involves the design of quieter vehicles, traffic management and road surface treatments, all of which result in less noise being generated.

Traffic management measures may be introduced, such as reducing traffic flow or vehicle speed or limiting the use of the road by heavy vehicles. However, such measures for traffic noise reduction would be difficult to be effectively enforced, and would reduce the capacity of the road, thus defeating the purpose of the road improvement works. Hence, these noise mitigation measures would be impractical for this Project.

A pervious macadam paving surface (i.e. friction course surfacing) has high acoustic absorption characteristics that can reduce traffic noise levels by 2.5 dB(A) when compared with impervious or concrete road surface for speed below 75 kph, according to CRTN. In practice, however, the use of pervious macadam paving or noise reducing surfacing material on low speed roads and roadways subject to start-stop traffic such as Ping Ha Road (with speed limit of 50 kph) is restricted, due to frequent maintenance requirements.

The improved Ping Ha Road will have a number of road junctions, loading and unloading bays, bus bays and pedestrian crossings. Experience with the use of this surfacing materials in Hong Kong indicates that the road surface will require frequent maintenance. The benefits of the reduced traffic noise would be offset by the inconvenience of frequent surfacing repair and replacement operations.

Potential sources of additional traffic noise can be minimised by omitting manhole covers in the carriageway as far as possible during the detailed design and by close supervision of finished pavement level tolerances during construction. Where possible, the existing utilities and drainage services should be diverted to the footpaths or to the central median space, to avoid placing manhole covers and valve chambers in the carriageway.

Control along Noise Path

Controlling traffic noise along its path includes interception by designing the road alignment to incorporate natural or man made topographical barriers or by constructing purpose-built noise screening structures.

Road alignment can be so designed that it incorporates features which will reduce traffic noise at sensitive developments. The road alignment can be altered so that the distance between the carriageway and the affected receiver is increased, thus permitting greater natural attenuation of noise along the path to the receiver.

The alignment of the improved Ping Ha Road is however fixed by the existing road alignment to a great extent. Additionally, many of the existing developments are situated right at the roadside. It would not be practical or effective to alter the road alignment to control traffic noise in this Project.

Purpose-built noise screening structures can be in the form of roadside barriers, earth bunds, partial enclosures or full enclosures.

Barriers may be provided along the sides of the carriageway. Under normal circumstances, barriers are more effective when provided close to the noise source. Conventional plain barriers are the simplest noise abatement structure to use. This noise screening option requires minimal space requirements and may easily be erected to suite various road conditions. However, the applicability of plain barriers may be fairly limited. Their uses are very often confined to where low-rise buildings are to be protected, or where there is an adequate set back of sensitive receivers. Also, the practical noise reductions normally achieved by noise barriers are about 5 to 10 dB(A) only, although a noise reduction of up to 20 dB(A) can be achieved under desirable conditions. Barrier installation should comply with the requirements set by authorities concerned, such as DFS, AC for T and C of P.

Alternatively, earth bunds could be provided to screen the noise. In rural areas, earth bunds covered with vegetation provide a less intrusive mitigation option than conventional plain barriers. However, this option generally requires a fairly large land intake. For example, earth bunds of 2 or 3 m height on flat ground would require a minimum land intake of 6 or 9 m respectively. Furthermore, the wide openings required in bunds at junctions and run-ins would render them ineffective and less attractive. To reduce the area of land intake, combinations of earth bunds with short plain barriers on top will be considered at the Design Stage of the Project.

Generally, partial enclosures provide a more effective noise protection to affected receivers than that offered by plain barriers. Subject to the availability of space and compliance with the safety requirements such as sightline distance, they could be built against the edge of road. A properly designed and located partial enclosure could easily achieve a noise reduction of 10 to 15 dB(A).

In terms of acoustical performance, full enclosures can reduce road traffic noise by a substantial amount. Despite their effectiveness on noise reduction, factors such as safety concerns, visual impacts, maintenance problems and ventilation

requirements may often render the application of full enclosures undesirable. For example, the improved Ping Ha Road will have a number of road junctions, loading and unloading bays, etc., and therefore the application of full enclosures in this case will not be effective or practical.

Control at NSRs

Control of traffic noise at the receiver includes insulation of sensitive facades, use of self-protecting buildings, orientation of building facades, building setback, and internal arrangement of rooms to screen sensitive areas. Site survey indicates that the existing receivers within the study area do not incorporate any of these measures.

Current practice in noise assessment and mitigation in Hong Kong is that the provision of noise insulation at receivers should only be considered as the last resort should the implementation of all feasible direct technical remedies prove to be impracticable and ineffective.

Having studied the nature of improvement works to Ping Ha Road, the existing road section does not undergo major modification in number of lanes (i.e. 25% increase in lanes) or substantial changes in alignment or characters (e.g. change into high speed road) of the existing road, therefore it should not be regarded as a new road for the purpose of this noise impact assessment. As such, the ExCo's directive *"Equitable Redress for Persons Exposed to Increased Noise Resulting from the use of New Roads"* is not applicable to this Project.

Noise Mitigation Proposal

The above review has shown clearly that the most practical measure to mitigate the impact is to control the traffic noise along the noise path. Taking into consideration the source-receiver configurations, noise environment, road conditions and other site constraints, various forms including plain barriers and inverted-L barriers, and configurations including the height and horizontal extent of the barriers have been considered at strategic locations to protect groups of NSRs where the predicted noise level in the design year exceed the HKPSG noise criteria. It should be noted that emergency vehicle access (EVA) for nearby villages and the existing run-ins/accesses have been take into account in formulating the noise mitigation proposal.

For a given form of barrier, both the height and horizontal extent of the barriers have been optimised by iterative calculations using the computer model.

The optimization process proceeds with examining the overall noise levels from the new and the existing roads for increasing heights and lengths and stops where the barrier produces no further or significant improvements in the overall noise levels. The optimised set of noise screening structures is described in Table 5.10 together with the target NSRs to be protected and the locations are shown schematically in Figures 5.5a and 5.5b.

Table 5.10 Schedule of Noise Screening Structures

Target NSR	Length of Direct Mitigation Measures (m)			
	3.5m Plain Barrier	4m Plain Barrier	5m Plain Barrier	Inverted-L Barrier (1)
Sha Chau Lei Tsuen (SCL-1)	-	40	-	-
Ha Tsuen Shi (HTS-1, HTS-1A, HTS-2A, HTS-3, HTS-4 and HTS-5)	-	-	-	200
Homes for the Aged near Tung Tau Tsuen (HA-5)	90	-	510	-
Planned "V" Zone (P1 to P8)	-	-	620	-
Future CDA sites	-	-	1030(2),(3)	-

Note: (1) 5m high inverted-L barrier with an inclined panel of 2m.
(2) Extent of noise barrier is subjected to the form and layout of the future CDA development.
(3) Noise barriers are of sound absorbing type to minimize the noise reflection effect.

The following paragraphs provide the rationale for the provision of the noise barriers.

Home for the Aged (HA-1 to HA-4)

The Homes for the Aged represented by HA-1 and HA-2 are expected to be affected by the future traffic noise from Ping Ha Road. However, the main noise contribution as shown in Table 5.11 should be from the section of the Ping Ha Road in front of the building and therefore outside the project limit. No direct technical remedies within the project limit are practical to reduce the impact.

Sha Chau Lei Tsuen (SCL-1 and SCL-2)

Taking into account of the noise abatement effectiveness of 2 to 3 dB(A), a 4m high plain barrier close to the southern project limit has been recommended to protect the low-rise houses represented by SCL-1, although the noise problem still cannot be ameliorated effectively due to the dominant noise contribution from the section of Ping Ha Road outside the Project limit.

Ha Tsuen Shi (HTS-1, HTS-2, HTS-1A and HTS-2A)

In view of the close proximity of domestic premises to improved Ping Ha Road, a 5m high inverted-L barrier with an inclined panel of 2m has been proposed to protect HTS-1, HTS-1A and HTS-2A which are likely to be adversely affected by the noise. Two openings will be reserved along the noise barrier as shown in figure 5.5a to maintain existing accesses for the resident, as required by HyD and DLO. Noise modelling had been carried out taking into account of the

openings and confirmed that with the proposed barrier in place, the predicted noise levels would meet the HKPSG limit.

Ha Tsuen Shi (HTS-3, HTS4, HTS-5 and SCH-1)

In order to protect the likely development of village houses as well (i.e. P1 and P2), a 5m high inverted-L barrier with an inclined panel of 2m has been proposed to protect HTS-3, HTS-4 and HTS-5. The predicted noise levels would comply with the HKPSG noise limit with the proposed barrier in place.

Sik Kong Wai (SKW-1 to SKW-4)

As SKW-1 to SKW-4 are over 150m from Ping Ha Road, the noise contribution from the road is less than 67 dB(A). In the unmitigated scenario, the noise levels at these receivers meet the HKPSG guideline. The exception is SKW-4 where the main noise contribution is from the adjacent access road for which no mitigation measures can be provided within the scope of this Project under the current policy.

Sik Kong Tsuen (SK-1 to SK-3)

As these receivers represented by SK-1, SK-2 and SK-3 are over 140m from Ping Ha Road, noise contribution from the road is less than 66 dB(A). In the unmitigated scenario, all noise levels are within the acceptable level, apart from SK-1 where the noise from the adjacent access road already exceeds 70 dB(A). As it is beyond the scope of this Project to propose mitigation for the existing access road, no mitigation measures are provided for this group of receivers.

It should be noted that, however, the planned village houses in front of Sik Kong Tsuen and the associated noise barriers as discussed below are likely to screen traffic noise from the improved Ping Ha Road effectively and hence improve the noise environment.

Lo Uk Tsuen (LUT-1 to LUT-3)

Because of the orientation of the sensitive facades and the distance of the houses from Ping Ha Road, no significant noise impacts are envisaged and therefore no mitigation measures are considered necessary. The conclusion is also valid for the space next to the NSR LUT-3 if buildings are constructed. In addition, an existing vehicular access has to be maintained after the road improvement also makes the installation of noise barrier overthere impossible.

Tung Tau Tsuen (TTT-1 to TTT-4, HA-5, HA-6 and TEMP)

Again because of the orientation and distance effects, no significant noise impacts on receivers represented by TTT-1, TTT-2, TTT3 and TTT-4 from traffic noise from Ping Ha Road are envisaged. The temple in the village is over 100m from Ping Ha Road and therefore is not expected to be adversely affected by traffic noise from the road. On the other hand, the home for the aged represented by HA-5 is expected to be adversely affected. As the home for the aged is a low-rise development, a 3.5m high plain barrier has been recommended

to protect the receiver. The predicted noise level would comply with the HKPSG limit after the implementation of the proposed barrier.

Sha Kong Wai Tsai (SKWT-1 to SKWT-7 and SCH-2)

Except SKWT-4, the other representative NSRs are not expected to be adversely affected by traffic noise from the road. As the noise level at SKWT-4 is dominated by Lau Fau Shan Road which is outside the Project limit, no mitigation scheme on the improved Ping Ha Road is deemed effective.

Future Land Uses (CDA and Village Type Development)

The proposed CDA on the east and west sides of Ping Ha Road between Tung Tau Tsuen and junction of Lau Fau Shan Road and Tin Wah Road has been predicted to be adversely affected by traffic noise from Ping Ha Road. If unmitigated, a building setback of about 40m is required to meet with the HKPSG criterion for dwellings. Based on the maximum allowable development potential for the CDA sites, a 5m high noise barrier is proposed to minimise the potantial road traffic noise impact on the CDA sites. With the proposed noise barrier in place, the setback would be reduced to 15m from the site boundary. In other words, with such 5m high plain barrier in place, any future developments within the area of about 15m from the kerb of the improved road are still likely to expose to noise level exceeding the HKPSG noise limit. As information on the development of CDA is not available, no other forms and configurations of barriers have been examined. The 70 dB(A) noise contours with a 5m high plain barrier along the site boundary are depicted in Figure 5.6.

With respect to planned village houses (i.e. P1 to P12), a 5m high inverted-L barrier with an inclined panel of 2m and a 5m high plain barrier are recommended to alleviate the noise impacts at P1 to P2 and P3 to P12 respectively. The predicted noise levels would comply with the HKPSG limit with the proposed barrier in place.

Table 5.11 presents the noise exposure levels at the NSRs under the proposed mitigation scheme.

Except those NSRs where the major traffic noise contribution is from the other existing roads, the results show that all of the other affected NSRs would achieve the HKPSG limit after the implementation of the proposed mitigation measures on the improved Ping Ha Road. The mitigated noise levels would be in the range of 49 to 73 dB(A).

Residual Impacts

As shown in Table 5.11, a number of representative NSRs, namely HA-1, HA-2, SCL-1, SKW-4, SK-1 and SKWT-4, still exceed the HKPSG criterion even with the proposed mitigation scheme in place. As the dominant noise contribution is from the other existing roads, no further direct mitigation measures on the improved Ping Ha Road are considered effective and practical.

Table 5.11 2011 Traffic Noise Levels (Mitigated)

NSR	Assessment Point (Storey)	Assessment Point (mPD)	Assessment Criterion L_{10} dB(A)	2011 Noise Level, dB(A)		
				Improved Ping Ha Road	Other Roads	Overall
HA-1	1	6.1	70	61	70	71
	3	11.7	70	61	70	71
HA-2	1	6.1	70	68	71	73
	3	11.7	70	68	71	73
HA-3	1	5.4	70	- (1)	64	64
	2	8.2	70	- (1)	64	64
HA-4	1	6.0	70	44	65	65
	2	8.8	70	44	65	65
SCL-1	1	6.1	70	63	71	72
	3	11.7	70	66	71	72
SCL-2	1	5.9	70	62	59	64
	3	11.5	70	62	59	64
HTS-1	1	5.8	70	67	60	68
	3	11.4	70	69	63	70
HTS-2	1	5.9	70	62	- (1)	62
	3	11.5	70	62	- (1)	62
HTS-1A	1	5.9	70	65	64	68
	3	11.5	70	68	65	70
HTS-2A	1	5.9	70	66	65	69
	3	11.5	70	67	65	69
HTS-3	1	5.9	70	67	66	70
	2	8.7	70	67	66	70
HTS-4	1	5.7	70	66	61	67
	2	8.5	70	66	61	67
HTS-5	1	5.6	70	63	58	64
SCH-1	1	5.2	65	54	55	58

Note: (1) Traffic noise generated from the road is completely screened by buildings nearby.

Table 5.11 (Cont'd)

NSR	Assessment Point (Storey)	Assessment Point (mPD)	Assessment Criterion L_{10} dB(A)	2011 Noise Level, dB(A)		
				Improved Ping Ha Road	Other Roads	Overall
SKW-1	1	6.2	70	58	60	62
	2	9.0	70	58	60	62
SKW-2	1	6.1	70	57	54	59
	3	11.7	70	58	55	60
SKW-3	1	6.2	70	59	65	66
	3	11.8	70	59	65	66
SKW-4	1	5.9	70	59	73	73
	3	11.5	70	59	73	73
SK-1	1	5.6	70	56	71	71
	3	11.2	70	57	71	71
SK-2	1	5.5	70	57	59	61
	3	11.1	70	58	61	63
SK-3	1	5.5	70	55	49	56
	3	11.1	70	56	57	60
LUT-1	1	4.7	70	61	55	62
	3	10.3	70	62	59	64
LUT-2	1	6.5	70	58	39	58
	3	12.1	70	58	46	58
LUT-3	1	4.4	70	68	53	68
	3	10.0	70	68	55	68
TTT-1	1	7.8	70	60	48	60
	3	13.4	70	60	52	61
TTT-2	1	6.8	70	62	45	62
	3	12.4	70	62	50	62
TTT-3	1	10.0	70	49	- (1)	49
TTT-4	1	7.5	70	52	- (1)	52
	3	13.1	70	52	- (1)	52

Note: (1) Traffic noise generated from the road is completely screened by buildings nearby.

Table 5.11 (Cont'd)

NSR	Assessment Point (Storey)	Assessment Point (mPD)	Assessment Criterion L_{10} dB(A)	2011 Noise Level, dB(A)		
				Improved Ping Ha Road	Other Roads	Overall
HA-5	1	5.7	70	65	52	65
	3	11.3	70	67	56	67
HA-6	1	6.2	70	61	45	61
	3	11.8	70	62	52	62
TEMP	1	10.2	65	60	50	60
SKWT-1	1	8.2	70	53	63	63
	2	11.0	70	53	63	63
SKWT-2	1	8.5	70	57	66	67
	3	14.1	70	57	66	67
SKWT-3	1	13.2	70	49	63	63
	2	16.0	70	49	63	63
SKWT-4	1	8.4	70	50	72	72
	3	14.0	70	50	72	72
SKWT-5	1	7.9	70	45	63	63
	2	10.7	70	45	63	63
SKWT-6	1	5.2	70	44	66	66
	3	10.8	70	47	66	66
SKWT-7	1	8.2	70	59	70	70
	3	13.8	70	59	70	70
SCH-2	1	9.3	65	54	65	65
P1	1	5.6	70	57	45	57
	3	11.2	70	69	59	69
P2	1	5.6	70	57	45	57
	3	11.2	70	68	58	68
P3	1	5.3	70	66	55	66
	3	10.9	70	69	62	70

Note: (1) Traffic noise generated from the road is completely screened by buildings nearby.

Table 5.11 (Cont'd)

NSR	Assessment Point (Storey)	Assessment Point (mPD)	Assessment Criterion L_{10} dB(A)	2011 Noise Level, dB(A)		
				Improved Ping Ha Road	Other Roads	Overall
P4	1	5.3	70	69	51	69
	3	10.9	70	69	60	70
P5	1	5.3	70	67	46	67
	3	10.9	70	70	60	70
P6	1	5.3	70	61	49	61
	3	10.9	70	69	60	70
P7	1	5.1	70	57	49	58
	3	10.7	70	64	60	66
P8	1	5.1	70	57	48	58
	3	10.7	70	64	59	65
P9	1	5.1	70	56	47	57
	3	10.7	70	63	59	64
P10	1	5.1	70	65	46	65
	3	10.7	70	65	58	66
P11	1	5.0	70	59	47	59
	3	10.6	70	69	54	69
P12	1	5.0	70	66	42	66
	3	10.6	70	68	53	68

Note: (1) Traffic noise generated from the road is completely screened by buildings nearby.

Before the improvement of Ping Ha Road, the noise levels at about 77 number of dwellings exceed the HKPSG criteria. Upon the operation of the improved Ping Ha Road, the estimated number of dwellings exceeding the HKPSG criterion are 93, if unmitigated. After the implementation of the proposed mitigation scheme, the estimated number of dwellings exceeding the HKPSG criterion would be 46.

93
46
47

Recommendations for Planned CDA

As shown in figure 5.5b, 1030 metres long 5m high plain noise barrier has been proposed for the planned CDA sites along both sides of the improved Ping Ha Road. The proposed noise barrier will be implemented by the proponent of the CDA developement instead of PM/NTN,TDD for the following reasons,

- The uncertainty of the layout and the programme for future CDA development makes the proposal unrealistic and the proposed noise barrier can thus be fine-tuned at the later stage pending on the design of the future CDA developments;
- The existence of several container yard along the future CDA sites makes the installation of noise barriers difficult at this stage. Existing accesses have to be mainatined so that numerous openings have to be reserved along the noise barrier. The acoustic effectiveness of the noise barrier is questionable.
- Proposed access for the future CDA developments are not clear and it is difficult to provide access in future after installing noise barriers along the CDA sites if the noise barriers are implemented at this stage.

It has been agreed among DPO, DLO & PM/NTN,TDD that the requirement for erection of the proposed 5m high noise barriers to mitigate the noise impacts should be incorporated into the lease conditions for the land zoned CDA. Notwithstanding this, a minimum 1.5m wide space along the improved Ping Ha Road as shown in figure 5.5b has to be reserved for barrier foundations during the road improvement works. In addition, assuming a 5m high plain noise barrier in place, a minimum buffer distance of approximately 15m from the road kerbs should be allowed for CDA development. Highways Department will be responsible for the maintenance of the noise barriers.

5.7 CUMULATIVE NOISE IMPACTS

5.7.1 Concurrent Projects

According to information made available by the Rural Planning and Improvement Strategy (RPIS), the following two RPIS minor works projects are currently being implemented in the Study Area.

- Project YL-109 is being undertaken by Highways Department and involves reconstruction of the access road to Fung Kong Tsuen in the northern section of the Study Area. Works include the raising of the existing access and provision of a drainage channel along the access roads. Works are to be completed by April 1997 and will not affect the proposed Ping Ha Road Improvement works which commences in July 1998.

- Project YL-148 is being undertaken by the Drainage Services Department and involves drainage improvement works at Ha Tsuen Shi in the southern section of the Study Area. The works include the construction of two 1.5 metre wide covered slotted drainage channels with a total length of 330 metres, to collect run off from Ha Tsuen Shi for discharge into Sik Kong Wai Channel. The works are to be completed by June 1996 and will not affect the proposed Ping Ha Road improvement works.

5.7.2 Cumulative Construction Impact

As the above-mentioned concurrent projects are scheduled to be completed before the commencement of the proposed Ping Ha Road improvement works, no cumulative construction impacts are anticipated.

5.7.3 Cumulative Operation Impact

Noise impacts arising from the roads other than the improved Ping Ha Road have been taken into considerations in the assessment of the traffic noise impacts and the formulation of recommended noise mitigation measures.

5.8 CONCLUSIONS AND RECOMMENDATIONS

5.8.1 Conclusions

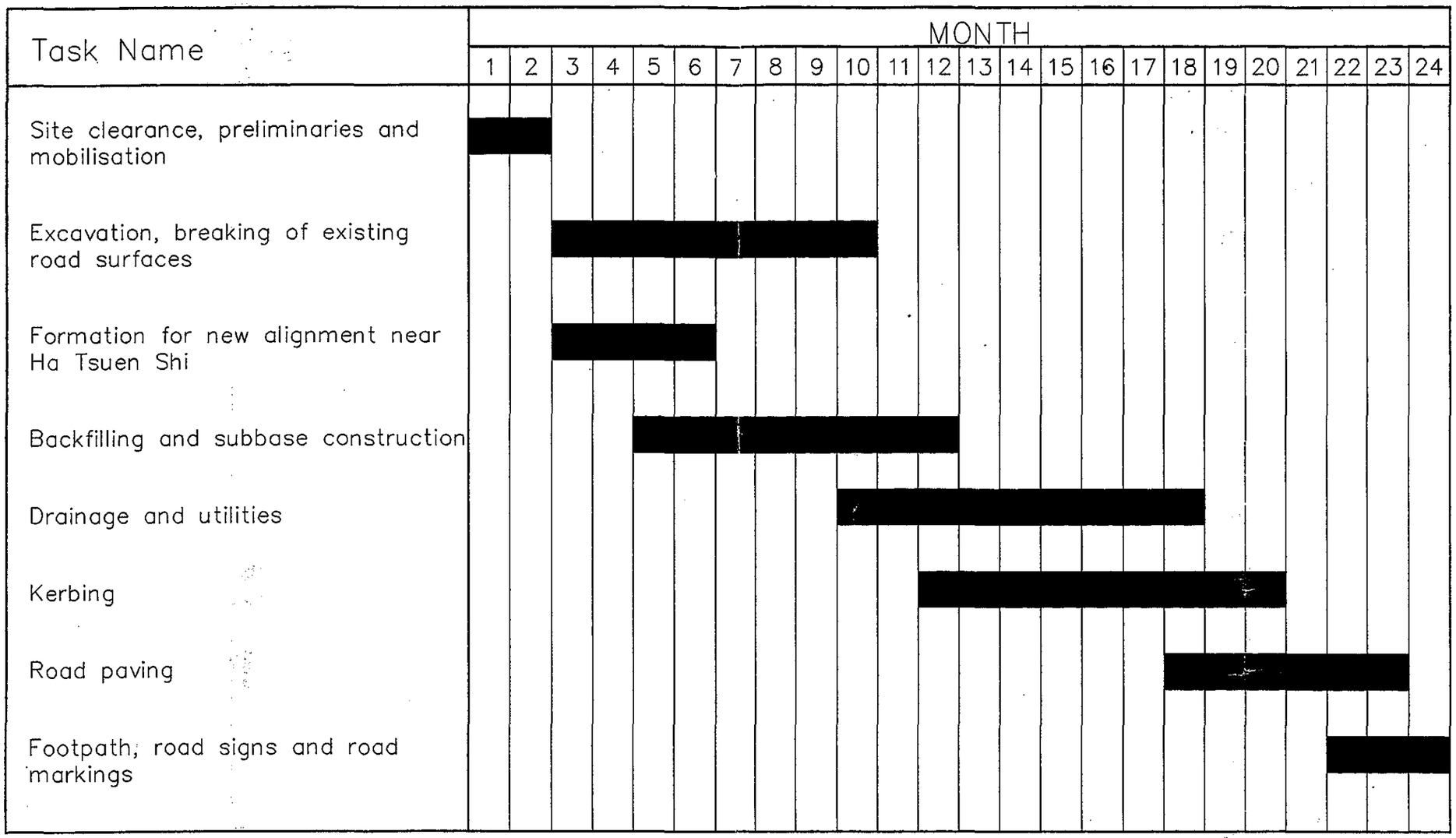
Construction of the Project has been shown to cause significant noise impacts on the noise sensitive receivers in the Study Area. The predicted maximum anticipated construction noise levels are above 75 dB(A) at most NSR locations and noise control measures will be required to mitigate the impacts. The most effective measure is to control the sound emissions from the powered mechanical equipment used on site. This involves either selecting silenced equipment, or reducing transmission of noise using mufflers, silencers, or acoustic enclosures. In addition, the installation of temporary noise barriers at the site boundary or around the noisy equipment would be effective in screening the low-rise receivers from the construction noise.

Road traffic noise will be a major environmental issue in the operation phase. Based on the projected traffic figures for 2011, it has been predicted that the traffic noise levels at most of the existing NSRs will exceed the HKPSG noise criteria. The noise mitigation scheme comprising plain barriers and inverted-L barriers of various heights and horizontal extents are recommended at various locations to screen the exposed receivers. Except those NSRs (i.e. HA-1, HA-2, SCL-1, SKW-4, SK-1 and SKWT-4) where the major traffic noise contribution is from the other existing roads, all of the other affected NSRs would achieve the HKPSG limit after the implementation of the proposed mitigation measures on the improved Ping Ha Road.

5.8.2 Recommendations

The following recommendations are made :

- inclusion of contract clauses with noise limit criteria to control construction noise from the improvement works.
- prevention of using noisy construction equipment as far as possible and careful planning for the operation of noisy equipment whenever necessary.
- application of temporary noise reducing measures such as earth embankment to enclose noisy construction activities.
- incorporation of the noise barrier scheme shown in Table 5.10 and Figure 5.5a by PM/NTN,TDD as part of the road design taking into account the need to maintain the existing run-ins/accesses, to protect the existing NSRs and the planned village sites.
- inclusion of the requirement of installing the noise barrier scheme shown in Table 5.10 and Figure 5.5b by proponents of future noise sensitive developments in the planned CDA sites. This can be enforced by introducing appropriate clauses in the lease conditions for the land zoned CDA.



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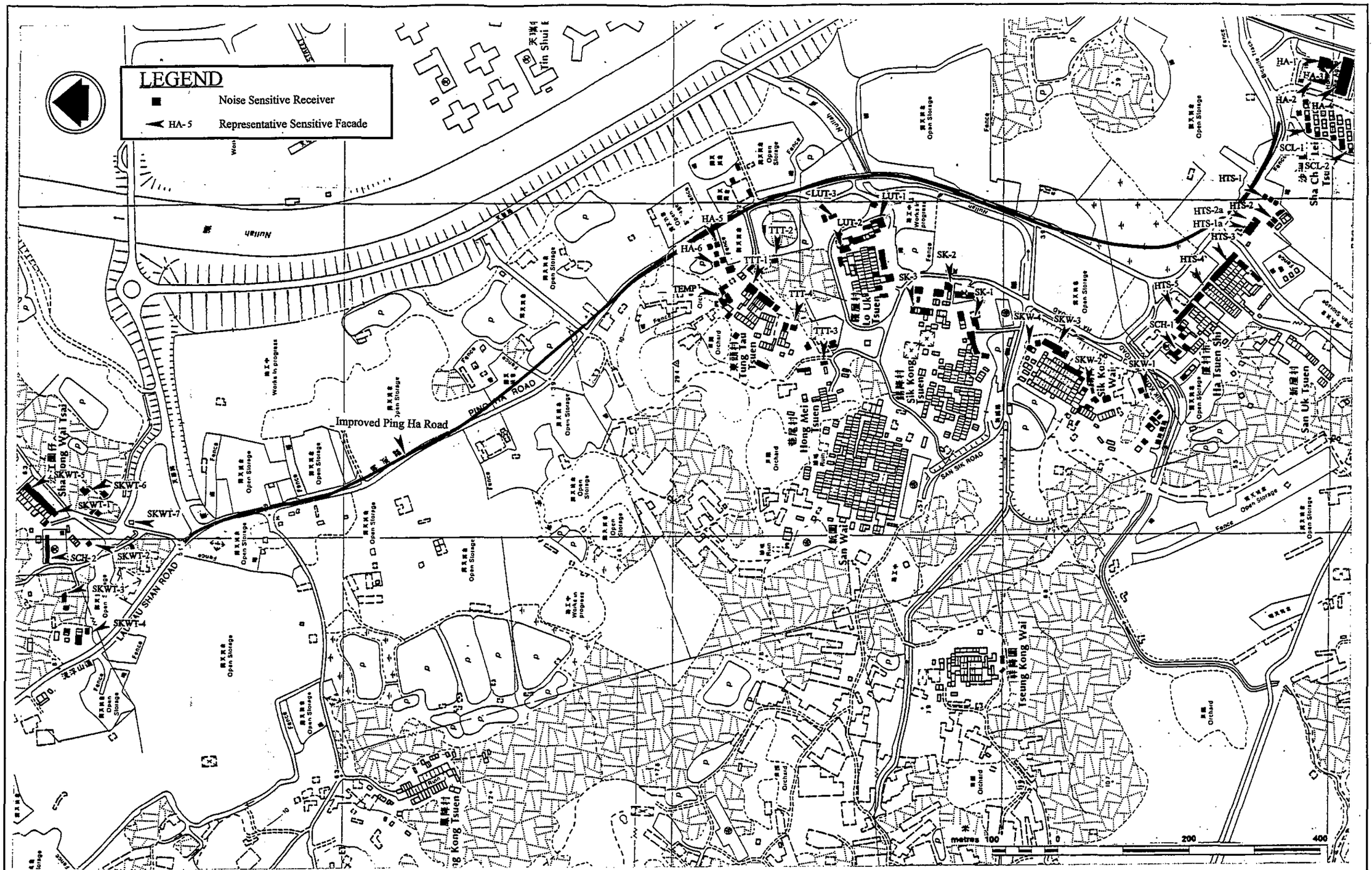
SWK Atria

Agreement No. CE3/94
Ping Ha Road Improvement - Ha Tsuen Section EIA & DIA Studies

Drawing Title
Preliminary Construction Programme

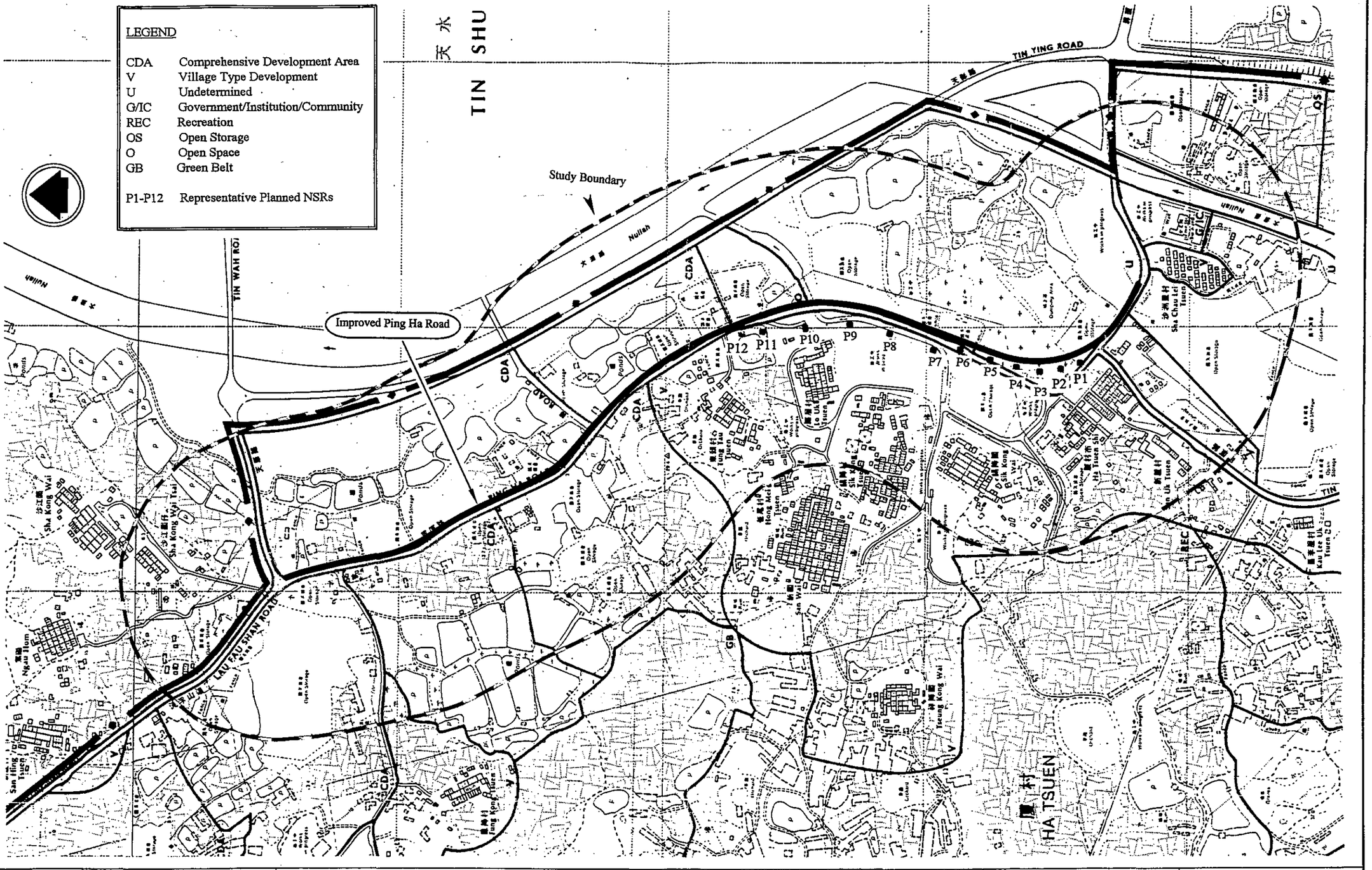
Figure No.	5.1	
Scale	N.T.S.	
Drawn	Approved	Revised
Checked	Date Nov 97	Date



Scott Wilson Kirkpatrick CONSULTING ENGINEERS in association with Aspinwall Clouston Enpac Limited SWK Atria	Agreement No. CE3/94 Ping Ha Road Improvement - Ha Tsuen Section EIA & DIA Studies Drawing Title Noise Sensitive Receivers and Representative Sensitive Facades	Figure No.	5.2
		Scale	As Shown
		Drawn	Approved / Revised
		Checked	Date Nov 97 / Date

LEGEND

CDA	Comprehensive Development Area
V	Village Type Development
U	Undetermined
G/IC	Government/Institution/Community
REC	Recreation
OS	Open Storage
O	Open Space
GB	Green Belt
P1-P12	Representative Planned NSRs



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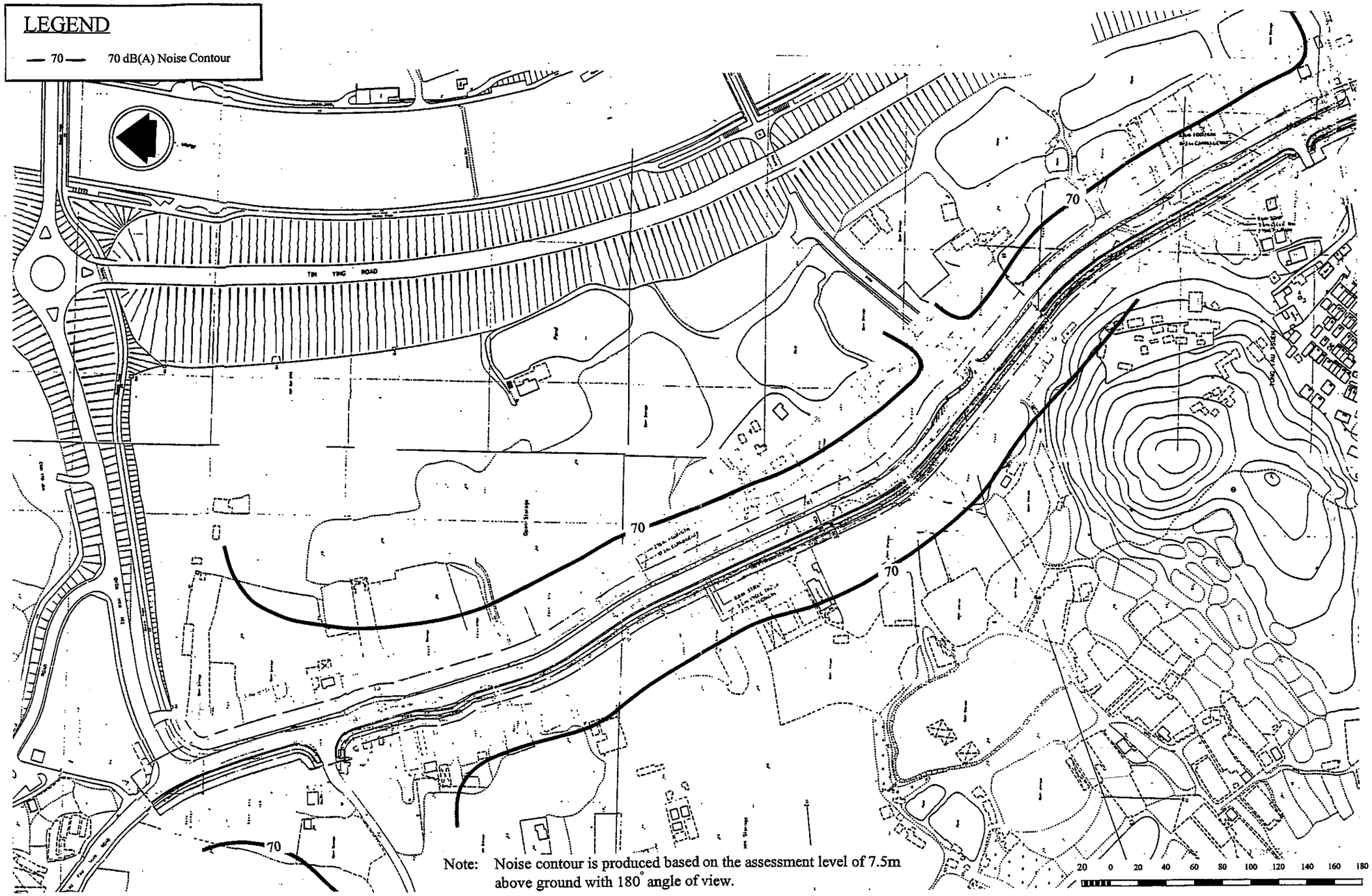
Ping Ha Road Improvement - Ha Tsuen Section EIA & DIA Studies

Drawing Title
Planned Land Uses Within Study Area

Figure No.	5.3	
Scale	1 : 7500	
Drawn	Approved	Revised
Checked	Date Nov 97	Date



Note: Noise contour is produced based on the assessment level of 7.5m above ground with 180° angle of view.

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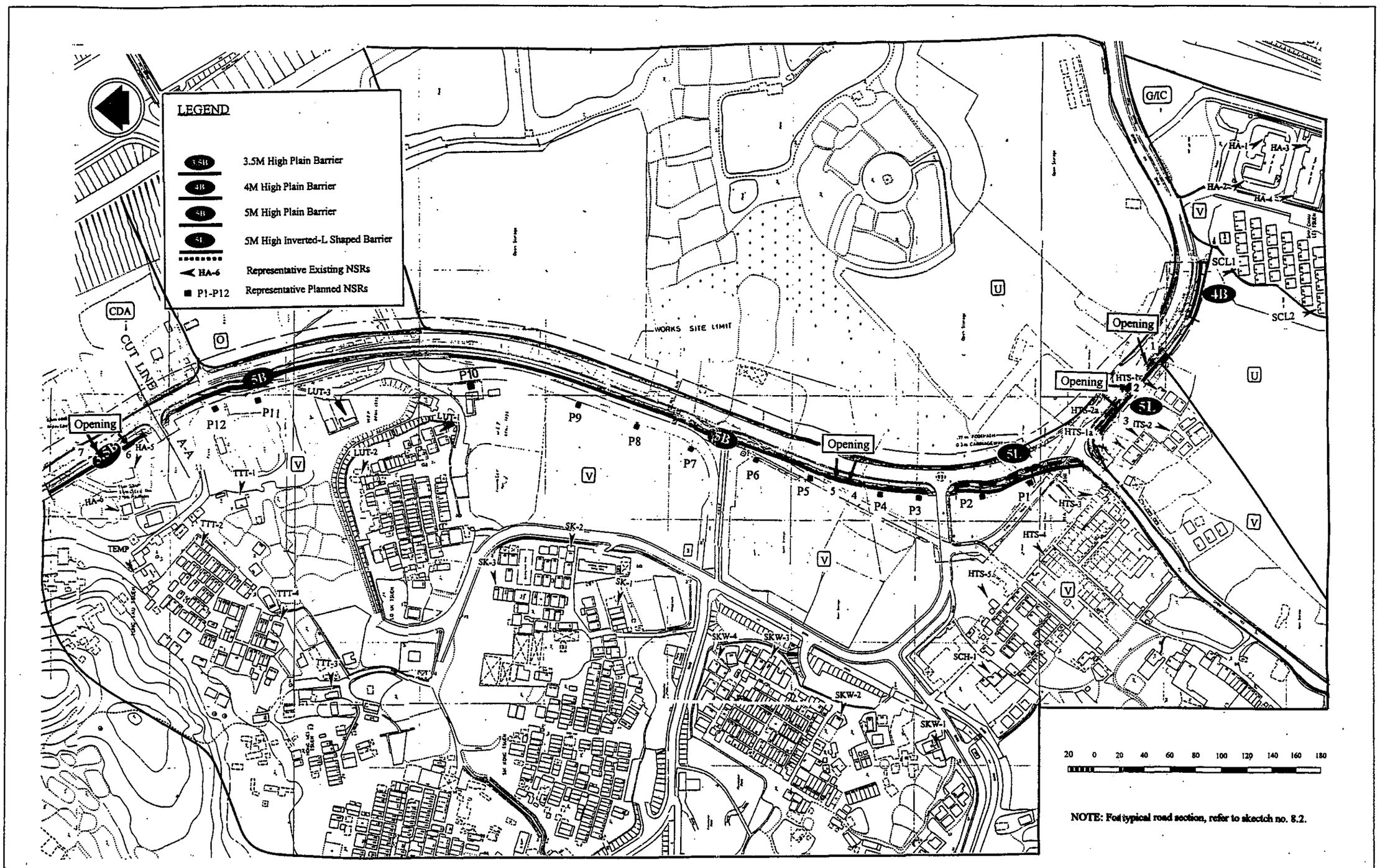
Ping Ha Road Improvement - Ha Tsuen Section EIA & DIA Studies

Drawing Title
2011 AM Peak Traffic Noise Contour for Planned CDA (Unmitigated)

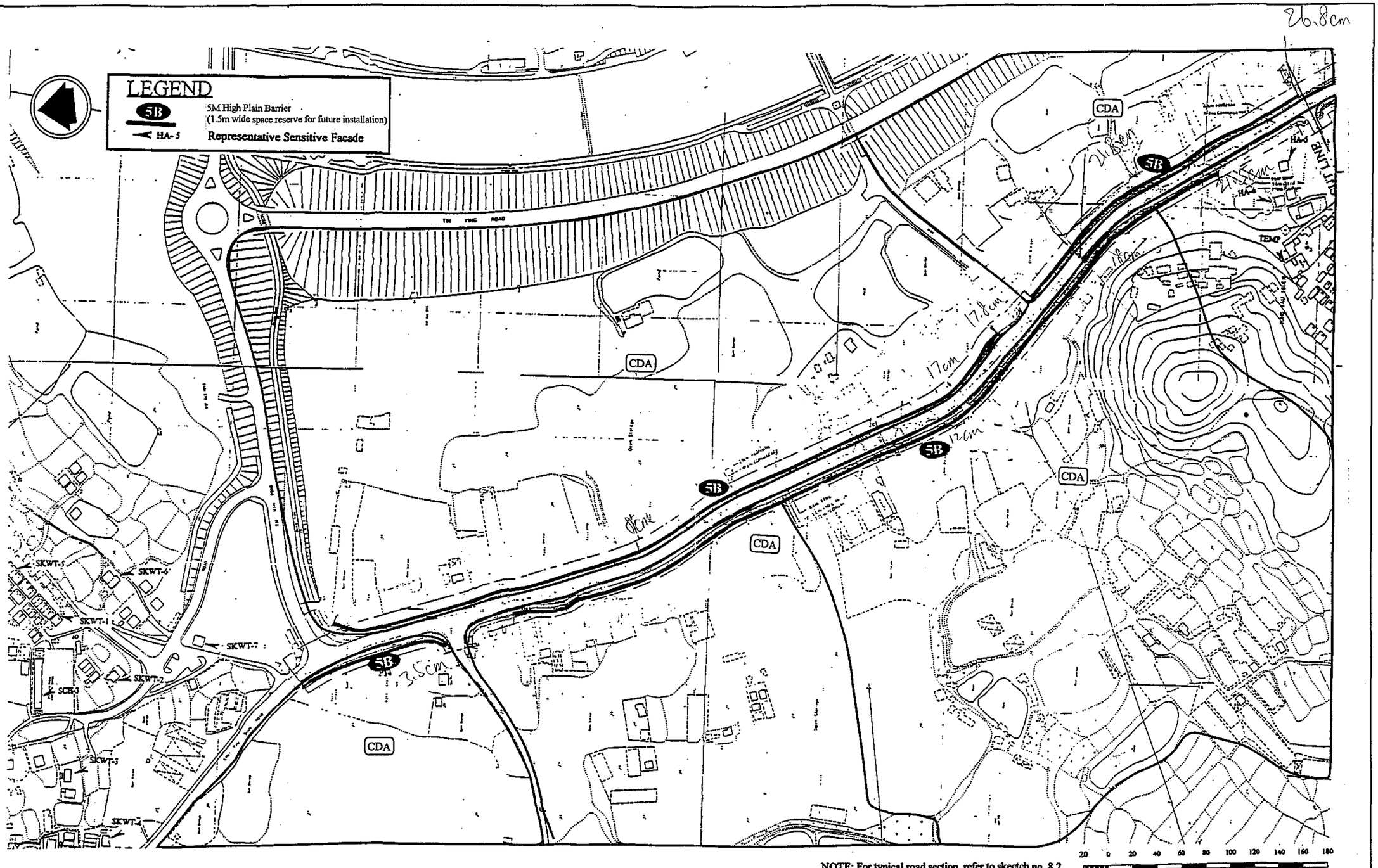
Figure No.	5.4	
Scale	As Shown	
Drawn	Approved	Revised
Checked	Date Nov 97	Date

180
6
30 m/cm



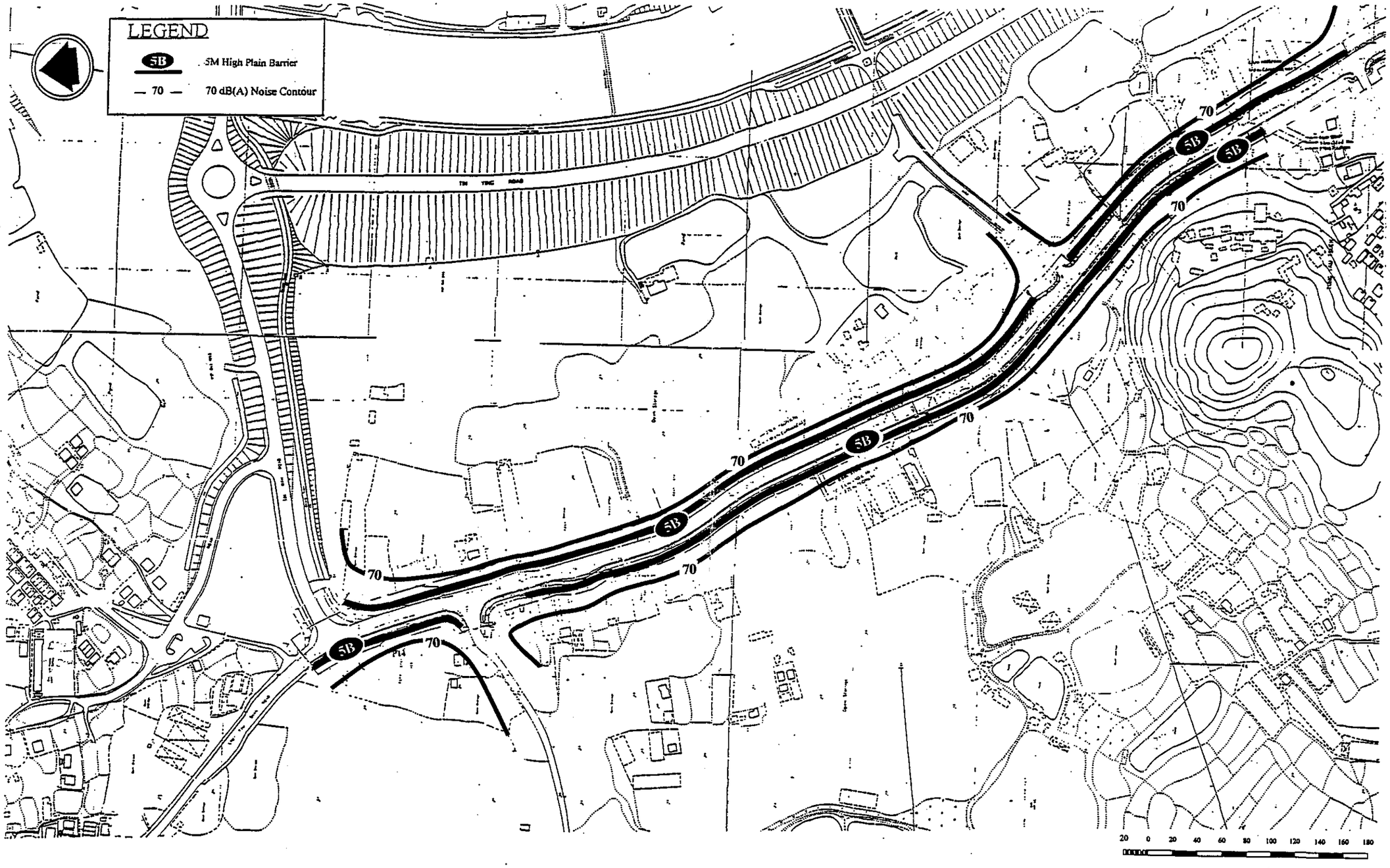
NOTE: For typical road section, refer to sketch no. 8.2.

Scott Wilson Kirkpatrick CONSULTING ENGINEERS in association with Aspinwall Clouston Enpac Limited SWK Atria	Agreement No. CE3/94 Ping Ha Road Improvement - Ha Tsuen Section EIA & DIA Studies Drawing Title Recommended Noise Mitigation Scheme	Figure No.	5.5a
		Scale	As Shown
		Drawn	Approved / Revised
		Checked	Date Nov 97 / Date

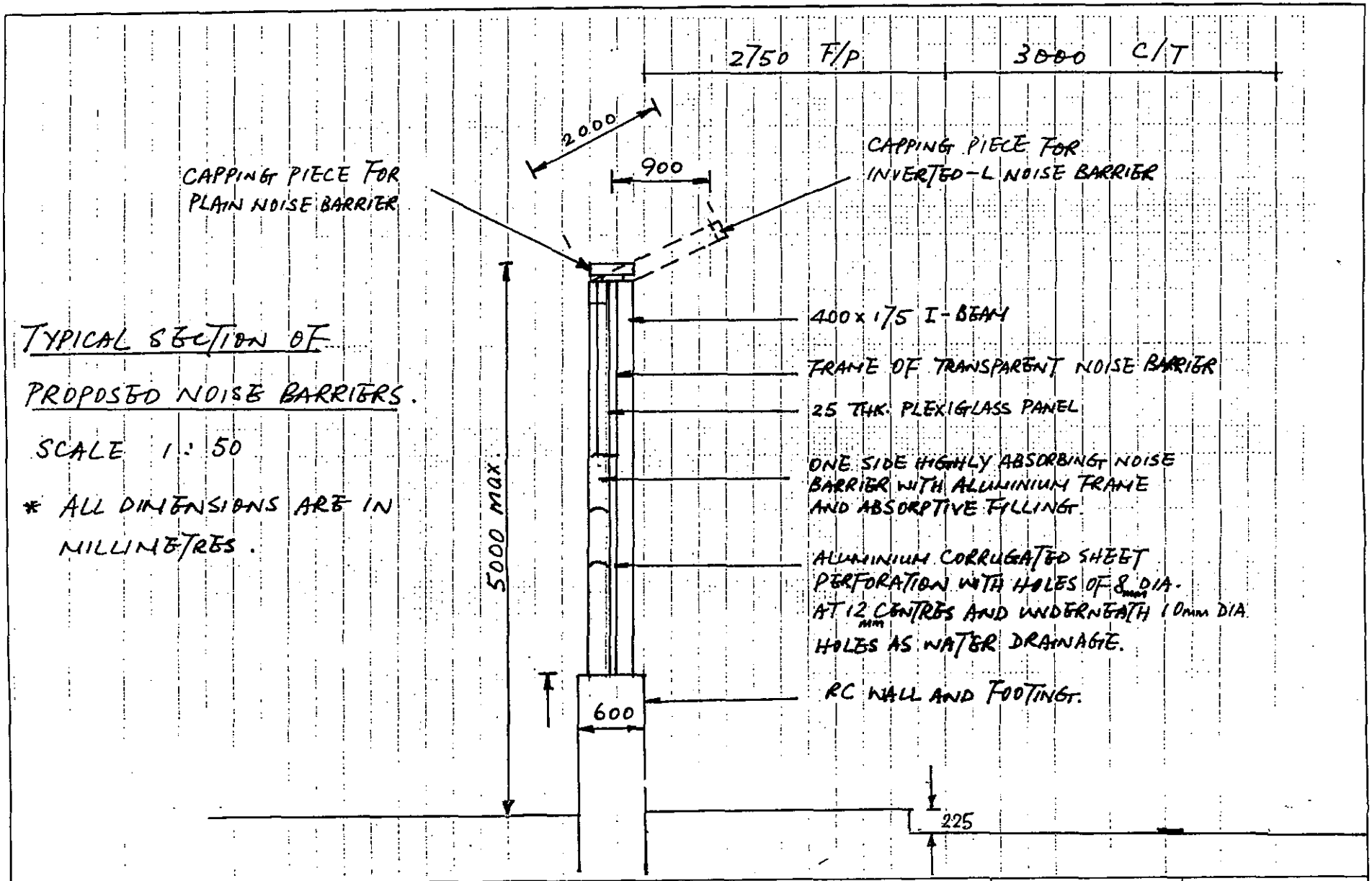


NOTE: For typical road section, refer to skectch no. 8.2.

Scott Wilson Kirkpatrick CONSULTING ENGINEERS in association with Aspinwall Clouston Enpac Limited SWK Atria	Agreement No. CE3/94 Ping Ha Road Improvement - Ha Tsuen Section EIA & DIA Studies Drawing Title Recommended Noise Mitigation Scheme For Planned CDA	Figure No.	5.5b
		Scale	As Shown
		Drawn / Approved / Revised	
		Checked / Date Nov 97 / Date	



Scott Wilson Kirkpatrick CONSULTING ENGINEERS in association with Aspinwall Clouston Enpac Limited SWK Atria	Agreement No. CE3/94 Ping Ha Road Improvement - Ha Tsuen Section EIA & DIA Studies Drawing Title 2011 AM Peak Traffic Noise Contour for Planned CDA (Mitigated)	Figure No	5.6
		Scale	As Shown
		Drawn	Approved / Revised
		Checked	Date Nov 97' / Date



TYPICAL SECTION OF PROPOSED NOISE BARRIERS.

SCALE 1 : 50

* ALL DIMENSIONS ARE IN MILLIMETRES.

Scott Wilson Kirkpatrick CONSULTING ENGINEERS in association with Aspinwall Clouston Enpac Limited SWK Atria	Agreement No. CE3/94 Ping Ha Road Improvement - Ha Tsuen Section EIA & DIA Studies Drawing Title **Typical Details of proposed noise barriers**

Figure No.	5.7	
Scale	N.T.S	
Drawn	Approved -	Revised
Checked	Date April 97	Date

6. WATER QUALITY IMPACT ASSESSMENT

6.1 Introduction

Construction and operation of the Ping Ha Road improvement scheme has the potential to affect the aquatic environment. This section includes :

- a description of the existing water environment along the Ping Ha Road corridor;
- identification and assessment of the potential impacts during construction and operation;
- recommendation of appropriate mitigation measures for amelioration of adverse impacts so that the proposed scheme can proceed without significant impact on the aquatic environment;
- assessment of residual impacts; and
- identification of monitoring requirements.

Under the Water Pollution Control Ordinance (WPCO), Hong Kong waters are divided into Water Control Zones (WCZs). Each WCZ has a designated set of statutory Water Quality Objectives (WQOs). Ping Ha Road lies within the Deep Bay Water Control Zone (DBWCZ) which was declared on 1 December 1990. Therefore any discharge to the Deep Bay WCZ is required to comply with the standards specified in the Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (1991) as issued under the provisions of the Water Pollution Control (Amendment) Ordinance 1990.

6.2 The Existing Environment

Ping Ha Road lies within the Tin Shui Wai Drainage Basin which covers approximately 23 km^3. The basin is dominated by Tin Shui Wai new town development (4 km^2) with major sub-catchments in the Study Area at Ha Tsuen and Lo Uk Tsuen. The Study Area includes the following aquatic environments that could be affected by the proposed project :

- drainage nullahs;
- currently used fish ponds/ponds;
- infilled ponds;
- marsh areas
- localised areas of seasonal standing water; and
- drainage ditches.

The Tin Shui Wai area has experienced significant development over recent years which has resulted in the recent engineered reconstruction of all major watercourses. The most important watercourses in the Study Area are the Tin Shui Wai nullah which discharges into Deep Bay, the Sik Kong Wai (SKW) channel which intersects Ha Tsuen Shi and Sik Kong Wai, and the Tsueng Kong Wai (TKW) channel which intersects Sik Kong Wai and Sik Kong Tsuen. The SKW and TKW channels converge east of Sik Kong Tsuen and Sik Kong Wai, to flow north to Lo Uk Tsuen (LUT) then east into the Tin Shui Wai nullah.

Nullahs

EPD do not routinely monitor the water or sediment quality of the SKW and TKW nullahs. However, it is apparent from site visits that the flow in the nullah is seasonally very variable. This is further considered in the Drainage Impact Assessment (DIA). At Lo Uk Tsuen the water quality in the nullah was dark, sediment laden and probably contaminated. The nullah also contained deposits of black sediment which may cause some odour nuisance to nearby residents and may be contaminated. Sediment within the nullah is likely to be derived from surface run-off and discharges of effluent such as livestock wastes. Livestock waste discharges not only have a powerful pollution potential, they also deliver a suspended solid load to the nullahs which results in the accumulation of contaminated sediments which can cause an odour nuisance and adversely affect the quality of the overlying water column.

EPD routinely monitor two locations in the main Tin Shui Wai nullah, upstream and downstream of the LUTS nullah discharge point. Data for 1994 is included in Table 6.1. Water quality in the upper and lower reaches of the nullah are classed as "fair" and "bad" respectively. The polluted nature of the nullah water is highlighted by the extremely high *E.coli* levels.

Table 6.1 : Water Quality Data for the Tin Shui Wai Nullah (1994)

Parameter	Unit	TSR1	TSR2
Dissolved Oxygen	$mg\ l^{-1}$	2.4 (0.3 - 7.6)	6.3 (0.6 - 9.5)
Biochemical Oxygen Demand	$mg\ l^{-1}$	19 (13 - 80)	14 (3 - 130)
Suspended Solids	$mg\ l^{-1}$	15 (6 - 140)	11 (6 - 110)
Ammoniacal Nitrogen	$mg\ l^{-1}$	1.75 (0.01 - 20.1)	0.78 (0.02 - 20.20)
pH		7.4 (6.8 - 10.5)	7.3 (7.0 - 8.6)
Aluminium	$\mu g\ l^{-1}$	215 (120 - 370)	170 (90 - 1300)
Cadmium	$\mu g\ l^{-1}$	0.20 (0.10 - 1.0)	0.1 (0.1 - 0.3)
Chromium	$\mu g\ l^{-1}$	7.0 (2.0 - 110)	1.0 (1.0 - 3.0)
Copper	$\mu g\ l^{-1}$	22.5 (2.0 - 37.0)	6.5 (1.0 - 28.0)
Lead	$\mu g\ l^{-1}$	2.5 (1.0 - 7.0)	3.5 (1.0 - 72.0)
Zinc	$\mu g\ l^{-1}$	165 (40 - 930)	70 (10 - 110)
E. coli	No/100 ml	3,160,302 (130,000 - 22,000,000)	900,249 (24,000 - 6,800,000)
Flow	l/sec^{-1}	NM	77 (6 - 315)

Note : Data are annual medians of monthly samples except those for E. coli which are geometric means
Data in brackets are the data range
NM = no measurement taken
Data extracted from River Water Quality in Hong Kong for 1993 (EPD, 1994)

It is apparent that the water quality has improved over recent years due to the implementation of the Water Pollution Control Ordinance (WPCO) and the Livestock Wastes Control Scheme (LWCS), both of which have reduced the

number of discharges from pollution sources. The LWCS in particular has reduced the loading of biochemical oxygen demand (BOD) by 75%, from 26,600 kg/day to 6,500 kg/day in 1993. However, the condition of the nullahs in this area is still largely influenced by livestock discharges, and implementation of the revised LWCS in this area is expected to result in further improvement in nullah water quality.

Ponds

Whilst the predominant land uses along the Ping Ha Road corridor are village development, open container storage and other informal uses (reclaimed agricultural/fish pond lots), there are a number of remaining pond areas, either used, disused or infilled. The pond areas are shown in Figure 3.1.

Most of the fish ponds appear to be disused, although the pond located on the road side north of Tung Tau Tsuen (to be infilled) appears to be fully utilised, and the pond between Tung Tau Tsuen and Lo Uk Tsuen appears to be used for irrigation and stormwater retention purposes.

Marsh Areas

There are a number of areas of marshland or infilled derelict fish pond along the Ping Ha Road corridor which provide an indicator of the low lying nature of the area and its susceptibility to flooding.

The main areas of marsh include the remaining sections of Ha Tsuen Marsh opposite Ha Tsuen Shi, and two areas located north and south of Tung Tau Tsuen along side the road. Along with the fish ponds and derelict infilled areas these areas will provide some capacity for the retention of storm waters but may have to be drained and partly infilled to accommodate the new road upgrading works. Ha Tsuen Marsh will be partly infilled to accommodate realignment of the road. Other areas of identified marsh areas are indicated on Figure 3.1.

Miscellaneous

The only other areas of water are those areas of the existing drainage system and localised areas of seasonal standing water.

6.3 Sensitive Receivers

It is apparent that due to the existing poor water quality neither the SKW, SKT nullahs or the TSW nullah can be regarded as sensitive receivers. Nevertheless, they should be protected throughout the road improvement scheme to prevent discharges of road/construction site run-off heavily laden with suspended solids which would add to the accumulation of sediment and flooding problems already experienced and further affect the downstream water quality at Deep Bay.

With regard to the pond and marsh areas, those areas which are not to be drained or infilled to accommodate the road scheme should be protected as far as practical during both construction and operation. It is noted that these areas probably already act as much needed storm water retention ponds and receive

road surface run-off and deposition of local dust. Such areas may provide locally important ecological habitats and should be considered as sensitive receivers.

On a regional scale, the Tin Shui Wai drainage basin is a water gathering ground for Deep Bay. Due to the ecological importance of the Deep Bay area, the groundwater in the Study Area should be considered as a sensitive receiver although it may already be affected by local activities and flooding events. In addition, it is apparent that materials are being used at several of the container storage areas and workshops which have the potential to cause groundwater contamination if spilt. Several localised areas indicated oil and hydrocarbon spills.

Deep Bay itself should be viewed as a regional sensitive receiver, since all water discharges from the Ping Ha Road area, whether via the surface water channels or the groundwater routes, eventually discharge there. Any adverse impact on water quality in the Ping Ha Road Study Area will ultimately affect Deep Bay.

The locations of water sensitive receivers are included in Figure 6.1.

6.4 Construction Phase Impact Assessment

During construction of the road improvements, the aquatic environment in the Study Area may be affected by the following pollution sources :

- spillages of oil/fuel, construction chemicals etc.;
- surface run-off from dust suppression activities, wheel washing facilities, soil/material storage areas;
- contaminated excavated materials;
- sewage discharges; and
- water from draining and dewatering activities.

The potential impacts of road construction on water quality will be dependent on the construction methods used. However, it is considered that the principal concern will relate to the discharge of surface run-off heavily laden with suspended solids, from the works sites into the nullahs, pond areas or marshy areas, during periods of rain.

Potential impacts will include increased flooding and sediment accumulation, turbidity, discoloration, BOD and nutrient enrichment. Serious impacts on water quality are not expected unless there are accidental spillages.

6.5 Operational Phase Impact Assessment

The potential for water quality impacts during the operation of the road are considered to be less than construction impacts and may result from the following:

- discharges of road surface run-off containing sediment and chemical contaminants, into the nullahs via the road drainage system to be installed;

- spillages of chemicals onto the road and discharge into the nullah.

Road Run-Off

It is apparent that road run off currently occurs during periods of rain resulting in discharge to existing waterways, and as such there will be no new contamination sources. The improved road will include a drainage system that will facilitate discharge of potential flood waters directly to the nullahs and reduce the risk of polluting existing fish ponds, marsh areas and groundwater. Increased traffic numbers and flows may increase the risk of contaminant laden run off being discharged to the local nullahs and the potential for pollution downstream.

Sediment will accumulate on the new road during dry periods, both from surface run-off from adjacent areas and from dust generated by the large number of container vehicles which will use the road. Most accumulation is expected in slightly depressed and at grade sections where sediment and silt will be carried. Material deposited on the road will contain a whole array of organic and inorganic chemicals. Material deposited on the road will be removed from the carriageway during rain events. Approximately 80 - 95% of the rainfall landing on road hard surfaces may reach the surface water drainage system. Climatic conditions and intensity of precipitation have a particular significant influence on the characteristics of run-off. Rain events in excess of 0.5 - 0.7 millimetres per hour are expected to remove up to 80% of the contaminant mass accumulated on the road and pavement. Any further rainfall run-off is likely to be relatively less polluted. The initial run-off which contains most of the particulate matter and the associated contaminants is referred to as the "first flush" and can have a significant impact if discharged direct into a sensitive receiving watercourse. This is especially the case following high intensity storms which tend to scour the road surface and can result in a relatively greater run-off pollutant load. Pollutant levels tend to be dependent on the local conditions, topography, climate and the degree of urbanisation.

A wide range of concentrations have been reported for contaminants in road run-off, as illustrated in Table 6.2. The contaminants of greatest concern with respect to water quality are particulates and heavy metals (such as iron, lead and zinc). Particulates may settle out rapidly in any receiving water system and can cause smothering of the bed, while some heavy metals are toxic to some sensitive life forms. The general effects of the major pollutants found in road run-off are indicated in Table 6.3. Tables 6.2 and 6.3 have been included for reference purposes only.

Table 6.2 : Reported Range of Some Constituents Found in Highway Run-Off

Constituent (all units mg l^{-1} except where stated)	Ellis 1986, 1989	Colwill *et al* 1984		
	Highway Run-off	Highway Run-off	Winter	Summer
Total Solids [1]	-	145 - 21,640	167 - 12,860	<15 - 3,700
Suspended Solids [2]	28 - 1,178	11 - 11,500	52 - 717	18 - 3,430
BOD [3]	12 - 32	-	-	-
COD [4]	128 - 171	5 - 1,058	44 - 362	36 - 575
Ammonia	0.02 - 1.6	-	-	-
Lead	0.15 - 2.9	0.01 - 113	3.16 - 28.7	1 - 80.1
PAH (mg l^{-1}) [5]	0.36 - 6.0	-	-	-

Note : 1 The matter left after evaporation and drying of a measured sample
2 The matter left on a filter paper after filtration
3 Biochemical Oxygen Demand
4 Chemical Oxygen Demand
5 Polycyclic Aromatic Hydrocarbons (mg l^{-1})

Table 6.3 : Effects of Pollutants Found in Highway Run-Off

Pollutant	Source	Potential effects
Suspended Solids	Wind blown particulates Vehicle corrosion Road surface wear	Smothering of the stream bed.
Oils/PAHs	Vehicle lubricants and coolants	Deoxygenation of water through increased biochemical oxygen demand (BOD). Creation of oil films that prevent re-aeration. Toxic to some life forms.
Heavy metals	Tyre wear Fuel Vehicle corrosion	Toxic to some life forms.
Nutrients (nitrates and phosphates)	Animal excreta Decaying vegetation Wind blown fertiliser	Eutrophication; increased algal growth may lead to deoxygenation.
Bacteria	Animal excreta Decaying vegetation	Public health problems, odour.

Whilst road run-off has the potential to cause adverse environmental impacts if discharged into sensitive aquatic environments, it is understood that most of the surface run-off from the road area will be directed towards the main Tin Shui Wai nullah. The pollution potential of this surface run-off, with respect to the

nullah and Deep Bay, is thus considered to be minimal due to the already highly polluted nature of the nullah. However, provision should be made to ensure that the road run-off is stripped of its sediment through the use of sediment traps, while run-off should also be prevented from entering any of the pond or marsh areas along the Ping Ha Road due to both concerns related to impacts on water quality but also related to concerns over localised flooding during rain events.

Spillages

Accidental spillages of oil or toxic materials are potentially the most damaging form of pollution from road run-off. Careful design of highway drainage should reduce the risk of water pollution from accidental spillages.

In addition to the above, the existing and planned land uses adjacent to the road also have the potential to impact upon the water environment. It is evident from the site visit that in several locations, minor spillages of oils and hydrocarbons have occurred which may have resulted in localised soil and groundwater pollution. The development of the road offers the potential to remove these contaminated land uses.

6.6 Mitigation Measures and Residual Impacts

Construction Phase

The following mitigation measures have been identified for implementation during the construction phase :

- temporary works should be well designed for the control of run-off from the site;
- all run-off from the construction site should pass through sediment traps. Such systems will allow interception of polluting material and controlled release of treated waters. Traps should be regularly maintained to prevent the release of sediment into the water environment or the nullah system and to prevent blockages. The systems should also be emptied following any accidental spillage event. Any spent oil should be collected, stored in barrels and disposed of in an appropriate manner. Any storage of waste oil should be undertaken in specially bunded areas such that spillages are contained. Run-off from the site will need to be fully compliant with the requirements of the Technical Memorandum on Effluent Standards;
- areas used for stockpiling of construction material should be treated in a manner that prevents erosion (i.e. covered by tarpaulin or similar fabric);
- dust suppression activities should use a minimum volume of liquid;
- water used for construction purposes on site should, as far as practical, be recycled for use;
- the site should be kept clean and tidy with construction materials and waste being stored such that they are not washed off-site;
- impacts associated with spillages should be managed through careful handling procedures. Oils and fuels should only be used and stored in designated areas which have pollution prevention facilities. Any contaminated excavated material should be handled, stored and

transported in a manner which does not allow contamination of water resources;

- fuel tanks and drums of fuel oils and other polluting fluids/chemicals should be provided with locks and bunded to a capacity of 110% of the storage capacity of the largest tank;
- sewage generated on site should be disposed of through connection of the sanitation facilities with the existing foul sewerage system. Discharge of sewage and domestic wastes from canteens, washrooms and toilet facilities can increase the BOD, nutrient and faecal bacteria load in the receiving systems, all of which will have an adverse impact on sensitive aquatic environments. It is expected that the low worker population will not add significantly to the load of the sewerage system. This is considered further in the DIA. Alternatively chemical toilet facilities with appropriate waste disposal measures may be necessary.

Through the adoption of these mitigation measures, and the fact that there are a limited number of sensitive receivers in the area around the road improvement scheme, no significant impacts on the water environment are envisaged during the construction phase since any potential impacts can be prevented through good site management techniques and codes of practice.

Operational Phase

All road run-off should be passed through sediment traps and oil/grease separators prior to discharge into the receiving environment.

The amount of sediment accumulating on the road surface is not expected to be large. However, the quantity can be reduced if the surrounding road-side is landscaped to prevent soil exposure. The road drainage system incorporated as part of the general road improvement scheme will facilitate drainage of run-off of flood waters directly into the nullahs thus preventing run-off into the adjacent fish ponds and marsh areas.

The number of sensitive receivers likely to be affected by spillages is limited. Any spillages can be contained by the kerbing for direction into the road drainage network and discharge into the nullah. Spill action plans should be formulated specifying the actions required in the case of spillages and the measures for controlling and cleaning up spills. Such a system will minimise the potential impacts from spillages as far as practical. The aims of any spill action plan should be to :

- sedimentation tanks/lagoons and drainage channels should be regularly inspected to ensure that they are not blocked and are functioning correctly;
- provide procedures for each category of spillage of light petroleum based compounds, cement etc.;
- provide guidelines for immediate handling of oil-based and hazardous materials;
- specify requirement for monitoring of the receiving water environment;
- provide details of appropriate pollution control equipment; and
- specify actions to restore the impacted receiving system.

If the measures highlighted above are adopted, and if the drainage network is maintained appropriately with sedimentation traps being regularly cleared, the impacts on the water environment should be minimal and the standards required in the Technical Memorandum of Effluent Standards should be achieved.

6.7 Monitoring and Environmental Management

For protection of the water quality during construction of the Ping Ha Road improvements, the following environmental monitoring and management measures should be incorporated into the Environmental Protection and Pollution Control Requirements in the contractor's specification, as a minimum :

- development of a spill action plan to include measures for dealing with spillages of hazardous chemicals and hydrocarbons;
- the impact of any spillages should be monitored;
- discharges should be monitored to ensure they comply with the Technical Memorandum of Effluent Standards and any applicable discharge licenses; and
- effluents containing cement-generated material should be checked periodically with respect to pH.

These measures should also be incorporated into the operational phase of the road for dealing with road run-off and spillages.

6.8 Conclusions

During construction and operation, the water quality of the already polluted Lo Uk Tsuen and Tin Shui Wai nullahs could be affected as could the local fish ponds, marsh areas and ground waters. Impacts would have to be severe to adversely affect the nullahs and downstream environments such as Deep Bay.

During construction sediment laden run-off from unpaved surfaces would inevitably discharge into the local aquatic environments if not properly contained or controlled and further contribute to the already high organic and chemical loading of the nullahs. Fish ponds and marsh areas could also be affected. The main risk of pollution would be from the risk of chemical/hydrocarbon spillage and measures should be undertaken to ensure that all chemicals and hydrocarbons are properly handled, stored and maintained and that a spill action plan is available for dealing with any spills.

Road run-off from Ping Ha Road which contains sediment and organic/inorganic pollutants currently discharges to the nullahs and roadside aquatic environments. The road improvements are intended to control this and a road drainage system will be incorporated to facilitate drainage of run-off and flood waters directly into the nullahs thus preventing run-off into the adjacent fish ponds and marsh areas. However, specific proposals would depend on any risk assessment undertaken. For operation of the road a spill action plan should be formulated for dealing with any spills particularly considering the risk of contamination of groundwaters and Deep Bay downstream.

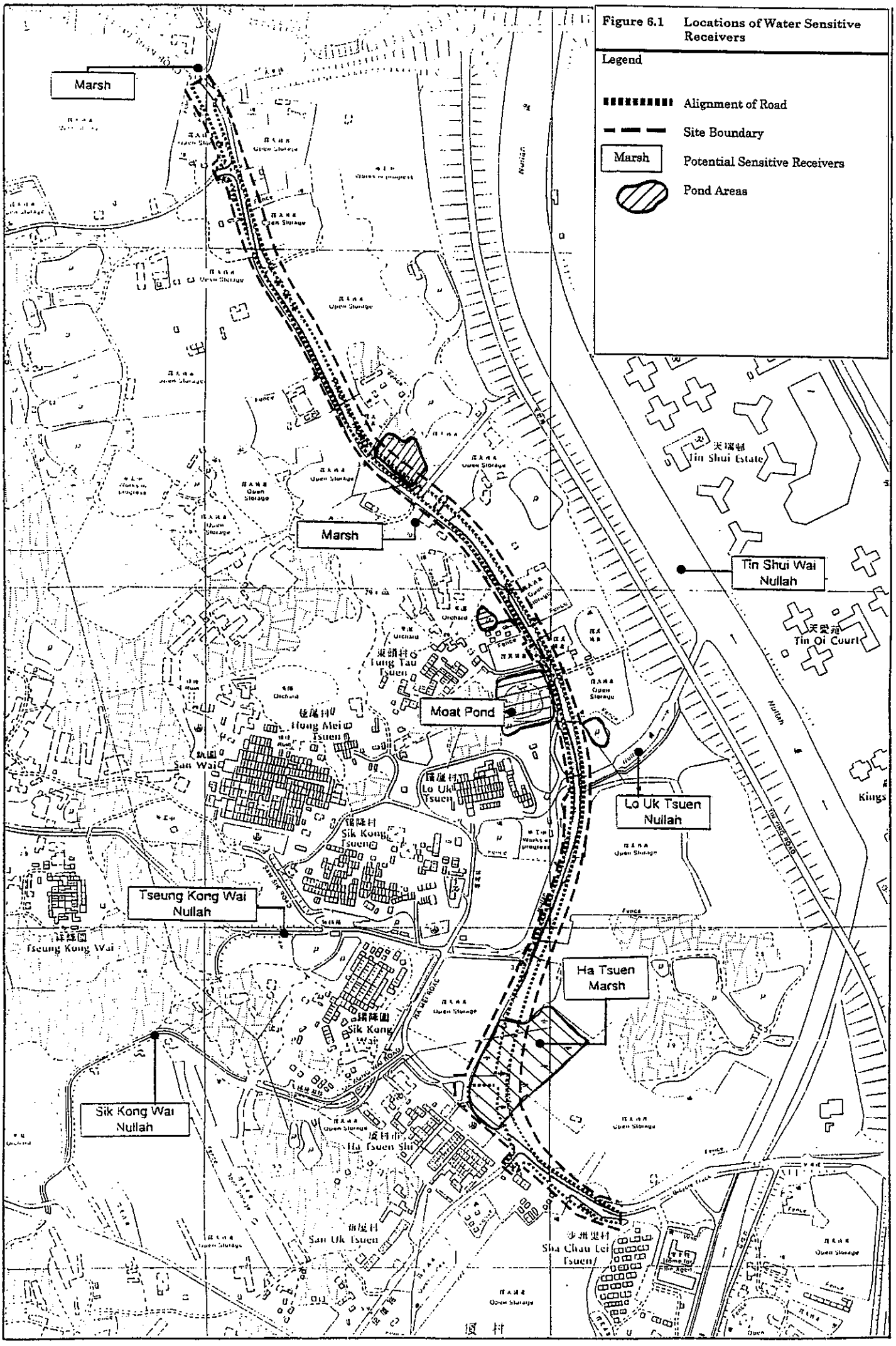


Figure 6.1 Locations of Water Sensitive Receivers
Legend
Alignment of Road
Site Boundary
Marsh
Potential Sensitive Receivers
Pond Areas
Marsh
Marsh
Tin Shui Wai Nullah
Moat Pond
Lo Uk Tsuen Nullah
Tseung Kong Wai Nullah
Ha Tsuen Marsh
Sik Kong Wai Nullah
Tin Shui Estate
Tin Oi Court
Tung Tau Tsuen
Hung Mei Tsuen
San Wai
Lo Uk Tsuen
Sik Kong Tsuen
Sik Kong Wai
Tseung Kong Wai
Ha Tsuen
San Uk Tsuen
Sha Chau Lei Tsuen
Kings
Nullah
Tin Shui Road
Fence
Open Storage
Orchard

7. WASTE MANAGEMENT

7.1 Introduction

Construction of the Ping Ha Road improvement scheme will generate waste material which will need to be handled, stored, transported and disposed of by appropriate methods such that any potential environmental impacts are controlled and minimised. This chapter details the type of wastes expected to be generated and how they should be managed in order to prevent adverse environmental effects.

7.2 Waste Management Regulations

The relevant waste management legislation which will require compliance during the construction phase includes the following :

- the Waste Disposal Ordinance (Cap. 354); and
- the Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354).

Under the Waste Disposal Ordinance (Cap. 354) construction waste is classified as a trade waste and the site contractor is responsible for its disposal. Under the Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354) chemical waste includes scrap material and unwanted substances specified under Schedule 1 of the Waste Disposal Regulation. Such materials are considered to have the potential to cause serious environmental, health and safety hazards if they are not stored and disposed of in an appropriate manner. If chemical wastes are to be generated, requiring handling, storage and subsequent disposal, the contractor must register as a chemical waste generator.

7.3 Construction Phase Impacts and Mitigation Measures

Throughout the construction phase the emphasis should be on the minimisation, recycling and reuse of wastes. Only when waste material cannot be reused on site or elsewhere in a useful capacity, or when reuse is not economically or technically feasible, should it be necessary to dispose of the waste material to an appropriate waste disposal facility. It is the contractors responsibility to identify appropriate waste disposal locations.

Waste Arisings

Wastes likely to be produced during construction comprise the following :

- waste spoil from site clearance, site preparation, excavation and earthworks;
- material resulting from excavation of ponds and marsh areas;
- waste construction material such as wood, metal scraps and concrete;
- chemical wastes generated by general site practices and vehicle and plant maintenance and servicing; and
- sewage and municipal wastes generated by site workers.

Since the precise location of the works areas and the construction methods will be determined by the site contractor at a later stage, it is not possible to fully quantify the extent and nature of all the wastes likely to arise. However, it has been possible to assess the wastes likely to be produced and the appropriate methods for their handling, storage and disposal based on the knowledge of general construction practices in Hong Kong.

Waste Spoil

Waste spoil is likely to be generated during the site clearance and preparation works and will predominantly include concrete, cement, rocks and soil. The total volume of the spoil material is not currently known and large quantities are not expected to be generated as the main activities will include breaking of existing hard surfaces with reclamation and infilling of wet areas and other low lying areas for elevation of the road level.

The majority of the material to be excavated should be clean and acceptable for reuse either on site for embankments, filling and elevation and grading the road level or for transportation to other sites with a materials deficit, namely public dumps or reclamation sites. Suitably inert materials include soil, rock, brick, concrete, aggregates, cement plaster/mortar and building debris. Much of the top surface material may be suitable for reuse as topsoil for landscaping purposes.

It is possible that some of the surface material to be excavated from the container storage areas and vehicle maintenance yards may be contaminated with fuel and oils. Such material will not be suitable for reuse as fill and should be disposed of at an appropriate waste disposal facility. Following a SMG meeting, a preliminary soil contamination assessment was carried out to confirm the status of potential contamination on site. The resultant Preliminary Contamination Assessment report is included in Appendix D.

Analysis of eight soil samples collected along the eastern side of the road and comparison against the Dutch Contamination Criteria have indicated contamination with heavy metals (zinc, copper and lead) and TPH (exceeding either B-level (1993 version) or intervention value (1994 version). Two of the soil samples were identified as exceeding the intervention value while four exceeded the Class B value. However, it is considered that such soil contamination was likely to be very localised and confined to restricted surface patches (< 1.0 metres diameter). The report recommended that surface materials contaminated in excess of the intervention levels (1994 version) may not be suitable for reuse as fill and as such the top 0.5 metres of surface material may need to be removed for appropriate disposal, following consultation with EPD.

Spoil material may need to be stockpiled until sufficient volumes are available either for reuse or disposal at an appropriate site. Environmental impacts generated during handling, storage and disposal of such waste will need to be controlled. Stockpiles should be clearly segregated in terms of material type, as this will aid in the potential for re-use of material and in final disposal if necessary. The potential adverse environmental impacts which can arise from stockpiled spoil include :

- adverse noise levels during un/loading and haulage;
- congestion of traffic routes during haulage;
- unsightly stockpiles on site;
- excessive dust levels during un/loading, storage and haulage;
- sediment laden run-off from overwatering; and
- exhaust emissions from haulage vehicles.

Any excavated material will need to be handled in a manner that minimises the release of fugitive dust, especially during hot and dry weather. This will require the use of dust suppression measures such as dampening with fine water spray and covering with tarpaulin. However, the use of water sprays should not generate silt laden run-off entering the water courses and cause subsequent adverse water quality impacts discussed above in Section 6. Reference should be made to the control of water quality impacts as discussed above in Section 6. Stockpiles can also be visually intrusive and use of plant can cause a noise nuisance. Such impacts can be mitigated through appropriate stockpile location, spraying and covering to minimise impacts related to noise, dust and visual intrusion for nearby sensitive receivers. Noise impacts can also be mitigated through the selection of quiet plant and working methods. Restricted working hours can also be introduced to reduce potential nuisance impacts.

The impacts indicated above and the resultant mitigation measures are also applicable for stockpiles of material imported onto the site for use as fill.

The following measures should be incorporated into the Environmental Pollution and Control Requirements for the contractors specification for stockpile management :

- locate stockpiles to minimise visual impacts and nuisance related to noise and air quality (dust);
- minimise land-take by minimising the size of the stockpiles and associated working areas;
- provide fencing to separate sensitive habits and landscape areas to prevent stockpiling at inappropriate locations;
- designate appropriate haulage routes;
- use dust suppression techniques;
- consider reducing noise impacts through restrictive working hours for noisy practices;
- use of quiet plant;
- prevent surface water pollution by the use of appropriate bunding, interceptors and direction of run-off into settlement ponds; and
- following removal of stockpiles, the area should be restored to its original condition.

Clearance of Ponds and Marsh Areas

The road alignment passes over the south west section of the Ha Tsuen Marsh in the southern section of the Study Area, several minor areas of surface water and marshy plots and a fish pond in the northern section. These areas will require removal of water, vegetation, sediments and saturated material for site preparation works.

The quality of surface water in these locations should be suitable for discharge into the nullahs but will require a discharge licence obtained from the Local Control Office of EPD. Any discharges to the nullah will need to comply with the requirements of the "Standards for effluents discharged into Group D inland waters", in the Technical Memorandum on Effluent Standards. Alternatively provision could be made for recirculating water to other water retention ponds or active fish ponds nearby.

Unconsolidated material removed from wet environments is likely to have a high water and organic content and as such re-use on site may not be feasible unless for landscaping purposes. However, drying of the material and reuse should be pursued if a beneficial use of the material can be identified. If any material removed from these areas is to be stockpiled in a saturated condition the area will need to be bunded with interceptors to contain and collect any water draining off. Water from the sediment may be contaminated with organic (pesticides and hydrocarbons), and inorganic (metals) pollutants. At this stage no data are available to confirm the quality of the sediment. Quantities of mud to be excavated from the wet areas will need to be determined during the geotechnical site investigation stage.

Disposal of waste from the wet areas will be the responsibility of the site contractor. In the absence of material balance data, vertical alignments and geotechnical data on soil composition it is not possible to estimate the amount material for disposal. It is considered unlikely that volumes will be significant and engineering techniques can be applied to minimise the need for major excavation requirements. As stated previously re-use of such material should be considered when appropriate. If the material is to be disposed of to landfill it will require dewatering to achieve a 30% solids content, with no free water present, possibly using a plate press. The liquid arisings will also require appropriate disposal and may need settlement or treatment prior to disposal to either the foul sewerage system or the nearby nullahs.

Waste Construction Material

Construction wastes expected to be generated during the road improvement works include the following :

- wood from the use of hoarding;
- unusable cement and grout mixtures; and
- materials and equipment wrappings.

Generation of construction wastes should be limited and determined by the contractor's working practices and site procedures and cannot be quantified at this stage. However, due to the inherent inert nature of such material, its disposal is unlikely to cause long-term environmental concerns. However, storage and stockpiling of such material prior to disposal could cause adverse impacts related to dust, visual impact, water quality and general health and safety issues. The impacts resulting from stockpiles and the applicable mitigation measures have been detailed in the previous section on "waste spoil".

It should be noted that excessive generation of construction material increases disposal costs and takes up valuable space in landfill sites. Where possible

construction wastes such as wood should be separated out from other wastes for recycling. Material recycling reduces the requirement for new construction materials, reduces collection, transport and disposal costs. Only when material cannot be reused should it be disposed of to landfill or public dump.

It will be the contractor's responsibility to ensure that waste is collected by approved licensed waste collectors and that appropriate measures are taken to minimise adverse impacts such as dust generation. The contractor must also ensure that all necessary waste disposal permits are obtained.

Chemical Wastes

Chemical wastes as defined in the Waste Disposal (Chemical Waste) (General) Regulation will require disposal by an appropriate means and could require pre-notification to EPD prior to disposal. An appropriate disposal facility could be the Chemical Waste Treatment Centre (CWTC) at Tsing Yi. If chemical wastes are to be generated, the contractor will need to register with EPD as a chemical waste producer and observe the requirements for chemical waste storage, labelling, transportation and disposal. The contractor will have to furnish EPD with the following information :

- particulars of the waste producer, a nominated contact person and type of business;
- particulars of the waste generation processes, locations of waste arisings; and
- waste types, quantities and generation rates.

The contractor will also need to consider the guidance in "A Guide to Chemical Waste Control Scheme: A Guide to the Registration of Chemical Waste Producers" and the "Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes".

The majority of chemical wastes likely to be generated during construction will result from plant and vehicle maintenance and servicing. Typical chemical waste materials expected to be generated include the following :

- solid wastes
  - used oil/air filters,
  - scrap batteries, and
  - vehicle parts.

- liquid wastes
  - used lubricants,
  - spent acid/alkali from batteries maintenance,
  - waste oils/grease,
  - gearbox fluids,
  - spent mineral oils/cleaning fluids, and
  - spent solvents/solution produced from cleaning activities.

It is not possible to quantify the chemical wastes likely to be generated given that it will depend on the contractor's on-site maintenance requirements and practices and the number of plant utilised. However, the majority of chemical

waste produced is expected to consist of waste lubricants and oils. Such liquid wastes have particular potential to cause surface water, ground and groundwater pollution and should be collected, stored and disposed of by an appropriate method. Some of this material may also be recyclable. These materials are hazardous since they can cause :

- toxic effects on site workers and nearby sensitive receivers;
- toxic effects on vegetation;
- adverse environmental impacts on surface water and ground water quality following spillage;
- adverse impacts on nullah waters and downstream environments following spillages;
- soil and groundwater contamination following spillages;
- fire hazards; and
- disruption to sewage treatments works if discharged to sewer.

Due to these potential environmental impacts, all chemical wastes must be handled with care and in accordance with the Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354) and relevant guidance documents.

Chemical wastes and liquid wastes should be stored in an appropriate manner with full concrete bunding and interceptors to prevent ground contamination. Any ground material contaminated by chemical spillage will need to be disposed of at an appropriate facility at the expense of the contractor.

Risks associated with spillage can be minimised by the following :

- appropriate storage of chemical wastes and isolation from working areas;
- secure storage areas;
- minimisation of waste production and careful handling of waste fuel and oil residues;
- spill absorbent material and emulsifiers should be available on site in case of spillages;
- storage of wastes remote from sensitive receivers such as residential properties and water bodies; and
- education of workers on the concepts of site cleanliness and appropriate waste management procedures.

The CWTC at Tsing Yi will accept chemical wastes and provide a collection service and necessary storage facilities. Material which is not acceptable to the CWTC such as spent batteries should be sent to a co-disposal landfill such as SENT Landfill.

Sewage Wastes

Sewage wastes will be generated by site construction workers. Untreated discharge of such material could cause odour, health and water quality impacts. As such, sewage generation should be treated or disposed of in a manner that minimises the potential environmental impacts. Sewage can be disposed of through connection of sanitation facilities with the existing foul sewerage system. Alternatively chemical toilet facilities with appropriate waste disposal measures may be necessary.

Municipal Wastes

Solid and liquid wastes will be generated by site workers during the construction phase. Approximately 1.298 kg/employee/day of municipal waste is expected to be generated (Monitoring of Municipal Solid Waste, 1991, 1992 EPD (1993) Hong Kong Government). The total quantity of waste generated will thus be dependent of the number on site workers the contractor proposes to use.

Municipal waste will be predominantly composed of food wastes, packaging and waste paper and should be collected and stored separately from construction material, excavated wastes, and chemical wastes. Construction wastes should be sorted on site into inert and non-inert fraction for re-use and recycling as far as practical by the contractor as described in the New Disposal Arrangements of Construction Waste (1992). Non-inert fraction containing greater than 20% by volume of inert content can be disposed of at landfills, whilst the inert fraction should be delivered to public dumps or other reclamation sites.

A temporary refuse collection facility should be set-up by the contractor. Wastes should be stored in black refuse bags prior to collection and disposal. A private waste collection firm may be commissioned by the site contractor to remove the waste regularly, to the satisfaction of the Engineer.

The storage of municipal wastes if not managed can give rise to several adverse environmental impacts, namely :

- odour nuisance if putrescible material is not collected on a frequent basis;
- wind-blow of material causing litter problems;
- vermin and pests in the waste storage area if it is not well maintained and cleaned regularly; and
- adverse visual impact.

Good site practice can ensure that adverse environmental impacts do not occur and should include at least the following measures :

- frequent collection of general refuse;
- regular maintenance and cleaning of the waste storage areas; and
- storage of material in suitable containers.

7.4 Operational Wastes

Operational wastes are not expected and thus further assessment is not required. However, a small quantity of silt material will be generated through routine maintenance of the drainage network, while waste materials may be produced following spillages. Spills can be managed and controlled through the implementation of a spill action plan as discussed in Section 6.

7.5 Conclusions

Construction works for the Ping Ha Road Improvement Scheme are expected to generate a number of waste materials, namely :

- waste spoil from site preparation and excavation;
- material removed from ponds, marsh areas and other wet areas;
- waste construction materials;
- chemical wastes;
- sewage wastes; and
- municipal wastes

Waste materials have the potential to cause adverse environmental impacts during generation, storage, transport and disposal. Provided that there is strict management and control of all wastes generated on site during the works, and that material is collected, handled, stored, transported and disposed of in an appropriate manner, no significant adverse environmental impacts are anticipated.

Wherever practicable the volumes of wastes generated during construction should be minimised, through recycling and reuse. Solid materials which cannot be recycled or reused will need to be disposed of to landfill, public dumps, or the chemical waste treatment plant. Liquid wastes may need treating prior to discharge.

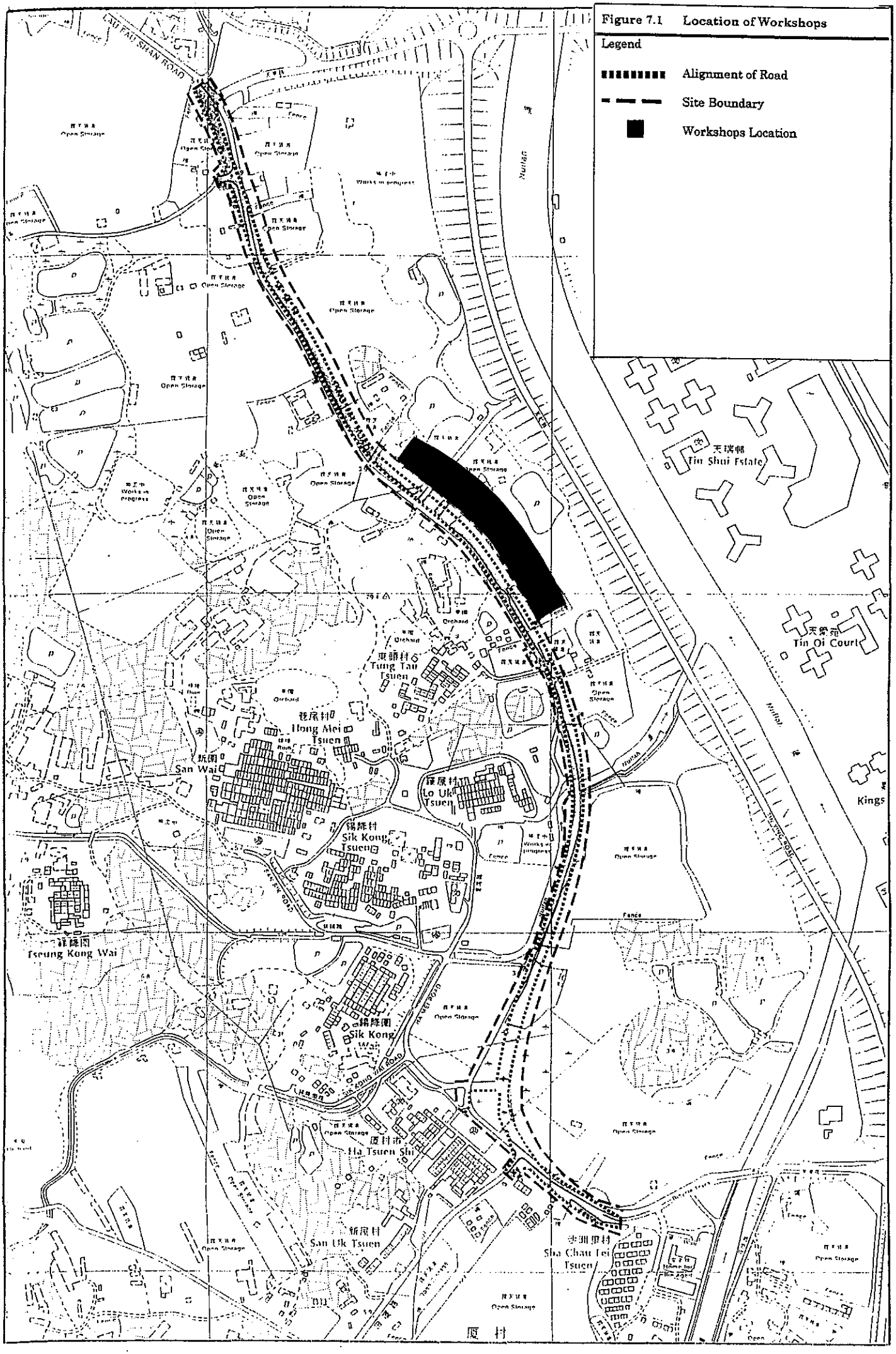


Figure 7.1 Location of Workshops
Legend
Alignment of Road
Site Boundary
Workshops Location
CAU FAU SHAN ROAD
Nullah
天瑞邨
Tin Shui Estate
天鎧苑
Tin Oi Court
東頭村
Tung Tau Tsuen
Hong Mei Tsuen
新圍
San Wai
Lo Uk Tsuen
錦綉村
Sik Kong Tsuen
Kings
TUEN MUN ROAD
SIK KONG WAI ROAD
Tseung Kong Wai
錦綉圍
Sik Kong Wai
厦村市
Ha Tsuen Shi
新屋村
San Uk Tsuen
Sha Chau Tei Tsuen
厦村

8. Landscape Improvements

8.1 Introduction

This section briefly describes the existing character of the Ping Ha Road in terms of its appearance and quality following a desk top study of maps, photographs and drawings. Appropriate mitigation measures are then recommended which will allow the road scheme to proceed without significant effects on the existing or proposed character.

The proposed development is described in detail in Section 3.

8.2 Description of Existing Streetscape

When travelling along the existing Ping Ha Road corridor, the adjacent land uses appear to be typical of the North West New Territories and are characterised by large expanses of container storage areas, vehicle repair and maintenance workshops, open areas for storage of construction machinery and vehicles, local village development, marshy areas, used and disused fish ponds, areas of vegetation, and concrete lined drainage nullahs. The horizon to the east of the road corridor is dominated by the high rise residences of the Tin Shui Wai New Town development. The northern section of the road seems to open out to the distant horizon towards Lau Fau Shan. The storage areas visually dominate the spaces immediately alongside the road corridor owing to their proximity and the conspicuous nature and height of stacked containers.

Ha Tsuen Marsh, a large marshy area adjacent to the intersection between Ping Ha and Ha Mei Roads, the lychee orchard and marsh areas north of Tung Tau Tsuen, fish ponds immediately north of Lo Uk Tsuen and Tung Tau Tsuen, the planted areas in the northern section of the road and the open marsh area at the junction with Lau Fau Shan Road are noticeable green spaces within an otherwise built up and semi-rural landscape. In Sha Chau Lei Tsuen, Ha Tsuen Shi and Lo Uk Tsuen, existing and future residential and commercial properties will overlook the existing road alignment. The Tang ancestral hall at Ha Tsuen Shi will also overlook the proposed scheme. The remainder of the areas adjacent to the existing road are generally informal and unplanned in nature and characterised by the open areas for the storage of containers and vehicle storage yards, and maintenance and repair workshops.

The majority of the existing road edge treatment is characterised by security fencing, street lighting, and poorly maintained or overgrown planting. A stand of mature trees is present adjacent to the road immediately north of Lo Uk Tsuen, screening off some new village style housing behind. At the northern end of the proposed scheme, a new planting scheme has recently been completed which includes trees, shrubs and raised planting beds, and there is a mature Albizia and bamboo stand 150 metres south of the junction with Lau Fau Shan Road.

8.3 Visual Impact Assessment

Quality of Existing Streetscape

The presence of the container storage areas, vehicle storage/maintenance areas and the predominantly undistinguished roadside treatment tend to dominate the local village amenity and areas of green space characterised by the existing fish ponds, marsh areas and orchard. Where roadside landscaping works have been done, it has significantly improved the quality of the streetscape. However, the streetscape remains essentially semi-rural in character.

Sensitive Viewers

A number of sensitive visual receptors (refer to Figure 3.1) are present along the proposed alignment and will have views of the new alignment. These include :

- the Home for the Aged and residential properties overlooking the existing road at Sha Chau Lei Tsuen;
- "village development" land use zone at the junction of Ping Ha Road and Tin Ha Road. Not yet developed;
- the Tang Ancestral Hall and village frontage at Ha Tsuen Shi;
- proposed village houses between Ha Tsuen Shi and Sik Kong Wai;
- new village houses at Lo Uk Tsuen;
- the Home for the Aged at Tung Tau Tsuen;
- tourists en route to the markets and fish restaurants at Lau Fau Shan; and
- recreational pedestrians (cyclists and walkers) along Ping Ha Road.

Effects on Streetscape Quality and Sensitive Viewers

An area of marshy land, two fishponds, an orchard of mature lychee trees and a mature Albizia approximately 20 to 30 years old, currently lie within the proposed alignment of the road improvements. The partial or total loss of these elements would be important changes and would result in a reduction of the diversity of the local village amenity.

The proposed changes to the appearance of the streetscape are not considered to be substantial. The primary land use would remain as a road and the alteration to the alignment is not extensive. There would be disruption during construction, but it would be of a limited period. However, the road scheme as currently proposed does not yet address the on-going encroachment of industrial development into areas which are zoned residential, and contain a number of sensitive viewers. The potential reduction of the diversity of the local village amenity would be reinforced by the visually homogenous character of the new road and disruption associated with increased traffic, further adversely affecting these sensitive viewers. The incorporation of landscape mitigation measures would redress this issue.

8.4 Landscape Mitigation Measures

Objectives of Landscape Mitigation Measures

The landscape mitigation measures should :

- reinforce the local scale of the villages and the rich textual fabric of the adjacent fish ponds; marsh; other wet areas, and green areas;
- recognise the importance of the road to tourists en route to Lau Fau Shan and recreational/pedestrian traffic by unifying and improving the streetscape; and
- attenuate the visually intrusive container storage areas and vehicle maintenance/ storage areas.

Reinforcement of the Local Scale of Villages and Adjacent Space

The proposed corridor should contain shade planting for the footpaths and cycleways and compensatory planting for existing areas to be lost to the road upgrading scheme. This would reduce the existing hostility of the environment to residential, pedestrian and recreational users through the following :

- reduction of the scale of wide road corridor to a more human level reflecting the importance of the village locality;
- improvement of the micro-climatic environment for pedestrians and cyclists;
- attenuation of the visual intrusion on views from both the roadside and from sensitive viewpoints; and
- separation of pedestrians and cyclists from vehicles.

The shade planting should be located on the embankments created to raise the road above flood level. Where possible, existing planting should be retained and integrated into the new planting. It is acknowledged that where possible planting of shrubs and trees should be outside of the footpath and make use of the embankment and other available green areas.

Cross sections of conceptual landscape treatment schemes are shown in Figures 8.1 to 8.3.

The planting should contain large-leafed evergreen trees such as Ficus and Cinnamomum spp, and create interest at eye to ground level with shade-tolerant shrubs. The existing Albizia approximately 150 metres south of the junction with Lau Fau Shan Road must be retained and included in the recommended planting recommendations. According to the available drawings it would be possible to retain the tree by relocating the bus stops ten to 20 metres south and diverting the foot path around the tree. During construction, any excavation under the tree line should be carried out carefully to avoid damage to tree roots. This will require excavation by hand and tying back of roots where necessary.

As roadside trees and amenities are highly likely to be affected during the road improvement works, the contractor will be subject to Regional Services Department (RSD) requirements.

Where the proposed road corridor crosses the Ha Tsuen Marsh near Tin Ha Road, the area closest to the Tang Ancestral Hall could include an interesting landscape design, along with the planned village houses, compensating for the loss of diversity in local village amenity in other areas. The landscape design could feature colourful planting with trees and ground cover.

The area either side of Ha Tsuen Marsh could also be used as an area for compensatory planting. This will create an area of visual interest and relief for local residents. The same could be carried out for any other marsh or pond areas to be encroached upon by the road upgrading scheme, particularly the areas north of Lo Uk Tsuen. The availability of Ha Tseun Marsh will also be determined by the recent planning approval for conversion to "Open Storage" land use.

The landscape mitigation measures will require further development once the road design has been developed in greater detail. For example, the height of the embankment on which the road will be constructed will dictate the extent of fill slopes and subsequently the volume of soil available for tree and shrub planting. Landscape mitigation measures should be submitted to RSD for vetting, consultation and endorsement regarding long-term maintenance objectives. Any planting measures will also need to consider the safety aspects for traffic accessing and leaving storage areas.

For maintenance by RSD, embankment slopes must be reasonably accessible by vehicles and safe for manoeuvring. for example, slopes will need to be less than 30° and verges will need to be more than one metre wide. Sufficient watering points will also need to be provided at appropriate locations.

Unifying and Improving the Streetscape

The treatment of the road edges with regard to new planting, embankments, new and re-instated fencing and noise attenuation barriers should have a unified and coherent design. The current disparate character of the road allows the container storage areas in the background to dominate visually and reinforce the industrial aspects of the existing streetscape. A unified landscape scheme would focus attention on the more interesting roadside foreground. This measure is justified by the importance of the road by tourist traffic, and the significant improvement made to Ping Ha Road by the recently completed works at the northern end of the site.

The appearance of fencing and noise barriers is of particular importance. They should be visually interesting and simple and light in structure and their colour must blend well with planting. Structures which have a high degree of external fittings should be avoided. Planting should be located next to proposed noise attenuation barriers, as vegetation can collect air-borne particulates trapped by structures to be later washed off by rainwater into the ground cover.

In order to achieve their objectives the Government Land Agent Task Force (Black Spots) have stated that they will supplement any landscape mitigation measures by landscaping any left over undeveloped Governmental land along the upgrade road corridor.

Attenuate the Visual intrusion of Container Storage Areas

The landscape mitigation measures recommended above would also have a key function of attenuating the visual intrusion of the container storage areas.

8.5 Conclusions

The existing "informal" land uses along the Ping Ha Road corridor have resulted in visual blight apart from a small number of green open spaces (marsh, fish pond, orchard, garden areas) and will continue to be unsightly for existing and new sensitive viewers. It is recommended that design of the proposed road improvements include the landscape mitigation measures described above to attenuate the visual intrusion and improve the micro-climate for future users especially pedestrians and cyclists.

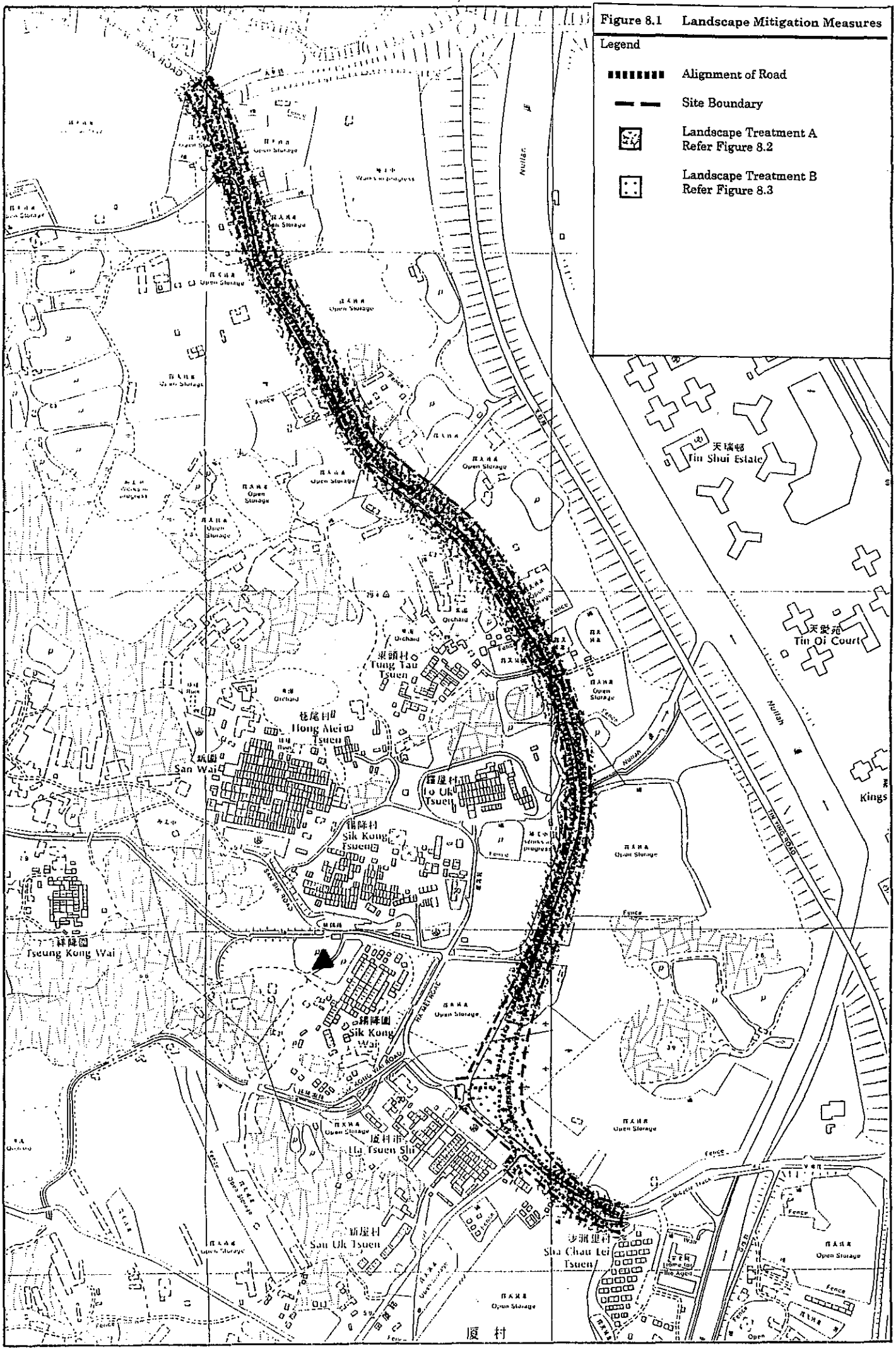


Figure 8.1 Landscape Mitigation Measures
Legend
Alignment of Road
Site Boundary
Landscape Treatment A
Refer Figure 8.2
Landscape Treatment B
Refer Figure 8.3
TUEN MUN ROAD
Nullah
天瑞邨
Tin Shui Estate
天愛苑
Tin Oi Court
東頭村
Tung Tau Tsuen
Hong Mei Tsuen
San Wai
Ho Uk Tsuen
Sik Kong Tsuen
Tseung Kong Wai
Sik Kong Wai
Ha Tsuen Shi
San Uk Tsuen
Sha Chau Lei Tsuen
Kings
TIN SHUI ROAD
SAN SIK ROAD
SIK KONG TSUEN ROAD
Open Storage
Orchard
Fence
厦村
Ha Tsuen

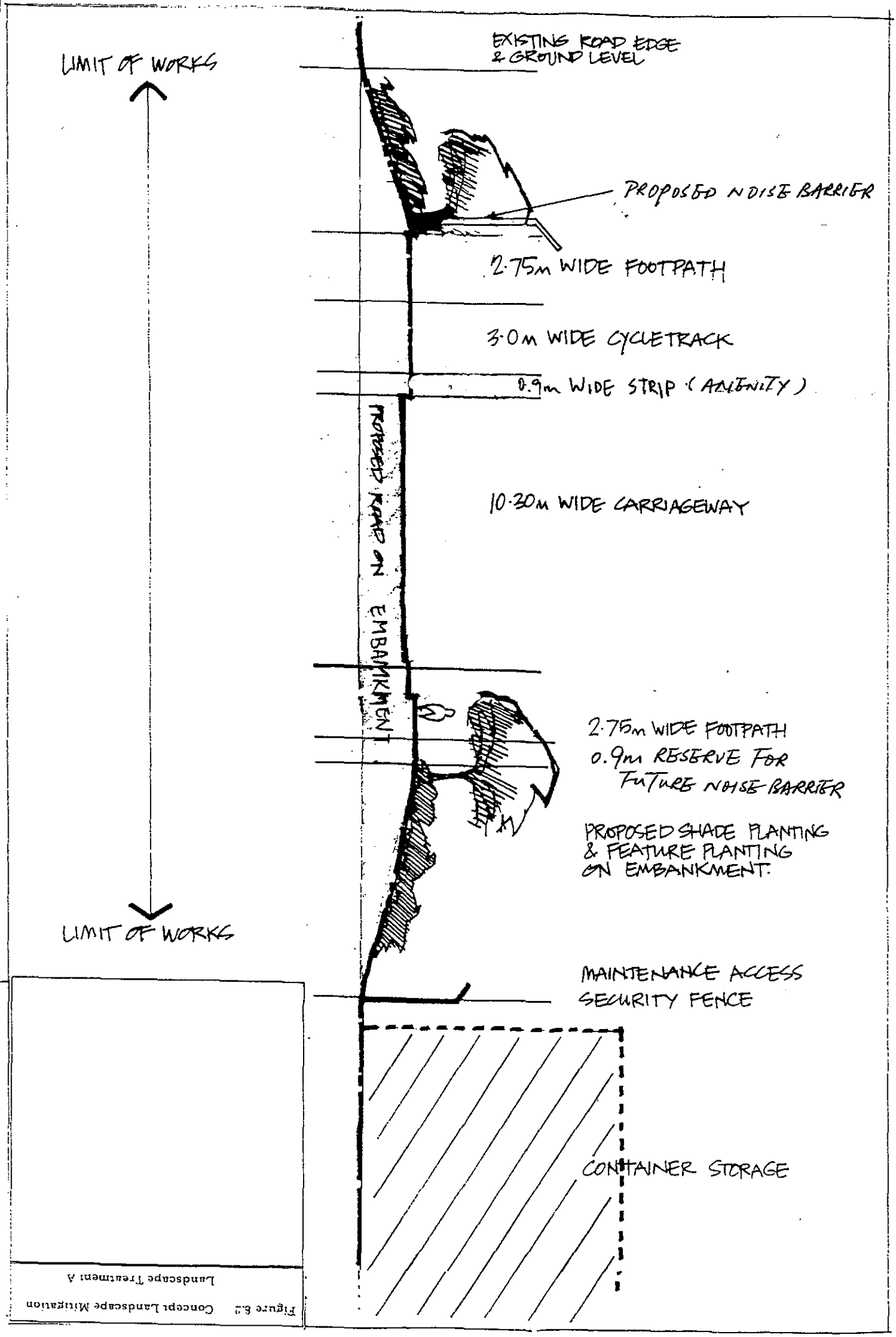


Figure 6.2 Concept Landscape Mitigation

Landscape Treatment A

Figure 8.3 Concept Landscape Mitigation

Landscape Treatment B

9. Planning and Land Use Impact Assessment

9.1 Introduction

It is necessary to identify and assess the impacts and implications of the Ping Ha Road upgrading scheme in terms of community issues and neighbouring land uses.

This section considers the nature of neighbouring land uses and the potential impacts on the local community and users of the road in terms of severance, disruption and disturbance, loss of recreation/amenity, landtake, development potential/land value and resource value of the area.

9.2 Existing Environment and Planning Documents

The Ping Ha Road corridor is included in the draft Ha Tsuen Outline Zoning Plan (OZP), gazetted on 10 June 1994. The OZP is the territory's statutory land use plan which designates official land uses and confirms the latest planning intentions for the area. The OZP states that "The planning intention for the Ha Tsuen Area is to direct growth for low density residential development and village expansion in selected areas where infrastructure provision permits, to retain the countryside features of the upland portion of the Area, to conserve suitable localities for recreation and agricultural uses, and to regularise the open storage development within appropriate locations".

According to the draft Ha Tsuen OZP, the land uses for the area include the following:

- the villages of Sha Chau Lei Tsuen, San Uk Tsuen, Ha Tsuen Shi, Sik Kong Wai, Sik Kong Tsuen, San Wai, Hong Mei Tsuen, Lo Uk Tsuen, and Tung Tau Tsuen located in "Village Type Development" land use zones;
- the areas along the north-west and north-east of Ping Ha Road within a "Comprehensive Development Area" (CDA) which includes existing container storage areas and vehicle maintenance yards and repair workshops. These are considered to be undesirable land uses which could be removed by attempting to 'upgrade' some of these areas in sympathy with the local context;
- "Open Space" on the east of Ping Ha Road opposite Lo Uk Tsuen;
- "Undetermined" land use zones south and south east of Ping Ha Road, including Ha Tsuen Marsh; and
- "Government/Institution/Community" land use covering the area of the Home for the Aged at Sha Chau Lei Tsuen.

A small number of antiquities and monuments in the vicinity of the Ping Ha Road corridor include the following :

- the Tang Ancestral Hall at Ha Tsuen Shi, built in 1793 (grade 1 monument);
- Ha Tsuen Old Market from the 19th century. Not graded. Not in existence as a building;

- Fung Shui wall at Ha Tsuen Shi;
- Yeung Hau Temple at Tung Tau Tsuen, built in the 18th century (declared monument); and
- archaeological sites at Ha Tsuen Shi and Tung Tau Tsuen.

It is unlikely that the antiquities and monuments mentioned above will be affected by the road works as they are set back from the road. The Ancestral Hall at Ha Tsuen Shi which faces onto the road could be affected by construction dust and noise. The various types of mitigation to be implemented are included in Sections 4 and 5.

The need for investigation of unidentified sites of archaeological interest along the road corridor is deemed to be outside the scope of this EIA study and will be dealt with separately by the client.

According to Planning Department, a number of small house applications have been approved by DLO/YL for location along the west side of Ping Ha Road opposite the Ha Tsuen Marsh. Some of this land is to be released through the eastwards realignment of the road across the remaining section of the marsh.

Previous statutory planning documents include the following:

- Development Permission Area Plan YL-HT/2, approved. Gazetted on 22 February 1994;
- Development Permission Area Plan. Gazetted on 12 July 1991;
- Interim Development Permission Area Plan. The first statutory plan, gazetted on 17 August 1990.

Land use commencing after the gazetted of each OPA Plan or the OZP should comply with the plans.

9.3 Construction Phase Impacts

The main issues associated with construction of the project will include community severance, disruption and disturbance, and landtake. Most of these impacts will be short term and result in benefits and improvements to the local area.

Construction activities likely to result in land use impacts will include :

- breaking of the road surface;
- excavation and filling of areas;
- grading of the road foundations;
- realignment of the road;
- relaying of the road surface; and
- works at the junctions of side roads.

Severance

Severance impacts during construction will primarily affect residences of the local villages and users of the Ping Ha Road and associated roads in the area as a

result of breaking of the road surface, realignment eastwards and road works required at the junctions of side roads.

Disruption and Disturbance

Access for local residences, traffic passing through the area and vehicles accessing the sites along Ping Ha Road and associated roads are likely to be disrupted during construction. Traffic flow along the roads is likely to be disrupted due to realignment and relaying of the road surface, and movement of heavy plant on the road moving on and off site. There may also be some deterioration of ambient air quality and noise due to locally increased dust levels and construction noise. These impacts will be short term.

Due consideration should be given to vehicular access of existing container storage yards, villages and small houses. Blocking of existing access points should be avoided. If unavoidable provision should be made for alternative access.

Loss of Recreation/Amenity

Loss of recreation or amenity areas are not expected to occur during the construction phase.

Landtake

Landtake during construction will comprise the temporary and permanent use of areas of land along both sides of the road.

For commencement of the construction works and realignment of the road, application will need to be made for resumption of commercial activities and acquisition of land along the eastern side of the road. Ha Tsuen Marsh and an operational fish pond will also be resumed along the eastern side. No dwellings should be affected.

Construction activities need to remain within the site boundary and not affect the land uses along both sides of the road. This is particularly important with respect to the fish ponds and green and wet areas near Tung Tau Tsuen and the eastern half of Ha Tsuen Marsh. Affected areas will need to be restored and reinstated.

9.4 Operational Phase Impacts

Loss of Recreation/Amenity

There appears to be one open area of recreational land, located in front of the Tang Ancestral Hall in Ha Tsuen Shi. During the site visit, this was being used for parking of vehicles and not its designated land use. There appear to be no other recreational or amenity areas along the road corridor apart from the wet areas, ponds and green areas that should be retained. As described above, Ha Tsuen Marsh as well as the ponds and green areas at Tung Tau Tsuen should be restored to retain some visual character.

Development Potential and Land Value

The general planning intentions of the OZP include for expansion of the villages and upgrading of some of the temporary buildings. It is anticipated that the upgrading of the Ping Ha Road and the improved access and drainage will contribute to the development potential of the area.
Comprehensive Development Areas also have an interest value and are quite valuable for respective owners.

9.5 Mitigation

Construction

The scope for mitigation of land use impacts during construction is often limited and the most effective mitigation measure is to avoid siting construction activities and particularly work sites in close proximity to sensitive receivers. Care should also be taken in setting out work areas and the phasing of general construction activities to ensures that impacts are minimised.

Phasing of works can be important in reducing the inevitable disruption due to traffic congestion. Heavy plant should not be used on roads during busy traffic periods.

If access to properties is blocked at any stage during construction, alternative access should be provided and maintained.

Where practicable, re-instatement should be undertaken on completion of the construction works to include:

- Ha Tsuen Marsh;
- ponds, green areas, marshland and areas of standing water; and
- Albizia tree in the northern section of the road.

Re-instatement of access to existing properties and areas should also be required.

Operation

Mitigation of operational land use impacts will to a certain extent be achieved through implementation of the mitigation measures recommended in previous sections for amelioration of noise, air quality, water quality, waste management, ecology and landscape impacts.

Additional mitigation can be provided through detailed design and management measures. A positive commitment to the management and maintenance of roadside landscape should be undertaken to maintain both the recreational and amenity value of the affected areas and the development potential and land values. This should also include landscaping of the area released following realignment to the road at Ha Tsuen Shi.

9.6 Conclusions

Detrimental impacts will occur during construction with resumption of land and commercial activities; and disruption and disturbance to local traffic flows for local village residents, users of the container/ vehicle areas and traffic passing through.

During operation, there will be loss of rural, green areas and storm water retention capacity if the eastern half of Ha Tsuen Marsh and the green areas and ponds around Tung Tau Tsuen are not retained.
Adverse impacts can also be reduced through the implementation of mitigation measures recommended in the preceding sections covering air quality noise, water quality, waste management, landscape and ecology.

The upgrading of Ping Ha Road will facilitate the general planning objectives of the OZP by improving road access and drainage of the area.

10. Ecological Impact Assessment

10.1 Introduction

The ecology assessment for this Project includes a description of the existing environment following the completion of a walkover survey with preliminary identification of habitats and species, and assessment of key issues for the construction and operational phases and recommendations for mitigation of potentially adverse impacts.

As road improvement works will only affect a narrow strip of disturbed area along the existing road corridor, no significant ecological impact is expected.

10.2 Existing Ecological Conditions

A walkover survey of the site was undertaken on 13 August 1996, between 0730 hours and 1030 hours to identify areas of interest in terms of flora and fauna. The areas identified are small, isolated, limited in their diversity of species and potential importance but they do provide some refuge for birds and insects, necessary relief from the visual blight of the open storage areas and important areas for the retention of storm waters that would otherwise cause flooding. These areas are subsequently referred to as Areas A to H. The survey was undertaken from south to north and details of the findings are included below. Reference should also be made to Figure 10.1.

Area A

Area A included the south west remains of the once important Ha Tsuen Marsh opposite Ha Tsuen Shi. Ha Tsuen Marsh was a freshwater marsh with emergent vegetation that dies back during the dryer winter seasons. Vegetation consisted of water hyacinth, taro, mixed perennial grasses and the creeper, *mikania guaco*. There was some evidence of organic pollution probably from road run-off and surface run-off from the adjacent storage and vehicle repair yards. The marsh was at a lower elevation than the road and likely to provide valuable flood storage capacity during the wet season.

At least five species of odenates were present (no species identified) and no bird species were recorded. However, it would be expected that such an area would be utilised by a number of wintering and migratory wetland species during the periods of September to April, for example, by *Gallinago spp.*, migratory warblers, wagtails and pipits. The area was probably too overgrown during the summer months to be utilised by breeding ardeids, and almost certainly suffer from extensive human disturbance due to its proximity to the road.

Area B

Area B was a small freshwater fish pond with emergent vegetation and banks covered in shrubs, located on the east side of the road and north of the LUTS nullah. The emergent vegetation consisted largely of a cash crop, which appeared to be water spinach although it was unclear whether the pond was commercially operated. The banks were covered with mature shrubs and mixed

perennial grasses, where Plain Prinia (*Prinia inornata*), were noted breeding. Two Chinese Pond Herons (*Ardeola bacchus*), one adult, one juvenile, were present and feeding on the edge of the open water.

Area C

Area C was the nullah at Lo Uk Tsuen. There was little vegetation in the nullah but during previous visits a number of ardeids had been observed.

Area D

Area D was a large moat shaped pond located on the west side of the road, north of Lo Uk Tuen. The pond was unfenced and accessed from the roadside, with very steep slopes. The northerly section of the pond was completely covered with emergent vegetation, water hyacinth, and had good numbers of odenates. The rest of the pond was open water and had abundant fish fry, despite the apparent poor water quality. An island in the centre supported mature shrubs and three Chinese Pond Herons were present. Being so close to the road, the pond was likely to suffer from polluted run-off from the road, high nutrient levels with organic and inorganic pollution. It was likely to regularly support small numbers of Chinese Pond Herons given the food supply and nearby protective cover.

Area E

Area E was a small freshwater marsh with extensive emergent vegetation, adjacent bamboo and a mature lychee orchard, located on the west side of the road, immediately north of Tung Tau Tsuen. Breeding birds were observed and included the White-rumped Munia (*Lonchura striata*), Crested Bulbul (*Pycnonotus jocusus*), and a Magpie Robin (*Copsycus saularis*).

Area F

Area F was a commercially operated fish pond located on the eastern side of Ping Ha Road, north of Tung Tau Tsuen and in the path of the proposed alignment. Excessive organic pollution was observed, evidenced by substantial algal bloom and quantities of floating debris such as polystyrene. The pond probably suffered from run-off from the road. The water quality was visually poor compared to other similar ponds in the Mai Po area. One adult Chinese Pond Heron, one Common Kingfisher (*Alcedo atthis*) and some unidentified odenates were observed. On previous visits, large fish had been observed in the pond.

Area G

Area G included a small number of individual trees approximately 150 metres south of the junction with Lau Fau Shan Road. They specifically comprised a mature Albizia approximately 20 to 30 years old on the eastern side of the road and a stand of bamboo on the western side of the road.

Area H

Area H was a small marsh located at the tip of the northern section of the road at the Lau Fau Shan junction. Similar to the other wet areas the marsh was

covered in emergent vegetation and should not be affected as it is outside of the works area.

10.3 Construction Phase Impacts and Mitigation

Direct Impacts

The alignment of the road is currently planned to cross the Ha Tsuen Marsh (Area A), the fish pond at Area F, and the location of the Albizia tree and bamboo in Area G resulting in loss of breeding and feeding grounds for insects and birds and local storm water retention capacity.

During construction, the site activities and any potential impacts should not affect the eastern half of Area A. Area F is likely to be completely filled in. Any excavation under the tree line of the Albizia should be carried out carefully to avoid damage to tree roots. This will require excavation by hand and tying back of roots where necessary.

Areas B, C, D, E and H are located on the outside boundaries of the proposed works site and could be adversely affected during construction if sufficient measures are not taken. This could result in increased sediment and nutrient levels of the water and degradation of habitat for birds and insects. Appropriate measures will need to be taken to ensure that the nullah and road side fish ponds and wet areas are not adversely affected with sediment laden run-off from the site activities and chemical spillages and careless construction practices.

Indirect Impacts

Indirect impacts would include the release of chemicals or excessive loads of sediment into the nullah affecting downstream environments such as Deep Bay. Spillages on site could affect and the local groundwaters. Given the existing poor water quality of Tin Shui Wai nullah and its discharges into Deep Bay the risk of this is low. Measures for handling, storage and disposal of chemicals are included in Section 7 and should be taken into consideration for the protection of local groundwaters and water courses.

10.4 Operational Phase Impacts and Mitigation

Direct Impacts and Mitigation Measures

According to available drawings the road will cross the western section of the marsh in Area A and the fish pond in Area F. These areas probably provide important local flood retention capacity as well as feeding and breeding grounds for local insects and birds. Loss of these areas will have an impact, but local flooding problems should be alleviated through construction of the road drainage system.

Efforts should be made to retain the eastern half of the Ha Tsuen Marsh for local ecology and landscape mitigation as discussed in Section 8. Many of the landscape mitigation measures recommended in Section 8 would be appropriate

as mitigation for any ecology impacts and assist to increase and sustain existing biodiversity in the local area.

It is acknowledged that the availability of the Ha Tsuen Marsh will depend on the recent planning approval for conversion of the area into Open Storage land use.

The existing Albizia tree south of the junction with Lau Fau Shan Road must be retained and included in the planting schemes recommended in the landscape assessment. It would be possible to retain the tree by relocating the bus stop ten to 20 metres further south and diverting the foot path around the tree.

Indirect Impacts and Mitigation Measures

Operation of the upgraded Ping Ha Road is unlikely to generate any indirect ecological impacts particularly if the appropriate drainage systems are incorporated with silt traps and spill containment measures. The road is likely to benefit the local water quality in the ponds, and areas of marshland and standing water as surface run-off will now be diverted directly to the nullah via the system, so reducing the occurrence of inorganic and organic pollution.

As far as practicable wet areas and green spaces should be retained for local ecological value, as well as for landscape mitigation purposes.

10.5 Conclusions

There appears to be little habitat of real value along the road corridor except for the breeding and feeding of local birds and insects (particularly odenates) and visual mitigation. For these reasons, as many areas as possible should be retained including the eastern section of Ha Tsuen Marsh, the moat pond north of Lo Uk Tsuen and the Albizia tree near the junction with the Lau Fau Shan Road.

The landscape mitigation measures recommended in Section 8 would be appropriate for amelioration of ecological impacts and assist to sustain and increase local biodiversity.

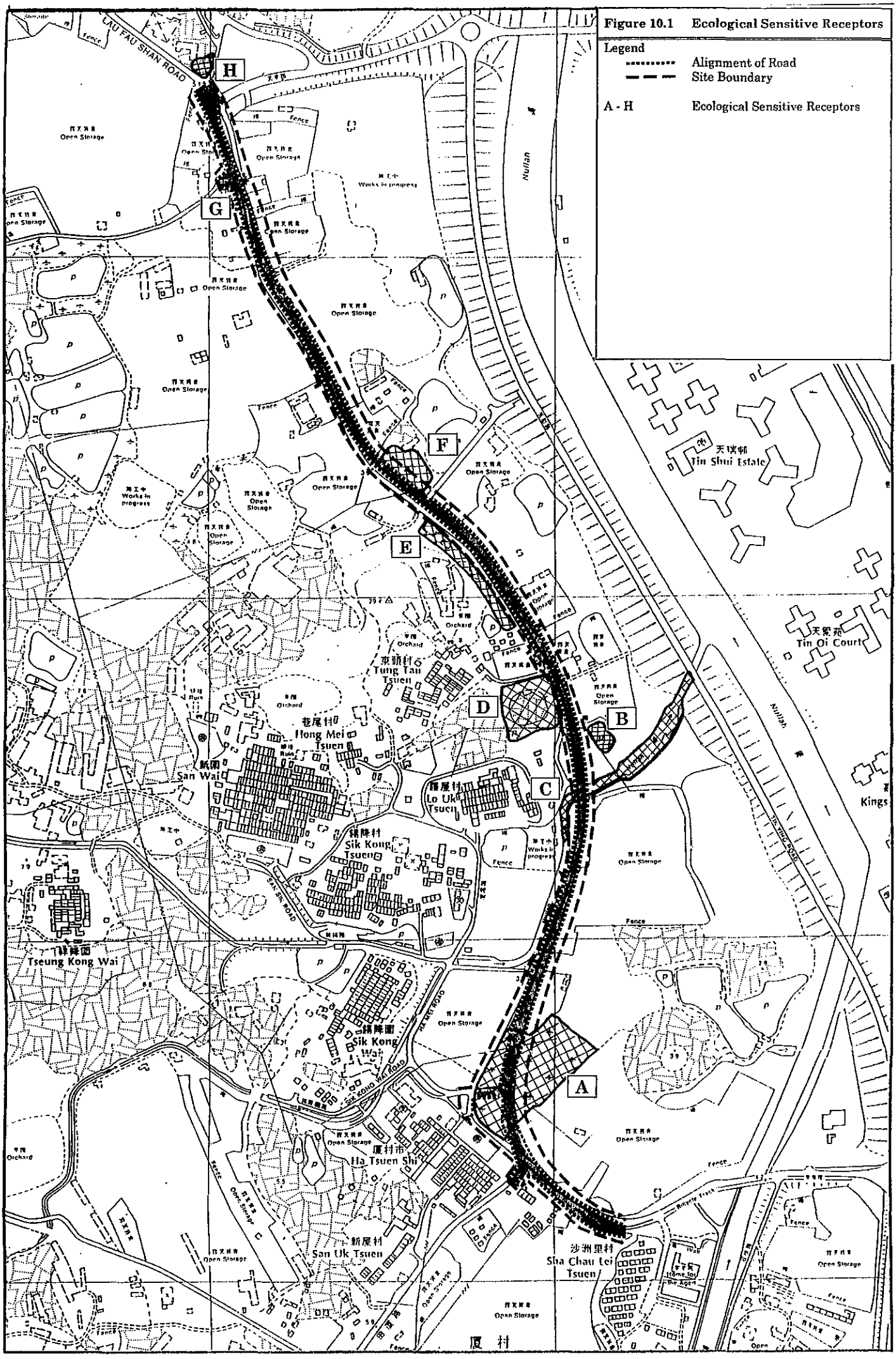


Figure 10.1 Ecological Sensitive Receptors
Legend
Alignment of Road
Site Boundary
A - H Ecological Sensitive Receptors
LAU FAU SHAN ROAD
Nullah
Tin Shui Estate
天瑞邨
Tin Oi Court
天愛苑
Tung Tau Tsuen
Hong Mei Tsuen
San Wai
Lo Uk Tsuen
Sik Kong Tsuen
Tseung Kong Wai
Sik Kong Wai
Ha Tsuen Shi
San Uk Tsuen
Sha Chau Lei Tsuen
SAN SIK ROAD
SIK KONG WAI ROAD
TIN TSUI ROAD
Kings
Open Storage
Works in progress
Orchard
Fence
A
B
C
D
E
F
G
H

11. Identification of Environmental Monitoring and Audit Requirements

11.1 Environmental Monitoring and Audit Manual

Identification of the Environmental Audit and Monitoring requirements for the Ping Ha Road project has been completed and a full Environmental Audit and Monitoring Manual (EMAM) is presented in Appendix C.

12. Summary and Recommendations

12.1 Scope of the EIA

The scope and objectives of the Environmental Impact Assessment for Ping Ha Road - Ha Tsuen Section, have been based on the requirements of the Brief and the key environmental impact issues identified in the Final Inception Report (July 1996).

The environmental issues addressed in this Study have included the following :

- construction dust;
- traffic emissions;
- noise levels during construction and operation;
- water quality for the nullah and adjacent fish pond areas during construction;
- impacts of effluent and road run off;
- management of wastes;
- landscape mitigation;
- ecology;
- land use and planning issues;
- mitigation of adverse impacts and assessment of residual impacts and their acceptability; and
- requirements for environmental monitoring and audit.

12.2 Summary of Adverse Impacts

Construction Phase

- 14 representative air quality sensitive receptors were selected for the worst case assessment of potential impacts from construction dust. Predictive modelling has indicated that during construction there should be no breach of the statutory Air Quality Objectives (AQO) or EPD guidelines at the facades of the existing and future ASRs provided that dust mitigation measures for 50% dust suppression are implemented.

- Construction of the project is expected to generate noise levels in excess of the NCO at noise sensitive receivers and noise amelioration, either at source or indirectly, will have to be carried out to ensure compliance with the NCO criteria.

- During construction, sediment laden run-off from unpaved surfaces would inevitably discharge into the local aquatic environments if not properly contained or controlled, and further contribute to the already high organic and chemical loading of the nullahs. Fish ponds and marsh areas could also be affected. The main risk of pollution would be from chemical/hydrocarbon spillage. However, construction impacts would have to be severe to adversely affect the water quality of the nullahs and downstream environments such as Deep Bay. The risk of such impacts occurring is therefore considered to be low.

- Waste materials have the potential to cause adverse environmental impacts during generation, storage, transport and disposal. Provided that there is strict management and control of all wastes generated on site during the works, and that material is collected, handled, stored, transported and disposed of in an appropriate manner, adverse environmental impacts are not anticipated. A preliminary assessment of soil surface contamination has indicated special disposal may be required at two locations. Consultation will be required with EPD.

- Detrimental impacts could occur during construction with the resumption of land, disruption and disturbance to local traffic flows for local village residents, users of the container/vehicle areas and traffic passing through, and blocking of existing access points.

- There appears to be little ecological habitat of real value along the road corridor except for the breeding and feeding of local birds and insects (particularly odenates) and visual mitigation. As many wet and green areas as possible should therefore be retained. The eastern section of Ha Tsuen Marsh in particular should be protected from construction activities along with the moat pond north of Lo Uk Tsuen which should not be encroached upon and the Albizia tree near the junction with the Lau Fau Shan Road which should be retained.

Operational Phase

- Air quality emissions are not expected to adversely affect potential sensitive receptors along the road corridor.

- It is expected that noise from passing traffic, in excess of the HKPSG will be generated at a number of sensitive receivers (including schools and homes for the aged) along the road, particularly at Ha Tsuen Shi, Sha Chau Lei Tsuen, the vicinity of Tin Ha Road, Sik Kong Wai, Lo Uk Tsuen, Tung Tau Tsuen.

- Road run-off from Ping Ha Road which contains sediment and organic/inorganic pollutants currently discharges to the nullahs and roadside aquatic environments. The road improvements are intended to control this and road drainage improvements will be incorporated to facilitate drainage of run-off and flood waters directly into the nullahs thus preventing run-off into the adjacent fish ponds and marsh areas.

- The existing "informal" land uses along the Ping Ha Road corridor have resulted in visual blight apart from a small number of green open spaces (marsh, fish pond, orchard, garden areas) and will continue to be unsightly for existing and new sensitive viewers.

12.3 Design and Mitigation

Construction Phase

- For the suppression of construction dust the EIA has recommended that either a speed limit of 10 km hr^{-1} is imposed for construction vehicles on unpaved site roads or that unpaved site roads are watered twice daily as necessary. Additional best practice working measures should also be included into the contractor's specification.

- The most effective method for controlling construction noise and sound emissions from PME, in excess of the NCO, is through the use of muffled or silenced equipment, supplemented with the installation of temporary noise barriers at the site boundary or around noisy activities. Recommendations for additional best practice working measures should also be included into the contractor's specification.

- The risk of sediment or spillages discharging from the site into the local aquatic environments should be controlled through the implementation of measures which will ensure that all chemicals and hydrocarbons are properly handled, stored and maintained and that a spill action plan is available for dealing with any spills. Recommendations for best practice working measures should also be included into the contractor's specification.

- EPD will require consultation on the need for appropriate disposal of contamination surface material.

- Disruption and disturbance to local residents and users of the Ping Ha Road should be minimised through programming and management of works and provision of alternative access points if necessary.

- The proposed road corridor should contain areas for compensatory planting and make use where practicable of the road embankments.

Operational Phase

- Traffic noise in excess of the HKPSG guidelines will require direct and indirect mitigation. The EIA has recommended erection of noise barriers at Ha Tsuen Shi and Sha Chau Lei Tsuen. Exco will need to provide indirect technical remedies such as good quality windows/double glazing and air conditioning units at the homes for the aged at Sha Chau Lei Tsuen and Tung Tau Tsuen and the school at Sik Kong Wai. Exco will also need to consider the application of indirect technical remedies for worst affected NSRs at Sha Chau Lei Tsuen and Sik Kong Wai. Residual impacts are predicted for Sha Chau Lei Tsuen and Sik Kong Wai.

- In order to attenuate the visual intrusion of the road improvement, long term ecological impacts, and improve the micro-climate for residents and future users especially pedestrians and cyclists a number of mitigation measures have been recommended. These include opportunities for planting along the embankments, compensatory planting and retaining

of existing areas. Design of the proposed road improvements should retain certain existing features such as the Albizia tree, ponds, areas of marshland, standing water and green areas in the northern section of the road, and Ha Tsuen Marsh, otherwise there will be loss of land and character. The land area to be released in front of Tang Ancestral hall in Ha Tsuen Shi should also be landscaped.

12.4 Beneficial Impacts

Upgrading of the Ping Ha Road will :

- facilitate the general planning objectives of the draft Ha Tsuen OZP;
- encourage the use of the CDA land uses, expansion of the villages and upgrading of the area;
- improve access to the area; and
- alleviate local flooding.

Apart from the predicted construction generated dust and noise levels which can ameliorated, traffic generated noise which will require indirect and direct mitigation, and recommendations for landscaping, no further adverse impacts are expected along the Ping Ha Road. With sufficient mitigation of short term (construction) and long term (operational) impacts the upgrading is likely to be generally beneficial to the local area.

Cumulative impacts arising from the project are not expected.

12.5 Environmental Monitoring and Audit

- Mitigation measures will need to be included in the contractors documents and particularly the Environmental Protection and Pollution Control Requirements to ensure that dust generation, noise levels, and water quality are controlled, impacts minimised and the required legislation and standards complied with.

- Practicable and cost-effective mitigation measures and methods will be recommended for the project to ensure potential impacts are maintained within appropriate Hong Kong and international environmental standards.

- Where possible mitigation measures should be incorporated into the design of the project at the earliest stage rather than being "bolted on" during construction and operation.

APPENDIX A

Current Projects in the Study Area

RPIS Minor Works

鄉郊規劃及改善策略小型工程

1. District 地區： Yuen Long District 元朗區

2. Ref No. 編號： YL - 148

3. PWP Item No. 工務編號： 025HH

4. Project Title 工程名稱：

Drainage Improvement at Ha Tsuen Shi, Yuen Long, NT

元朗廈村市排水渠改善工程

5. Scope of works 工程範圍：

Construction of two 1.5m wide covered slotted drainage channels of total length 330m to collect run-off from Ha Tsuen Shi to Sek Kong Wai Channel.

建造兩條1.5米闊，共330米長有槽溝的有蓋排水渠，用以收集由廈村市至錫降圍的雨水。

6. Existing Condition 現時情況：

Frequent flooding due to indiscriminate fillings in the area and indequate capacity of existing stormwater drainage system.

由於附近有大量填泥及現有的排水系統容量不足，故導致經常水浸。

7. Start Date 開工日期： 03/1995

8. Completion Date 完工日期： 06/1996

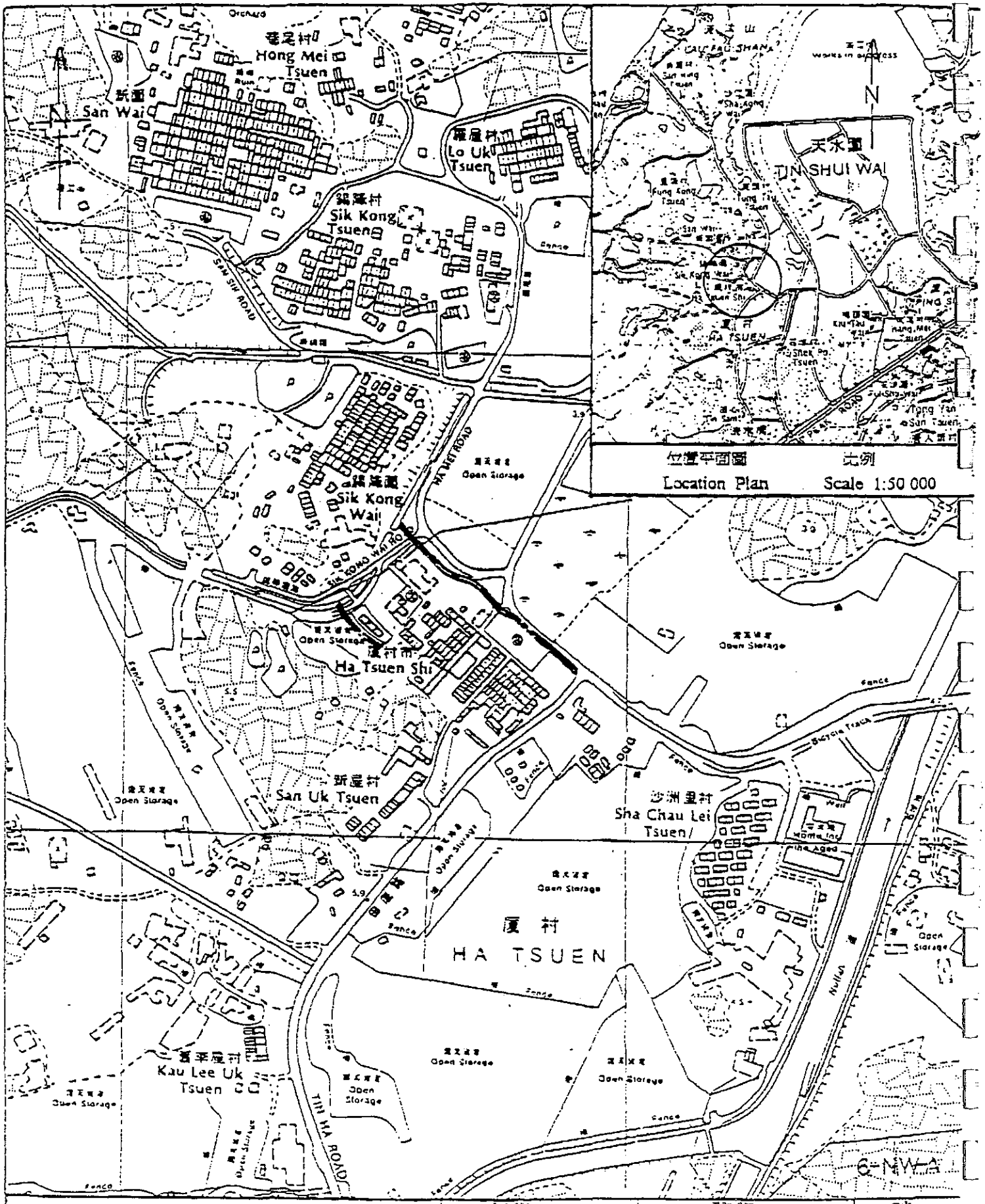
9. Project Estimate 估價： $ 3.30 M（百萬元）

10. Works Agency 工程部門： DSD 渠務署

11. Maintenance Agency 維修部門： DSD 渠務署

12. Land Resumption 徵收土地： Required 需要

13. Population to be served 受惠人數： 800



YUEN LONG DISTRICT 元朗區

Drainage Improvement at Ha Tsuen Shi, Yuen Long, NT

YL-148

RP 2361

1:5 000

Rural Planning & Improvement Strategy

RPIS Minor Works

鄉郊規劃及改善策略小型工程

1. District 地區： Yuen Long District 元朗區

2. Ref No. 編號： YL - 109

3. PWP Item No. 工務編號： 484TH

4. Project Title 工程名稱：

Reconstruction of access road to Fung Kong Tsuen

鳳降村通道重建工程

5. Scope of works 工程範圍：

Existing access to be raised, drainage channel to be provided along access.

提升現時通道，及沿通道鋪設排水渠。

6. Existing Condition 現時情況：

Serious flooding due to uncontrolled landfilling adjacent to the access.

由於有不受控制的填泥活動，故通道經常出現水浸。

7. Start Date 開工日期： 05/1996

8. Completion Date 完工日期： 04/1997

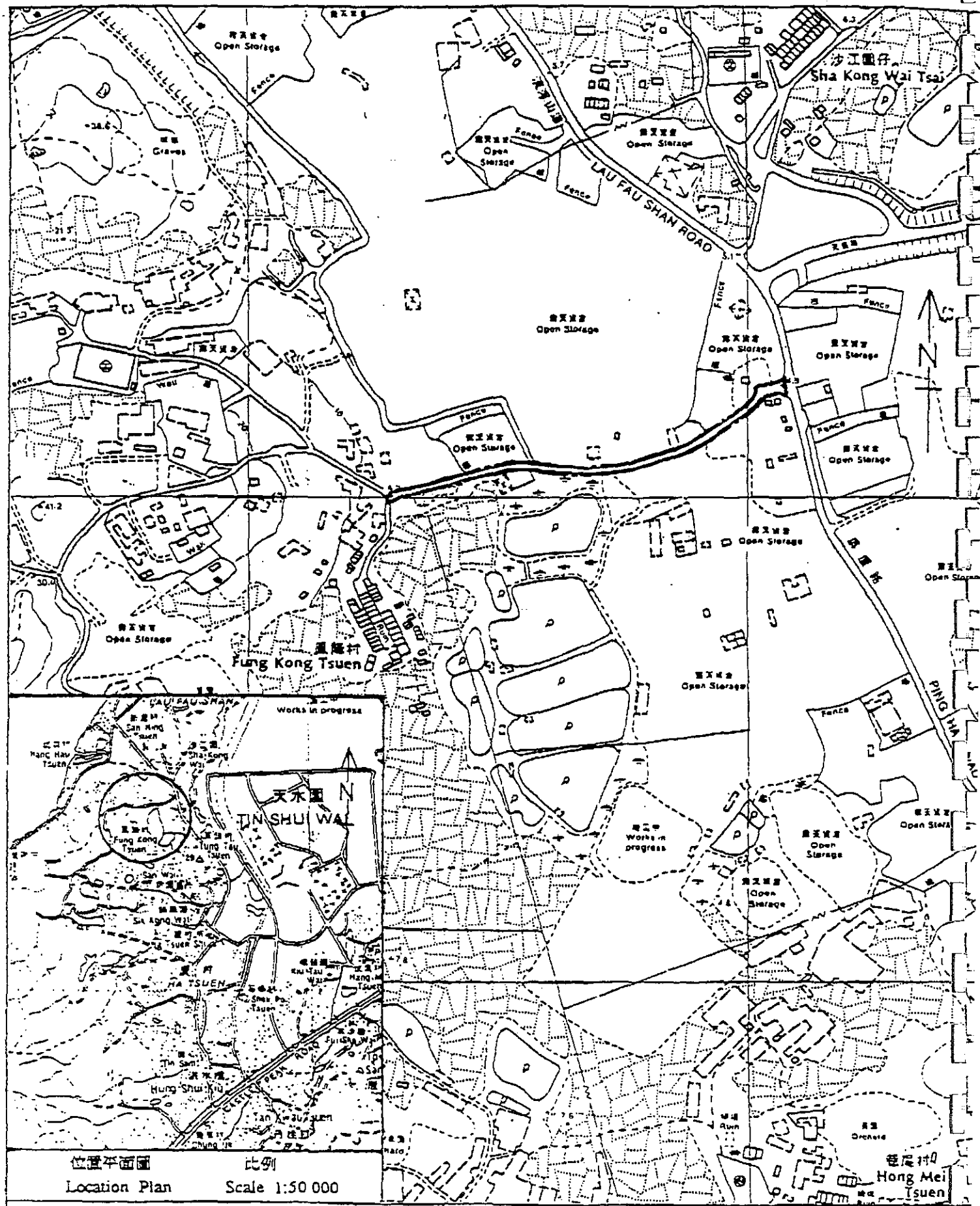
9. Project Estimate 估價： $ 3.10 M（百萬元）

10. Works Agency 工程部門： HyD 路政署

11. Maintenance Agency 維修部門： HyD 路政署

12. Land Resumption 徵收土地： Required 需要

13. Population to be served 受惠人數： 1000



位置平面圖 比例
Location Plan Scale 1:50 000

YUEN LONG DISTRICT 元朗區

ref. no. 參考編號: YL-109

drawing no. 圖則編號: RP 2424

scale 比例: 1:5 000

project title 建議名稱

Reconstruction of access road to Fung Kong Tsuen
鳳崗村通道重建工程

drawn | date

checked | date

鄉郊規劃及改善策略組
Rural Planning & Improvement Strategy

政務總署

APPENDIX B

Fugitive Dust Model, Calculation of Emission Factors for Construction Dust

Appendix B

Ping Ha Road - Ha Tsuen Section EIA
Fugitive Dust Model
Calculation of Emission Factors of Construction Dust

A.1 In order to obtain a prediction of future construction dust levels, many assumptions and simplifications have been made concerning the physical conditions and timing of activities on the site. 20000 m^3 is assumed to be excavated and transported by trucks within 40 days. The average capacity of the trucks is 10 m^3 and therefore,

the average no. of trucks moving on site per day = 20000/10/40 = 50 trucks/day

A.2 The USEPA publication Compilation of Air Pollutant Emission Factors (AP-42) has been used to obtained the emission factors for unpaved haul roads and aggregate handling. The following factors have been used in the present assessment:

Dust from Unpaved Haul Roads

1.530056 kg veh^{-1} km^{-1} travelled, based on:

- particle size ≤ 30 µm
- 5% silt content of road surface based on Table 11.2.1_1 in AP-42 (gravel road)
- mean vehicle speed of 20 km hr^{-1}
- mean vehicle weight of 25.0 Mg
- 20 wheel per vehicle
- 50 days per year with precipitation of 0.254 mm or more
- average trip distance is 1.5 km

Emission rate for unpaved haul roads = 1.530056 x 50 x 1.5 kg/day = 114.75 kg/day ≒ 115 kg/day

Aggregate Handling

$$k(0.0016)\frac{(\frac{u}{2.2})^{1.3}}{(\frac{m}{2})^{1.4}} kg/Mg = 0.0004548 kg/Mg$$

- k = particle size multiplier = 0.74
- u = mean speed wind (m/s) = 2
- M = material moisture content (%) = 0.7

Assume 220 Mg of aggregate will be handled per day, the emission rate for aggregate handling

= 0.004548 x 220 kg/day = 1 kg/day

APPENDIX C

Preliminary Site Contamination Assessment Report

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GLOSSARY

Consultant	Aspinwall Clouston Limited
EPD	Environmental Protection Department
ProPECC PN3/94	Practice Note for Professional Persons PN3/94
QA	Quality Assurance
SMG	Study Management Group
SWK	Scott Wilson Kirkpatrick (Hong Kong) Limited
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
TPH	Total Petroleum Hydrocarbon

1. SUMMARY AND RECOMMENDATIONS

1.1 Summary

To assess the degree and extent of surface contamination along the proposed site of the Ping Ha Road improvement works, a preliminary site contamination assessment was undertaken on 8 May 1997. An initial walk over survey was carried out to identify the location of potentially contaminated areas resulting in a total of eight soil samples being collected for the analysis of heavy metals, total petroleum hydrocarbons (TPH) and Benzene, Toluene, Ethylbenzene, Xylene (BTEX) levels. In most cases, soil samples were obtained from areas, where staining was observed, next to the road pavement outside vehicle repair/maintenance workshops. Most of the ground surfaces inside the workshop areas were fully paved with either tarmac or concrete and it was not possible to retrieve samples from the impenetrable ground surface.

The results of the analysis were compared to the Dutch Indicative Index in accordance with the ProPECC PN3/94 and also the proposed intervention level. Levels in excess of "B-value" imply pollution to an extent that requires further investigation. A breach of the intervention level indicates that immediate action is required.

Analysis of the results have indicated that some of the soil samples taken along the Ping Ha Road were contaminated with heavy metals (in particular zinc, copper and lead) and TPH in excess of the B-value and/or intervention value). Two of the soil samples were identified as exceeding the intervention value while four exceeded the Class B value. However, it is considered that such soil contamination was likely to be very localised and confined to restricted surface patches (< 1.0 metres diameter) near the workshops. It is also likely that the degree of contamination decreased with soil depth.

1.2 Recommendations

The Draft Final EIA (Section 7) recommended that the majority of the surface material to be excavated for site preparation work should be clean and acceptable for reuse either on-site or off-site. It also noted that assessment may be required for assessment of potentially contaminated areas.

The Dutch Criteria intervention values (1994 version) were exceeded for zinc and TPHs (C10-C35) in sample SWK/02 and heavy TPHs (C15-C35) in sample SWK/07. Sample SWK/02 was taken from an area where oil/diesel had leaked or spilled in a crane workshop and sample SWK/07 was taken from the entrance of a car repair workshop. The identified contamination is considered typical of these types of operations. The observed patches of surface material that were sampled for contamination were less than 0.1 meter in diameter and samples were retrieved from a maximum depth of 20 cm.

It is therefore concluded that contamination of surface material along the Ping Ha Road is likely to be limited in terms of extent and volume. However, the top 0.5 metres of surface material in locations SWK/02 and SWK/07 may not be suitable for reuse as fill and may need to be removed for appropriated disposal in consultation with EPD. Based on the results of the assessment an estimate of 0.5 metre^3 of surface material may therefore need to be removed, from each of the locations, for disposal off-site.

Figure 4.4 includes the locations of identified contamination.

2. INTRODUCTION

2.1 Background

This report presents the results of a preliminary site contamination assessment referred to in the Ping Ha Road Improvement - Ha Tsuen Section Project EIA report.

Section 7 of the EIA discussed the impacts and assessment of solid wastes for the construction phase (site preparation) and identified the potential for contamination of surface materials along Ping Ha Road with fuel and oils from local activities. Such material is considered to be unsuitable for reuse as fill and is required to be disposed of in an appropriate manner. The final disposal method will be determined by the level and volumes of contamination.

During a project SMG meeting (25 March 1997) EPD advised of the need for a site contamination assessment to determine the presence and extent of soil contamination within the site boundary of the Ping Ha Road upgrading works. Based on the Consultant's knowledge of the site and the activities (container storage, vehicle repair and maintenance yards) being carried out alongside Ping Ha Road, it was considered that a simplified approach as stipulated under paragraph 13 of the ProPECC PN3/94 would be acceptable as a special case. This simplified approach was agreed by EPD in principle (EPD letter reference EP/N6/28IV dated 24 April 1997 refers) and the Consultant was subsequently instructed by the Project Manager to proceed with the site contamination assessment on 5 May 1997 (SWK letter reference 94944/9999/2159 refers). The investigation commenced on 8 May 1997.

2.2 Objectives and Scope of Works

The objectives of the soil contamination assessment were as follows:

- to identify potential locations (hot spots) of soil contamination within the site boundary of the proposed Ping Ha Road upgrading works;
- to carry out sampling at the hot spots and analyse for predetermined parameters;
- to assess the level of contamination by classifying the soil samples in accordance with the Dutch Indicative Index as specified in ProPECC PN3/94; and
- to identify the presence of contaminated material and determine the need for appropriate disposal.

2.3 Limitations and Exceptions of Assessment

This report has been prepared by the Consultants with all reasonable skill, care and diligence in accordance with the terms of agreement with the Project Manager.

The information contained in this report is intended to provide an indication of potential surface contamination along the Ping Ha Road at identified hot spots. It should be recognised that site conditions and land uses may change with time. Further checking and visual identification may be required to verify existing hotspots and identify additional hotspots, particularly if the report is used after a protracted delay. This could be carried out during preparation of the site formation works, as a walkover survey by the Contractor.

The report has not been prepared for use by parties other than the Project Manager for the Ping Ha Road improvement study. It may or may not contain sufficient information for purposes of other parties or for other uses. The Consultant accepts no responsibility to third parties to whom this report, or any part thereof, is made known. Any third party relies upon the report at its own risk.

3. METHODOLOGY

3.1 Site Inspection

An initial walk-over survey along the Ping Ha Road and surrounding area (within the proposed site boundary) was undertaken on 15 May 1997 to confirm the locations of potential contamination hot spots. This included identification and screening of existing land uses for potentially contaminative sources, signs of contamination (i.e. oil marks and stress or die-back of vegetation) as well as an investigation of ground surface conditions (i.e. paved areas with or without obvious cracks, unpaved areas and areas covered with vegetation). Soil samples were then collected where potential contamination was suspected.

3.2 Soil Sampling

Loose material sitting on the soil surface was cleared before sampling. Soil samples, down to a depth of two metres were to be collected by a hand held soil auger wherever soil conditions allowed. However, due to the compacted nature of the ground (probably due to heavy vehicles driving over the ground and parking) only surface samples could be retrieved. Soil samples were then placed in sampling jars (250 ml) provided by the laboratory. Direct contact between bare hands and soil samples was avoided to prevent cross contamination and sampling equipment was cleaned between sampling locations.

Sampling also included for duplicates.

Soil samples were described and logged according to their texture, colour, porosity and plasticity.

3.3 Sample Handling and Transportation

All soil samples were collected on site and immediately stored at low temperature in an icebox packed with ice. Cross contamination of samples during transportation and storage was avoided by storing in properly sealed sampling jars with Teflon lids. All soil samples were accompanied to the laboratory on the same day of sampling using the appropriate chain-of-custody protocol.

3.4 Laboratory Analysis

Soil samples were analysed for heavy metals, TPH and BTEX. The results were compared with the Dutch Indicative Index (1993 version) as recommended in ProPECC PN3/94 as well as the revised intervention value (1994 version). The soil samples were then classified with reference to Class B of the 1993 version and the 1994 intervention values. Relevant parameters from the Dutch Indicative Index with "B-values" and intervention values are included in Table 3.1.

Table 3.1 Dutch Criteria for Relevant Parameters

Component	Dutch Criteria	
	1993 B Level *	1994 Intervention Level **
Arsenic	30	55
Barium	400	625
Cadmium	5	12
Chromium	250	380
Cobalt	50	240
Copper	100	190
Lead	150	530
Mercury	2	10
Molybdenum	40	200
Nickel	100	210
Selenium	50	-
Zinc	500	720
Benzene	0.5	1
Toluene	3	130
Ethylbenzene	5	50
Xylene	5	25
C6 - C9 (Fuel Oil)	100	-
C10 - C14 (Mineral Oil)	1000	5000
C15 - C28 (Mineral Oil)	1000	5000
C29 - C35 (Mineral Oil)	1000	5000

Note : * *further investigation required*
** *immediate action is required*

4. INVESTIGATION RESULTS

4.1 Site Description and Land Use

The study site for this preliminary soil contamination assessment was confined to a narrow band (ten metres wide) along the eastern side of Ping Ha Road. The ten metre strip was located within the proposed site boundary and will require excavation/ grading for site preparation activities. The western boundary was not expected to affect existing land uses and was mainly residential, fully paved and showed no signs of potential contamination. However, a petrol station was located on the western side of Ping Ha Road near the junction with Tin Ha Road but this is unlikely to be affected by the proposed road improvement works. Inspection of the petrol station revealed that the ground surface was paved with concrete and without obvious cracks.

A description of existing land uses alongside Ping Ha Road is included in Section 3 of the EIA report. Land uses generally comprised container storage areas, car/vehicle repairing and maintenance workshops and other purpose workshops, village residences, pond areas and green/ marsh areas.

For the purpose of this soil contamination assessment, a preliminary walk-over survey was undertaken to identify the land uses and potential locations of contamination (hot spots). It was noted that the major land uses along the eastern side of Ping Ha Road included workshops for car vehicle maintenance and repair, metal work, stone/marble work and crane maintenance. Other land uses included container storage areas, cultivation areas, marsh/ponds and village residences. A description of current land uses along the Ping Ha Road is included in Figure 4.1 and a description of existing ground surface conditions is included in Figure 4.2.

An assessment of the ground surface conditions indicated that over 80% of the sites were paved either with concrete or tarmac, particularly the car repairing workshops. It was understood from workshop operators that the surfaces had been paved to provide a hard surface for heavy vehicles accessing the workshops. During the walk-over survey, a narrow strip (approximately one metre wide) of unpaved ground surface was observed along the eastern edge of the pavement along the Ping Ha Road. Soil samples were retrieved from areas where spillage of oils, chemicals, stressing/die-back of vegetation were observed or indicated by workshop operators. When it was not possible to sample from the paved workshop areas, soil samples were taken from the strip of ground between the pavement and the workshops. In addition, most of the car repair workshop operational areas were located outside the ten metre boundary from the road side and the space in between was used for parking purposes. In this regard, the potential for direct contamination of the soil from the car repair workshops within the ten metres boundary was not considered to be significant enough for sampling.

A description of sites that were screened for potential contamination and later sampled is included in Table 4.1. Photographs of the potential contamination sources (workshops) and sampling locations taken during the site assessment exercise are included in Appendix A. Figure 4.3 indicates the locations of the photographs and samples that were retrieved.

Table 4.1 Screening of Sites for Potential Contamination

Site Identification (Photo. ID)	Landuse	Identification of Potential Contamination	Remarks	Samples Taken (Sample ID)
1 - 3	CRW	Oil mark/ stains noted on ground surface.	Physical working area was paved with tarmac. Sampling was undertaken on the other inside the workshop area.	SWK/01
4 - 6, 10	CRW	Oil mark/ stains noted on ground surface, spillages from diesel drums.	Ground surface inside workshop area paved with tarmac; samples taken outside workshop.	SWK/02
7 - 9	CSA	Oil mark/ stains noted on ground surface.	Ground surface inside workshop area paved with tarmac; samples taken outside workshop.	SWK/03
11	OS	Die-back of vegetation, oily water surface	Ground surface inside and outside workshop paved with tarmac and concrete; not suitable for sampling.	-
12	CRW	Oil mark/ stains noted on ground surface.	Ground surface inside and outside workshop paved with tarmac and concrete; not suitable for sampling.	-
13 - 15	MW	Oil mark/ stains noted on ground surface, probably spillages from diesel drums.	Ground surface inside workshop area paved with tarmac; samples taken outside workshop.	SWK/04 & 05*
16	CRW	Oil mark/ stains noted on ground surface.	Ground surface inside and outside workshop paved with tarmac and concrete; not suitable for sampling.	-
17	CRW	Oil mark/ stains noted on ground surface.	Ground surface inside and outside workshop paved with tarmac and concrete; not suitable for sampling.	-
18	CRW	Oil mark/ stains noted on ground surface.	Ground surface inside and outside workshop paved with tarmac and concrete; not suitable for sampling.	-
19 - 21	CRW	Oil mark/ stains noted on ground surface.	Ground surface inside workshop area paved with tarmac; samples taken outside workshop.	SWK/06
22	CRW	Oil mark/ stains noted on ground surface.	Ground surface inside and outside workshop paved with tarmac and concrete; not suitable for sampling.	-
23 - 24	CRW	Oil mark/ stains noted on ground surface.	Ground surface inside workshop area paved with tarmac; samples taken outside workshop.	SWK/07
25	CRW	Oil mark/ stains noted on ground surface.	Ground surface inside and outside workshop paved with tarmac and concrete; not suitable for sampling.	-
-	CRW	Oil mark/ stains noted on ground surface.	Ground surface inside workshop area paved with tarmac; samples taken outside workshop.	SWK/08

Note: * - *Duplicate Sample*
CRW - *Car Repair Workshop*
CSA - *Container Storage Area*
OS - *Open Storage*
MW - *Metal Workshop*

4.2 Description of Soil Samples

A description of the soil samples collected from the eight sampling locations are summarised in Table 4.2.

Table 4.2 Description of Soil Samples Collected

Sample No.	Sampling Depth (cm)	Description
1	0 - 20	Brown, clay, sticky, very low porosity
2	0 - 20	Black, loamy clay, smell of rotting organic material, very low porosity, presence of root fragments, moist
3	0 - 20	Dark Brown, sandy, colour lighter with depth, low porosity
4	0 - 20	Dark grey, sandy, colour lighter with depth, high porosity, not cohesive
5*	0 - 20	Dark grey, sandy, colour lighter with depth, high porosity, not cohesive
6	0 - 40	Dark brown, clay, not plastic, moderately porous
7	0 - 20	Dark brown, clay, not plastic, moderately porous
8	0 - 10	Dark brown, clay, colour lighter with depth, moderately porous

Note : * *Duplicate field sample for purposes*

4.3 Analysis of Data

Samples were analysed for heavy metals, BTEX and TPH since it was anticipated in the EIA report that soil contamination would mainly comprise fuel and oil contaminants arising from the container storage areas and vehicle maintenance workshops. This assumption was further supported during the walk-over survey on 15 May 1997 where it was noted that the main source of soil contamination were likely to be from car repairing workshops scattered along the eastern side of Ping Ha Road on unpaved ground surface.

Soil samples retrieved during the sampling were sent to ALS laboratory for analysis and the results are summarised in Table 4.3. Laboratory analysis certificates, QA/QC data and chain-of-custody documentation are included in Appendix B.

Analysis of the soil sample indicated the following :

- BTEX levels were not measured above the "level of reporting" in any of the soil samples;
- TPH levels (mineral oils) exceeded the Dutch criteria (B level) and intervention levels in samples SWK/02 and SWK/07;
- Copper, lead and zinc levels were within the intervention levels but exceeded the Dutch criteria (B level) for samples SWK/01, 03, 05, 07 and 08.
- Zinc levels exceeded the Dutch criteria (B level) and intervention levels in sample SWK/02;

Due to hard impenetrable ground conditions, it was possible to retrieve soil samples from a maximum depth of 40 cm only. Consequently, no soil depth profile samples were obtained.

However, the uncontaminated nature of soil samples taken from a profile depth of 0 - 40 cm (SWK/06) have indicated that contamination may decrease with depth as would be expected.

Analysis for duplicate samples SWK/04 and 05 indicate a percentage difference of less than 50% on all of the analytes except for Barium, Cobalt, Copper, and C29-C35 which exhibit a variation in excess of 100%. The higher % difference in the samples could be due to lateral/vertical variation of contamination in the samples retrieved.

Figure 4.4 includes the locations of samples where the Dutch Criteria (1993 and 1994 Versions) levels were exceeded.

4.4 Conclusions and Recommendations

The Draft Final EIA (Section 7) recommended that the majority of the surface material to be excavated for site preparation work should be clean and acceptable for reuse either on-site or off-site.

The results of the contamination assessment undertaken indicate that the Dutch Criteria intervention values (1994 version) were exceeded for zinc and heavy TPHs in sample SWK/02 and heavy TPHs in sample SWK/07. Sample SWK/02 was taken from an area where oil/diesel had leaked or spilled in a crane workshop and sample SWK/07 was taken from the entrance of a car repair workshop. The identified contamination is considered typical of these types of operations. The observed patches of surface material that were sampled for contamination were less than 0.1 meter in diameter and samples were retrieved from a maximum depth of 20 cm.

It is therefore concluded that contamination of surface material along the Ping Ha Road is likely to be limited in terms of extent and volume. However, the top 0.5 metres of surface material in locations SWK/02 and SWK/07 may not be suitable for reuse as fill and may need to be removed for appropriated disposal in consultation with EPD. Based on the results of this assessment an estimate of 0.5 metre^3 of surface material may therefore need to be removed, from each of the locations, for disposal off-site.

Table 4.3 Soil Test Results and Comparison with the Dutch Criteria (1993 & 1994)

Parameter	Units	LOR	SWK/01	SWK/02	SWK/03	SWK/04	SWK/05	SWK/06	SWK/07	SWK/08	B-Value	Intervention Value
Depth	m	N/A	0 - 20	0 - 20	0 - 20	0 - 20	0 - 20	0 - 40	0 - 20	0 - 10	N/A	N/A
Moisture Content (dried @103°C)	%	0.1	17.3	26.3	7.9	7.7	9.3	19.5	7.6	12.8	N/A	N/A
Arsenic	mg/kg	1	13	4	4	2	2	3	4	2	30	55
Barium	mg/kg	0.1	69.5	134	43.9	45	95	28.7	144	44.9	400	625
Cadmium	mg/kg	0.02	0.27	0.68	0.23	0.24	0.31	0.26	0.43	0.30	5	12
Chromium	mg/kg	0.1	10.8	33.0	14.1	12.8	13.5	13.1	72.4	12.3	250	380
Cobalt	mg/kg	0.1	5.4	4.6	4.6	1.7	4.3	2.4	5.8	3.9	50	240
Copper	mg/kg	0.1	22.2	78.2	35.1	103	50.1	33.2	163	110	100	190
Lead	mg/kg	0.1	164	125	41.5	53.3	47.4	74.3	251	90.5	150	530
Mercury	mg/kg	0.04	0.04	<LOR	<LOR	<LOR	<LOR	0.05	<LOR	0.06	2	10
Molybdenum	mg/kg	0.1	3.6	3.6	2.0	3.2	2.3	2.1	6.9	1.5	40	200
Nickel	mg/kg	0.1	3.8	12.3	8.9	4.6	5.4	12.3	20.4	5.4	100	210
Selenium	mg/kg	1	1	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	1	50	-
Zinc	mg/kg	0.1	131	1340*	512	469	691	466	656	485	500	720
Benzene	mg/kg	0.2	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.5	1
Toluene	mg/kg	0.2	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	3	130
Ethylbenzene	mg/kg	0.2	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	5	50
Xylene	mg/kg	0.4	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	5	25
C6 - C9 (Fuel Oil)	mg/kg	10	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	100	-
C10 - C14 (Mineral Oil)	mg/kg	50	<LOR	3860	<LOR	<LOR	<LOR	<LOR	77	<LOR	1000	5000
C15 - C28 (Mineral Oil)	mg/kg	100	<LOR	29100*	475	156	108	139	7640*	<LOR	1000	5000
C29 - C35 (Mineral Oil)	mg/kg	100	<LOR	2350	166	233	118	123	6800*	<LOR	1000	5000
Exceed B Value	**N/A**	**N/A**	**Y**	**Y**	**Y**	**N**	**Y**	**N**	**Y**	**Y**	-	-
Exceed Intervention Level	**N/A**	**N/A**	**N**	**Y**	**N**	**N**	**N**	**N**	**Y**	**N**	-	-

Note: Exceeds Class B Value
* Exceeds Intervention Level

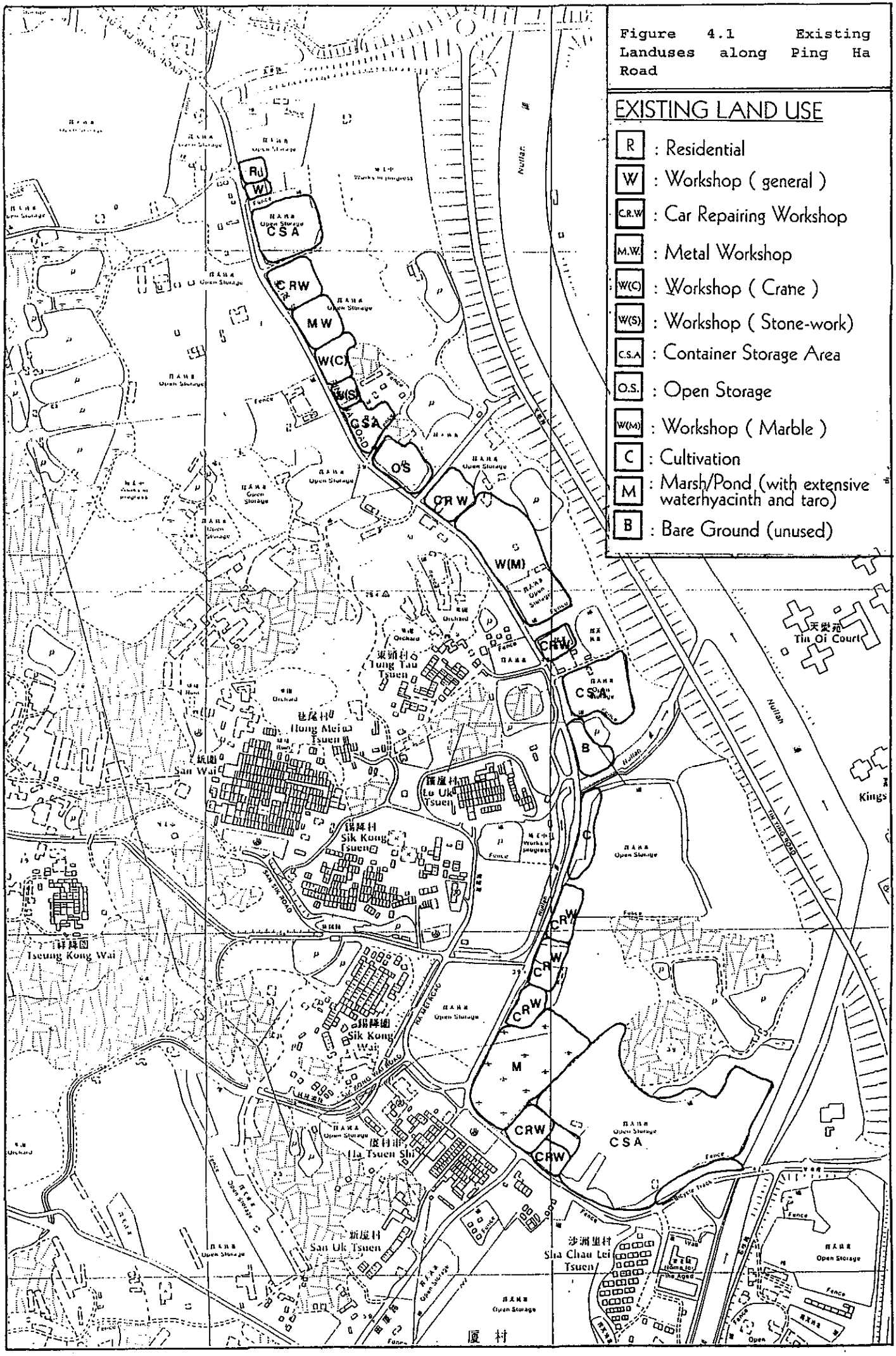


Figure 4.1 Existing Landuses along Ping Ha Road

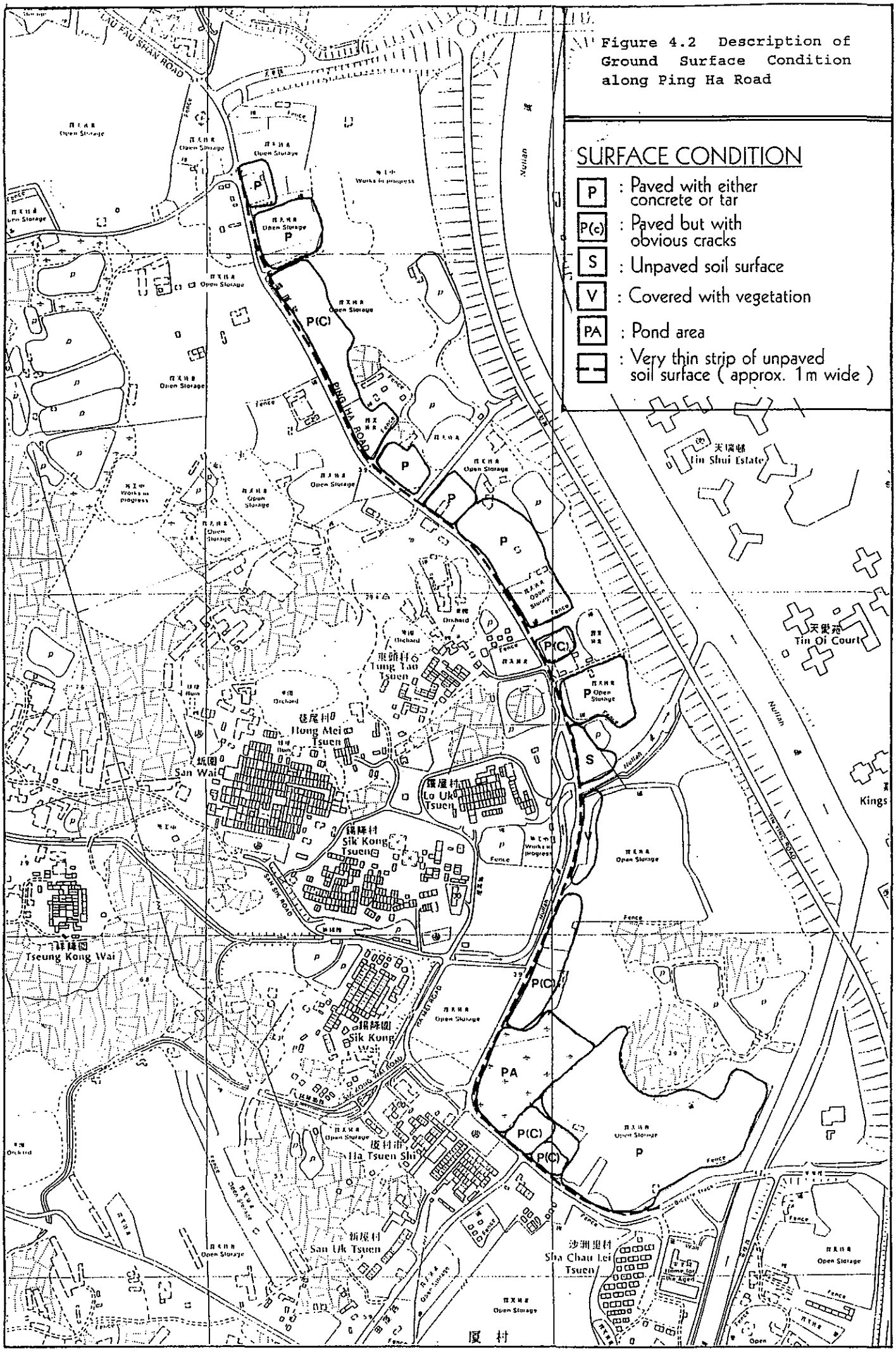


Figure 4.2 Description of Ground Surface Condition along Ping Ha Road

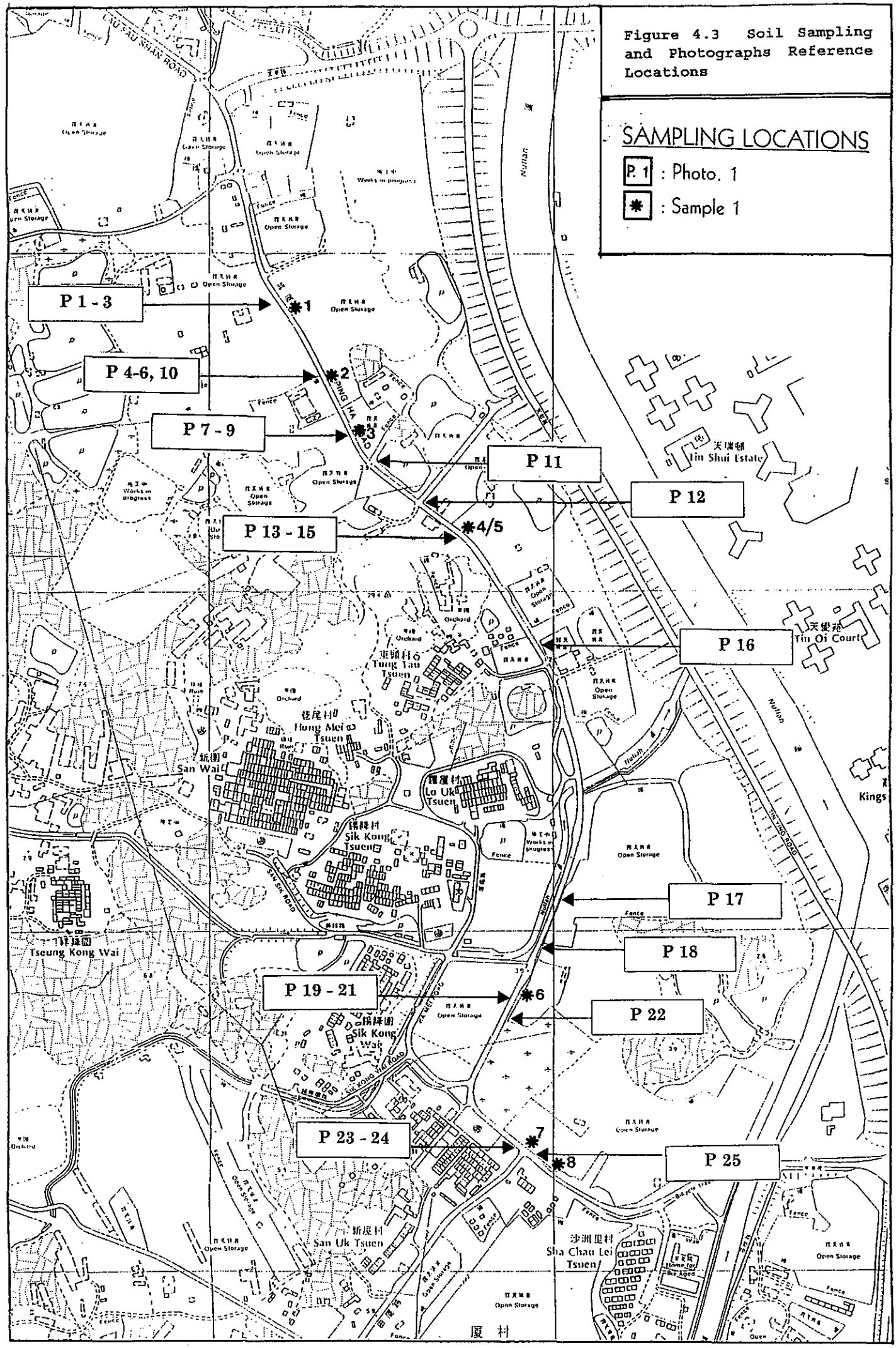


Figure 4.3 Soil Sampling and Photographs Reference Locations

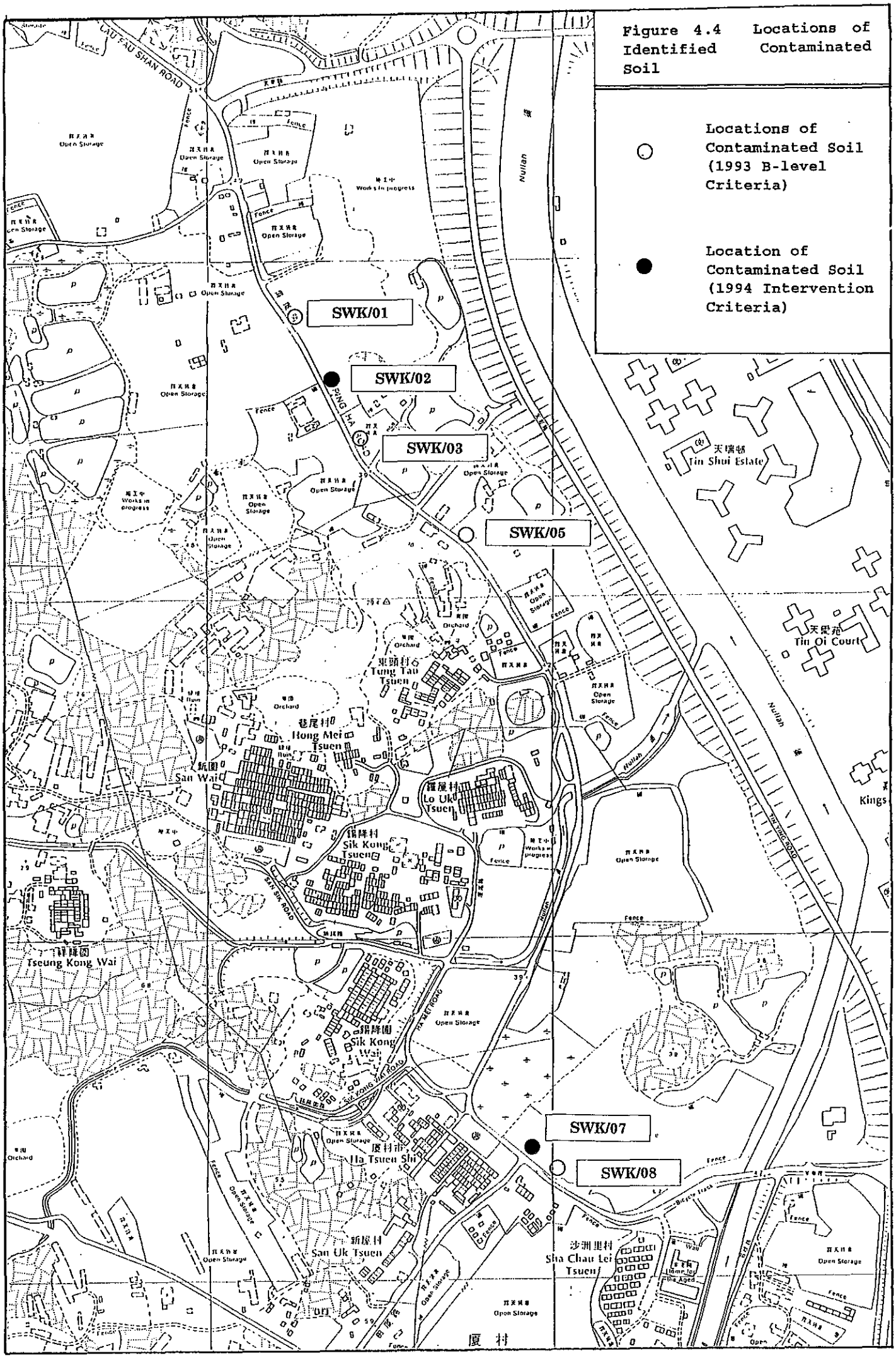


Figure 4.4 Locations of Identified Contaminated Soil
Locations of Contaminated Soil (1993 B-level Criteria)
Location of Contaminated Soil (1994 Intervention Criteria)
SWK/01
SWK/02
SWK/03
SWK/05
SWK/07
SWK/08
CAU TAU SHAN ROAD
PING SHA
Nullah
Tin Shui Estate
天瑞邨
Tin Oi Court
天愛苑
Tung Tau Tsuen
東頭村
Hong Mei Tsuen
巷尾村
San Wai
新圍
Lo Uk Tsuen
羅屋村
Sik Kong Tsuen
錫降村
Tseung Kong Wai
錫降圍
Sik Kong Wai
錫降圍
SIK KONG ROAD
Ha Tsuen Shi
廈村市
San Uk Tsuen
新屋村
Sha Chau Lei Tsuen
沙洲里村
廈村
Open Storage
Works in progress
Orchard
Fence

APPENDIX A

PHOTOGRAPHS

Close view of sampling location SWK/01

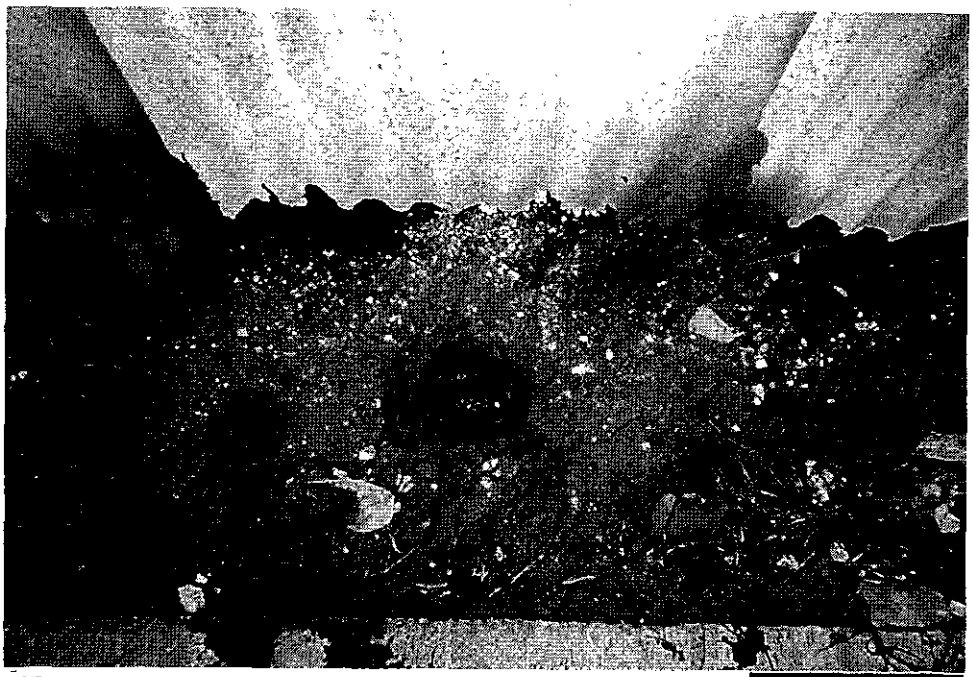
PHOTO 1

Entrance of car repairing workshop where sample SWK/01 was taken from

PHOTO 2

General view of surrounding environment of sample location SWK/01

PHOTO 3



Close view of sampling location SWK/02

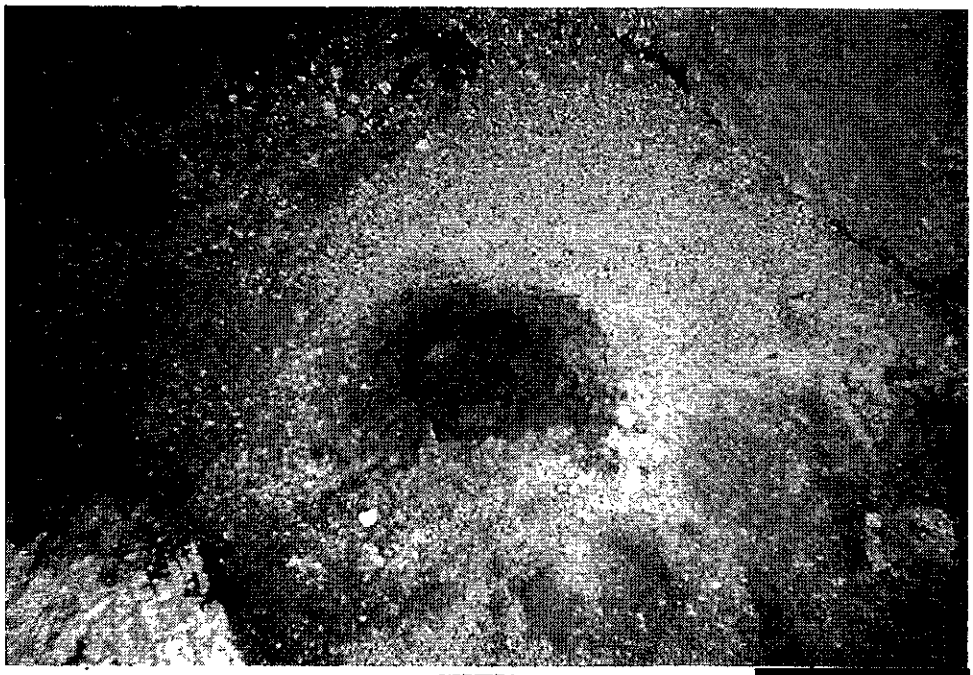
PHOTO 4

Sample SWK/02 was taken by the side of the road pavement next to the workshop fencing

PHOTO 5

Sample location SWK/02 in relation to the workshop area (note the tarmac paved ground surface inside workshop

PHOTO 6



Close view of sample location SWK/03

PHOTO 7

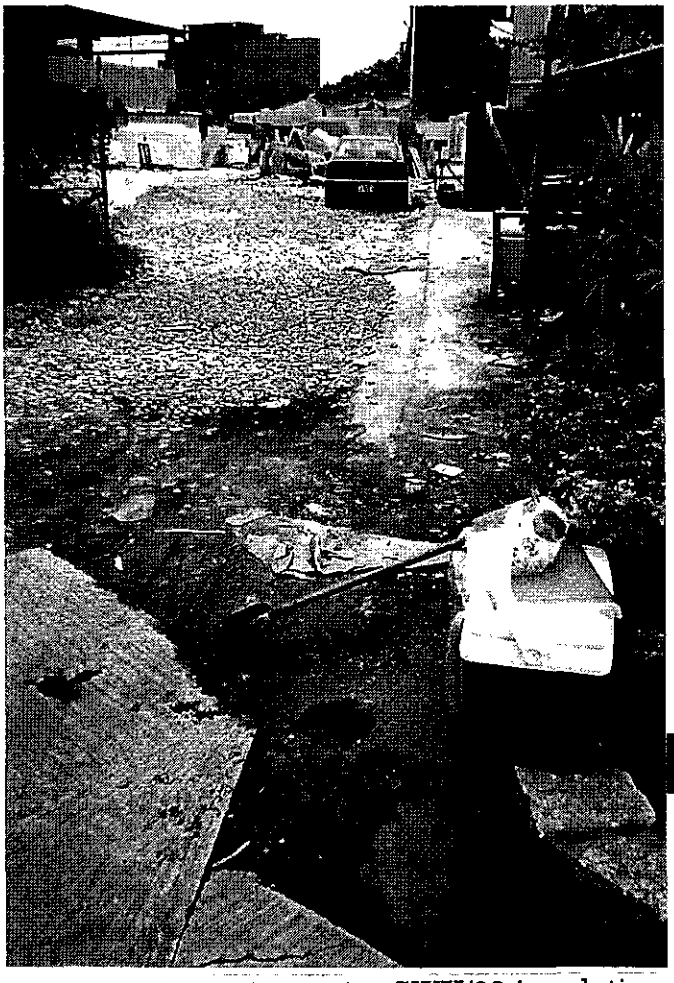


PHOTO 8

Location of sampling point SWK/03 in relation to the entrance of container storage area

PHOTO 9

General view of sample location SWK/03 (sample SWK/03 was taken in between the road pavement and the container storage area entrance)

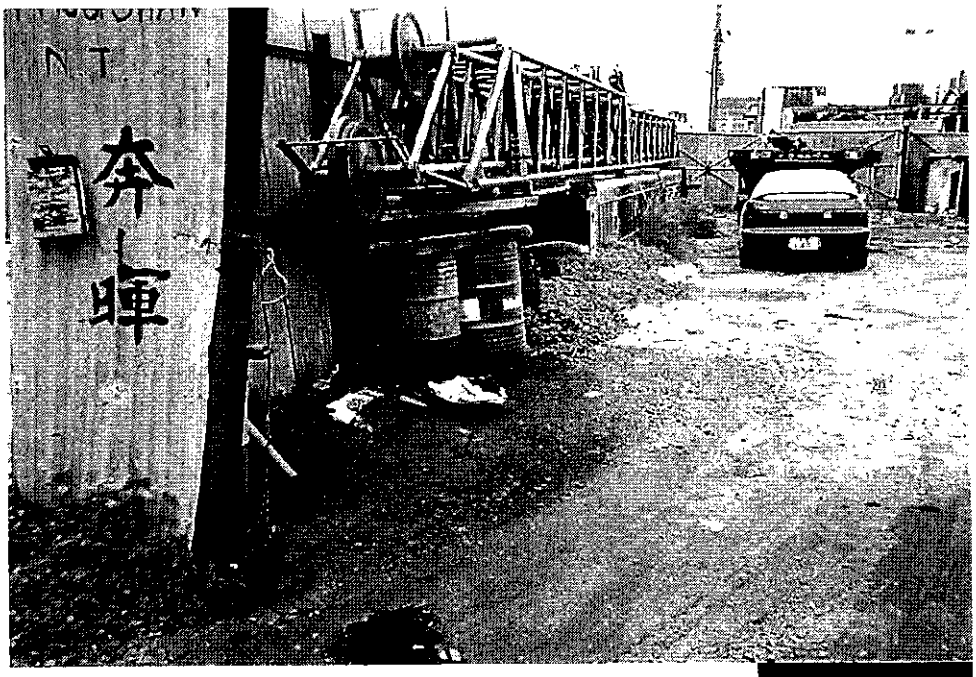


PHOTO 10

Sign of oil spillage from diesel drums near sampling location SWK/02

Pond of stagnant water standing by the side of pavement outside an open storage area causing difficulty for sampling (although die-back of vegetation was observed)

PHOTO 11

Entrance of a car repairing workshop where soil samples were not taken due to tarmac paved ground surface

PHOTO 12

Close view of sampling location SWK/04 and 05

PHOTO 13

PHOTO 14

Soil sample for SWK/04 and 05 was taken outside the workshop and by the side of road paved due to impenetrable nature of the tarmac paved ground surface inside workshop

View of the workshop entrance at sampling location for SWK/04 and 05

PHOTO 15

Oil marks noted on ground surface but no sample was taken because of tarmac paved hard ground surface

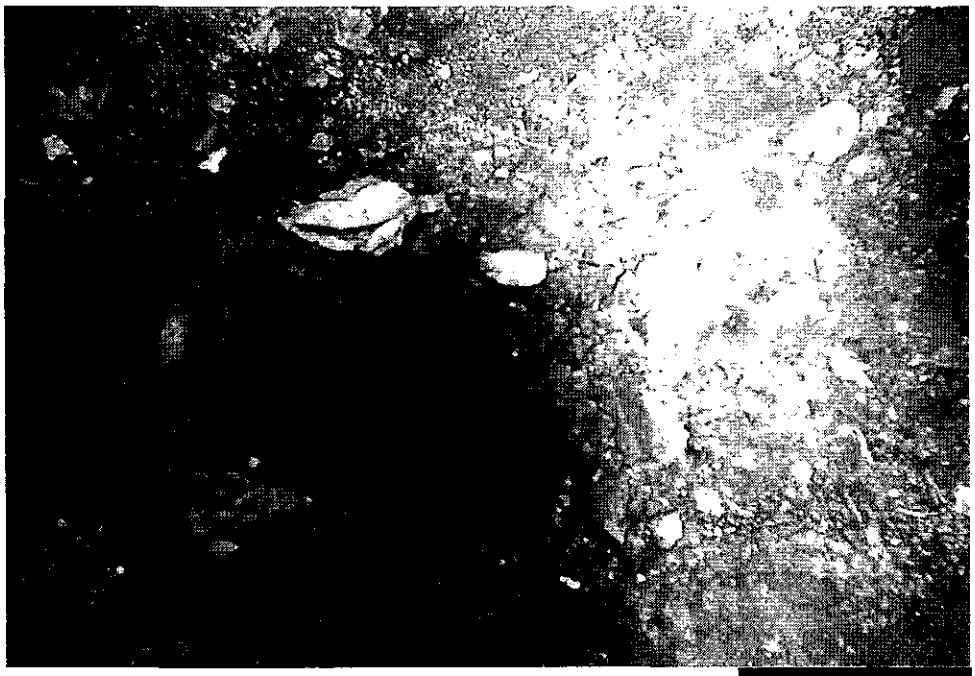
PHOTO 16

Entrance of a car repairing workshop where soil samples were not taken due to tarmac paved ground surface

PHOTO 17

Entrance of car repairing workshop where soil samples were not taken due to tarmac paved ground surface

PHOTO 18



Close view of sample location SWK/06

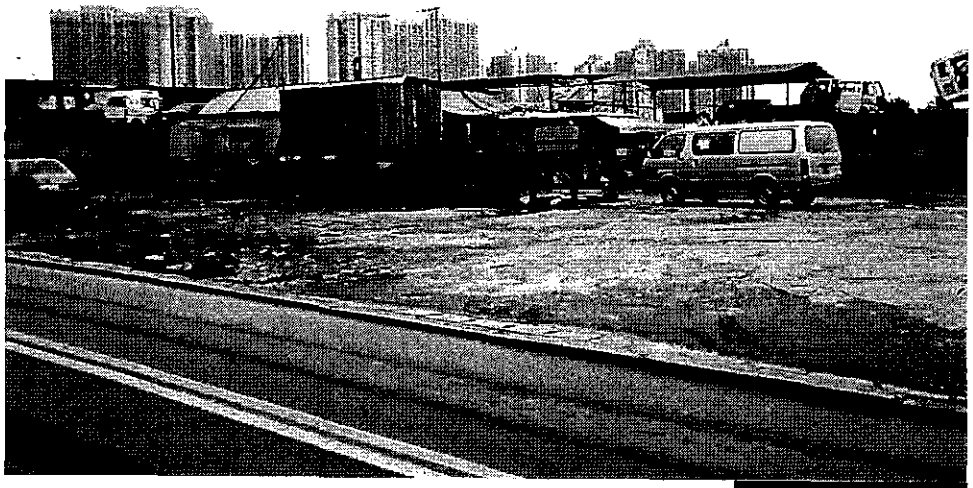
PHOTO 19

General view of entrance of a car repairing workshop where sample SWK/06 was taken from

PHOTO 20

General view of sample location SWK/06 (sample was taken from the strip of vegetation along the pavement

PHOTO 21

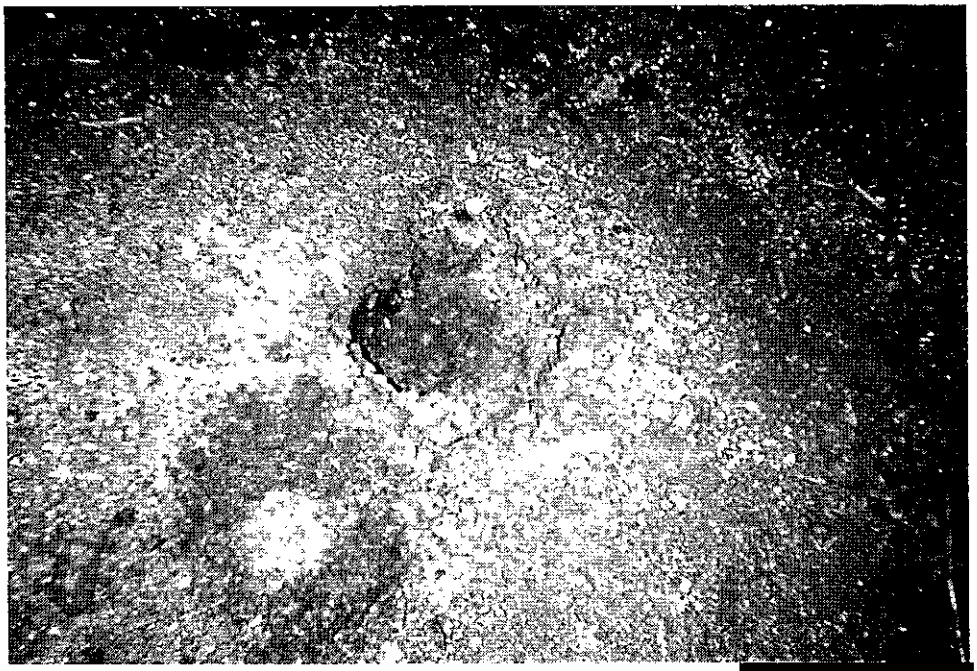


Entrance of a car repairing workshop where soil samples were not taken due to tarmac paved ground surface

PHOTO 22

General view of entrance of a car repairing workshop where sample SWK/07 was taken from

PHOTO 23



Close view of sample location SWK/07

PHOTO 24

PHOTO 25

Entrance of a car repairing workshop where soil samples were not taken due to tarmac paved ground surface

APPENDIX B

LABORATORY INFORMATION

ALS Technichem (HK) P/L

[redacted]

ANALYTICAL REPORT

CONTACT: FRAN BATTERSHILL
CLIENT: ASPINWALL CLOUSTON
ADDRESS: 18F KINWICK CENTRE
32 HOLLYWOOD ROAD
CENTRAL, HONG KONG

LABORATORY: HONG KONG
BATCH NUMBER: 1879
SUB BATCH: 0
No. OF SAMPLES: 8
DATE RECEIVED: 08/05/97
DATE COMPLETED: 27/05/97

ORDER No.: SAMPLE TYPE: SOIL PROJECT:

Method	Analysis description	Units	LOR	SWK/01 08/05/97	SWK/02 08/05/97	SWK/03 08/05/97	SWK/04 08/05/97
EA-055	Moisture Content (dried @ 103°C)	%	0.1	17.3	26.3	7.9	7.7
EG-020	Silver	mg/kg	0.1	0.1	0.2	<0.1	0.2
	Arsenic	mg/kg	1	13	4	4	2
	Barium	mg/kg	0.1	69.5	134	43.9	45.0
	Cadmium	mg/kg	0.02	0.27	0.68	0.23	0.24
	Cobalt	mg/kg	0.1	5.4	4.6	4.6	1.7
	Chromium	mg/kg	0.1	10.8	33.0	14.1	12.8
	Copper	mg/kg	0.1	22.2	78.2	35.1	103
	Molybdenum	mg/kg	0.1	3.6	3.6	2.0	3.2
	Nickel	mg/kg	0.1	3.8	12.3	8.9	4.6
	Lead	mg/kg	0.1	164	125	41.5	53.3
	Selenium	mg/kg	1	1	<1	<1	<1
	Tin	mg/kg	0.1	1.4	2.6	1.9	1.3
	Zinc	mg/kg	1	131	1340	512	469
EG-035	Mercury	mg/kg	0.04	<0.04	<0.04	<0.04	<0.04

[redacted]

COMMENTS:

Samples as received digested by USEPA method 3051 prior to the determination of metals. Results reported on a dry weight basis.

• This is the Final Report which supersedes any preliminary reports with this batch number. • Results apply to sample(s) as submitte

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Melbourne

ANALYTICAL REPORT

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CLIENT: ASPINWALL CLOUSTON
ADDRESS: 18F KINWICK CENTRE
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CENTRAL, HONG KONG

LABORATORY: HONG KONG
BATCH NUMBER: 1879
SUB BATCH: 0
No. OF SAMPLES: 8
DATE RECEIVED: 08/05/97
DATE COMPLETED: 27/05/97

ORDER No.: SAMPLE TYPE: SOIL PROJECT:

Method	Analysis description	Units	LOR	SWK/05 08/05/97	SWK/06 08/05/97	SWK/07 08/05/97	SWK/08 08/05/97
EA-055	Moisture Content (dried @ 103°C)	%	0.1	9.3	19.5	7.6	12.8
EG-020	Silver	mg/kg	0.1	0.1	0.1	0.2	<0.1
	Arsenic	mg/kg	1	2	3	4	2
	Barium	mg/kg	0.1	95.0	28.7	144	44.9
	Cadmium	mg/kg	0.02	0.31	0.26	0.43	0.30
	Cobalt	mg/kg	0.1	4.3	2.4	5.8	3.9
	Chromium	mg/kg	0.1	13.5	13.1	72.4	12.3
	Copper	mg/kg	0.1	50.1	33.2	163	110
	Molybdenum	mg/kg	0.1	2.3	2.1	6.9	1.5
	Nickel	mg/kg	0.1	5.4	12.3	20.4	5.4
	Lead	mg/kg	0.1	47.4	74.3	231	90.5
	Selenium	mg/kg	1	<1	<1	<1	1
	Tin	mg/kg	0.1	1.2	0.7	2.4	0.9
	Zinc	mg/kg	1	691	466	656	485
EG-035	Mercury	mg/kg	0.04	<0.04	0.05	<0.04	0.06

COMMENTS:

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ALS Technichem (HK) P/L

ANALYTICAL REPORT

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ADDRESS: 18F KINWICK CENTRE
32 HOLLYWOOD ROAD
CENTRAL, HONG KONG

LABORATORY: HONG KONG
BATCH NUMBER: 1879
SUB BATCH: 0
No. OF SAMPLES: 8
DATE RECEIVED: 08/05/97
DATE COMPLETED: 27/05/97

ORDER No.: SAMPLE TYPE: QUALITY CONTROL PROJECT:

Method	Analysis description	Units	LOR	SWK/01 % SPK REC		SWK/08 CHK
EA-055	Moisture Content (dried @ 103°C)	%	0.1	----		12.7
EG-020	Silver	mg/kg	0.1	%99.0		0.1
	Arsenic	mg/kg	1	%97		2
	Barium	mg/kg	0.1	%99.0		44.9
	Cadmium	mg/kg	0.02	%94.0		0.31
	Cobalt	mg/kg	0.1	%114		3.8
	Chromium	mg/kg	0.1	%82.0		12.4
	Copper	mg/kg	0.1	121.0	%	119
	Molybdenum	mg/kg	0.1	%106		1.7
	Nickel	mg/kg	0.1	81.0	%	5.5
	Lead	mg/kg	0.1	%91.0		93.8
	Selenium	mg/kg	1	%88		1
	Tin	mg/kg	0.1	%106		1.1
	Zinc	mg/kg	1	%125		520
EG-035	Mercury	mg/kg	0.04	%103		0.06

COMMENTS:

Results which appear on this report are routine laboratory checks for QUALITY CONTROL purposes.

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• Results apply to sample(s) as submitted

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ADDRESS: 18F KINWICK CENTRE
32 HOLLYWOOD ROAD
CENTRAL, HONG KONG

LABORATORY: HONG KONG
BATCH NUMBER: 1879
SUB BATCH: 1
No. OF SAMPLES: 8
DATE RECEIVED: 08/05/97
DATE COMPLETED: 27/05/97

ORDER No.: SAMPLE TYPE: SOIL PROJECT:

Method	Analysis description	Units	LOR	SWK/01 08/05/97	SWK/02 08/05/97	SWK/03 08/05/97	SWK/04 08/05/97
EA-055	Moisture Content (dried @ 103°C)	%	0.1	17.3	26.3	7.9	7.7
EP-071-SS	TOTAL PETROLEUM HYDROCARBONS						
	C6 - C9 Fraction	mg/kg	10	<10	<10	<10	<10
	C10 - C14 Fraction	mg/kg	50	<50	3860	<50	<50
	C15 - C28 Fraction	mg/kg	100	<100	29100	475	156
	C29 - C36 Fraction	mg/kg	100	<100	2350	166	233

COMMENTS:

Samples analysed on an as received basis. Results reported on a dry weight basis. Sample preparation techniques: Semivolatile - Separato Funnel and Tumbler, Volatile - Purge & Trap. Sample analysis techniques: Semivolatile components - GC/MS; TPH - GC/FID; Volatile components - GC/MS; Pesticides - GC/ECD, GC/MS. As headspace was

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ANALYTICAL REPORT

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ADDRESS: 18F KINWICK CENTRE
32 HOLLYWOOD ROAD
CENTRAL, HONG KONG

LABORATORY: HONG KONG
BATCH NUMBER: 1879
SUB BATCH: 1
No. OF SAMPLES: 8
DATE RECEIVED: 08/05/97
DATE COMPLETED: 27/05/97

ORDER No.: SAMPLE TYPE: SOIL PROJECT:

Method	Analysis description	Units	LOR	SWK/05 08/05/97	SWK/06 08/05/97	SWK/07 08/05/97	SWK/08 08/05/97
EA-055	Moisture Content (dried @ 103'C)	%	0.1	9.3	19.5	7.6	12.8
EP-071-SS	TOTAL PETROLEUM HYDROCARBONS						
	C6 - C9 Fraction	mg/kg	10	<10	<10	<10	<10
	C10 - C14 Fraction	mg/kg	50	<50	<50	77	<50
	C15 - C28 Fraction	mg/kg	100	108	139	7640	<100
	C29 - C36 Fraction	mg/kg	100	118	123	6800	<100

COMMENTS:

observed in all sample containers, possible loss of C6-C9 TPH may occur. Thus, these results should be considered minimum values.

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CLIENT: ASPINWALL CLOUSTON
ADDRESS: 18F KINWICK CENTRE
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CENTRAL, HONG KONG

LABORATORY: HONG KONG
BATCH NUMBER: 1879
SUB BATCH: 2
No. OF SAMPLES: 8
DATE RECEIVED: 08/05/97
DATE COMPLETED: 27/05/97

ORDER No.: SAMPLE TYPE: SOIL PROJECT:

Method	Analysis description	Units	LOR	SWK/01 08/05/97	SWK/02 08/05/97	SWK/03 08/05/97	SWK/04 08/05/97
EA-055	Moisture Content (dried @ 103°C)	%	0.1	17.3	26.3	7.9	7.7
EP-080-SS	BTEX						
	Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2
	Toluene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2
	Chlorobenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2
	Ethylbenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2
	meta- & para-Xylene	mg/kg	0.4	<0.4	<0.4	<0.4	<0.4
	ortho-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2

COMMENTS:

Samples analysed on an as received basis. Results reported on a d
weight basis. Sample preparation techniques: Semivolatile - Separat
Funnel and Tumbler, Volatile - Purge & Trap. Sample analysis
techniques: Semivolatile components - GC/MS; TPH - GC/FID; Volati
components - GC/MS; Pesticides - GC/ECD, GC/MS. As headspace was

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LABORATORY: HONG KONG
BATCH NUMBER: 1879
SUB BATCH: 2
No. OF SAMPLES: 8
DATE RECEIVED: 08/05/97
DATE COMPLETED: 27/05/97

ORDER No.: SAMPLE TYPE: SOIL PROJECT:

Method	Analysis description	Units	LOR	SWK/05 08/05/97	SWK/06 08/05/97	SWK/07 08/05/97	SWK/08 08/05/97
EA-055	Moisture Content (dried @ 103°C)	%	0.1	9.3	19.5	7.6	12.8
EP-080-SS	BTEX						
	Benzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2
	Toluene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2
	Chlorobenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2
	Ethylbenzene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2
	meta- & para-Xylene	mg/kg	0.4	<0.4	<0.4	<0.4	<0.4
	ortho-Xylene	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2

COMMENTS:

observed in all sample containers, possible loss of volatiles may occur. Thus, these results should be considered minimum values.

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