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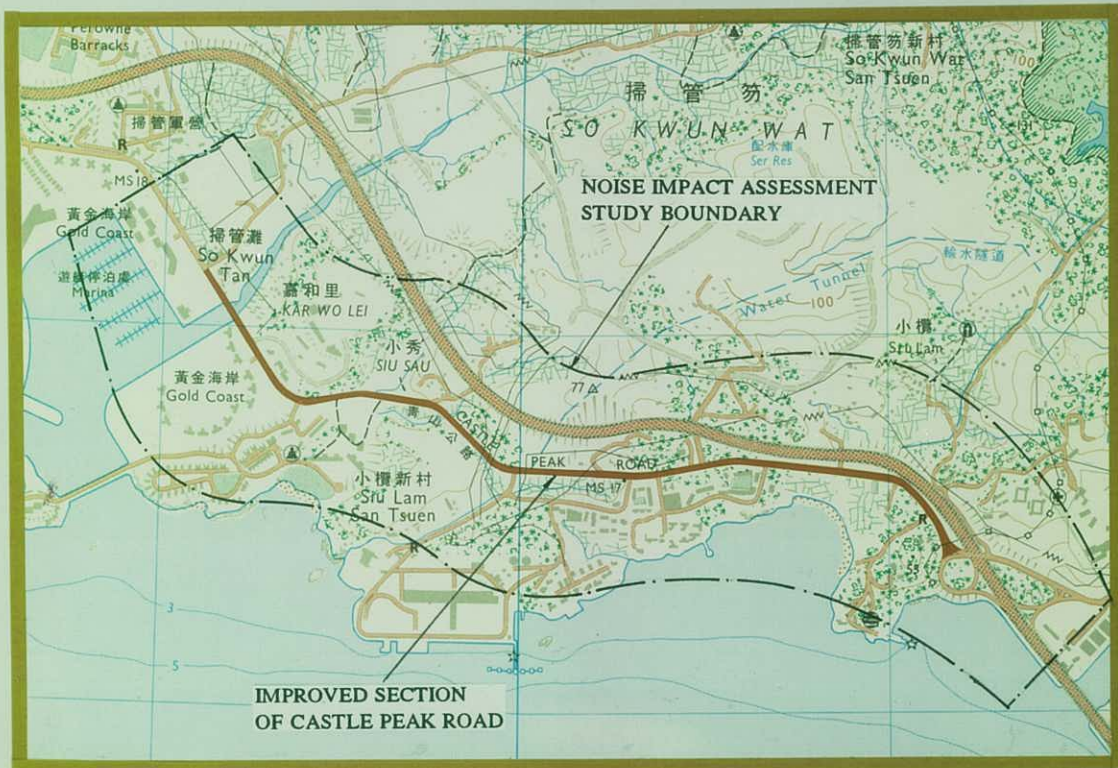
HIGHWAYS DEPARTMENT HONG KONG GOVERNMENT

AGREEMENT NO. CE 23/93

IMPROVEMENT TO CASTLE PEAK ROAD FROM SIU LAM TO SO KWUN TAN

NOISE IMPACT ASSESSMENT

EXECUTIVE SUMMARY



July 1995

Highways Department
 3rd floor, Ho Man Tin Government Offices
 88 Chung Hau Street
 Ho Man Tin, Kowloon

Peter Fraenkel BMT (Asia) Ltd.
 with
 Enpac Limited
 Urbis Travers Morgan Limited

EIA/D11-3/P5

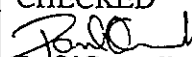
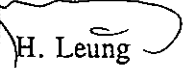
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AGREEMENT NO. CE 23/93

IMPROVEMENT TO CASTLE PEAK ROAD
FROM SIU LAM TO SO KWUN TAN

NOISE IMPACT ASSESSMENT STUDY

EXECUTIVE SUMMARY

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HIGHWAYS DEPARTMENT
HONG KONG GOVERNMENT

AGREEMENT NO. CE23/93

**IMPROVEMENT TO CASTLE PEAK ROAD
FROM SIU LAM TO SO KWUN TAN**

NOISE IMPACT ASSESSMENT

**EXECUTIVE SUMMARY
(ISSUE 1)**

JUNE 1995

Highways Department
3rd floor, Ho Man Tin Government Offices
88 Chung Hau Street
Ho Man Tin
Kowloon

Peter Fraenkel BMT (Asia) Ltd.
with
Enpac Limited
Urbis Travers Morgan Limited

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1. INTRODUCTION

In order to cater for the increasing traffic demand arising from developments along Castle Peak Road (CPR) and to relieve the heavy traffic flow on Tuen Mun Road (TMR) prior to the planned opening of Route 3 - Country Park section in 1998, the section of CPR from Siu Lam Interchange to So Kwun Tan is to be upgraded from a single 7.3m wide carriageway to a dual two lane carriageway. The scheme has been discussed in the T&TC of Tuen Mun District Board on 16 May 1993 and was supported by the District Board members.

In 1993 the Environmental Protection Department (EPD) conducted an Environmental Review for the project and recommended that a Noise Impact Assessment should be carried out to address the potential noise impact arising from the operation of powered mechanical equipment during the construction stage and the increased traffic during the operation phase. As part of the overall project planning for the road improvement works, Highways Department (NT Region) commissioned Peter Fraenkel BMT (Asia) Ltd. in association with Enpac Ltd. and Urbis Travers Morgan Ltd. in 1993 to carry out this Noise Impact Assessment Study. The main purpose of the Study was to provide information on the extent of the cumulative noise impact resulting from the proposed improvement works and to recommend practical mitigation measures to minimize the potential impact. The location of the Study Area is shown on Figure 1.

2. PROJECT CHARACTERISTICS

2.1 Site Description

The Study Area covers about 300m either side of the section of CPR between its junction with So Kwun Tan Road to the west and its grade separated junction with TMR at Siu Lam to the east. The road is a two-lane single carriageway of 7.3m width. Footpaths, where they exist at all are generally sub-standard. TMR runs parallel to CPR along the Study Area, the two being closest at the eastern end of the Study Area where the separation varies from 10 to 25 m.

2.2 Land Use

The Study Area comprises mainly a mix of agricultural land, lorry parks, container storage, and dwellings. Toward the west of the Study Area are several newly completed high-rise residential developments e.g. Gold Coast Development and Peridot Court. Tai Lam Village, in the middle of the Study Area, consists of village settlements and low-rise villas. There are several government quarters near the Siu Lam Interchange, and Siu Lam Hospital is north of TMR here, and overlooking CPR.

Future development planned for the Study Area includes :

- the site of the former desalination plant which is designated a Comprehensive Development Area;
- a Comprehensive Development Site north of TMR near the Siu Lam Interchange, for which planning for private residential development is at an advanced stage;
- a Comprehensive Development Site at Siu Sau at the existing container storage area;
- a Comprehensive Development Site at So Kwun Tan on the northern side of CPR;
- a PSPS development at So Kwun Tan north of TMR;

- Several sites zoned as R(B) along the southern side of CPR east of Peridot Court and on both sides of the junction of Tsing Fat Street and CPR.

Figure 2 shows the locations of the future development sites and planned land uses.

2.3 Proposed Road Scheme

The road will be upgraded to a dual 2 lane carriageway, each carriageway being 7.3m wide. A 3.5m wide footpath/verge will be provided on each side and the carriageways will be separated by a central reserve 3.2m wide comprising two 0.5m wide marginal carriageway strips with a 2.2m wide concrete profile barrier.

2.4 Construction Works

Two-way traffic will be maintained at all times during construction with new traffic lanes provided to allow diversion of traffic from the existing road so that it can be reconstructed to the new line, level, and pavement thickness. The road improvement works are likely to take 30 months, involving the following major activities :

- Preliminary works and mobilization;
- Earthworks and drainage along the widened alignment;
- Construction of new first carriageway kerbing and paving;
- Breaking out of existing carriageway;
- Construction of new second carriageway.

While the contractor will be able to work at more than one location at any one time, the necessity of maintaining two-way traffic flows will make it impractical for more than one construction activity to progress simultaneously at the same location.

In addition to the above operations, a new bridge will be constructed parallel to the existing one across the river at So Kwun Tan and a pedestrian bridge will be constructed across CPR at Tai Lam village. The widening necessary to provide a second carriageway will require the construction of widened embankments and cuttings.

3. STUDY METHODOLOGY

3.1 Identification of Representative Noise Sensitive Receivers

From a study of all noise sensitive receivers in the Study Area, it has been estimated that a total of approximately 800 dwellings (including 290 north facing units in Gold Coast Development) are likely to be adversely affected by the increase in road traffic noise from the improved road. For the purpose of the assessment, forty one noise sensitive receivers (NSR's), mainly dwellings, along this section of the CPR have been selected to represent both existing and future receivers likely to be affected by the improvement works. Figures 3 to 5 show the locations of these receivers.

3.2 Construction Noise Assessment

Construction noise impact has been assessed using the procedures stipulated in the *Technical Memorandum on Noise from Construction Work other than Percussive Piling* and *BS5228:Part*

I:1984. The maximum anticipated noise levels due to various construction activities at the forty one representative receiver facades have been calculated using the sound power levels from the *BS5228:Part I:1984*, where appropriate. Recent noise measurements of construction equipment on site have shown that these sound power levels are more representative of the silenced equipment used by most contractors than those of the Technical Memorandum. In the absence of appropriate data, the sound power levels from the technical memorandum are also used. As no evening or night works are anticipated, the construction noise is therefore assessed with reference to the recommended noise criterion of 75 dB(A) Leq (30 min) in the Practice Note for Professional Persons PN2/93 issued by the Environmental Protection Department.

3.3 Operation Noise Assessment

Operation noise impact has been assessed with reference to the *Hong Kong Planning Standards and Guidelines* (HKPSG) which stipulate that the maximum noise levels at the external facade of dwellings due to road traffic from new or improved roads should not exceed 70 dB(A) L10(1-hr.). The UK Department of Transportation procedures "*Calculation of Road Traffic Noise*" 1988 has been used to calculate the facade noise levels at the forty one representative receivers. Traffic forecasts for 2011 are obtained from the "Local Traffic Study" conducted by Delcan International Corporation. In addition, the prevailing traffic noise levels at these receiver locations have also been calculated using the traffic counts performed by Transport Department in 1992.

3.4 Visual Impact Assessment

The assessment of the landscape and visual impact of the proposed noise barriers has been carried out with respect to EPD advice note (2/90) relating to the 'Application of the EIA Process to Major Private Sector Projects' and Chapter 10 of the HKPSG - Landscape and Conservation.

As the physical location of the proposed noise barriers would be contained entirely within the works area of the new road, there would not be any direct impact on the existing landscape. The impact on the landscape would be limited to changes in character resulting from the introduction of new elements. In this respect landscape impact would be equivalent to visual impacts. The assessment, therefore, concentrates principally on the visual impacts.

4. CONSTRUCTION NOISE IMPACT AND MITIGATION

4.1 Construction Noise Impact

During the construction period, the operation of powered mechanical equipment such as pneumatic breakers, vibratory rollers and backhoes will generate noise that impacts the daytime environment. Typically, the noise is predominantly low-pitch, with impulsive, tonal, or intermittent character.

For the purpose of this assessment, the maximum anticipated noise levels at the external facade of the representative receivers have been calculated assuming that all equipment items for a given activity are concentrated at one point on the alignment closest to the receiver under consideration.

Noise levels resulting from road construction activities (earthworks, drainage, kerbing, pavement excavation, paving), bridge, retaining wall and noise barrier construction activities have been predicted, and have been found to be in excess of the construction noise criterion. While it is unlikely that construction noise levels actually experienced will be as high as those predicted, since concentration of equipment at one point as assumed for the purposes of the assessment is unlikely to occur, mitigation measures will be implemented to control construction noise, particularly for those receivers close to the roadside.

4.2 Noise Mitigation

The construction assessment has concluded a need for noise control during the construction. Contractually, a noise limit together with a noise monitoring and action plan can be specified in the contract to control noise.

A range of noise control measures that are generally applicable could be implemented on this project. Noise generated by stationary and earth-moving plant such as compressors, excavators, bulldozers, loaders, dumpers and concrete pumps, can be reduced through proper maintenance of the exhaust system and the fitting of exhaust silencers. Isolation of vibrating engine components, installation of acoustic enclosures and damping of vibrating panels can also reduce engine noise. Enclosures for piling hammers can significantly reduce the noise from percussive piling operations. The numbers of items of equipment in use at a particular location can be reduced. Temporary noise barriers can be erected between the construction works and nearby sensitive receivers.

It has been demonstrated that by appropriate combination of the above measures, it is feasible for the construction noise criterion to be met at all affected sensitive receivers. However, as it is not feasible to dictate the methods of construction or equipment to be adopted by the contractor, it is proposed that noise control requirements be incorporated into the tender/contract documents which specify the noise standards to be met and the noise monitoring requirements to ensure that these standards are indeed achieved.

Baseline monitoring prior to the commencement of any construction activity is necessary in order to confirm the existing noise environment in the study area. Compliance monitoring would be carried out throughout the construction period, with monthly reports on the results of the monitoring being prepared. As part of the monitoring programme, an action plan would specify actions to be taken by the Engineer and the Contractor in the event of target noise levels being exceeded, or should independent complaints be received on noise due to construction work.

5. OPERATION NOISE IMPACT AND MITIGATION

5.1 Operation Noise Impact

Increased traffic from CPR and TMR is predicted to increase the traffic noise levels at the representative receivers. Table 1 shows the current (1992) traffic noise and the predicted future (2011) noise levels at the facades of the representative receivers.

As shown in the table, both the current and future traffic noise levels exceed the HKPSG noise guideline at most representative receivers. Noise mitigation measures are therefore necessary to alleviate the future noise impact of the increased traffic on CPR.

5.2 Noise Mitigation

A detailed analysis of the future traffic noise levels reveals the following noise contributions:

- Towards the eastern end of the Study Area (approximately east of the Castle Bay development), the traffic noise is predominated by the TMR traffic because TMR carries higher traffic volume and runs virtually adjacent to CPR along this section of the alignment. The contribution from TMR alone is expected to exceed the HKPSG noise criterion.
- In the central portion of the Study Area (approximately between Castle Bay development and Peridot Court), the influence of TMR traffic diminishes as the horizontal and vertical alignments of TMR and CPR diverge. Generally, the contribution from CPR traffic predominates over that from TMR traffic in this area.
- In the western end of the Study Area (approximately west of Peridot Court), the influence of TMR further reduces as its horizontal and vertical alignments diverge further from those of CPR. Except at the Housing Authority's PSPS site in Area 56, the contribution from CPR traffic predominates over that from TMR.

In order to meet the HKPSG noise criterion, all practical direct technical measures have been examined. These include :


- noise barriers, including panel-type barriers up to 5m high and cantilevered or top-bent type barriers to cover the nearside traffic lane;
- total enclosures to cover both carriageways;
- friction course surfacing.

Total noise enclosures are generally effective in reducing traffic noise, but have a number of disadvantages in their application in this project e.g. reduced air quality inside enclosures, possible need for forced ventilation, frequent maintenance and cleaning, special lighting requirements, resiting of some bus bays, etc. More importantly, road safety, emergency services and the need to break up the enclosures at junctions, run-ins and pedestrian accesses make them impractical and ineffective for all sections of CPR in the Study Area. In addition, the use of enclosures for the eastern section would not be very effective due to the predominant effect of TMR traffic. Overall noise levels at sensitive receivers would not be reduced significantly.

The use of friction course surfacing is effective as it would reduce noise at source by 2.5 dB(A) for vehicle speeds below 75 km/hr. However, due to the nature and the use of the road (stop-start traffic, junctions, run-ins, bus bays, and road curvature), friction course surfacing along CPR would require frequent maintenance and repair, and would be impractical for use along much of the route.

Table 1 - Current and Future Traffic Noise Levels at Representative NSRs without Mitigation

Representative Receiver Name	L ₁₀ (peak hour) Noise (dB(A))					
	Overall Facade Noise Levels and Comparison			Contributions from Separate Roads in 2011		
	2011 (1)	1992 (2)	Difference	Castle Peak Rd	Tuen Mun Rd	Castle Peak Rd: Contribution to Overall Noise Level (3)
Siu Lam Hospital (outbuilding)	76.6	73.4	3.2	72.1	74.7	1.9
Apartment (unnamed)	77.6	75.7	1.9	70.9	76.5	1.1
C.S.D. Staff Quarters 1	80.8	76.7	4.2	78.1	77.5	3.3
C.S.D. Staff Quarters 2	77.7	74.4	3.3	73.9	75.4	2.3
C.S.D. Staff Quarters 3	69.4	65.9	3.5	65.8	66.9	2.5
C.S.D. Staff Quarters 4	77.9	73.7	4.2	75.2	74.5	3.4
Marine Police Staff Quarters	76.7	72.5	4.2	74.0	73.3	3.4
Village House 1	73.3	71.6	1.6	69.8	73.0	0.3
Castle Bay Villas 1	79.2	75.0	4.2	76.1	76.2	3.0
Castle Bay Villas 2	75.6	70.9	4.7	73.4	71.6	4.0
House at TWIL 23A	74.8	71.3	3.4	70.0	73.0	1.8
Villa De Mer	74.2	69.3	4.9	71.7	70.5	3.7
Apartment (unnamed)	73.0	66.1	6.9	72.2	65.3	7.7
Castle Peak Villa	73.5	69.2	4.3	70.8	70.1	3.4
Ivanhoe Villa	82.1	74.4	7.7	81.7	71.3	10.8
Fiona Garden	81.4	73.1	8.2	81.2	67.0	14.4
Silvern Garden	75.6	68.1	7.5	75.1	65.8	9.8
Village House 2	77.7	68.6	9.1	77.7	45.4	32.3
Kam Po Court	75.2	68.3	6.9	74.6	66.6	8.6
Lof On Fai Comprehensive Dev. Area	68.8	64.4	4.3	66.6	64.7	4.1
Village House 3	63.4	56.2	7.2	63.4	--	63.4
Village House (TS) (temporary)	71.9	65.9	6.0	71.2	62.9	8.5
Peridot Court (Upper level)	74.0	68.6	5.4	73.2	66.4	7.6
Peridot Court (Mid level)	73.7	67.5	6.2	73.3	62.9	10.8
Peridot Court (Lower level)	73.2	67.5	5.7	72.5	65.0	8.2
Pearl Island 1	74.2	67.1	7.1	74.2	--	74.2
Pearl Island 2	73.0	65.9	7.1	73.0	--	73.0
Pearl Island 3	70.6	63.6	7.0	70.6	--	70.6
Pearl Island 4	72.0	65.0	7.0	72.0	--	72.0
Gurkha Married Quarters (AP3)	76.0	69.1	6.8	75.9	57.2	18.8
Gurkha Married Quarters (AP4)	75.7	69.2	6.5	75.5	62.2	13.5
Gurkha Married Quarters (AP5)	72.8	66.2	6.7	72.7	57.7	15.1
Yee On Residence for Senior Citizens	81.2	74.1	7.1	81.2	--	81.2
Beauve Peninsula	68.0	61.3	6.7	67.9	52.7	15.3
Village House 4	70.4	63.9	6.5	70.4	--	70.4
Village House 5	68.1	60.9	7.2	68.1	--	68.1
Village House 6	77.1	70.3	6.8	76.9	63.6	13.5
Village House 7	69.9	62.9	7.0	69.9	--	69.9
Village House 8	71.7	64.7	7.0	71.7	--	71.7
Gold Coast Block 6 (Upper level)	73.8	68.1	5.7	73.3	64.6	9.2
Gold Coast Block 3 (Upper level)	74.5	68.7	5.8	74.0	65.0	9.5
Gold Coast Block 1 (Upper level)	72.1	66.7	5.4	71.2	64.6	7.5
Gold Coast Block 6 (Mid level)	75.6	69.1	6.5	75.4	61.4	14.2
Gold Coast Block 3 (Mid level)	75.6	69.1	6.5	75.4	61.5	14.1
Gold Coast Block 1 (Mid level)	72.5	66.3	6.2	72.2	61.4	11.4
Gold Coast Block 6 (Lower level)	76.7	70.0	6.7	76.6	57.3	19.4
Gold Coast Block 3 (Lower level)	74.3	67.6	6.7	74.3	54.6	19.7
Gold Coast Block 1 (Lower level)	68.8	62.9	5.9	68.4	58.3	10.5
Proposed PSPS Housing at Area S6	80.0	74.0	1.0	58.6	80.0	0.0

 NSRs which do NOT qualify for Equitable Redress under the eligibility criteria for insulation.

Noise barriers are found to be effective at protecting dwellings at the western end of the improved road, near the Gold Coast Development, and for dwellings on the south side of the road between Tsing Fat Street and Tsing Tai Road. At Tai Lam village and to the east, as far as the Siu Lam Interchange, noise barriers would also reduce the noise from CPR traffic. However, the predominance of noise from TMR traffic make noise barriers ineffective in reducing the overall noise levels.

In order to determine the most effective mitigation measures to protect the dwellings from future traffic noise, three options of noise mitigation have been investigated. They are :

- Option 1 - Noise barriers with friction course surfacing where applicable (Figures 6-8).
- Option 2 - Noise barriers without friction course surfacing (Figures 9-11).
- Option 3 - Noise barriers where effective in reducing the overall traffic noise (Figures 12-14).

The configuration of the noise barriers for each option has been optimized to make the most effective use of the barriers under given site constraints, e.g. junctions, run-ins, etc. The objective has been to meet the HKPSG noise criterion as much as possible.

Option 1 includes friction course surfacing along three sections of CPR, where maintenance requirements would not totally preclude its use. However, high levels of maintenance would still be expected on these three stretches of CPR. Other technical problems associated with the alternating of sections of roadway surfaced with porous friction course surfacing with sections of roadway with asphalt wearing course would also have to be overcome before the use of friction course along short sections of CPR would become feasible.

Tables 2, 3 and 4 present the current and future traffic noise levels for each of the three options. The noise contributions from CPR and TMR, and the overall noise reduction are also shown.

Table 2 - Current and Future Traffic Noise Levels at Representative NSRs
Noise Barriers with Friction Course (Figures 6-8)

Representative Receiver Name	L ₁₀ (peak hour) Noise (dB(A))						Overall Noise Level Difference b/n Mitigated/Unmitigated
	Overall Facade Noise Levels and Comparison			Contributions from Separate Roads in 2011			
	2011 (1)	1992	Difference (2)	Castle Peak Rd	Tuen Mun Rd	Castle Peak Rd: Contribution to Overall Noise Level (3)	
Siu Lam Hospital (outbuilding)	76.2	73.4	2.8	70.9	74.7	1.5	0.4
Apartment (unnamed)	77.2	75.7	1.5	69.2	76.5	0.7	0.4
C.S.D. Staff Quarters 1	79.6	76.7	2.9	75.4	77.5	2.1	1.2
C.S.D. Staff Quarters 2	76.5	74.4	2.1	70.0	75.4	1.1	1.2
C.S.D. Staff Quarters 3	68.0	65.9	2.1	61.3	66.9	1.1	1.4
C.S.D. Staff Quarters 4	75.3	73.7	1.6	67.5	74.5	0.8	2.6
Marine Police Staff Quarters	74.2	72.5	1.7	67.5	73.3	0.9	2.5
Village House 1	73.1	71.6	1.5	58.3	73.0	0.1	0.2
Castle Bay Villas 1	77.1	75.0	2.1	69.8	76.2	0.9	2.1
Castle Bay Villas 2	72.3	70.9	1.4	64.1	71.6	0.7	3.3
House at TWIL 23A	73.6	71.3	2.3	64.5	73.0	0.6	1.2
Villa De Mer	71.3	69.3	2.0	63.3	70.5	0.8	2.9
Apartment (unnamed)	72.7	66.1	6.6	71.8	65.3	7.4	0.3
Castle Peak Villa	72.0	69.2	2.8	67.4	70.1	1.9	1.5
Ivanhoe Villa	78.6	74.4	4.2	77.7	71.3	7.3	3.5
Fiona Garden	80.9	73.1	7.8	80.7	67.0	13.9	0.5
Silvern Garden	71.4	68.1	3.3	70.0	65.8	5.6	4.2
Village House 2	76.6	68.6	8.0	76.6	45.4	31.2	1.1
Kam Po Court	70.1	68.3	1.8	67.5	66.6	3.5	5.1
Lok On Pai Comprehensive Dev. Area	67.3	64.4	2.9	63.8	64.7	2.6	1.5
Village House 3	62.1	56.2	5.9	62.1	-	62.1	1.3
Village House (TS)	67.5	65.9	1.6	65.4	63.4	4.1	4.4
Peridot Court (Upper level)	71.9	68.6	3.3	70.5	66.4	5.5	2.1
Peridot Court (Mid level)	70.0	67.5	2.5	69.0	62.9	7.1	3.7
Peridot Court (Lower level)	69.2	67.5	1.7	67.1	65.0	4.2	4.0
Pearl Island 1	72.9	67.1	5.8	72.9	-	72.9	1.3
Pearl Island 2	70.3	65.9	4.4	70.3	-	70.3	2.7
Pearl Island 3	66.1	63.6	2.5	66.1	-	66.1	4.5
Pearl Island 4	69.8	65.0	4.8	69.8	-	69.8	2.2
Gurkha Married Quarters (AP3)	65.9	69.1	-3.2	65.3	57.2	8.7	10.1
Gurkha Married Quarters (AP4)	70.2	69.2	1.0	69.4	62.2	8.0	5.5
Gurkha Married Quarters (AP5)	66.5	66.2	0.3	65.9	57.7	8.8	6.3
Yee On Residence for Senior Citizens	67.6	74.1	-6.5	67.6	-	67.6	13.6
Beaulieu Peninsula	65.5	61.3	4.2	65.3	52.7	12.8	2.5
Village House	70.4	63.9	6.5	70.4	-	70.4	0.5
Gold Coast Block 6 (Upper level)	73.8	68.1	5.7	73.3	64.6	9.2	0.0
Gold Coast Block 3 (Upper level)	74.4	68.7	5.7	73.9	65.0	9.4	0.1
Gold Coast Block 1 (Upper level)	72.1	66.7	5.4	71.2	64.6	7.5	0.0
Gold Coast Block 6 (Mid level)	75.8	69.1	6.7	75.6	61.4	14.4	-0.2
Gold Coast Block 3 (Mid level)	76.2	69.1	7.1	76.0	61.5	14.7	-0.6
Gold Coast Block 1 (Mid level)	72.6	66.3	6.3	72.3	61.1	11.5	-0.1
Gold Coast Block 6 (Lower level)	76.6	70.0	6.6	76.5	57.3	19.3	0.1
Gold Coast Block 3 (Lower level)	74.2	67.6	6.6	74.2	54.6	19.6	0.1
Gold Coast Block 1 (Lower level)	66.8	62.9	3.9	66.1	58.3	8.5	2.0
Village House 5	66.5	60.9	5.6	66.5	-	66.5	1.6
Village House 6	72.8	70.3	2.5	72.3	63.6	9.2	4.3
Village House 7	69.3	62.9	6.4	69.3	-	69.3	0.6
Village House 8	71.7	64.7	7.0	71.7	-	71.7	0.0
Proposed PSPS Housing at Area 56	80.0	79.0	1.0	57.5	80.0	0.0	0.0

NSRs which do NOT qualify for Equitable Redress under eligibility criteria for insulation.

Table 3 - Current and Future Traffic Noise Levels at Representative NSRs
Noise Barriers without Friction Course (Figures 9-11)

Representative Receiver Name	L ₁₀ (peak hour) Noise (dB(A))						
	Overall Facade Noise Levels and Comparison			Contributions from Separate Roads in 2011			
	2011 (1)	1992	Difference (2)	Castle Peak Rd	Tuen Mun Rd	Castle Peak Rd: Contribution to Overall Noise Level (3)	Overall Noise Level Difference b/n Mitigated/Unmitigated
Siu Lam Hospital (outbuilding)	76.7	73.4	3.3	72.4	74.7	2.0	-0.1
Apartment (unnamed)	77.8	75.7	2.1	71.9	76.5	1.3	-0.2
C.S.D. Staff Quarters 1	79.7	76.7	3.0	75.6	77.5	2.2	1.1
C.S.D. Staff Quarters 2	76.3	74.4	1.9	69.1	75.4	0.9	1.4
C.S.D. Staff Quarters 3	67.4	65.9	1.5	57.9	66.9	0.5	2.0
C.S.D. Staff Quarters 4	75.0	73.7	1.3	64.9	74.5	0.5	2.9
Marine Police Staff Quarters	73.8	72.5	1.3	64.4	73.3	0.5	2.9
Village House 1	73.3	71.6	1.7	61.3	73.0	0.3	0.0
Castle Bay Villas 1	77.6	75.0	2.6	72.1	76.2	1.4	1.6
Castle Bay Villas 2	72.5	70.9	1.6	65.7	71.6	0.9	3.1
House at TWIL 23A	73.7	71.3	2.4	65.2	73.0	0.7	1.1
Villa De Mer	71.3	69.3	2.0	63.4	70.5	0.8	2.9
Apartment (unnamed)	73.6	66.1	7.5	72.9	65.3	8.3	-0.6
Castle Peak Villa	72.0	69.2	2.8	67.5	70.1	1.9	1.5
Ivanhoe Villa	78.7	74.4	4.3	77.8	71.3	7.4	3.4
Fiona Garden	81.3	73.1	8.2	81.1	67.0	14.3	0.1
Silvern Garden	72.0	68.1	3.9	70.8	65.8	6.2	3.6
Village House 2	79.0	68.6	10.4	79.0	45.4	33.6	-1.3
Kam Po Court	70.6	68.3	2.3	68.4	66.6	4.0	4.6
Lok On Pai Comprehensive Dev. Area	67.6	64.4	3.2	64.4	64.7	2.9	1.2
Village House 3	63.5	56.2	7.3	63.5	-	63.5	-0.1
Village House (TS) (temporary)	69.1	65.9	3.2	67.8	63.4	5.7	2.8
Peridot Court (Upper level)	72.6	68.6	4.0	71.4	66.4	6.2	1.4
Peridot Court (Mid level)	70.9	67.5	3.4	70.2	62.9	8.0	2.8
Peridot Court (Lower level)	70.1	67.5	2.6	68.5	65.0	5.1	3.1
Pearl Island 1	73.0	67.1	5.9	73.0	-	73.0	1.2
Pearl Island 2	70.3	65.9	4.4	70.3	-	70.3	2.7
Pearl Island 3	66.1	63.6	2.5	66.1	-	66.1	4.5
Pearl Island 4	69.8	65.0	4.8	69.8	-	69.8	2.2
Gurkha Married Quarters (AP3)	66.4	69.1	-2.7	65.8	57.2	9.2	9.6
Gurkha Married Quarters (AP4)	70.4	69.2	1.2	69.7	62.2	8.2	5.3
Gurkha Married Quarters (AP5)	66.9	66.2	0.7	66.3	57.7	9.2	5.9
Yee On Residence for Senior Citizens	67.6	74.1	-6.5	67.6	-	67.6	13.6
Beaufieu Peninsula	65.5	61.3	4.2	65.3	52.7	12.8	2.5
Village House	70.4	63.9	6.5	70.4	-	70.4	0.5
Gold Coast Block 6 (Upper level)	73.8	68.1	5.7	73.3	64.6	9.2	0.0
Gold Coast Block 3 (Upper level)	74.5	68.7	5.8	74.0	65.0	9.5	0.0
Gold Coast Block 1 (Upper level)	72.1	66.7	5.4	71.3	64.6	7.5	0.0
Gold Coast Block 6 (Mid level)	75.8	69.1	6.7	75.6	61.4	14.4	-0.2
Gold Coast Block 3 (Mid level)	76.2	69.1	7.1	76.0	61.5	14.7	-0.6
Gold Coast Block 1 (Mid level)	72.7	66.3	6.4	72.4	61.1	11.6	-0.2
Gold Coast Block 6 (Lower level)	76.6	70.0	6.6	76.5	57.3	19.3	0.1
Gold Coast Block 3 (Lower level)	74.2	67.6	6.6	74.2	54.6	19.6	0.1
Gold Coast Block 1 (Lower level)	66.9	62.9	4.0	66.2	58.3	8.6	1.9
Village House 5	68.3	60.9	7.4	68.3	-	68.3	-0.2
Village House 6	74.8	70.3	4.5	74.5	63.6	11.2	2.3
Village House 7	69.3	62.9	6.4	69.3	-	69.3	0.6
Village House 8	71.7	64.7	7.0	71.7	-	71.7	0.0
Proposed PSPS Housing at Area 56	80.0	79.0	1.0	58.2	80.0	0.0	0.0

NSRs which do NOT qualify for Equitable Redress under eligibility criteria for insulation.

Table 4 - Current and Future Traffic Noise Levels at Representative NSRs
Indirect Mitigation at Siu Lam (Figures 12-14)

NSR	L ₁₀ (peak hour) Noise (dB(A))						
	Overall Facade Noise Levels and Comparison			Contributions from Separate Roads in 2011			
	2011 (1)	1992	Difference (2)	Castle Peak Rd	Tuen Mun Rd	Castle Peak Rd: Contribution to Overall Noise Level (3)	Overall Noise Level Difference btn Mitigated/Unmitigated
Siu Lam Hospital (outbuilding)	76.6	73.4	3.2	72.1	74.7	1.9	0.0
Apartment (unnamed)	77.6	75.7	1.9	70.9	76.5	1.1	0.0
C.S.D. Staff Quarters 1	80.8	76.7	4.1	78.1	77.5	3.3	0.0
C.S.D. Staff Quarters 2	77.7	74.4	3.3	73.9	75.4	2.3	0.0
C.S.D. Staff Quarters 3	69.4	65.9	3.5	65.9	66.9	2.5	0.0
C.S.D. Staff Quarters 4	77.9	73.7	4.2	75.2	74.5	3.4	0.0
Marine Police Staff Quarters	76.7	72.5	4.2	74.0	73.3	3.4	0.0
Village House 1	73.2	71.6	1.6	69.7	73.0	6.2	0.1
Castle Bay Villas 1	79.2	75.0	4.2	76.2	76.2	3.0	0.0
Castle Bay Villas 2	75.5	70.9	4.6	73.3	71.6	3.9	0.1
House at TWIL 23A	74.7	71.3	3.4	69.9	73.0	1.7	0.1
Villa De Mer	74.2	69.3	4.9	71.7	70.5	3.7	0.0
Apartment (unnamed)	73.2	66.1	7.1	72.4	65.3	7.9	-0.2
Castle Peak Villa	73.3	69.2	4.1	70.5	70.1	3.2	0.2
Ivanhoe Villa	81.7	74.4	7.3	81.3	71.3	10.4	0.4
Fiona Garden	81.3	73.1	8.2	81.1	67.0	14.3	0.1
Silvern Garden	72.0	68.1	3.9	70.8	65.8	6.2	3.6
Village House 2	79.0	68.6	10.4	79.0	45.4	33.6	-1.3
Kam Po Court	70.6	68.3	2.3	68.4	66.6	4.0	4.6
Lok On Pal Comprehensive Dev. Area	67.7	64.4	3.3	64.6	64.7	3.0	1.1
Village House 3	63.5	56.2	7.3	63.5	-	63.5	-0.1
Village House (TS) (temporary)	69.1	65.9	3.2	67.8	63.4	5.7	2.8
Peridot Court (Upper level)	72.6	68.6	4.0	71.4	66.4	6.2	1.4
Peridot Court (Mid level)	70.9	67.5	3.4	70.2	62.9	8.0	2.8
Peridot Court (Lower level)	70.1	67.5	2.6	68.5	65.0	5.1	3.1
Pearl Island 1	73.0	67.1	5.9	73.0	-	73.0	1.2
Pearl Island 2	70.3	65.9	4.4	70.3	-	70.3	2.7
Pearl Island 3	66.1	63.6	2.5	66.1	-	66.1	4.5
Pearl Island 4	69.8	65.0	4.8	69.8	-	69.8	2.2
Gurkha Married Quarters (AP3)	66.4	69.1	-2.7	65.8	57.2	9.2	9.6
Gurkha Married Quarters (AP4)	70.4	69.2	1.2	69.7	62.2	8.2	5.3
Gurkha Married Quarters (AP5)	66.9	66.2	0.7	66.3	57.7	9.2	5.9
Yee On Residence for Senior Citizens	67.6	74.1	-6.5	67.6	-	67.6	13.6
Beautiful Peninsula	65.5	61.3	4.2	65.3	52.7	12.8	2.5
Village House 4	70.4	63.9	6.5	70.4	-	70.4	0.0
Gold Coast Block 6 (Upper level)	73.8	68.1	5.7	73.3	64.6	9.2	0.0
Gold Coast Block 3 (Upper level)	74.5	68.7	5.8	74.0	65.0	9.5	0.0
Gold Coast Block 1 (Upper level)	72.1	66.7	5.4	71.3	64.6	7.5	0.0
Gold Coast Block 6 (Mid level)	75.8	69.1	6.7	75.6	61.4	14.4	-0.2
Gold Coast Block 3 (Mid level)	76.2	69.1	7.1	76.0	61.5	14.7	-0.6
Gold Coast Block 1 (Mid level)	72.7	66.3	6.4	72.4	61.1	11.6	-0.2
Gold Coast Block 6 (Lower level)	76.6	70.0	6.6	76.5	57.3	19.3	0.1
Gold Coast Block 3 (Lower level)	74.2	67.6	6.6	74.2	54.6	19.6	0.1
Gold Coast Block 1 (Lower level)	66.9	62.9	4.0	66.2	58.3	8.6	1.9
Village House 5	68.3	60.9	7.4	68.3	-	68.3	-0.2
Village House 6	74.8	70.3	4.5	74.5	63.6	11.2	2.3
Village House 7	69.3	62.9	6.4	69.3	-	69.3	0.6
Village House 8	71.7	64.7	7.0	71.7	-	71.7	0.0
Proposed PSPS Housing at Area 56	80.0	79.0	1.0	58.2	80.0	0.0	0.0

NSRs which do NOT qualify for Equitable Redress under the eligibility criteria for insulation.

As further provision of direct technical measures is deemed ineffective and impractical, indirect measures e.g. sound insulation, have been considered to redress the residual impact at those dwellings which are likely to be exposed to increased noise levels resulting from the road improvement. A detailed assessment with reference to a set of "eligibility criteria" based on the "UK Noise Insulation Regulation 1975" has shown that a number of receivers would qualify for consideration for insulation. Table 5 summarizes the no. of dwellings exceeding the HKPSG noise criterion and the no. of dwellings qualifying for consideration for insulation for each of the three options identified. The corresponding figures without mitigation are also shown for comparison.

Table 5 - Dwelling Units Exceeding the HKPSG Criterion and Eligible for Consideration for Equitable Redress

	Unmitigated Scenario	Mitigated Scenario		
		Option 1	Option 2	Option 3
No. of Dwellings exceeding the HKPSG	740 (100%)	570 (77%)	610 (83%)	610 (83%)
No. of Dwellings meeting the eligibility criteria for insulation	740 (100%)	444 (60%)	496 (67%)	601 (81%)

Numbers in brackets are the percentages of the total dwellings affected.

In addition to predicting the impact of the traffic noise from the improved Castle Peak Road on existing developments within the study area, the potential impact on planned future development has been assessed. The impact at the Lok On Pai desalination plant, which is zoned as a Comprehensive Development Area, is not expected to exceed the HKPSG criterion. It is understood that the planned residential development at So Kwun Wat development area, north of Tuen Mun Road has incorporated noise protection measures to reduce traffic noise from Tuen Mun Road. These measures will also be effective in reducing the impact of Castle Peak Road, and the noise from additional traffic on the improved Castle Peak Road is not expected to have a significant impact on this planned development. The traffic noise levels from the improved CPR are expected to exceed the HKPSG criterion at the remaining two Comprehensive Development Areas within the study area, at Siu Sai and at So Kwun Tan. It will be necessary for noise protection measures to be included with any future development of these sites. Noise levels at areas zoned for future R(B) type development, along the western end of the study area would also exceed the HKPSG criterion. It is recommended that single aspect development be considered for these areas, whereby only non-sensitive facades (bathrooms, kitchens, store rooms etc) face the roadway.

5.3 Cost Estimates

On the assumption that barriers are constructed of a combination of GRC and clear acrylic glass panels, the capital costs have been derived for each of the three noise mitigation options. Table 6 presents the capital costs for the three options.

**Table 6 - Capital Costs for Direct Mitigation Measures
 and Residual Insulation**

		Option 1 (HK\$ m)	Option 2 (HK\$ m)	Option 3 (HK\$ m)
DIRECT MITIGATION	Barriers	50.7	64.0	31.0
	Friction Course	1.5	-	-
Cost of Direct Mitigation		52.2	64.0	31.0
Cost of Residual Insulation		7.8	8.7	10.6
TOTAL COST		60.0	72.7	41.6

5.4 Evaluation of Effectiveness

The effectiveness of the three options in reducing the overall noise levels has been evaluated with reference to the situation without mitigation. As is clear from Table 5, Option 1 which combines friction course surfacing with noise barriers can reduce noise levels to below the HKPSG criterion at 170 units or 23% of the dwellings at which noise levels would otherwise exceed the criterion, while Options 2 and 3 can reduce the noise levels to below the criterion at 17% of the dwellings. In terms of the effectiveness in meeting the HKPSG criterion, the difference is considered insignificant. Option 3 is found to be as effective as Options 1 and 2 because the direct technical measures identified in Options 1 and 2 along the eastern section of CPR, between Tai Lam Village and Siu Lam Interchange, cannot effectively reduce overall noise levels at the receivers, due to the proximity of Tuen Mun Road. However, as shown in Table 6, Options 1 and 2 would incur additional capital costs of \$18 million and \$30 million respectively more than that if Option 3 is adopted. In addition, implementation of Option 1 would lead to significant disruption of traffic at regular intervals during friction course surfacing maintenance periods. It would appear that Option 3 gives a more cost-effective solution in terms of meeting the HKPSG criterion than the other two options, as it can provide the same level of noise control for the residents of dwellings along CPR as options 1 and 2, but at considerably reduced cost.

6. VISUAL IMPACT AND MITIGATION

6.1 Landscape and Visual Context

From Siu Lam to So Kwun Tan the Castle Peak Road undulates across a series of small headlands and intervening bays and valleys, running between the line of the Tuen Mun Road Expressway and the coastal plain. The area is generally well vegetated with linear belts of trees running between the two road corridors and larger blocks of woodland on the relatively undisturbed hillslopes and surrounding areas of partially cultivated agricultural land.

Along the road corridor there are numerous properties, most commonly two or three storey modern houses set in short terraces within small estate developments, or simple single storey detached buildings set within the wooded hillside.

6.2 Proposed Noise Barriers

All three noise mitigation options incorporate vertical barriers and partial enclosures of the kerbside lane of one carriageway with heights varying from 1m to 7m. Option 1 incorporates friction course surfacing along sections of CPR. Where barriers are required, they would be continuous along the road except where breaks are required for access to existing side roads and sites.

6.3 Visual Assessment

The visual impact of the barriers/partial enclosures on existing development along CPR would be most severe for those properties adjacent to the roadside and the proposed noise barrier structures. At properties that are set back somewhat from the roadside the visual impact of the noise barriers would be less severe. The barriers would form a strong linear man-made element in the landscape. Their uniform appearance would contrast with the surrounding natural elements, though they would be similar in nature to the existing detractors in the landscape, CPR and TMR and their associated cuttings and traffic.

The visual impact of the barriers on the road users would be quite severe, resulting in a significant reduction in the quality of environment, particularly for pedestrians, due to loss of visual amenity in obstructing views out from the road, wind tunnelling along the road, and increasing safety fears due to the perceived proximity of the traffic (especially HGV's) and the lack of means of escape.

6.4 Landscape Mitigation Measures and Effectiveness

As the size and form of noise barriers is determined by the noise impact assessment, the mitigation of the visual impact of the barriers is limited to possible architectural treatment in blending them into the surrounding landscape setting.

It is proposed that the barriers be constructed of a solid lower portion, consisting of patterned panels, with the upper portion, and the roof section of partial enclosures in transparent perspex panels or similar. The lower solid panels could incorporate a wide variety of surface patterns, finished in dark green or brown. This would be overlain with a framework of raised strips formed in areas of varying pattern and density, and of different depth to create texture and shading effect. Figures 15-17 indicate the sort of treatment that would be possible.

The proposed architectural treatment of the barriers would help to mitigate their visual impact in all affected views, and would reduce the impact of many of them to an acceptable level.

Several of the properties, however, are very close to the road and the barriers will be dominant elements in the landscape, obstructing much of the previous view. The treatment of the surface finishes will only tone down their impact on these properties, and in cases the residual impact will still be relatively high.

7. ENVIRONMENTAL MONITORING AND AUDIT

As an integral part of this noise impact assessment, the environmental monitoring and auditing requirements have also been determined and specified in order to :

- ensure that noises from the construction and operation of the project are kept to acceptable levels;
- establish procedures for checking the effectiveness of the proposed mitigation measures;
- provide the means by which compliance may be checked, exceedance documented and corrective action recorded.

Baseline monitoring should be carried out prior to the commencement of any construction activity on site, to establish the existing noise environment in the study area. Compliance monitoring of construction noise can be carried out by the Contractor under supervision of the Engineer during construction. Detailed monitoring and audit requirements for the construction phase should be specified in the construction contract.

A post-project audit at some time after completion of the project, when traffic levels have built up along Castle Peak Road, would provide a useful assessment of the effectiveness of the mitigation measures adopted.

8. CONCLUSIONS

The noise impact assessment has identified that traffic noise levels at many of the existing and future developments along the CPR would increase and exceed the HKPSG noise criterion following the upgrading of the road. Various options for reducing the noise to the HKPSG noise criterion have been investigated. The proposed solution is to use noise barriers where they are shown to be effective in reducing noise and elsewhere to redress the residual impacts by sound insulation. The capital cost of the noise barriers proposed is \$31.0 million.

Additional surveys and studies are required to determine the details of the mitigation scheme, both for the direct noise control measures and the insulation package, and to confirm the eligibility of the dwellings along the route for consideration for provision of insulation.

Based on a 30-month construction programme and assumptions on the type and number of standard powered mechanical equipment likely to be employed for the works, it is anticipated that construction noise would exceed the recommended noise criterion at many receiver locations, if unmitigated. However, it has been shown to be feasible to meet the noise criterion using standard noise control measures, such as those suggested in the "A Practical Guide for the Reduction of Noise from Construction Works", published by the EPD. In order to better enforce noise control measures in this project, noise control requirements have been specified for inclusion in the tender/contract documents specifying the noise standards to be met and requirements for noise monitoring on the site.

9. RECOMMENDATIONS

9.1 Construction Noise

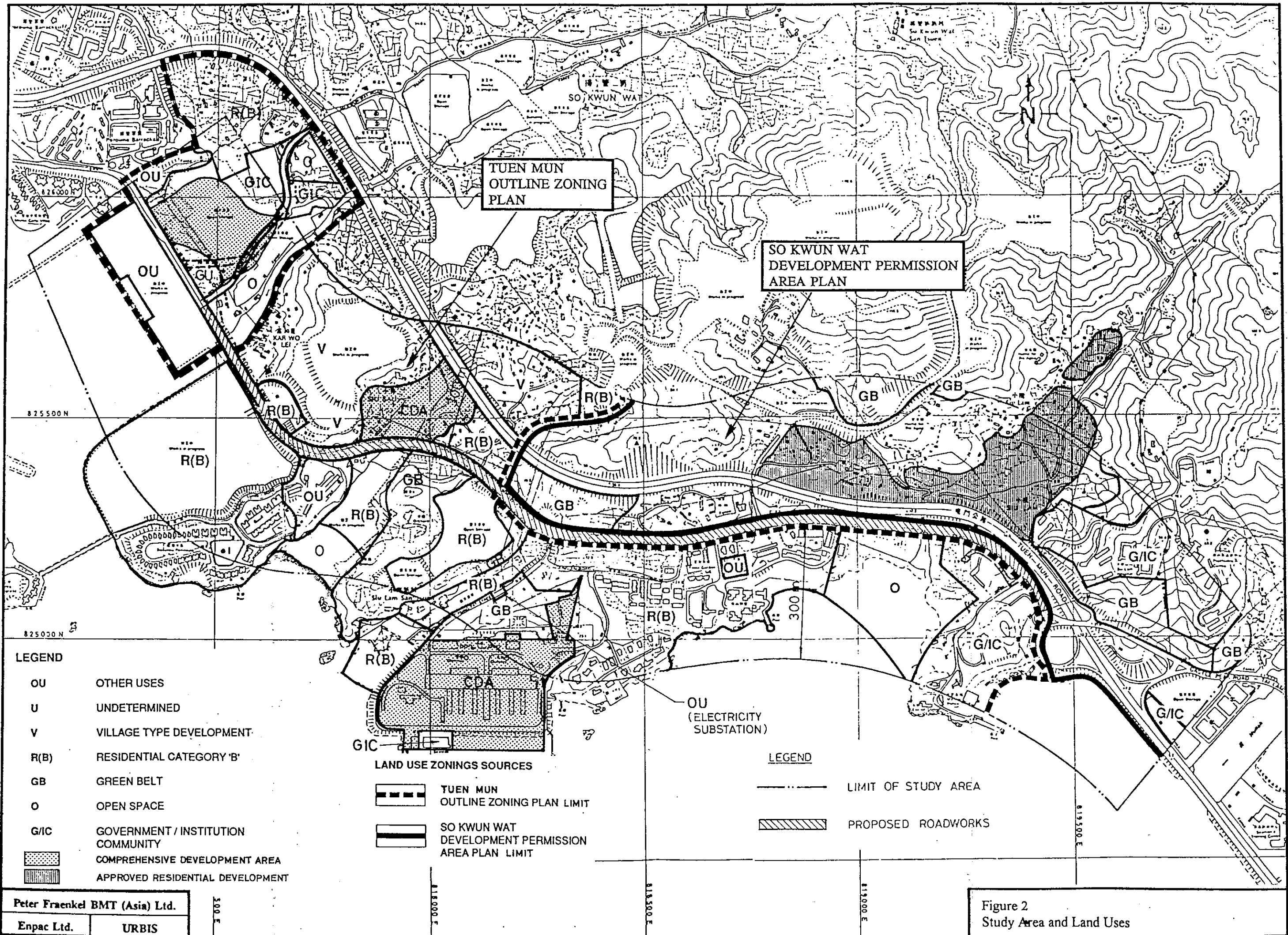
To meet the requirements for mitigating construction noise in accordance with specified criteria it is recommended that:-

- The construction contractor be required to comply with the measures listed in para 6.1.2 of the Final Report (FR) as far as is practical.
- The construction contract specification includes the provisions of para 7.1.3 a) to k) inclusive in the FR.
- Compliance with the specification be monitored in accordance with Section 9.3 of the FR.
- Where possible any permanent noise mitigation proposals recommended be installed prior to roadworks construction.

9.2 Traffic Noise

The recommended noise mitigation scheme for implementation along the improved Castle Peak Road from So Kwun Tan to Siu Lam Interchange is the scheme presented in this report as Option 3, No Direct Mitigation at Siu Lam. The extent of the direct noise mitigation measures proposed are indicated on Figures 12 to 14 inclusive. The provision of direct mitigation measures (noise barriers and partial enclosures) is recommended for the western end of the study area (So Kwun Tan to Tai Lam village, west) where such measures are effective. No direct measures are proposed for the eastern section of the study area (Tai Lam village, east, to Siu Lam Interchange) as such measures have been found to be ineffective in controlling noise here due to the proximity of TMR to CPR. Instead, affected receivers along this section of the study area should be considered for acoustic insulation as a remedial measure. The recommended direct mitigation measures would reduce peak hour traffic noise levels to below the HKPSG criterion of 70dB(A) at approximately 130 dwelling units at which traffic noise levels would be considerably in excess of 70dB(A) were no mitigation measures installed. Even with the extensive noise barriers recommended, some 600 dwelling units would still meet the eligibility requirements for consideration for equitable redress. It is recommended that the provision of acoustic insulation measures be considered at these dwellings.

FIGURES



TUEN MUN
OUTLINE ZONING
PLAN

SO KWUN WAT
DEVELOPMENT PERMISSION
AREA PLAN

LEGEND

- OU OTHER USES
- U UNDETERMINED
- V VILLAGE TYPE DEVELOPMENT
- R(B) RESIDENTIAL CATEGORY 'B'
- GB GREEN BELT
- O OPEN SPACE
- G/IC GOVERNMENT / INSTITUTION COMMUNITY
- [Stippled Box] COMPREHENSIVE DEVELOPMENT AREA
- [Hatched Box] APPROVED RESIDENTIAL DEVELOPMENT

- LAND USE ZONINGS SOURCES
- [Dashed Line] TUEN MUN OUTLINE ZONING PLAN LIMIT
 - [Solid Line] SO KWUN WAT DEVELOPMENT PERMISSION AREA PLAN LIMIT

LEGEND

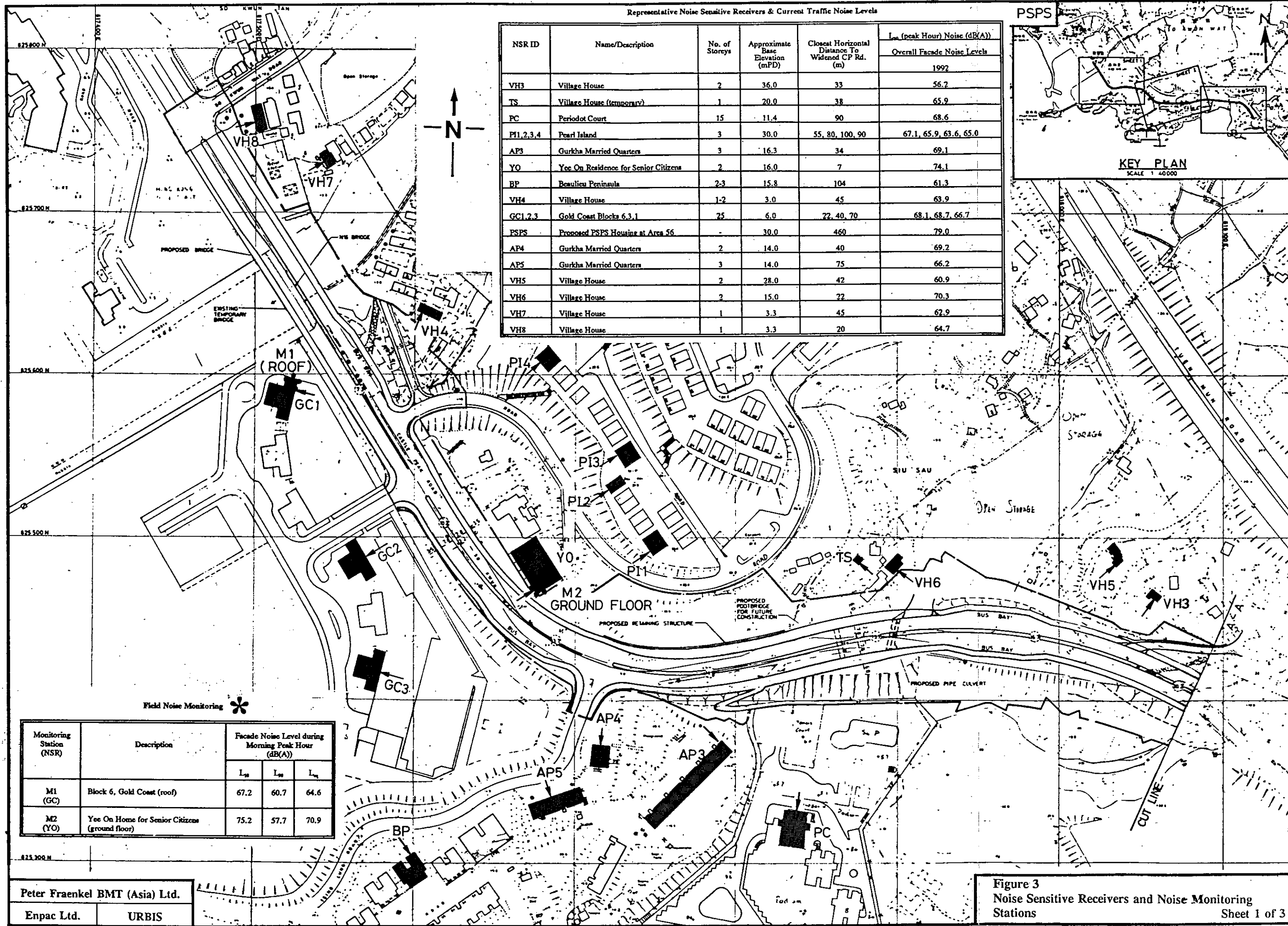
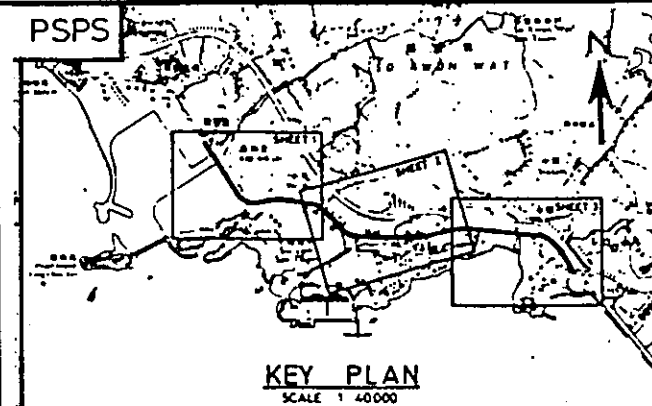
- [Dotted Line] LIMIT OF STUDY AREA
- [Hatched Box] PROPOSED ROADWORKS

Peter Fraenkel BMT (Asia) Ltd.
Enpac Ltd. URBIS

Figure 2
Study Area and Land Uses

Representative Noise Sensitive Receivers & Current Traffic Noise Levels

NSR ID	Name/Description	No. of Storeys	Approximate Base Elevation (mPD)	Closest Horizontal Distance to Widened GP Rd. (m)	L _{eq} (peak Hour) Noise (dB(A))	
					Overall Facade Noise Levels	
					1992	
VH3	Village House	2	36.0	33	56.2	
TS	Village House (temporary)	1	20.0	38	65.9	
PC	Periodot Court	15	11.4	90	68.6	
PI1,2,3,4	Pearl Island	3	30.0	55, 80, 100, 90	67.1, 65.9, 63.6, 65.0	
AP3	Gurkha Married Quarters	3	16.3	34	69.1	
YO	Yee On Residence for Senior Citizens	2	16.0	7	74.1	
BP	Beaulieu Peninsula	2-3	15.8	104	61.3	
VH4	Village House	1-2	3.0	45	63.9	
GC1,2,3	Gold Coast Blocks 6,3,1	25	6.0	22, 40, 70	68.1, 68.7, 66.7	
PSPS	Proposed PSPS Housing at Area 56	-	30.0	460	79.0	
AP4	Gurkha Married Quarters	2	14.0	40	69.2	
AP5	Gurkha Married Quarters	3	14.0	75	66.2	
VH5	Village House	2	28.0	42	60.9	
VH6	Village House	2	15.0	22	70.3	
VH7	Village House	1	3.3	45	62.9	
VH8	Village House	1	3.3	20	64.7	



Field Noise Monitoring *

Monitoring Station (NSR)	Description	Facade Noise Level during Morning Peak Hour (dB(A))		
		L ₉₀	L ₅₀	L ₁₀
M1 (GC)	Block 6, Gold Coast (roof)	67.2	60.7	64.6
M2 (YO)	Yee On Home for Senior Citizens (ground floor)	75.2	57.7	70.9

Field Noise Monitoring *

Monitoring Station (NSR)	Description	Facade Noise Level during Morning Peak Hour (dB(A))		
		L ₁₀	L ₅₀	L ₉₀
M3 (FG)	Fiona Garden (roof)	74.7	64.7	71.4
M4 (VH2)	Village House (ground floor)	70.7	52.3	66.9
M5 (KP)	Kam Po Court (3-4m above ground)	68.7	63.3	66.7

Representative Noise Sensitive Receivers & Current Traffic Noise Levels

NSR ID	Name/Description	No. of Storeys	Approximate Base Elevation (mPD)	Closest Horizontal Distance To Widened CP Rd. (m)	L ₁₀ (peak Hour) Noise (dB(A))
					Overall Facade Noise Levels 1992
CB2	Castle Peak Villas	2	25.6	13	70.9
TW	House at TWIL 23A	2	19.8	20	71.3
DM	Villa De Mer	2	12.5	49	69.3
AP2	Apartment (unnamed)	2	28.1	28	66.1
CP	Castle Peak Villa	6	15.3	122	69.2
IV	Ivanhoe Villa	3	18.0	20	74.7
FG	Fiona Garden	3	26.8	15	73.1
SG	Silvern Garden	2	22.1	51	68.1
VH2	Village House	1	20.0	29	68.6
KP	Kam Po Court	2	23.9	71	68.3
CDA	Future Comprehensive Development			100	64.4

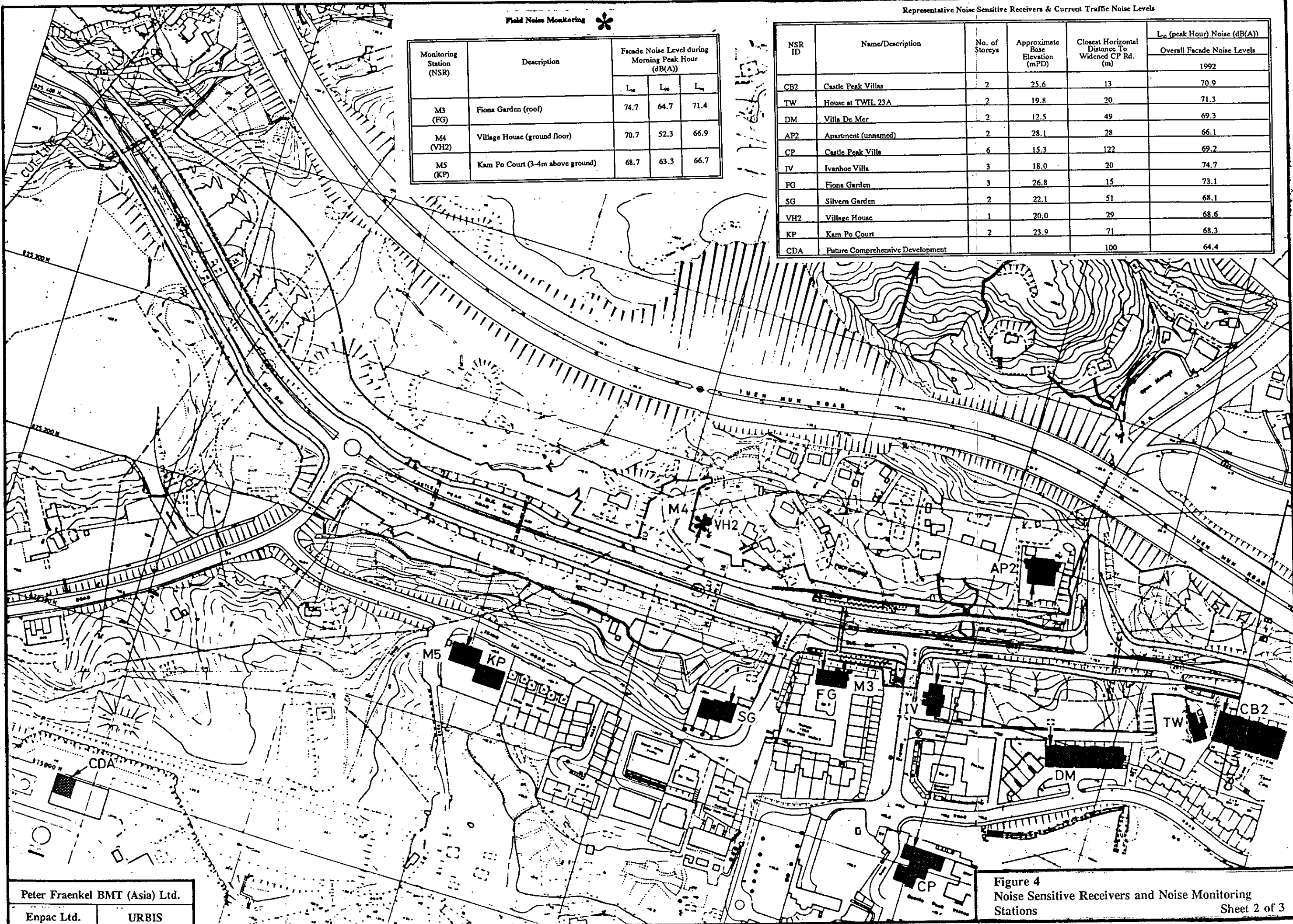
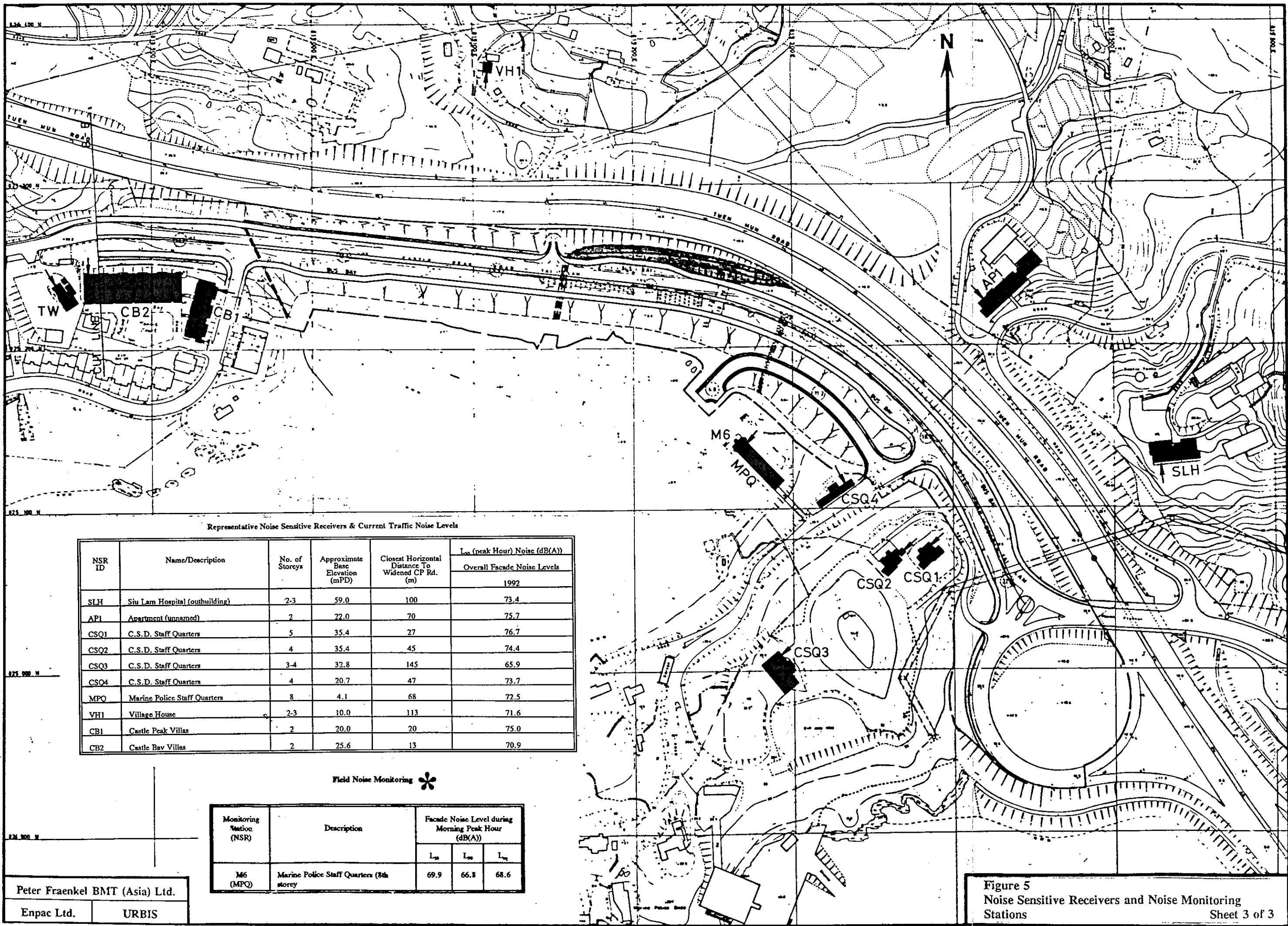


Figure 4
Noise Sensitive Receivers and Noise Monitoring Stations
Sheet 2 of 3



Representative Noise Sensitive Receivers & Current Traffic Noise Levels

NSR ID	Name/Description	No. of Storeys	Approximate Base Elevation (mPD)	Closest Horizontal Distance To Widened CP Rd. (m)	L _a (peak Hour) Noise (dB(A))	
					Overall Facade Noise Levels	1992
SLH	Siu Lam Hospital (outbuilding)	2-3	59.0	100	73.4	
AP1	Apartment (unnamed)	2	22.0	70	75.7	
CSQ1	C.S.D. Staff Quarters	5	35.4	27	76.7	
CSQ2	C.S.D. Staff Quarters	4	35.4	45	74.4	
CSQ3	C.S.D. Staff Quarters	3-4	32.8	145	65.9	
CSQ4	C.S.D. Staff Quarters	4	20.7	47	73.7	
MPQ	Marine Police Staff Quarters	8	4.1	68	72.5	
VH1	Village House	2-3	10.0	113	71.6	
CB1	Castle Peak Villas	2	20.0	20	75.0	
CB2	Castle Bay Villas	2	25.6	13	70.9	

Field Noise Monitoring *

Monitoring Station (NSR)	Description	Facade Noise Level during Morning Peak Hour (dB(A))		
		L ₉₀	L ₅₀	L ₁₀
M6 (MPQ)	Marine Police Staff Quarters (8th storey)	69.9	66.8	68.6

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 Enpac Ltd. URBIS

Figure 5
 Noise Sensitive Receivers and Noise Monitoring Stations
 Sheet 3 of 3

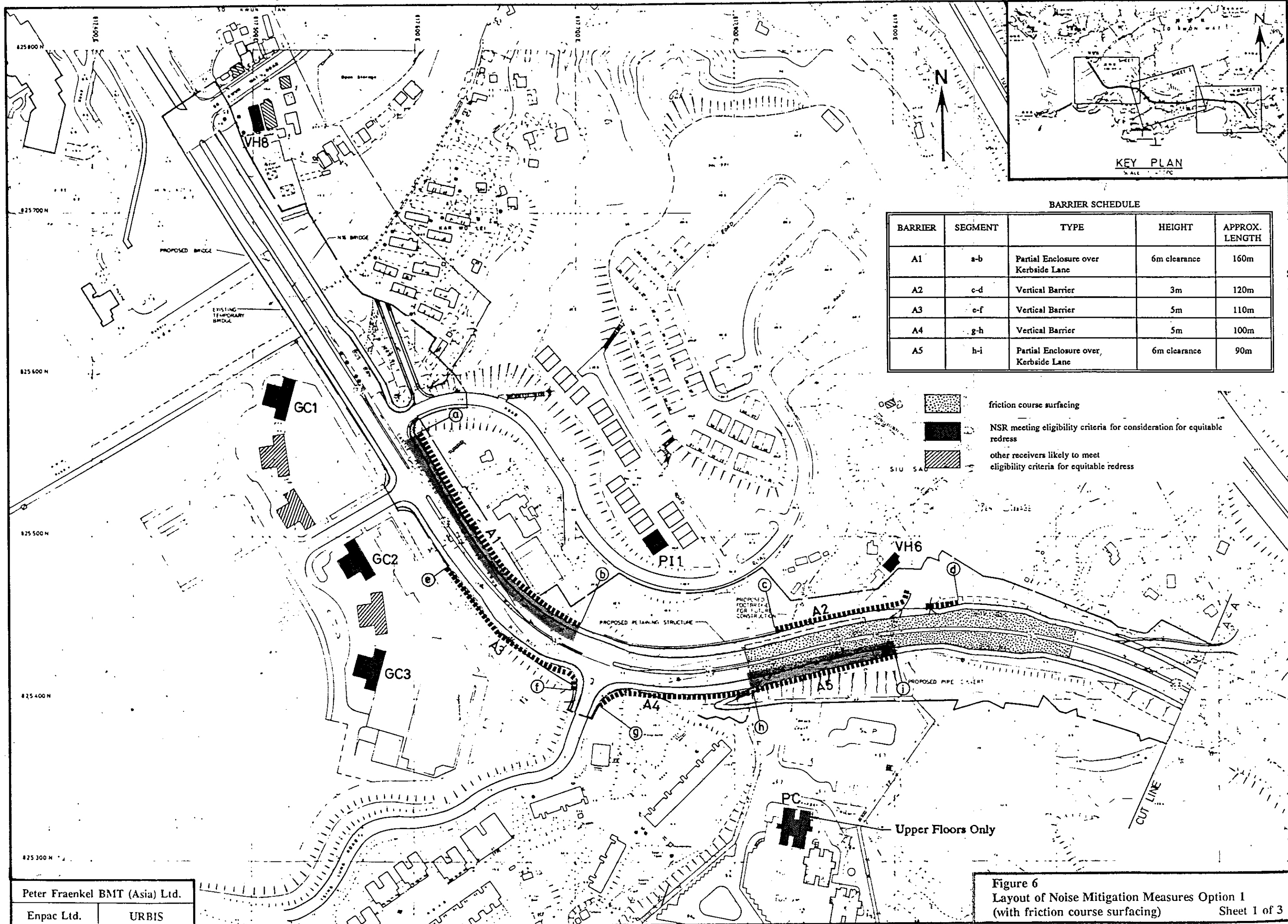
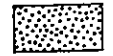


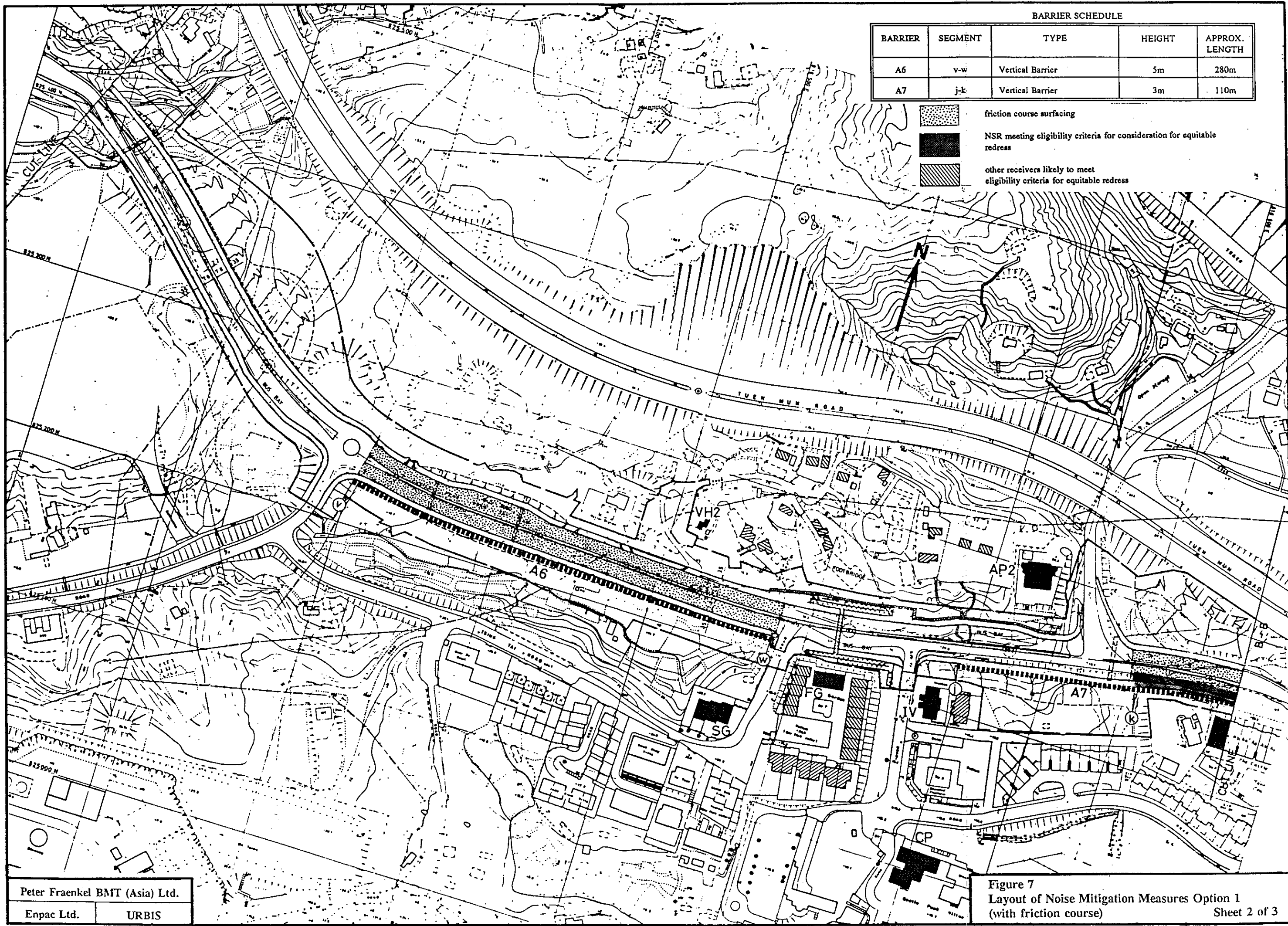


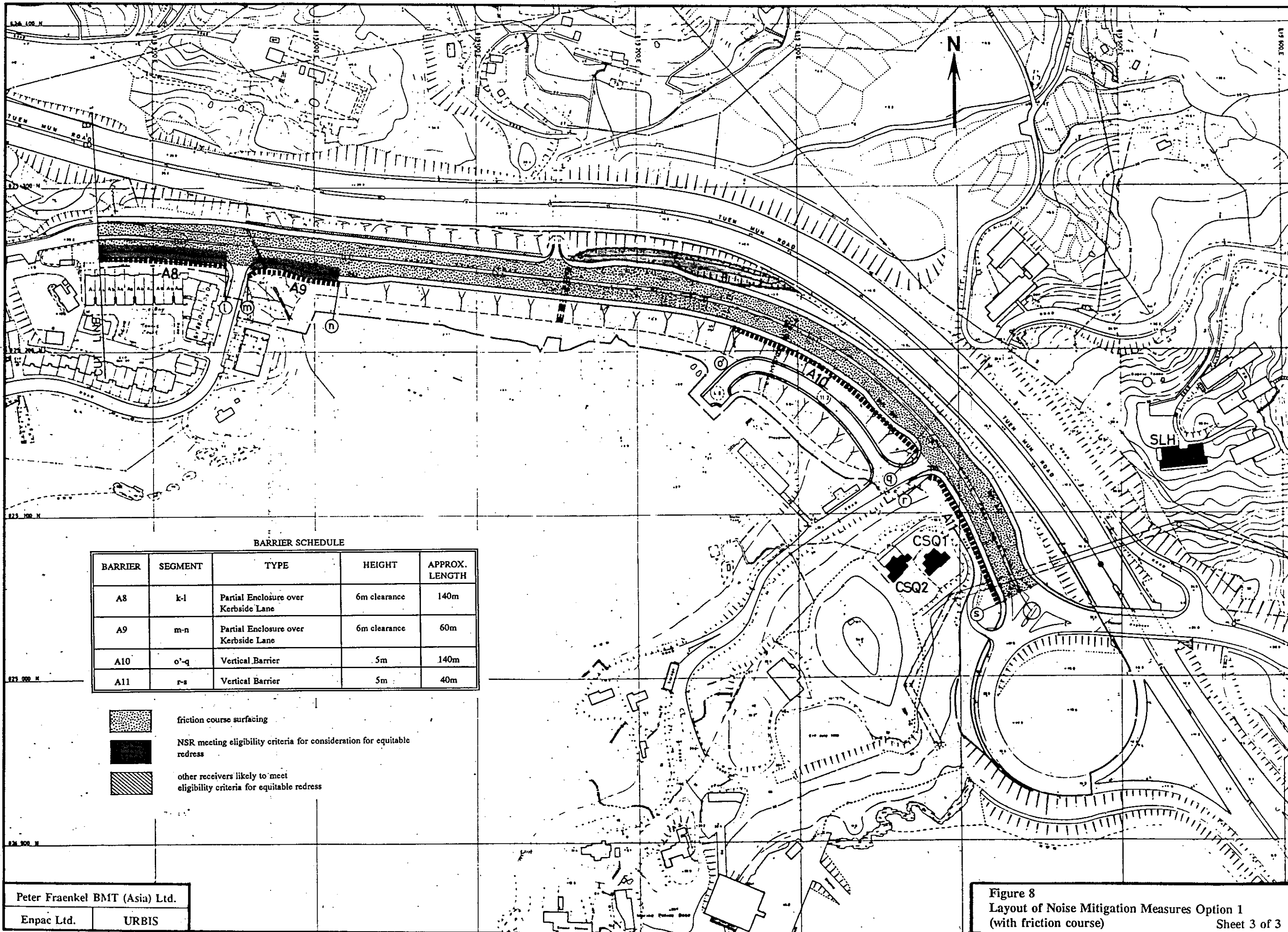
Figure 6
 Layout of Noise Mitigation Measures Option 1
 (with friction course surfacing) Sheet 1 of 3

BARRIER SCHEDULE

BARRIER	SEGMENT	TYPE	HEIGHT	APPROX. LENGTH
A6	v-w	Vertical Barrier	5m	280m
A7	j-k	Vertical Barrier	3m	110m

-  friction course surfacing
-  NSR meeting eligibility criteria for consideration for equitable redress
-  other receivers likely to meet eligibility criteria for equitable redress





BARRIER SCHEDULE

BARRIER	SEGMENT	TYPE	HEIGHT	APPROX. LENGTH
A8	k-l	Partial Enclosure over Kerbside Lane	6m clearance	140m
A9	m-n	Partial Enclosure over Kerbside Lane	6m clearance	60m
A10	o-q	Vertical Barrier	5m	140m
A11	r-s	Vertical Barrier	5m	40m



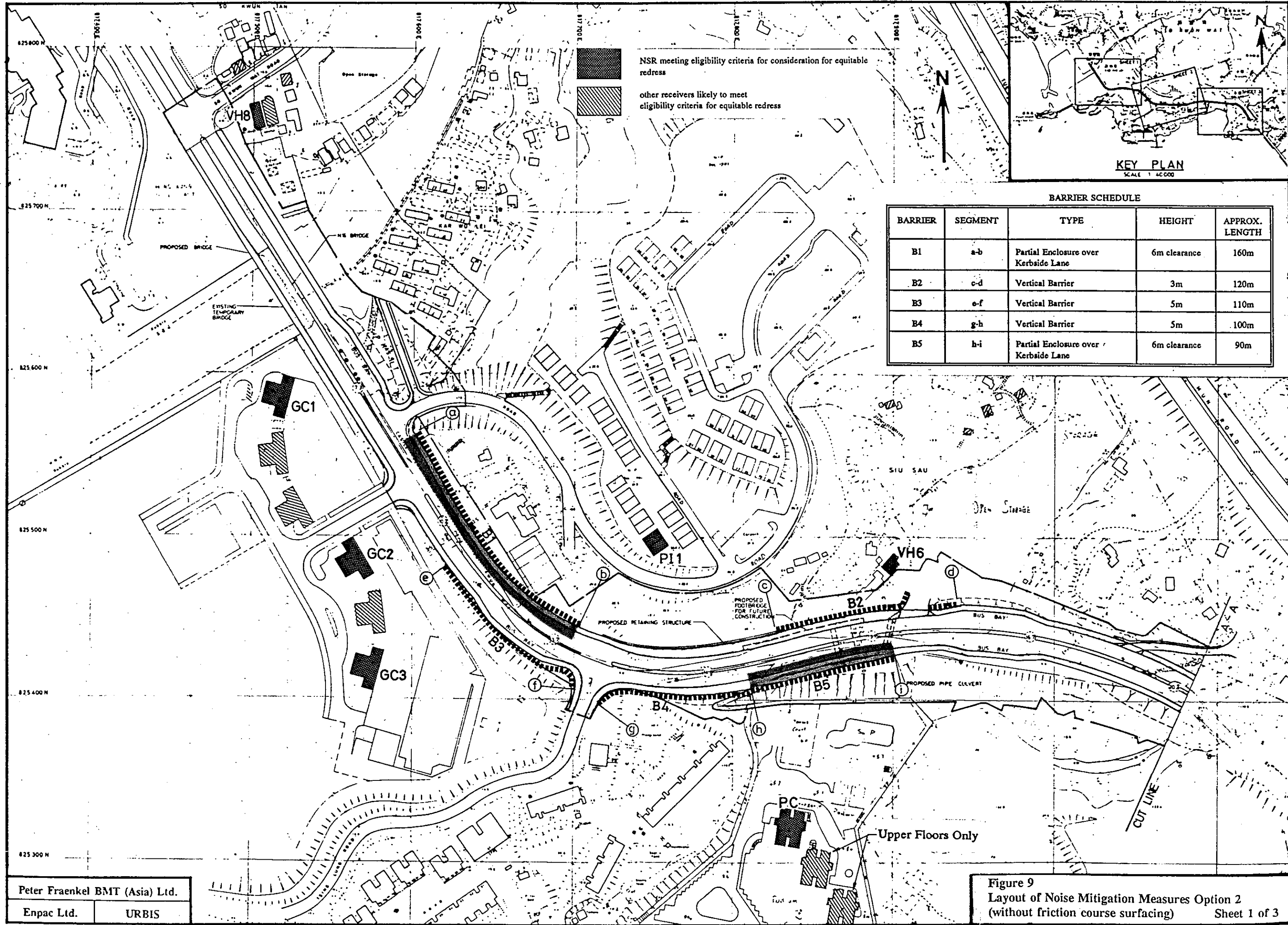
friction course surfacing



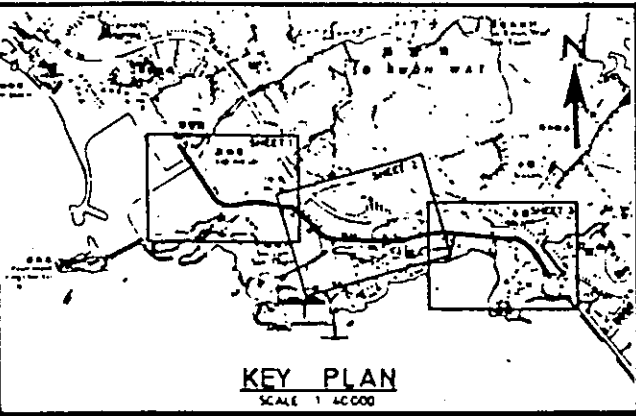
NSR meeting eligibility criteria for consideration for equitable redress



other receivers likely to meet eligibility criteria for equitable redress



NSR meeting eligibility criteria for consideration for equitable redress
 other receivers likely to meet eligibility criteria for equitable redress





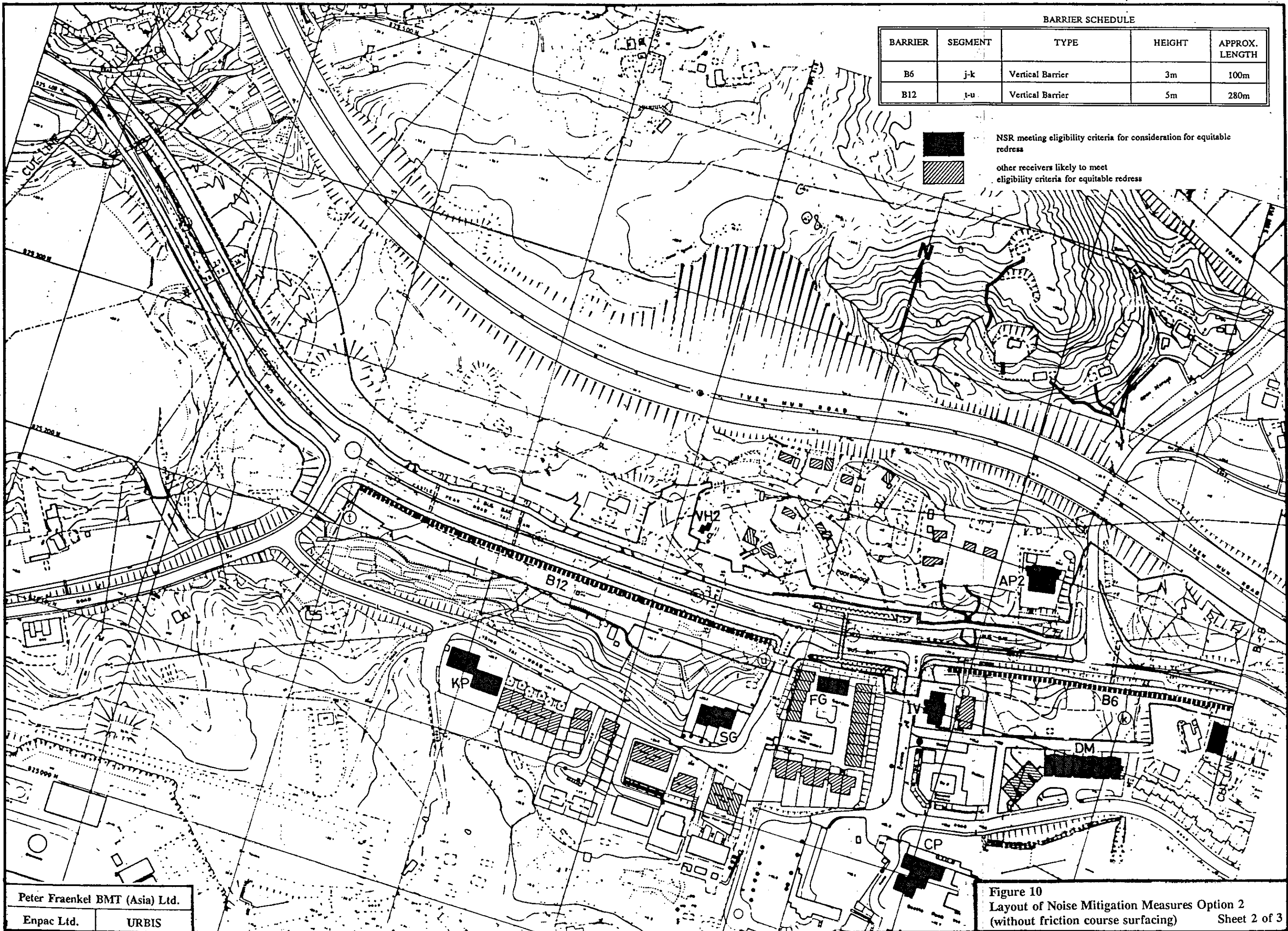
BARRIER SCHEDULE

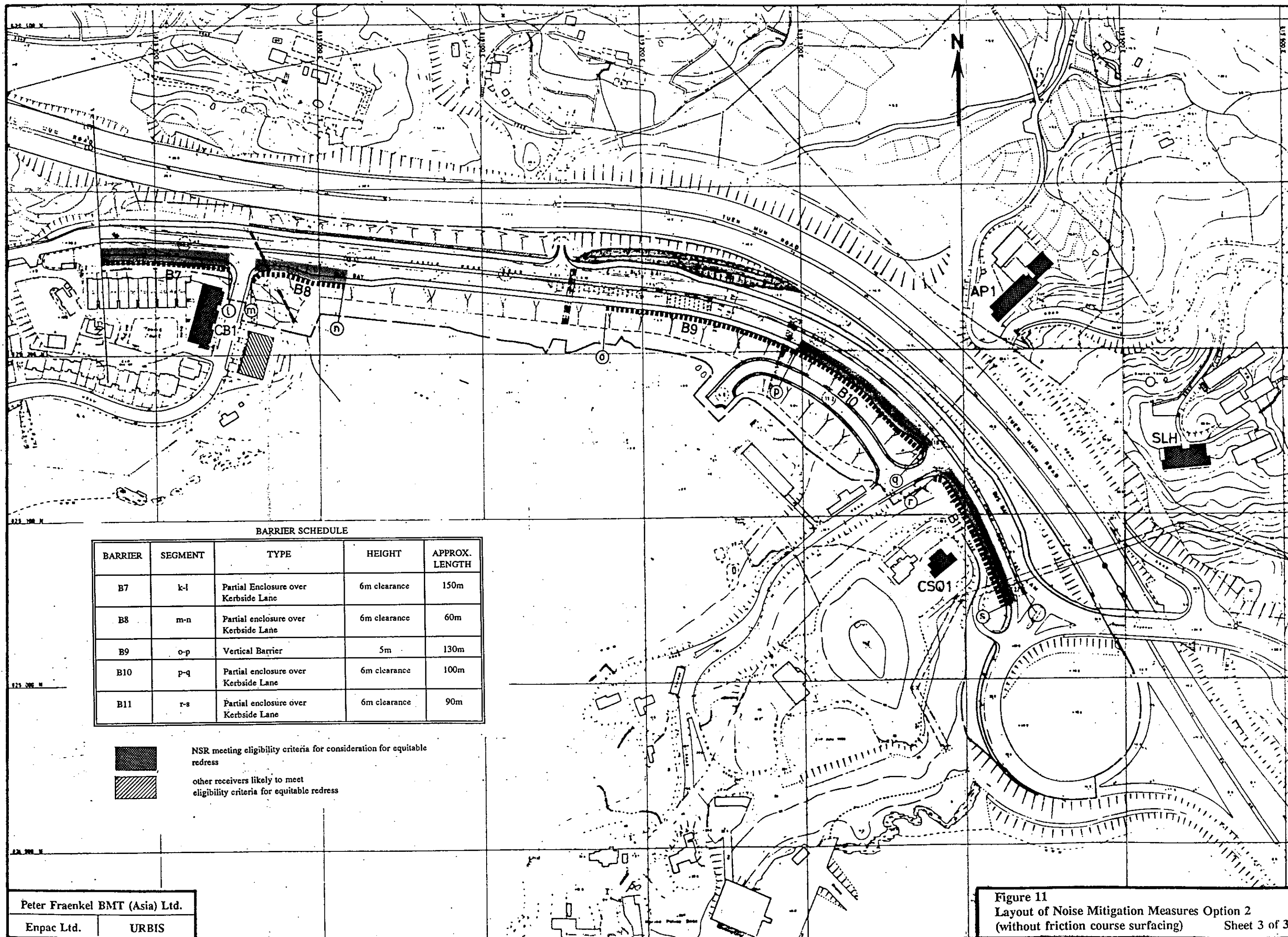
BARRIER	SEGMENT	TYPE	HEIGHT	APPROX. LENGTH
B1	a-b	Partial Enclosure over Kerbside Lane	6m clearance	160m
B2	c-d	Vertical Barrier	3m	120m
B3	e-f	Vertical Barrier	5m	110m
B4	g-h	Vertical Barrier	5m	100m
B5	h-i	Partial Enclosure over Kerbside Lane	6m clearance	90m

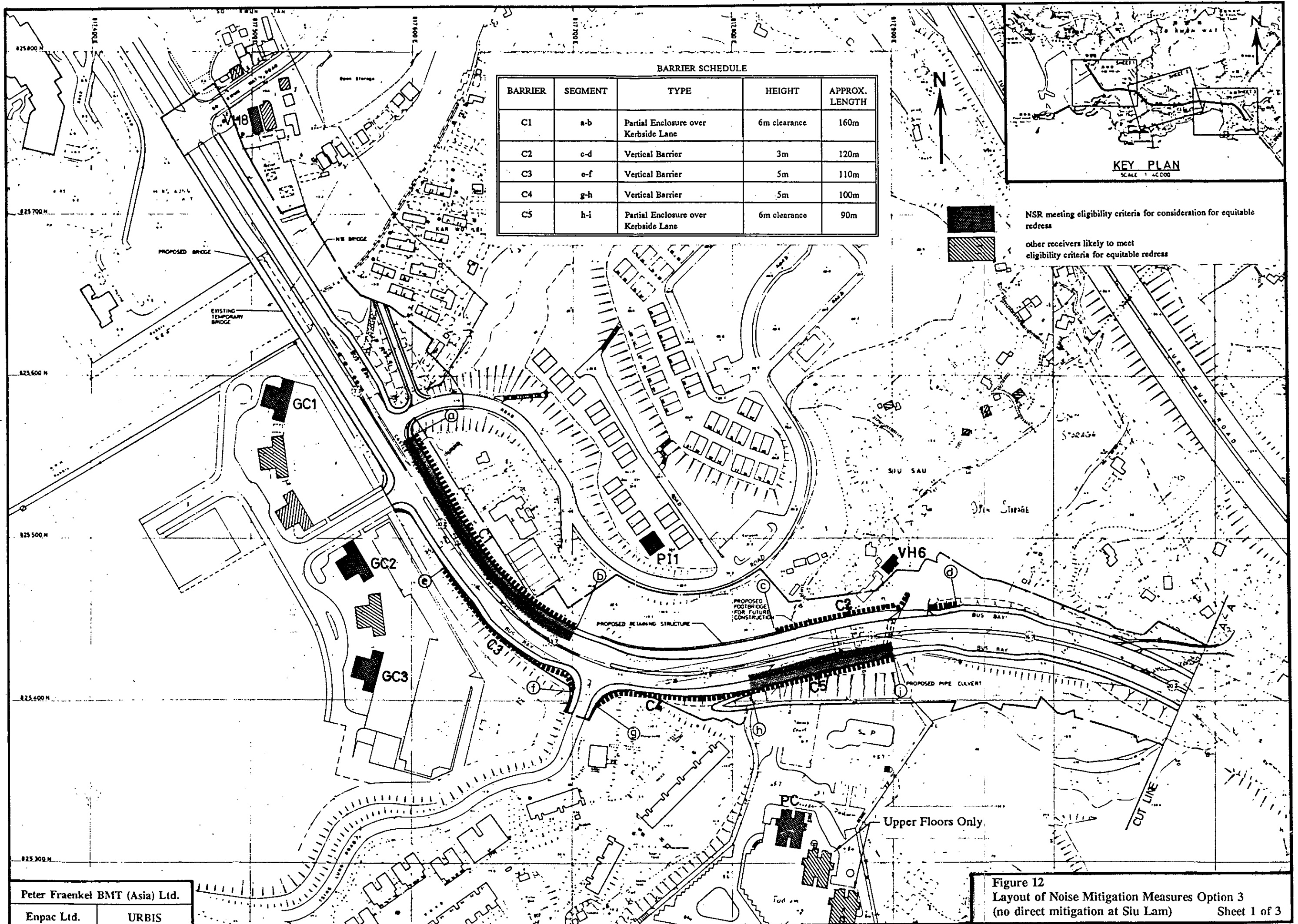
BARRIER SCHEDULE

BARRIER	SEGMENT	TYPE	HEIGHT	APPROX. LENGTH
B6	j-k	Vertical Barrier	3m	100m
B12	t-u	Vertical Barrier	5m	280m

 NSR meeting eligibility criteria for consideration for equitable redress
 other receivers likely to meet eligibility criteria for equitable redress





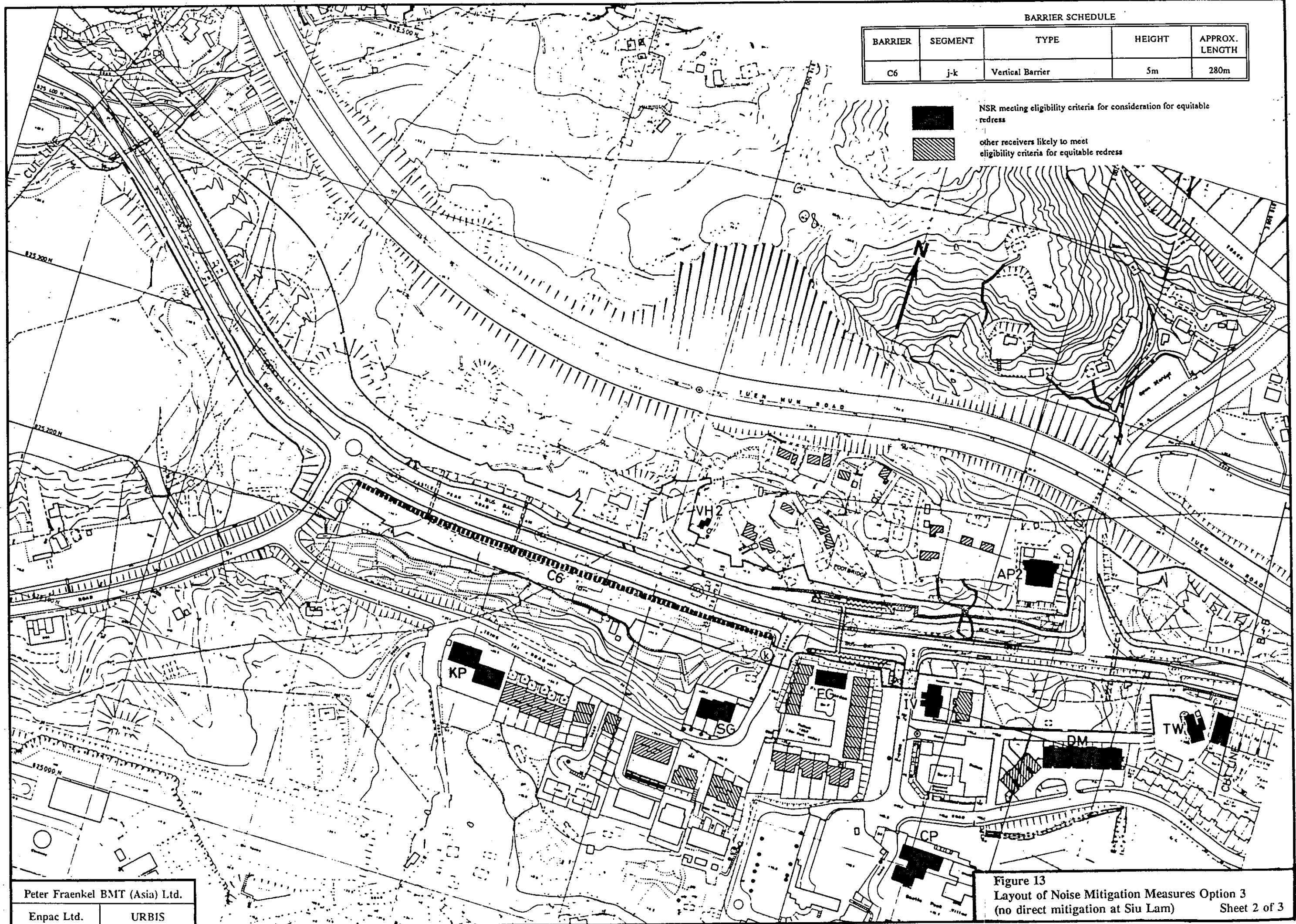


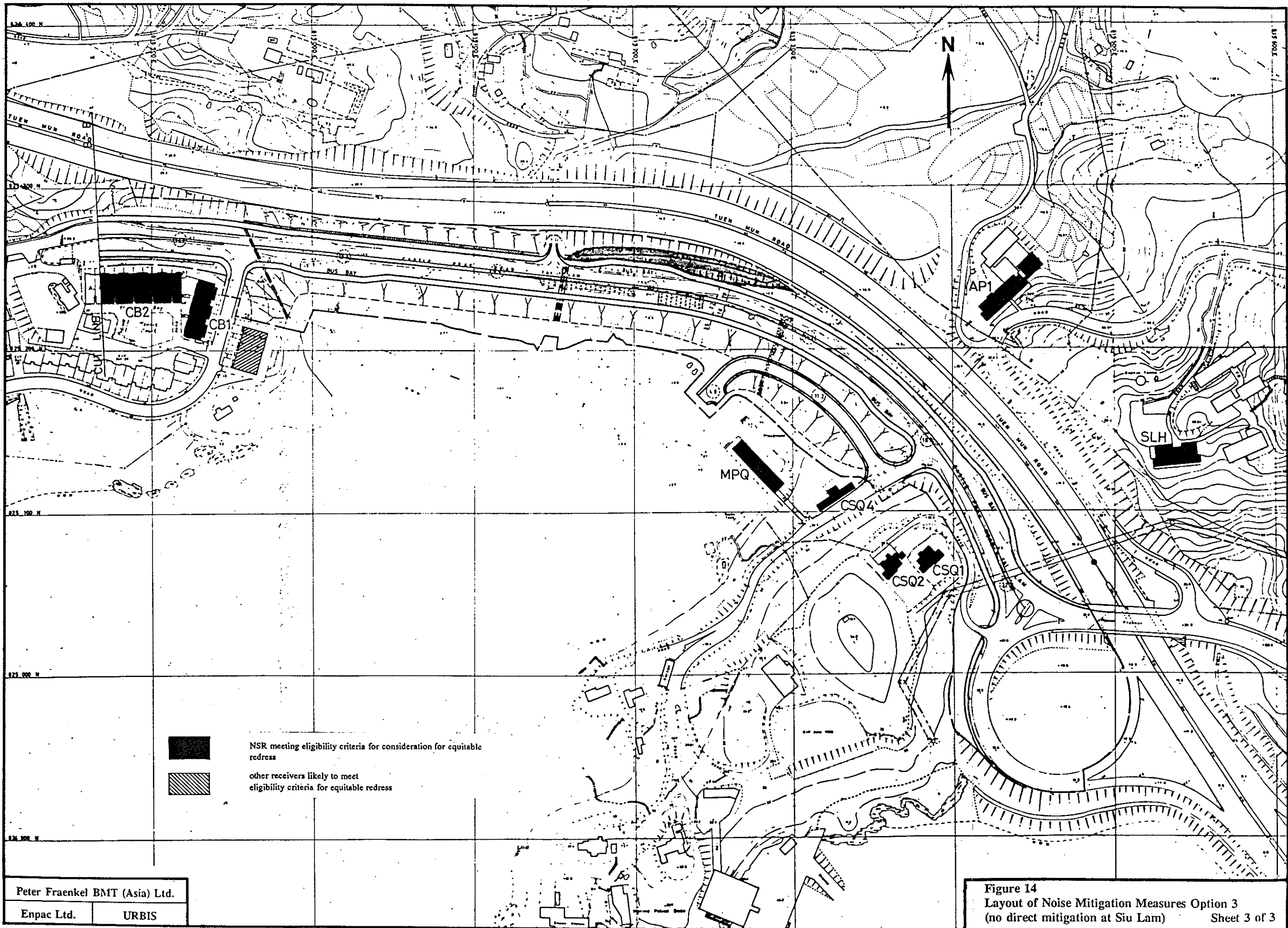


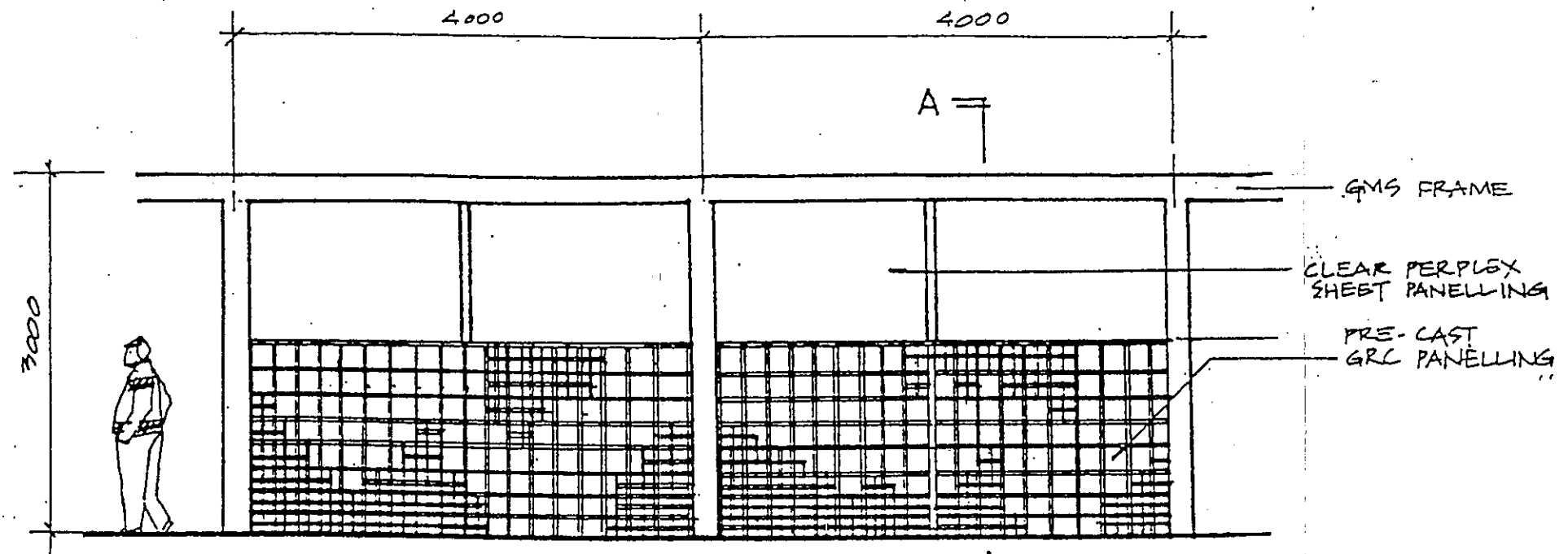
BARRIER SCHEDULE

BARRIER	SEGMENT	TYPE	HEIGHT	APPROX. LENGTH
C6	j-k	Vertical Barrier	5m	280m

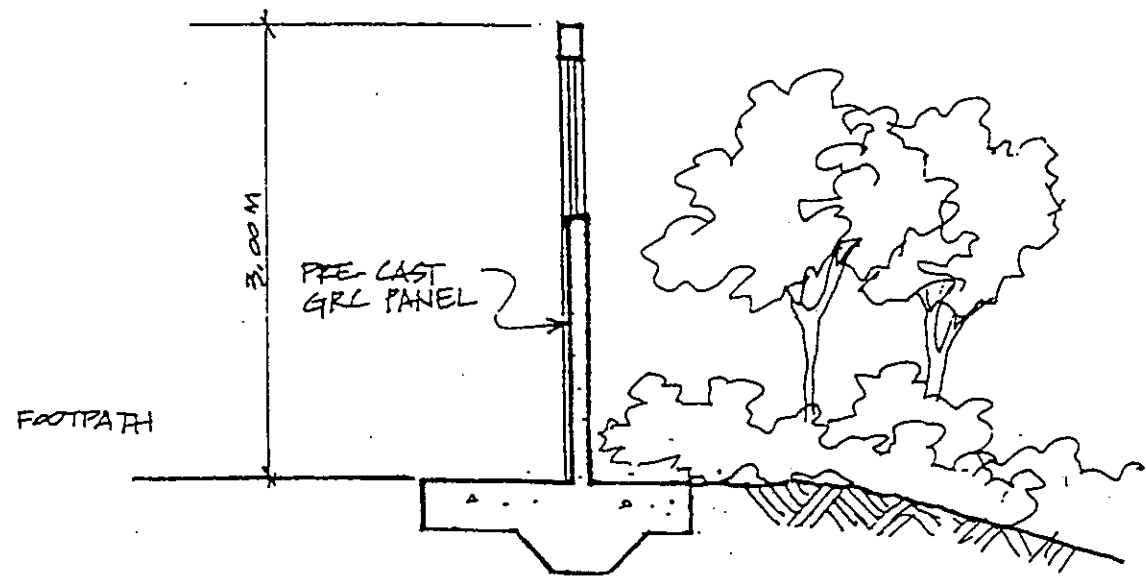
-  NSR meeting eligibility criteria for consideration for equitable redress
-  other receivers likely to meet eligibility criteria for equitable redress





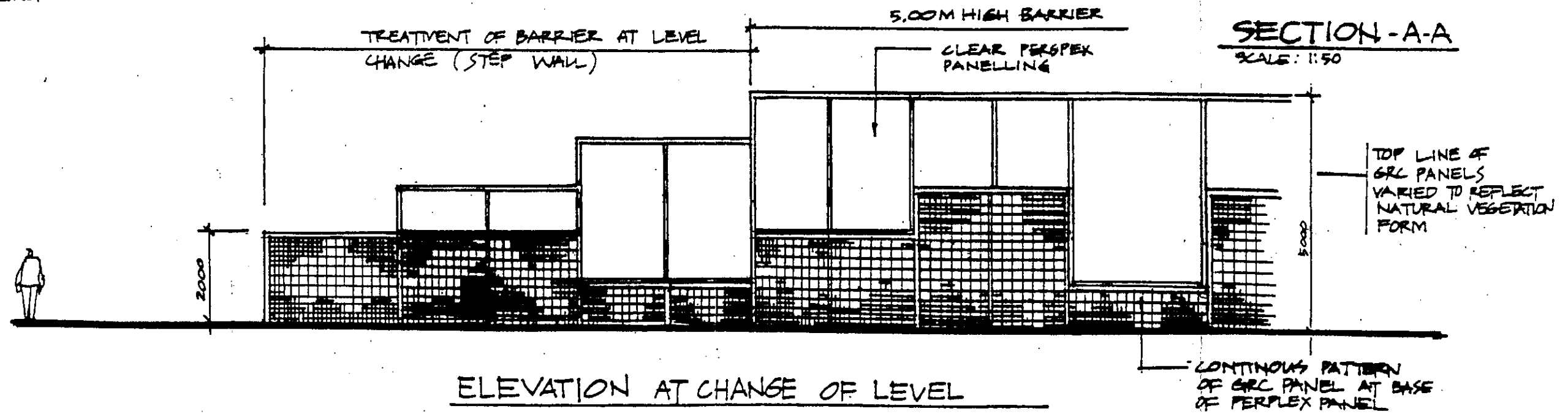
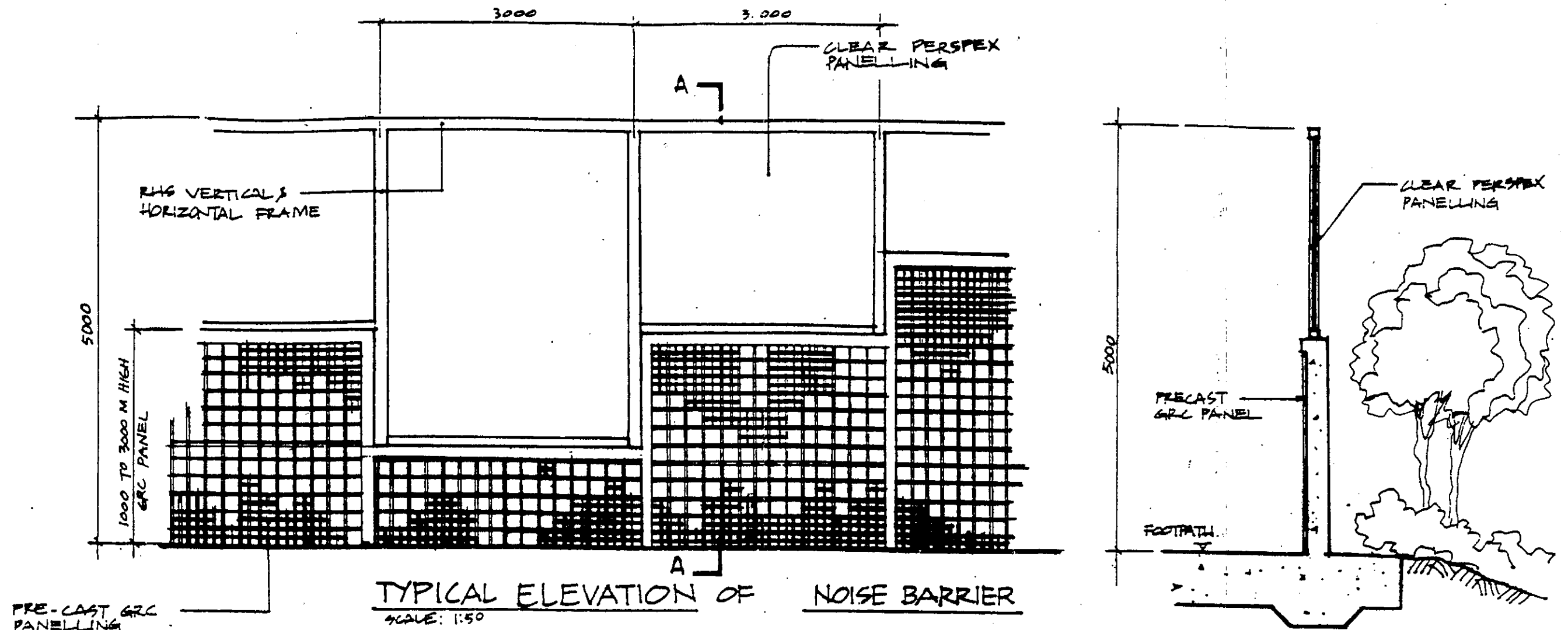


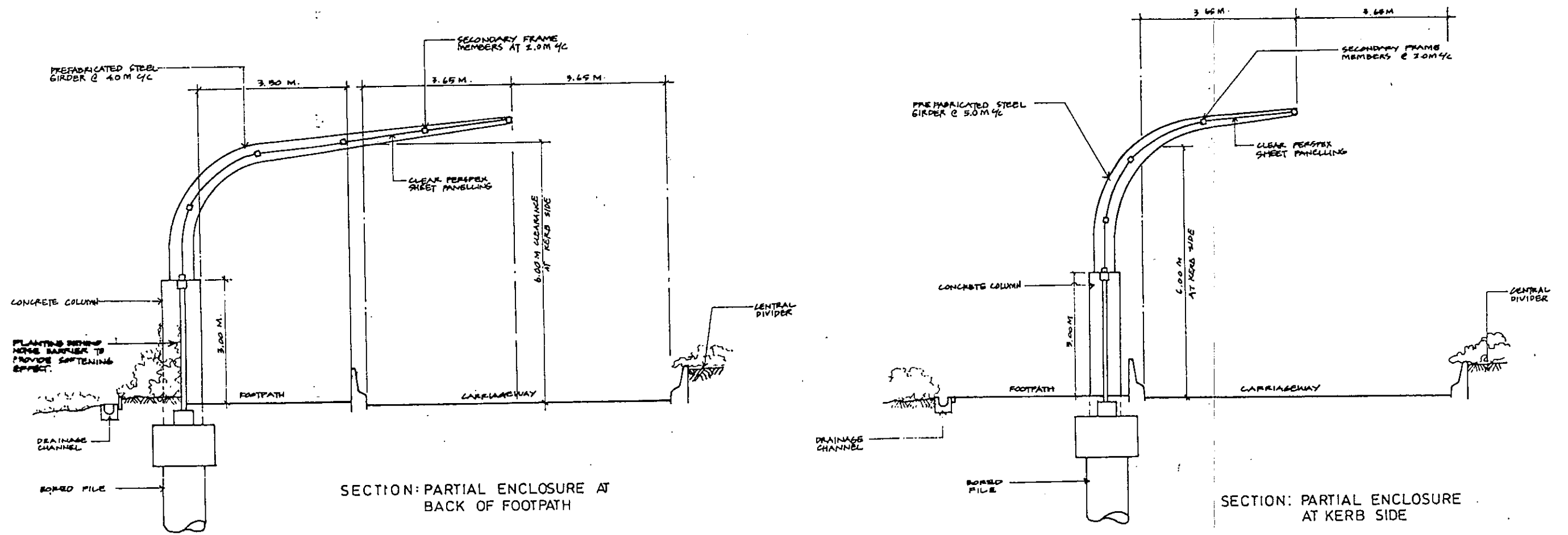
ELEVATION
1:50



SECTION - A-A
1:50

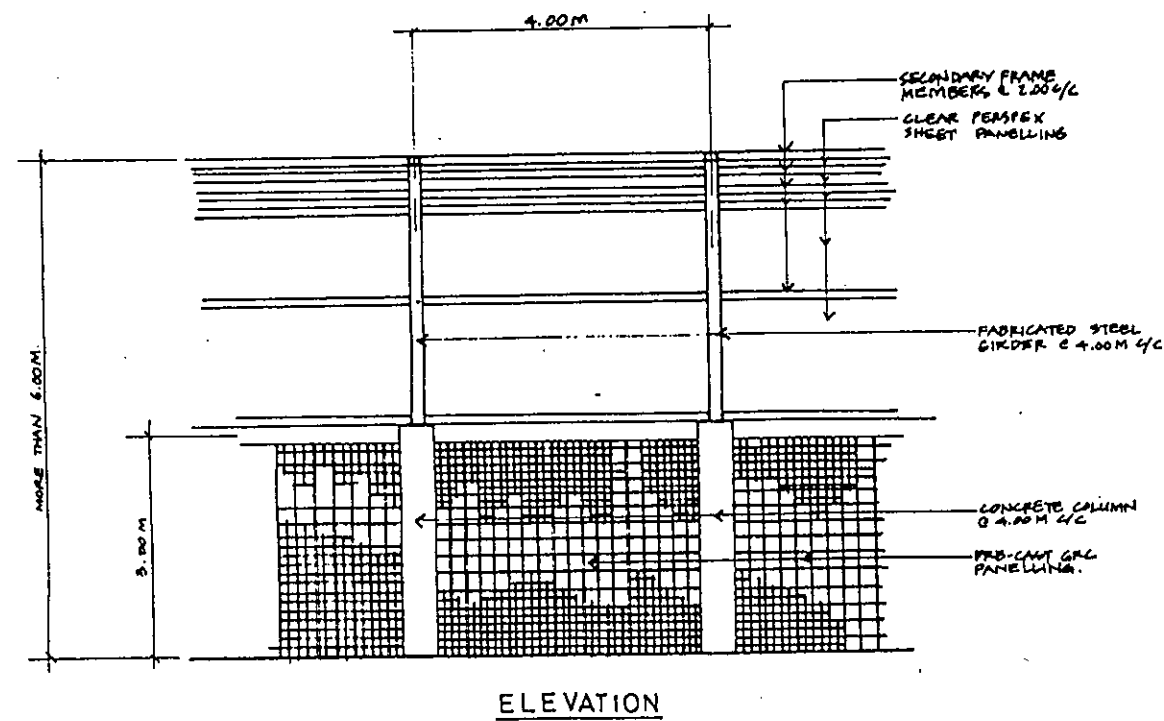
Figure 15
Visual Impact Mitigation
(Noise Barrier 3m high)





SECTION: PARTIAL ENCLOSURE AT BACK OF FOOTPATH

SECTION: PARTIAL ENCLOSURE AT KERB SIDE



ELEVATION