3 NOISE

3.1 INTRODUCTION

This section presents a detailed study of potential construction and operational noise impacts associated with the planned developments in Tuen Mun Area 54.

Noise impacts affecting the existing Noise Sensitive Receivers (NSRs) and those planned at the proposed sites will be assessed according to the standards specified in the *Environmental Impact Assessment Ordinance* (EIAO), *Noise Control Ordinance* (NCO) and their subsidiary Technical Memoranda.

Practical mitigation measures will be recommended, where necessary, to reduce the noise impacts to within stipulated limits or other appropriate guidelines. Further environmental control measures will also be explored to minimize the residual impacts. The requirements of Environmental Monitoring and Audit (EM&A) during the construction phase and operational phase will also be outlined in this section.

3.2 ENVIRONMENTAL LEGISLATION AND CRITERIA

3.2.1 *Construction Phase*

The principal legislation on the control of construction noise is the NCO. Various Technical Memoranda (TMs), which stipulate control approaches and criteria, have been issued under the NCO. The following TMs are applicable to the control of noise from construction activities:

- *Technical Memorandum on Noise from Percussive Piling* (PP-TM);
- *Technical Memorandum on Noise from Construction Work other than Percussive Piling* (GW-TM); and
- *Technical Memorandum on Noise from Construction Work in Designated Areas* (DA-TM).

Apart from the above, the EIAO also provides means to assess construction noise impacts. The *Technical Memorandum on Environmental Impact Assessment Process* (EIAO-TM), issued under the EIAO, gives guidelines and noise criteria for evaluating construction noise impacts.

Percussive Piling

Percussive Piling is prohibited at any time on Sundays and public holidays and during the weekday evening and night-time hours (1900-0700 hours, Monday through Saturday). A Construction Noise Permit (CNP) is required for such works during the weekday daytime hours (0700-1900 hours, Monday through Saturday).

When assessing a CNP application for the carrying out of percussive piling, the Environmental Protection Department (EPD) is guided by the PP-TM. The EPD will look at the difference between the Acceptable Noise Levels (ANLs), as promulgated in the PP-TM, and the Corrected Noise Levels (CNLs) in

conjunction with the proposed piling activities. Depending on the level of noise impact on nearby NSRs, the EPD would allow 3, 5 or 12 hours of daily piling time (see *Table 3.2a*).

Table 3.2a ***Permitted Hours of Operation for Percussive Piling (not involving the use of diesel, pneumatic and/or steam hammers)***

Amount by which CNL exceeds ANL	Permitted hours of operation on any day not being a holiday
more than 10 dB(A)	0800 to 0900 and 1230 to 1330 and 1700 to 1800
between 0 dB(A) and 10 dB(A)	0800 to 0930 and 1200 to 1400 and 1630 to 1800
no exceedance	0700 to 1900

For any educational institutions, hospitals or medical clinics identified for this EIA Study, the ANLs should be adjusted by a -10 dB(A) correction factor in the subsequent noise assessment, taking account of the relative noise sensitivity of these uses.

The Government is committed to phase out the use of diesel, pneumatic and steam hammer pile drivers, which are particularly noisy. Such pile drivers cannot be used after 1 October 1999. In preparation for the incoming legislative control, the Government has already (since July 1997) administratively banned the use of diesel hammers in Government projects.

As issuance of CNP by the Noise Control Authority regarding percussive piling would depend on the application submitted according to the procedures laid down in PP-TM, noise assessment with respect to percussive piling activities have been excluded in this study.

General Construction Works (during normal working hours)

Under the EIAO, noise impacts arises from general construction works during normal working hours (i.e. 0700 to 1900 on any day not being a Sunday or public holiday) at the openable windows of buildings is to be assessed in accordance with the noise criteria as given in the EIAO-TM. The EIAO-TM noise standards are presented in *Table 3.2b* below.

Table 3.2b ***EIAO-TM Daytime Construction Noise Standards ($L_{eq,\ 30\ min}$ dB(A))***

Uses	Acceptable Noise Standards
Domestic Premises	75
Hotels and Hostels	75
Educational Institutions (school hours)	70
Educational Institutions (during examination periods)	65

Practicable direct mitigation measures would be recommended, where appropriate, to ensure that the noise levels are reduced to within the noise standards.

3.2.2 *Operational Phase*

Road Traffic Noise

The assessment of road traffic noise during the operational phase of the project is within the scope of EIAO-TM. The relevant criteria are shown in *Table 3.2c*.

Any road traffic noise levels, predicted at 1m from the sensitive façades of any noise sensitive premises and exceed these criteria are considered to be causing adverse environmental impacts. Practicable direct mitigation measures would be recommended, where appropriate, to ensure that the noise levels are reduced to within the noise standards.

Table 3.2c ***EIAO-TM Road Traffic Noise Standards***

Uses	Road Traffic Noise ($L_{10, (1\ hr)}$ dB(A))
Domestic Premises	70
Educational institutions	65
Places of public worship and courts of law	65
Hospitals	55

Fixed Noise Sources

Noise from fixed sources, including that from industrial-type establishments, is governed by the EIAO-TM and *Technical Memorandum for the Assessment of Noise from Places Other Than Domestic Premises, Public Places or Construction Sites* (IND-TM). The EIAO-TM stated that the level of the intruding noise at external façade of the nearest sensitive use should be at least 5 dB(A) below the appropriate ANL shown in the IND-TM or, in the case of background being 5 dB(A) lower than the ANL, should not be higher than the background.

The IND-TM states that ANLs for fixed noise sources depending upon the sensitivity of the area where the NSR is located and the relevant ANLs are shown in *Table 3.2d*.

Table 3.2d ***Acceptable Noise Levels for Fixed Noise Sources ($L_{eq, 30\ min}$ dB(A))***

Time Period	Area Sensitivity Rating		
	A	B	C
Day and Evening (0700 to 2300 hours)	60	65	70
Night (2300 to 0700 hours)	50	55	60

The existing land use in Tuen Mun Area 54 is considered to be composed of low-rise or village type developments. According to the IND-TM, the Study Area is classified to be Area Type (iv) (Area other than those above) and is not affected by any Influencing Factors. As a result, an Area Sensitivity Rating of B is assigned to the NSRs lie within the Study Area. For planning purposes, the noise limit during the daytime and evening periods will be 60 dB(A) and 50 dB(A) during the night-time.

In any event, the ASR assumed here is for indicative assessment only given, for example, the details of the plant layout are not yet available and the buildings layout is only provisional. It should be noted that fixed noise sources are controlled under Section 13 of the NCO. Nothing in this report shall bind the Noise Control Authority in assessing noise from these sources upon the receipt of complaints. The Authority shall assess the noise impacts based on the contemporary conditions/situations.

Rail Noise

Rail noise, including the noise from West Rail and from the future Light Rail Transit (LRT), if built, is governed by the IND-TM. Besides, the EIAO-TM also provided guidelines on noise assessment, including that the level of intruding noise at the external façade of sensitive use should not exceed the appropriate ANLs given in the IND-TM (see *Table 3.2d* above) and L_{max} levels during the period of 2300-0700 hours should not exceed 85 dB(A).

3.3 DESCRIPTION OF THE ENVIRONMENT

3.3.1 *Baseline Conditions*

The context of existing environs of the Study Area is rural in nature. Village type developments, small plots of agricultural land, open storage yards and isolated small industrial establishments are found within the Study Area.

Existing noise sources contributing to the background noise level of the Study Area are identified to be:

- operational noise from open storage yards;
- noise from fixed plant or industrial premises, located at the north-eastern part of the site and from the southern Castle Peak Hospital and Tuen Mun Hospital; and
- traffic noise from existing access roads and the nearby road network.

Noise from open storage yards is characterised by the intermittent noise when there are loading and unloading operations. These areas will be removed for housing developments in the future, therefore noise impacts from these areas will not exist to pose an effect on the future sensitive uses.

As advised by the Planning Department, a Section 16 application of a housing development in an area located north of the proposed distributor road, Road D7 has been granted by the Town Planning Board. *Figure 3.3a* shows the location of this housing development site. It is understood that this development is planned for a total of 123 low rise houses and the nearest NSR of this proposed development is about 120 m from the proposed Road D7.

In addition, the Town Planning Board has agreed to rezone the area around San Hing Tsuen to the north of the proposed Road D7, i.e. the north-eastern part of the site, from "Industrial (Group D)" to "Residential (Group E)(R(E))" on the draft Lam Tei and Yick Yuen Outline Zoning Plan No. S/TM/LTYY/1. The proposed rezoning is to phase out industrial use in San Hing Tsuen. Hence, noise impacts from the fixed plants at San Hing Tsuen on the planned developments would not

be anticipitated in the future. *Figure 3.3a* also shows the location of this rezoning area.

Observation from site visits revealed that noise from fixed plant or industrial premises at Castle Peak Hospital and Tuen Mun Hospital are not prominent to cause a nuisance to the future sensitive uses within the Study Area. *Table 3.3a* below presents the results from a noise survey undertaken in Tuen Mun areas. Sampling locations are given in *Figure 3.3b*.

Table 3.3a ***Noise Survey Results***

Location	L_{10}, dB(A)	L_{90}, dB(A)	L_{eq}, dB(A)	Remarks
Tuen Mun Hospital(M1)	69	55	65	Traffic noise was the dominant source
Castle Peak Hospital(M2)	59	55	58	

Measurement results indicated that the dominant source at Tuen Mun Hospital was the traffic on the local road network. Noise impacts arising from fixed plants or industrial premises are considered minimal.

3.3.2 *Future Conditions*

The future noise climate will be dominated by the traffic both from roads and from railway developments. Potential noise sources in the future operational phase include:

- operational train noise of West Rail, the alignment of which runs alongside the Tuen Mun Nullah;
- operational noise from the future LRT development within the reserved area; and
- traffic noise from the proposed distributor road, internal estate roads and other improved/widened access roads within Tuen Mun Area 54.

Based on the findings in *West Rail - Final Assessment Report: West Kowloon to Tuen Mun Centre - Environmental Impact Assessment* (EIAO Register Ref. No. EIA-149/1998), the operational train noise of West Rail will be screened by Siu Hong Court and that planned developments within the Study Area would not be impacted by rail noise.

3.4 *IDENTIFICATION OF SENSITIVE RECEIVERS*

Representative NSRs, as defined in EIAO-TM and NCO, have been identified for the assessment of noise during construction and operational phases. All domestic premises, hotel, library, court of law, performing art centres, place of worship, medical clinic, educational institution and temporary housing accommodation are considered as NSRs. *Table 3.4a* lists all representative NSRs. Locations of the NSRs are shown in *Figure 3.4a*.

Table 3.4a *Identified Representative Noise Sensitive Receivers*

NSR	Description	Construction Phase	Operational Phase
N1	Planned Joint User G/IC Development (Site 5) (indoor games hall, clinic and social welfare facilities)	✗	✓
N2	Planned SH at Site 1	✓	✓
N3	Planned Educational Uses at Site 1A	✓	✓
N4	Po Tong Ha	✓	✓
N5	Village House (north of Tsz Tin Tsuen) (future village zone)	✓	✓
N6	Tsz Tin Tsuen	✓	✓
N7	Siu Hang Tsuen	✓	✓
N8	Planned Public Rental Estate at Site 2	✗	✓
N9	Planned Educational Uses at Site 4A (next to PRE site)	✗	✓
N10	Planned Educational Uses at Site 4A (next to HOS site)	✗	✓
N11	Kei Lun Wai	✓	✓
N12	Planned HOS at Site 4	✗	✓
N14	Planned PSPS at Site 3	✗	✓
N15	Planned G/IC Development at Site 6 (Government Farm)	✗	✓
N16	Vertical Interim Housing Development (Area 29)	✓	✓
N17	Goodrich Garden and Blossom Garden	✓	✓
N18	Siu Hin Court	✓	✓
N19	Existing low-rise residential buildings next to Castle Peak Hospital	✓	✓
N20	Castle Peak Hospital	✓	✓
N21	Tuen Mun Government School	✓	✓
N22	Siu Hong Court	✓	✓
N23	Yau Tze Tin Memorial College	✓	✓
N24	San Hing Tsuen	✓	✓
N24A	Village House, south of San Hing Tsuen	✓	✓
N25	Approved Section 16 Application Housing Development	✓	✓
N26	Rezoning Area south of San Hing Tsuen	✗	✓
N27	Village extension area north of Po Tong Ha	✓	✓

In addition to the four existing villages within the Study Area, other NSRs mainly of residential, educational and medical uses located within 300m from the Study Area boundary have been included in the construction phase assessment as they would be impacted by construction works in conjunction with the planned developments.

The future planned noise sensitive uses will mainly consist of residential developments (the high-rise residential estates, the village zone to the north of Tsz Tin Tsuen and the village extension area north of Po Tong Ha), educational institutions and G/IC developments. Road traffic noise assessment will focus on the planned sensitive uses and existing developments in the vicinity of the proposed distributor road. The assessment of road traffic noise at existing NSRs with considerable buffer distances has been excluded as the impact from the new distributor road on these NSRs is expected to be low. Local access roads, estate roads or village accesses would not be assessed as it is envisaged that traffic flows on these roads would not be high. Hence, these local roads would have limited potential for noise impacts.

As the approved Section 16 application housing development site is located within 300 m from the Study Area boundary, assessment of construction and operational noise impacts for this development site have also been included in this EIA Study.

It is expected that the construction works in Tuen Mun Area 54 will be completed before the occupation of NSR N26 (the rezoning area located south of San Hing Tsuen), and thus construction noise impact would not be assessed for this NSR.

As no NSRs have been identified in the New Life Farm during site visit, it has been excluded from the noise impacts assessment.

3.5 *IDENTIFICATION OF IMPACTS*

3.5.1 *Construction Noise*

Potential source of noise during construction phase is the use of Powered Mechanical Equipment (PME) on site for each activity during different construction stages. The main construction activities in the implementation programme are planned to be undertaken between July 2002 and April 2008. The preliminary construction works programme for developing Tuen Mun Area 54 is presented in *Figure 3.5a*.

The works will be divided into two phases: Phase 1 (or Development Package 1) which includes building construction at Site 1 and road construction from Tuen Mun Area 29 up to Site 1 and; Phase 2 (or Development Package 2) which includes building construction works within Sites 2, 3 and 4 and road construction extended up to Lam Tei Interchange. Phasing of construction works are outlined as follows:

- Phase 1 site formation works and road construction, July 2002 to July 2004;
- Phase 1 piling works and building construction, April 2003 to March 2006;
- Phase 2 site formation works and road construction, October 2003 to August 2007; and
- Phase 2 piling works and building construction, April 2005 to April 2008.

Major construction works and activities likely to pose noise impacts on existing NSRs are:

- site formation for road construction and building works;
- superstructure construction; and
- road construction and drainage/utility works.

The assumed plant inventory for each construction activity during Phase 1 and Phase 2 works is indicated in *Table 3.5a*. The plant inventory represents only the number of plant that is in use simultaneously at any one time during the various stages of the development. They do not represent the number of plant that will exist at each construction site. The proposed plant inventory is adequate and would meet the intended project implementation programme.

Table 3.5a ***Assumed Plant Inventory for Phase 1 and 2 Construction Works***

Construction Stage/Activity	Plant	No. used in Phase 1	No. used in Phase 2
Site Formation	Breaker (mass > 35 kg)	1	3
	Air compressor	1	3
	Excavator	1	3
	Lorry	1	3
Roadworks			
• Excavation	Excavator	1	1
	Lorry	1	1
	Breaker (mass > 35 kg)	1	1
	Air compressor	1	1
• Placement of Road Base	Lorry	1	1
	Compactor, vibratory	1	1
	Loader	1	1
• Kerbing	Concrete Lorry Mixer	1	1
	Poker Vibrator	1	1
• Levelling of New Road	Grader	1	1
	Bulldozer	1	1
• Road Paving	Asphalt Paver	1	1
	Road Roller	1	1
	Vibratory Roller	1	1
	Lorry	1	1
Superstructure Construction			
• Piling	Bored Piling rig	1	3
• Concreting Works	Concrete Lorry Mixer	1	3
	Poker Vibrator	1	3
• Formwork and Reinforcement	Mobile Crane	1	3

Construction Stage/Activity	Plant	No. used in Phase 1	No. used in Phase 2
	Air Compressor	1	3
	Winch (pneumatic)	1	3
	Bar bender and cutter	1	3
	Saw, circular, wood	1	3
• Material Handling	Tower Crane	1	3
	Mobile Crane	1	3
	Hoist, passenger/material	1	3
Drainage/Utility Works			
• Trench Excavation	Excavator	1	1
	Lorry	1	1
• Preparation of Formation	Breaker (mass > 35 kg)	1	1
	Air Compressor	1	1
• Pipe/utility installation	Mobile Crane	1	1
• Construction of Manhole	Concrete Lorry Mixer	1	1
	Poker Vibrator	1	1
• Backfilling	Loader	1	1
	Roller, vibratory	1	1

Construction noise assessment has been undertaken and is described in *Section 3.7.1.*

3.5.2 *Road Traffic Noise*

During the operational phase, road traffic noise will be the dominant noise source within the Study Area and potentially affecting both the existing and planned noise sensitive developments. Sources of noise within Tuen Mun Area 54 are identified to be road traffic on the proposed distributor road, internal estate roads and other local access roads. As mentioned in *Section 3.4*, it is envisaged that the dominant noise source would be the traffic on the new distributor road while the traffic flow on local access roads, estate roads or village accesses would be low. Hence, these local roads would have limited potential for noise impacts. Notwithstanding the above, local roads are often characterised by high level of roadside activities with building developments located in close proximity. This often renders the implementation of noise barriers impractical.

Tsing Lun Road, Ming Kum Road and Tsun Wen Road, which fall outside Tuen Mun Area 54, are also sources of traffic noise affecting the future high-rise residential uses in Sites 2, 3 and 4. The predicted future traffic volume on these roadways is large and with high percentage of heavy vehicles in the traffic stream.

Moreover it is proposed as junction improvements that the existing Tsing Lun Road will be widened from 2 lanes to 4 lanes (for the section from Lam Tei to Site 2 Access). In connection with this change, the future Tsing Lun Road will be

considered as a new road and thus noise impacts arising from this proposed widening will be assessed.

Noise from Tuen Mun Road, Castle Peak Road and Yuen Long Highway is envisaged to be screened by the existing Siu Hong Court and the effect from these roadways on sensitive uses in Tuen Mun Area 54 will be limited. As such, these roadways are excluded in the modelling assessment.

Assessment of road traffic noise, with the main focus on traffic noise impacts associated with the new distributor road and the proposed widening section of Tsing Lun Road, has been undertaken and is described in *Section* 3.7.2 of this report.

3.5.3 *Fixed Noise Sources*

Fixed noise sources within Tuen Mun Area 54 would include the planned sewage pumping station at Site 2 and the proposed public transport interchanges (PTIs) in Sites 2 and 3. Noise impact on nearby low-rise and high-rise NSRs would be likely if noise emissions from these sources are uncontrolled.

For the proposed sewage pumping station, it is anticipated that noise emanating from exhaust vents, louvres or any vibrating surface and machinery can be sufficiently controlled by the installation of suitable acoustic louvres, silencers, dampers and noise absorptive lining. With the noise limits mentioned in *Section* 3.2.2 taken into account for the design of the sewage pumping station, noise impact from this source would be minimal.

The proposed PTIs in Sites 2 and 3 are covered and located under the proposed commercial centre. Noise from PTI operations would therefore be sufficiently screened. In addition, suitable acoustic treatment is expected to be incorporated into the design of the PTIs and therefore, noise impact is not expected from the PTIs during the operational phase. The ingress and egress of the PTIs shall be located away from the nearby noise sensitive developments.

Based on the above assumptions, assessment on noise from fixed noise sources has been excluded from this EIA Study.

The assessment of noise from fixed plant and industrial premises located at Castle Peak Hospital and Tuen Mun Hospital is excluded as no prominent noise source was identified during site visits and noise measurements conducted (*See Section* 3.3.1). In addition, as advised by the Planning Department, the Town Planning Board has agreed to rezone the area around San Hing Tsuen to the north of the proposed Road D7 from "Industrial (Group D)" to "Residential (Group E) (R(E))" on the draft Lam Tei and Yick Yuen Outline Zoning Plan No. S/TM-LTYY/1. The proposed rezoning is to phase out industrial use in San Hing Tsuen. Hence, noise impacts from the fixed plants at San Hing Tsuen on the planned developments would not be anticipated in the future.

3.5.4 *Rail Noise*

Operational noise from the West Rail would affect the surrounding environment. As mentioned in *Section* 3.3.2, the noise of West Rail will be sufficiently screened by the residential towers of Siu Hong Court. Planned sensitive uses within Tuen Mun Area 54 would not be impacted by rail noise of West Rail.

Although a LRT reserve has been included alongside the alignment of the proposed distributor road, there is currently not yet any commitment from KCRC to build and operate the LRT extension in Tuen Mun Area 54. For this reason, detailed assessment of noise associated with LRT operations could not be undertaken in this EIA Study. As light rail will be categorised as a designated project, if it is later confirmed to be built, a separate EIA Study would need to be conducted before work proceed.

To address the likely noise impact from the future LRT operation, a semi-quantitative noise assessment has been conducted and is enclosed in *Annex A*. Source data was obtained through on-site noise surveys near Lam Tei. It has been assumed that there would be 2-car LRT vehicles running on the reserve with a time headway of 4 minutes as the worst case.

The assessment results indicated that for NSRs at a distance 25 m from the LRT track, noise exceedance of 2 dB(A) beyond the noise limit (i.e. Acceptable Noise Level of 65 dB(A) as given in IND-TM) was predicted during daytime and evening peak periods. A noise impact of up to 12 dB(A) was also predicted during night time. In view of the predicted exceedance, track side barrier should be considered at positions with insufficient horizontal buffer between the LRT track and the nearby NSRs. Detailed noise assessment is recommended during the detailed design stage after the LRT development is confirmed.

3.6 ASSESSMENT METHODOLOGY

3.6.1 *Construction Noise*

The assessment of noise impact from the works associated with the planning developments was undertaken based on the procedure outlined in the GW-TM. In general, the methodology is as follows:

- locate representative NSRs that may be affected by the works;
- determine plant teams for corresponding construction activities; based on available information or agreed plant inventories;
- assign sound power levels (SWLs) to the PME proposed based on the GW-TM or other sources;
- calculate the correction factors based on the distance between the NSRs and the notional noise source position of the work sites;
- apply corrections such as potential screening effect and acoustic reflection, if any, in the calculations; and
- predict construction noise levels at NSRs in the absence of any mitigation measures.

The total sound power level (SWL) associated with each activity has been established based on the assumed plant inventory, and the details are enclosed in *Annex B*. The notional point of each work site has been established in accordance with the procedure stated in the GW-TM. Noise impacts at NSRs were evaluated by comparing the predicted noise levels with the EIAO-TM daytime construction noise limits ($L_{eq,\,30\,min}$ dB(A)), as given in *Section 3.2.1*.

During both Phase 1 and Phase 2, roadworks and drainage/utility works will be undertaken concurrently and hence, cumulative noise levels were calculated by assuming that all the noisiest activities during roadworks and drainage works will be undertaken simultaneously at work sites with the same distance from a particular NSR. For Phase 2 building works, including site formation and superstructure construction, predicted noise levels from all the building sites (Sites 2, 3 and 4) were taken into account for calculation of the cumulative noise impacts. Construction noise impacts on nearby NSRs due to the widening works at Tsing Lun Road were also assessed.

Night-time works are not expected and therefore, noise criteria stipulated for the restricted hours period are not applicable in this study. If there is any construction work during the restricted hours, it is the responsibility of the contractors to comply with the requirements of the NCO and relevant TMs. The contractor should submit CNP applications and will be assessed by the EPD. Conditions stipulated in CNPs should be strictly followed.

Cumulative Noise Impacts Due to Concurrent Construction of Roadworks and Building Works

Based on information given in the construction programme (see *Figure 3.5a*), there will be concurrent construction of Road D7 and building sites during both Phase 1 and Phase 2. The types of construction activities in roadworks and building works that will be taken place concurrently during each phase is outlined as folows:

For Phase 1, such activities are:

- site formation for roadworks and site formation for building works; and
- roadwork activities, drainage/utility works and superstructure construction for building sites.

For Phase 2, such activities are:

- site formation for roadworks and superstructure construction for building sites; and
- roadwork activities, drainage/utility work and superstructure construction for building works.

Cumulative noise impacts due to the above listed concurrent construction activities for Road D7 and the building sites were accounted. Details of the assessment are addressed in *Section 3.7.1* and *Section 3.8.1*. The calculation details are given in *Annex C*.

Mitigation measures will be considered when noise impacts at the NSRs are identified. A re-evaluation of the total SWL for each construction activity will be made by assuming the use of practical mitigation measures such as quiet plant, the use of barriers and restricting the operation of construction equipment.

3.6.2 *Road Traffic Noise*

Road traffic noise calculations have been undertaken in accordance with the UK methodology *Calculation of Road Traffic Noise* (CRTN), which is currently required by the EPD.

The road scheme within the Study Area and the surrounding road network have been divided into 125 road segments, each of which has been assigned with one of 19 road layouts. A road layout defines the road width, surface type, traffic condition and if applicable, the height and locations of roadside barriers. The segmentation process was carried out in accordance with the CRTN procedure and the noise modelling was carried out using *HFANoise* road traffic noise model, which fully implements CRTN procedures and methodologies. Hard ground, as defined in CRTN, has been assumed throughout the Study Area and all other features that may result in noise screening will be defined in the model.

In order to predict impacts from future traffic conditions, the EPD recommends that, in line with CRTN procedures, traffic noise should be modelled based on the worst case year traffic forecast within 15 years after the opening of the development. Year 2021 is considered as the worst case year and have been used in this assessment to assess the road traffic noise impacts associated with the planned developments. *Table 3.6a and Figure 3.6a* present the traffic data used in road noise assessment (morning peak hour traffic forecasts). The traffic figures presented are calculated based on the forecasting methodology and assumptions agreed with Transport Department.

Traffic noise impacts were then assessed against the EIAO-TM road traffic noise limits of $L_{10, \text{peak hour}}$ 70 dB(A) for residential uses and $L_{10, \text{peak hour}}$ 65 dB(A) for educational institutions. Any predicted levels exceeding the EIAO-TM road traffic noise limits are considered to constitute significant impacts and practicable direct mitigation measures will be recommended. For G/IC sites, if noise sensitive uses such as government staff quarters, educational institutions, libraries, homes for the aged and clinics, are to be built, then noise impact assessments would be required. In this Study, assessment of traffic noise impacts were conducted for the proposed G/IC sites to evaluate whether they are suitable for any noise sensitive developments.

Figures 3.6b and 3.6c show the location of the existing roads and new roads in this proposed development respectively.

Table 3.6a Traffic Forecasts for the Year 2021, AM Peak Hour

Road	From	To	2-way Traffic Flow (veh/hr)	Percentage of Heavy Vehicles (%)	Speed (km/hr)
Proposed Distributor Road	Ming Kum	Site 3 & 4 Access	4211	34	50
	Site 3 & 4 Access	Site 1 Access	2069	35	50
	Site 1 Access	Village Overflow Access	1669	45	70
	Village Overflow Access	Hong Po/Tsing Lun Road	1679	45	70
Tsing Lun Road	Lam Tei	Site 2 Access	1655	40	50
	Site 2 Access	Tsing Chung Koon Road	1569	40	50
	Tsing Chung Koon Road	Tsun Wen Road	729	39	50
Tsun Wen Road	Proposed Distributor Road	Leung Wan Street	2209	46	50
	Leung Wan Street	Tsing Lun Road	2227	42	50
Ming Kum Road	Proposed Distributor Road	Leung Tak Street	2500	43	50
	Leung Tak Street	Tsing Tin Road	1144	29	50

3.7.1 Construction Noise

The unmitigated predicted noise levels at the worst case representative NSRs for each construction stage have been predicted and the results are given in *Table 3.7a*. *Figures 3.7a to 3.7f* show the locations of noise assessment points in construction phase. For NSR N25 (Approved Section 16 Application of Housing Development north of Road D7), the location of the noise assessment point is shown in *Figure 3.7r*. Detailed construction noise calculations are presented in *Annex C*. The predictions were conducted taking into account of distance attenuation, potential screening effects and façade reflection. All NSRs have been assumed to have a direct line of sight to the appropriate construction activity and rely on openable windows for ventilation. For this planning feasibility study, detailed construction programme is not available and therefore, detailed investigation on the duration of predicted impact cannot be undertaken.

Prediction results in *Table 3.7a* indicated that those NSRs located close to the proposed work sites for road and superstructure constructions would be impacted during daytime period in the absence of any noise abatement measures. NSRs located relatively remote from the work sites, such as NSRs N2 (Planned SH at Site 1), N3 (Planned Educational Use at Site 1A), N6 (Tsz Tin Tsuen), N11 (Kei Lun Wai), N17 (Goodrich Garden and Blossom Garden), N18 (Siu Hin Court), N19 (Existing low-rise residential buildings next to Castle Peak Hospital), N21 (Tuen Mun Government School), N22 (Siu Hong Court), N24 (San Hing Tsuen) and N25 (the approved Section 16 Application housing development north of Road D7) would not be affected by the works based on the findings of this assessment.

Construction Works in Phase 1

In Phase 1, road construction and drainage/utility work were identified to be the most noisy construction stage given the predicted noise impacts at N7 (Siu Hang Tsuen) and N16 (Vertical Interim Housing Development in Tuen Mun Area 29). A maximum noise level of 84 dB(A) was predicted at N16 (Vertical Interim Housing Development in Tuen Mun Area 29) owing to the proximity of the construction activities. Site formation for building works and associated superstructure construction would generate noise impacts at nearby NSRs. NSR N4 (Po Tong Ha) would be the worst affected in conjunction with these activities.

Cumulative noise levels due to concurrent construction of roadworks and building works, based on the tentative construction programme (see *Figure 3.5a*), have been calculated. The predicted noise levels are shown in *Table 3.7a*. The worst cumulative noise level was 84 dB(A) predicted at N16 (Vertical Interim Housing Development in Tuen Mun Area 29), which was due to the concurrent undertaking of roadworks, drainage/utility works and superstructure construction. Cumulative noise impacts were also predicted at N4 (Po Tong Ha) and N7 (Siu Hang Tsuen).

Construction Works in Phase 2

Referring to the prediction results in *Table 3.7a*, noise impact was predicted at NSRs close to the proposed work sites of Phase 2 construction. The impacted NSRs due to the works in Phase 2 include N3 (Planned Educational Use at Site 1A) during examination periods, N5 (Village House, north of Tsz Tin Tsuen),

N20 (Castle Peak Hospital), N23 (Yau Tze Tin Memorial College) during both normal and examination periods and N27 (Village extension area north of Po Tong Ha).

Critical construction stages were identified to be site formation works for both road construction and building construction. Maximum noise levels of 81 dB(A) were predicted at N5 (Village House, north of Tsz Tin Tsuen) and N27 (Village extension area north of Po Tong Ha) during roadworks and drainage/utility works. These NSRs would also be affected by site formation for roadworks, with predicted noise impact of 4 dB(A).

Site formation activity for building works would lead to noise impacts on N20 (Castle Peak Hospital) and N23 (Yau Tze Tin Memorial College). Noise exceedance of 9 dB(A) was predicted at N20 (Castle Peak Hospital). Noise exceedances of 2 dB(A) and 7 dB(A) were predicted at N23 (Yau Tze Tin Memorial College) during normal and examination periods respectively.

The cumulative noise impacts on the NSRs, when there are concurrent construction of roadworks and building works, were also evaluated. Cumulative noise impacts were predicted at N3 (Planned Educational Use at Site 1A) during examination periods, N5 (Village House, north of Tsz Tin Tsuen), N20 (Castle Peak Hospital), N23 (Yau Tze Tin Memorial College) during both normal and examination periods, N24A (village House, south of San Hing Tsuen and north of Road D7) and N27 (Village extension area north of Po Tong Ha). A maximum cumulative noise exceedance of 7 dB(A) was predicted at N23 (Yau Tze Tin Memorial College) during examination periods. The cumulative noise impact was mainly due to concurrent undertaking of roadworks, drainage/utility works and superstructure construction.

Judging from the buffer distance between the sites and NSRs, noise impacts associated with the works would be likely. Effective mitigation measures and proper environmental control practice should be adopted during the two construction phases of the project in order to reduce the noise impacts from the works. Mitigation measures proposed to reduce the identified noise impacts during construction stages are discussed in *Section 3.8.1.*

Proposed widening of Tsing Lun Road in Phase 1

Unmitigated predicted noise levels at selected NSRs during the construction for the widening of Tsing Lun Road in Phase 1 were calculated. Results were shown in *Table 3.7b.*

Table 3.7b indicates exceedances of the daytime construction noise criterion were at N22 (Siu Hong Court) and N23 (Yau Tze Tin Memorial College) during both normal and examination periods. This is due to the close proximity of these NSRs to the proposed widening section of Tsing Lun Road. Mitigation measures proposed to reduce the identified noise impacts are addressed in *Section 3.8.1.*

Table 3.7a Predicted Construction Noise Level (dB(A)) - General Construction Works

NSR	Description	Max. PNL - site formation for road works (dB(A))	Max. PNL - roadworks and drainage works (dB(A))	Max. PNL - site formation for housing site (dB(A))	Max. PNL - superstructure construction (dB(A))	Predicted Cumulative Noise Level during Phase 1[3] (dB(A))	Predicted Cumulative Noise Level during Phase 2[4] (dB(A))	Critical Construction Stage/Activity causing noise exceedance
N2	Planned SH at Site 1	-/63	-/65	-/63	-/60	-	65/66	-
N3	Planned Educational Use at Site 1A	-/64	-/66	-/63	-/60	-	66/67	-
N3	Planned Educational Use at Site 1A (during examination periods)	-/64	-/66	-/63	-/60	-	66/67	Phase 2 - site formation and excavation during roadwork construction
N4	Po Tong Ha	75[1]/71[2]	77/73	81/63	78/60	82/80	71/73	Phase 1 - site formation for building works;
N5	Village House (north of Tsz Tin Tsuen)	57/79	58/81	56/66	53/63	59/59	79/81	Phase 2 - site formation and excavation during roadwork construction
N6	Tsz Tin Tsuen	60/71	62/73	60/70	57/67	63/63	72/74	-
N7	Siu Hang Tsuen	81/62	83/64	67/74	64/71	81/83	71/71	Phase 1 - site formation and excavation during roadwork construction;
N11	Kei Lun Wai	58/58	60/60	58/70	55/67	61/61	67/68	
N16	Vertical Interim Housing Development (Area 29)	82/55	84/57	61/72	58/69	82/84	69/69	Phase 1 - site formation and excavation during roadwork construction;
N17	Goodrich Garden and Blossom Garden	69/53	71/55	59/67	56/64	69/71	64/64	-
N18	Siu Hin Court	62/52	64/54	56/66	53/63	63/64	63/63	-
N19	Existing low-rise residential buildings next to Castle Peak Hospital	68/53	69/55	59/69	56/66	68/70	66/67	-
N20	Castle Peak Hospital	60/54	61/56	57/74	54/71	62/62	71/71	Phase 2 - site formation for building works
N21	Tuen Mun Government School	54/55	56/57	53/63	50/60	57/57	62/62	-
N22	Siu Hong Court	54/63	56/65	55/74	52/71	58/58	71/72	
N23	Yau Tze Tin Memorial College	54/67	56/69	55/72	52/69	57/57	71/72	Phase 2 - site formation for building works
N23	Yau Tze Tin Memorial College (during examination periods)	54/67	56/69	55/72	52/69	57/57	71/72	Phase 2 - site formation for building works
N24	San Hing Tsuen	53/65	55/67	53/63	50/60	56/56	66/68	-
N24A	Village House, south of San Hing Tsuen	53/74	55/75	54/67	51/64	56/56	74/76	Phase 2 - site formation and excavation works during roadwork construction

NSR	Description	Max. PNL - site formation for road works (dB(A))	Max. PNL - roadworks and drainage works (dB(A))	Max. PNL - site formation for housing site (dB(A))	Max. PNL - superstructure construction (dB(A))	Predicted Cumulative Noise Level during Phase 1[3] (dB(A))	Predicted Cumulative Noise Level during Phase 2[4] (dB(A))	Critical Construction Stage/Activity causing noise exceedance
N25	Approved Section 16 Application of Housing development north of Road D7	-/70	-/72	-/60	-/57	-	70/72	
N27	Village extension area north of Po Tong Ha	62/**79**	64/**81**	60/62	57/59	65/65	**79**/**81**	Phase 2 - site formation and excavation works during roadwork construction

Note :
(1) Predicted Noise Level for construction works in Phase 1
(2) Predicted Noise Level for construction works in Phase 2
(3) Cumulative noise impacts from Site formation for both Roadwork + Building works / Roadworks + Drainage works + Superstructure construction
(4) Cumulative noise impacts from Site formation for Roadworks + Superstructure Construction / Roadworks + Drainage works + Superstructure construction

Table 3.7b ***Predicted Construction Noise Level (dB(A)) - Proposed widening of Tsing Lun Road***

NSR	Description	Max. PNL - widening of Tsing Lun Road (dB(A))	Noise Exceedance	Critical Construction Activitiy causing noise exceedance
N6	Tsz Tin Tsuen	68	-	-
N11	Kei Lun Wai	63	-	-
N22	Siu Hong Court	**85**	10	Excavation during roadwork construction
N23	Yau Tze Tin Memorial College	**78**	8	Excavation during roadwork construction
N23	Yau Tze Tin Memorial College (during examination periods)	**78**	13	Excavation during roadwork construction

3.7.2 *Road Traffic Noise*

Road traffic noise modelling for Year 2021 has been undertaken at representative NSRs and the prediction results are given in *Tables 3.7d* to *3.7i*. Noise predictions have been made at different receiver heights and at the worst impacted façades of NSRs. Locations for noise assessment are shown in *Figures 3.7g* to *3.7r*. The assessment of impacts associated with the project during the worst prediction year would base on the prediction results and compare with the road traffic noise standards stipulated in EIAO-TM.

Existing sensitive uses including N18 (Siu Hin Court), N20 (Castle Peak Hospital) and N21 (Tuen Mun Government School) have been excluded in this assessment as these NSRs are relatively remote from the new distributor road and the proposed widening section of Tsing Lun Road. In addition, substantial screening by the high-rise buildings located at Sites 3 and 4 are expected, noise impacts from the distributor road and the proposed widening section of Tsing Lun Road on these NSRs are considered limited. The assessment of noise at New Life Farm (Site 7) was also excluded as it is confirmed through site visit that there is no noise sensitive development at the New Life Farm. The building block is a 3-storeys office/farm house building which, based on the criteria given in *Annex 13* of the EIAO-TM, is not considered as a NSR.

Regarding the planned G/IC uses proposed on Site 5, it will be developed as a joint user building accommodating indoor games halls, clinic and social welfare facilities. This NSR will be allowed for fixed windows and air-conditioning. Considering the noise insulation achieved, no significant noise impact is anticipated. For G/IC Site 6, details as well as the layout of the G/IC development is not available at this stage, noise predictions have been made at a position 10 m offset from the road kerb of the distributor road.

Existing Sensitive Uses

Information on the number of storeys, dwellings and ground levels in mPD for existing sensitive uses is shown in *Table 3.7c*. Prediction results of road noise levels at existing NSRs are shown in *Table 3.7d*. Location of noise assessment points are given in *Figures 3.7g to 3.7k*. For N25 (Approved Section 16 Application of Housing Development north of Road D7), the noise assessment point is shown in *Figure 3.7r*.

During the operational phase of Tuen Mun Area 54, noise impacts from the traffic on the new distributor road and local road network at existing NSRs would be likely except at NSRs N24 (San Hing Tsuen), N24A (Village house, south of San Hing Tsuen) and N25 (Approved Section 16 Application of Housing Development north of Road D7). With the buffer distance between these NSRs and the roads, noise impacts at these NSRs would be limited.

For NSRs N26 (Rezoning area south of San Hing Tsuen) and N27 (Village extension area north of Po Tong Ha), noise exceedances in the range of 1-6 dB(A) were predicted. This is due to their close proximity to the proposed Road D7 and hence mitigation measures have to be implemented on Road D7 to protect these areas.

Existing low-rise NSRs N4 (Po Tong Ha), N5 (village houses, north of Tsz Tin Tsuen (future village zone)), N6 (Tsz Tin Tsuen) and N7 (Siu Hang Tsuen) would be impacted by the new distributor road, with noise exceedances in the range of

2 to 9 dB(A) at the worst affected premises. A maximum noise level of 79 dB(A) was predicted at the Village House to the north of Tsz Tin Tsuen during morning peak hour. Noise impact predicted at N11 (Kei Lun Wai - façade no. 951) was mainly due to the traffic on the existing Tsing Lun Road.

High-rise residential buildings N16 (Vertical Interim Housing Development, Area 29) and N17 (Goodrich Garden and Blossom Garden) would experience noise impact from road traffic. Predicted noise exceedances were in the range of 3-8 dB(A). Analysis of noise prediction results indicated some of the façades of NSR N16 (Vertical Interim Housing Development, Area 29) would be impacted by the new distributor road while those façades distant away from this new road would be impacted by the traffic on existing roads. For NSR N17 (Goodrich Garden and Blossom Garden), the dominant noise contributors were identified to be the traffic on Ming Kum Road and Tsun Wen Road. Similar situation was encountered for NSR of N19 (Existing low-rise residential buildings next to Castle Peak Road).

Table 3.7c ***Details of Existing Noise Sensitive Receivers Identified for Road Traffic Noise Assessment***

NSR	Description	Facade No.	No. of Storeys	No. of Dwellings	Ground mPD Level
N4	Po Tong Ha	600	3	1	27.0
		601	3	1	23.0
		605	3	1	16.2
N5	Village House (north of Tsz Tin Tsuen) (future village zone)	983	3	1	8.5
		984	3	1	8.5
		345	3	1	9.0
N6	Tsz Tin Tsuen	975	3	1	8.1
N7	Siu Hang Tsuen	664	3	1	14.8
		665	3	1	14.8
		675	3	1	22.2
		981	3	1	21.0
N11	Kei Lun Wai	679	3	1	6.5
		951	3	1	6.5
N16	Vertical Interim Housing Development (Area 29)	954	29	672	16.1
		955	29	672	16.1
		956	29	1008	16.1
		688	29	1008	16.1
N17	Goodrich Garden	656	38	296	23.0
	Blossom Garden	650	31	240	20.7

NSR	Description	Facade No.	No. of Storeys	No. of Dwellings	Ground mPD Level
N19	Existing low-rise residential buildings next to Castle Peak Hospital	645	4	1	15.9
		660	4	1	16.5
		661	4	1	16.5
N22	Siu Hong Court	961	32	248	8.0
		957	32	248	8.0
		371	32	248	8.0
		364	32	248	7.6
		355	32	248	7.0
		346	32	248	17.2
		381	32	248	17.2
N23	Yau Tze Tin Memorial College	590	5	-	8.4
N24	San Hing Tsuen	676	5	1	11.5
N24A	Village House, south of San Hing Tsuen	677	5	1	9.0
N25	Approved Section 16 Application of Housing Development north of Road D7	900	3	1	11.0
N26	Rezoning area south of San Hing Tsuen	950	5	1	9.0
N27	Village extension area north of Po Tong Ha	844	3	1	9.1
		851	3	1	17.0
		854	3	1	16.0
		855	3	1	10.0

Noise impact was also predicted at N22 (Siu Hong Court) with exceedance of up to 10 dB(A). The identified noise impact was mainly contributed from the proposed widening of Tsing Lun Road.

NSR N23 (Yau Tze Tin Memorial College) would also be impacted by road traffic, with predicted noise exceedance of up to 9 dB(A). The identified noise impact was due to the small buffer distance between the NSR and the proposed widening section of Tsing Lun Road. Moreover this NSR was located close to the roundabout junction that noise from the traffic going through this junction would contribute to the noise exceedance.

Table 3.7d ***Predicted Road Noise Levels ($L_{10,1\text{-}hr}$ dB(A)) for Existing NSRs***

NSR	Description	Facade no.	Lower Floor	mPD Level	Middle Floor	mPD Level	Top Floor	mPD Level
N4	Po Tong Ha	600	73	28.5	73	31.5	73	34.5
		601	72	24.5	72	27.5	72	30.5
		605	69	17.7	69	20.7	70	23.7

NSR	Description	Facade no.	Lower Floor	mPD Level	Middle Floor	mPD Level	Top Floor	mPD Level
N5	Village House (north of Tsz Tin Tsuen)	983	77	10.0	78	13.0	78	16.0
		984	73	10.0	74	13.0	74	16.0
		345	79	10.5	79	13.5	79	16.5
N6	Tsz Tin Tsuen	975	72	9.6	72	12.6	72	15.6
N7	Siu Hang Tsuen	664	74	16.3	74	19.3	75	22.3
		665	74	16.3	75	19.3	75	22.3
		675	68	23.7	68	26.7	69	29.7
		981	70	22.5	70	25.5	71	28.5
N11*	Kei Lun Wai	679	65	8.0	65	11.0	65	14.0
		951	76(76.3)	8.0	76(76.3)	11.0	76(76.3)	14.0
N16	Vertical Interim Housing Development (Area 29)	954	77	21.1	77	60.3	75	94.4
		955	77	21.1	77	60.3	75	94.4
		956	76	21.1	76	60.3	74	94.4
		688	75	21.1	75	60.3	74	94.4
N17*	Goodrich Garden and Blossom Garden	656	78(77.5)	28.0	76(75.3)	67.2	74(72.5)	136.2
		650	76(75.7)	25.7	75(74.5)	64.9	73(72.7)	112.7
N19*	Existing low-rise residential buildings next to Castle Peak Hospital	645	74(73.7)	17.4	74(73.6)	20.4	74(73.6)	24.0
		660	80(80.2)	18.0	80(80.0)	21.0	80(79.7)	24.0
		661	77(76.6)	18.0	77(76.6)	21.0	77(76.5)	24.0
N22	Siu Hong Court	961	66	13.0	69	55.0	69	97.0
		957	69	13.0	72	55.0	71	97.0
		371	70	13.0	75	55.0	72	97.0
		364	73	12.6	76	54.6	73	96.6
		355	69	12.0	72	54.0	70	96.0
		346	67	22.2	72	64.2	70	106.2
		381*	77(76.8)	22.2	74(73.6)	64.2	72(71.4)	106.2
N23	Yau Tsz Tin Memorial College	590	73	14.2	73	21.0	74	31.2
N24	San Hing Tsuen	676	65	13.0	65	19.0	65	25.0
N24A	Village House (south of San Hing Tsuen)	677	57	10.5	59	16.5	65	22.5

NSR	Description	Facade no.	Lower Floor	mPD Level	Middle Floor	mPD Level	Top Floor	mPD Level
N25	Approved Section 16 Application of Housing Development north of Road D7	900	68	12.5	68	15.5	68	18.5
N26	Rezoning area south of San Hing Tsuen	950	74	10.5	76	16.5	76	22.5
N27	Village extension area north of Po Tong Ha	844	73	10.6	73	13.6	73	16.6
		851	75	18.5	75	21.5	75	24.5
		854	74	17.5	74	20.5	75	23.5
		855	71	11.5	72	14.5	72	17.5

* Noise impacts dominated by traffic on existing roads.
( )Noise level contributed from existing roads.

Planned Residential Uses

Predicted noise levels for planned residential uses are presented in *Tables 3.7e* to *3.7h*. *Table 3.7e* lists out the predicted noise levels at the worst affected façades of N2 (Planned SH at Site 1) and the assessment locations are given in *Figure 3.7l*. Prediction results indicated that residential blocks of N2 would experience noise impacts in the range of 1 to 5 dB(A). In view of the heavy traffic and insufficient setback from the distributor road (approximately 40 m), noise impact would be likely at the façades facing this roadway. Although the assessment has already included a podium of 13.5 m high into the modelling scheme, screening provided is not adequate to eliminate the noise impacts thoroughly.

Table 3.7e ***Predicted Road Noise Levels ($L_{10,1\text{-}hr}$ dB(A)) for Site 1, SH (N2)***

Facade no.	No. of Storeys	Ground mPD Level	Lower Floor	mPD Level	Middle Floor	mPD Level	Top Floor	mPD Level
611	26	37.1	72	42.1	75	67.3	74	109.3
612	26	37.1	67	42.1	68	67.3	68	109.3
613	26	37.1	72	42.1	74	67.3	73	109.3
621	26	37.1	67	42.1	75	67.3	73	109.3
622	26	37.1	64	42.1	67	67.3	67	109.3
631	26	37.1	65	42.1	75	67.3	73	109.3
632	26	37.1	61	42.1	66	67.3	66	109.3
641	26	37.1	65	42.1	74	67.3	73	109.3
642	26	37.1	59	42.1	65	67.3	65	109.3
651	26	37.1	68	42.1	75	67.3	73	109.3
652	26	37.1	60	42.1	64	67.3	65	109.3

Facade no.	No. of Storeys	Groun d mPD Level	Lower Floor	mPD Level	Middle Floor	mPD Level	Top Floor	mPD Level
653	26	37.1	69	42.1	71	67.3	70	109.3

Table 3.7f *Predicted Road Noise Levels ($L_{10,1\text{-}hr}$ dB(A)) for Site 2, Public Rental Estate (N8)*

Facade no.	No. of Storeys	Ground mPD Level	Lower Floor	mPD Level	Middle Floor	mPD Level	Top Floor	mPD Level
711	33	10.0	74	15.0	74	54.2	72	101.8
991	33	10.0	73	15.0	72	54.2	70	101.8
992	33	10.0	73	15.0	72	54.2	70	101.8
712	33	10.0	75	15.0	73	54.2	71	101.8
993	33	10.0	73	15.0	71	54.2	69	101.8
994	33	10.0	73	15.0	70	54.2	68	101.8
995	33	10.0	72	15.0	70	54.2	68	101.8
996	33	10.0	73	15.0	71	54.2	69	101.8
721	33	10.0	77	15.0	74	54.2	72	101.8
722	33	10.0	71	15.0	71	54.2	69	101.8
731	41	6.9	70	11.9	71	51.1	70	121.1
732	41	6.9	62	11.9	64	51.1	67	121.1
886	41	6.9	56	11.9	56	51.1	59	121.1
751	41	7.0	48	12.0	67	51.2	70	121.2
761	41	7.0	64	12.0	67	51.2	70	121.2
762	41	7.0	67	12.0	67	51.2	66	121.2
763	41	7.0	56	12.0	59	51.2	60	121.2
771	41	9.0	59	14.0	60	53.2	61	123.2
772	41	9.0	63	14.0	64	53.2	64	123.2

Table 3.7f presents the predicted noise levels at the worst affected façades of N8 (Planned Public Rental Estate at Site 2). Assessment locations used are illustrated in *Figure 3.7n*. Prediction results indicated that the residential blocks of N8 would experience noise impacts in the range of 1 to 7 dB(A). Predicted noise exceedance were mainly attributed to the traffic on the new distributor road and the proposed widening section of Tsing Lun Road. The maximum noise level of 77 dB(A) was predicted at façade 721 (refers to lower floor noise level).

Referring to the results, predicted noise levels at façade nos. 991, 992, 993 and 994 were lower than that at façade nos. 711 and 712. Similarily, predicted noise levels at façade nos. 995 and 996 were lower than that at façade no. 721. In view of the assessment point locations (refer to *Figure 3.7n*), blank façades should be considered as one of the mitigation measures to reduce noise impacts.

For the building blocks having façades facing inward and away from Tsing Lun Road, such as façades 732 and 886, noise impacts were not expected according to the prediction results. Façades 751 and 761 were protected by the building block of commercial centre and the proposed car park.

Table 3.7g *Predicted Road Noise Level ($L_{10,1\text{-}hr}$ dB(A)) for Site 3, PSPS (N14)*

Facade no.	No. of Storeys	Ground mPD Level	Lower Floor	mPD Level	Middle Floor	mPD Level	Top Floor	mPD Level
500	32	22.0	**76**	27.0	**75**	66.2	**73**	111.0
501	32	22.0	**74**	27.0	**72**	66.2	70	111.0
502	32	22.0	**77**	27.0	**75**	66.2	**73**	111.0
503	32	22.0	65	27.0	65	66.2	64	111.0
504	32	22.0	69	27.0	70	66.2	69	111.0
505	32	22.0	56	27.0	59	66.2	59	111.0
811	39	22.0	69	27.0	**71**	66.2	**71**	130.6
812	39	22.0	68	27.0	**71**	66.2	**71**	130.6
813	39	22.0	65	27.0	68	66.2	67	130.6
814	39	22.0	65	27.0	67	66.2	67	130.6
821	39	22.0	61	27.0	65	66.2	64	130.6
831	39	22.0	69	27.0	**71**	66.2	**71**	130.6
832	39	22.0	70	27.0	**71**	66.2	**71**	130.6
841	41	14.4	68	19.4	69	72.6	69	128.6
842	41	14.4	69	19.4	69	72.6	70	128.6
344	41	14.4	65	19.4	67	72.6	67	128.6
861	41	12.0	43	17.0	64	70.2	65	126.2

Table 3.7g shows the predicted noise levels at the worst affected façades of N14 (Planned PSPS at Site 3) and the assessment locations are shown in *Figure 3.7o*. The assessment points selected are the worst affected locations for the purpose of this assessment. Regarding the single aspect block proposed for this site, the main objective is to ensure no sensitive façades facing the distributor road directly. This measure could not only mitigate noise impacts, but also maximise the development potential of the site. The single aspect design could also provide screening and protection for the building blocks located inside the site. In addition, the assessment has already included the screening effect from a two level car park and a commercial centre proposed within the site. The disadvantage of applying single aspect block is that it will limit the possible options for the internal layout design of the buildings.

Other direct mitigation measures, such as roadside barriers, cannot be implemented at Site 3 to protect the housing developments as there are significant space limitation in this section of the road. Moreover, the site is located close to road junctions and so the use of direct mitigation measures will affect the safety sight lines at these junctions. Furthermore, the gradient of Road D7 is greater than 1% with speed limit at 50 km/hr, therefore adopting low noise

road surfacing is not generally recommended. Given the above reasons, the application of single aspect block in building designs would be the best effective way to serve the aim of maximising the development potential of Site 3 and protecting the most population of residents from adverse noise impacts.

Prediction results indicated that residential blocks of N14 would experience noise impacts in the range of 1 to 7 dB(A). The noise impact predicted for Site 3 was dominated by the traffic on the distributor road. The level of noise impact varies with the buffer distance of sensitive façades from the distributor road and the angle of exposure to the distributor road.

Table 3.7h ***Predicted Road Noise Levels ($L_{10,1\text{-}hr}$ dB(A)) for Site 4, HOS (N12)***

Facade no.	No. of Storeys	Ground mPD Level	Lower Floor	mPD Level	Middle Floor	mPD Level	Top Floor	mPD Level
510	21	27.0	63	32.0	64	57.2	65	85.2
922	21	27.0	64	32.0	65	57.2	66	85.2
512	21	27.0	62	32.0	63	57.2	63	85.2
911	41	12.0	49	17.0	65	70.2	65	126.2
912	41	12.0	60	17.0	64	70.2	66	126.2
517	41	12.0	57	17.0	61	70.2	64	126.2
395	41	12.0	47	17.0	62	70.2	63	126.2
397	41	12.0	57	17.0	60	70.2	61	126.2
399	41	12.0	44	17.0	57	70.2	59	126.2
391	41	10.0	59	15.0	60	68.2	62	124.2
393	41	10.0	60	15.0	62	68.2	63	124.2
377	41	10.0	56	15.0	63	68.2	63	124.2
378	41	10.0	54	15.0	61	68.2	62	124.2
379	41	10.0	55	15.0	62	68.2	62	124.2
382	41	10.0	48	15.0	62	68.2	62	124.2
383	41	10.0	50	15.0	62	68.2	63	124.2
386	41	10.0	50	15.0	62	68.2	63	124.2
387	41	10.0	55	15.0	62	68.2	63	124.2
390	41	10.0	58	15.0	63	68.2	64	124.2

Table 3.7h presents the predicted noise levels at the worst affected façades of N12 (Planned HOS at Site 4). Assessment locations used are illustrated in *Figure 3.7p*. Prediction results indicated that noise levels at all of the NSRs comply with the EIAO-TM road traffic noise criterion.

Planned School Sites and G/IC Sites

Prediction results for planned school sites and G/IC sites are given in *Table 3.7i*. *Figure 3.7m* shows the assessment locations for schools at Site 1A and *Figure 3.7q* shows the assessment locations for schools at Site 4A. *Figure 3.7o* shows the

assessment location for G/IC site 6 (Façade 700). At Site 1A (N3), sensitive façades of the proposed school having a line of sight to the proposed distributor road exceeded the EIAO-TM road traffic noise criterion (ie 65 dB(A)) in the range of 1-4dB(A) (façade 531 and 541). The distributor road was found to be the dominant source contributing noise impact at these façades.

Except for Schools 3 and 4 of N3, no noise exceedance were predicted at other schools. Therefore noise abatement measures are required only for School 3 in order to protect it from noise impact.

Considering the predicted traffic noise level at the G/IC Site 6 (predicted at 10 m from the road kerb of Road D7) is over 80 dB(A), this site (where the specific use is yet to be confirmed) is not suitable for noise sensitive development without any appropriate mitigation measures.

For the planned G/IC at Site 5, indoor recreation centre and clinic will be developed at this location. It is envisaged that fixed window and central air-conditioning would be provided and therefore, noise impacts are not anticipated.

Table 3.7i ***Predicted Road Noise Levels ($L_{10,1\text{-}hr}$ dB(A)) for Schools and G/IC Sites***

School	Facade no.	Ground mPD Level	1/F	mPD Level	3/F	mPD Level	6/F	mPD Level
N3 - Sch 3	531	18.0	**68**	23.8	**68**	30.6	**69**	40.8
N3 - Sch 4	541	22.0	63	27.8	65	34.6	**66**	44.8
N10 - Sch 5	587	10.0	57	15.8	58	22.6	60	32.8
N10 - Sch 6	585	10.0	58	15.8	60	22.6	61	32.8
N10 - Sch 7	580	10.0	58	15.8	59	22.6	60	32.8
N10 - Sch 8	581	10.0	61	15.8	63	22.6	63	32.8
N9 - Sch 9	576	7.0	63	12.8	63	19.6	64	29.8
N9 - Sch 10	579	7.0	60	12.8	61	19.6	61	29.8
N9 - Sch 11	569	7.0	63	12.8	63	19.6	64	29.8
N9 - Sch 12	573	7.0	64	12.8	64	19.6	64	29.8
N15 (G/IC Site 6)	700	15.0	**80**	20.8	**81**	27.6	**80**	37.8

In view of the predicted noise impacts at different planning areas as well as the predicted noise nuisance at existing NSRs, mitigation measures to reduce these impacts are required and are addressed in *Section 3.8.2*.

3.8 MITIGATION OF ADVERSE IMPACT

3.8.1 Mitigation Measures For Construction Noise

Noise emissions from construction sites can be minimised through good site practice, selecting quiet plant, adopting quieter working methods, erection of barriers to screen out the noise source and pose restriction on the use of noisy equipment on site. The recommended mitigation measures detailed in this

section should be incorporated into the Contract Specification in order to ensure the environmental performance of construction works.

The Contractor may develop a different package of environmental control measures to meet the required noise standards, but the following illustrates a feasible approach to mitigate the predicted noise impacts during the construction phase.

Good Site Practice

Good site practice and noise management can considerably reduce the noise impact from construction site activities on nearby NSRs. The following package of measures should be followed during each phase of construction:

- only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction works;
- machines and plant that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
- plant known to emit noise strongly in one direction, should, where possible, be orientated to direct noise away from nearby NSRs;
- silencers or mufflers on construction equipment should be utilised and should be properly maintained during the construction works;
- mobile plant should be sited as far away from NSRs as possible; and
- material stockpiles and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities.

Although it is difficult to quantify the noise reduction achieved, the environmental performance of the works would be improved through these control practices.

Selecting Quieter Plant and Working Methods

The use of quiet plant is identified to be a feasible solution to tackle the adverse impacts associated with the construction works. The Contractor may be able to obtain particular models of plant that are quieter than standard types given in GW-TM. The benefits achievable in this way will depend on the details of the Contractors' chosen methods of working, and it is considered too restrictive to specify that a Contractor has to use specific items of plant for the construction operations. It is therefore both preferable and practical to specify an overall plant noise performance specification to apply to the total SWL of all plant to be used on site so that the Contractor is allowed some flexibility to select plant to suit his needs.

Quiet plant is defined as PME whose actual SWL is less than the value specified in GW-TM for the same piece of equipment. Examples of SWLs for specific silenced PME taken from a British Standard, namely *Noise Control on Construction and Open Sites, BS5228 : Part 1 : 1997*, which are known to be used are given in *Table 3.8a*.

Table 3.8a *Sound Power Levels for Specific Silenced PME*

PME	BS5228 Table no.	Ref no.	SWL dB(A) max
Breaker	C.2	10	110
Bulldozer	C.3	65	110
Mobile Crane	C.7	110	106
Air Compressor	C.7	25	98
Concrete Pump	C.6	36	106
Dump Truck	C.9	29	109
Excavator			
- for trenching	C.3	97	105
- for ground excavation	C.3	35	106
Generator	C.7	62	100
Lorry	C.9	27	105
Loader	C.3	97	105
Concrete Lorry Mixer	C.6	35	100
Vibratory Roller	C.3	115	102
Grader	C.3	76	111
Road Roller	C.8	27	104
Poker Vibrator	C.6	32	100

It should be noted that various types of silenced equipment can be found in Hong Kong. However, the EPD, when processing a CNP application, will apply the noise levels contained in the GW-TM, unless the noise emission of a particular piece of equipment can be validated by certificate or demonstration.

The mitigated noise levels at identified NSRs are shown in *Table 3.8b*. With the use of quiet plant on site, the overall maximum noise reduction to the worst predicted noise levels for site formation for roadworks was 6 dB(A). The associated reduction in noise emission during road construction and drainage and utility works was in the range of 4 to 5 dB(A). The noise reduction for site formation in association with building construction was found to be 6 dB(A).

With the implementation of the above measures, residual noise impacts as well as cumulative noise impacts were still predicted at NSRs N4 (Po Tong Ha), N5 (Village House, north of Tsz Tin Tsuen), N7 (Siu Hang Tsuen), N16 (Vertical Interim Housing Development, Area 29), N20 (Castle Peak Hospital), NSR 23 (Yau Tze Tin Memorial College) during examination periods and N27 (Village extension area north of Po Tong Ha). For NSR 23, with a more stringent noise standards during examination periods (ie 65 dB(A)), an exceedances of 3 dB(A) and 4 dB(A) for cumulative noise impacts were predicted during Phase 2 (See *Table 3.8b*). Site formation works and superstructure construction works associated with building construction during Phase 2 were found to cause the exceedance at NSR 23 during examination periods. In order to reduce the noise impacts at these NSRs, further mitigation measures are therefore required.

Use of Temporary and Movable Noise Barriers

In general, noise barriers of 3 m to 5 m height located between noisy construction activities and NSRs could give a noise reduction of up to 5 dB(A) from screening (estimated in accordance with the GW-TM). It would be possible for the Contractor to provide purpose-built noise barriers or screens constructed of appropriate material to be located close to operating PME, in order to achieve this level of noise reduction. This could also be achieved by erecting temporary noise barriers along the proposed roads and at active work sites. Certain types of PME, such as generators and compressors, can be completely screened giving a total noise reduction of 10 dB(A) or more.

It is anticipated that a movable noise barrier with a suitable footing and a small cantilevered upper portion can be located within a few metres of a static plant and within about 5 m of more mobile equipment such as excavator and mobile crane etc, such that the line of sight could be blocked by the barriers viewed from the NSRs. The estimated noise reduction by means of screening, provided that the barriers are carefully located, can provide at least 10 dB(A) noise attenuation for static plant and 5 dB(A) for mobile plant. The noise screening benefit for each plant considered in this assessment is listed below:

- Stationary Plant - assuming 10 dB(A) reduction: poker vibrator, concrete pump, generator and air compressor; and

- Mobile Plant - assuming 5 dB(A) reduction: excavator, grader, road roller, vibratory roller, mobile crane and concrete lorry mixer.

Predicted noise levels with the use of quiet plant and barriers to reduce the identified noise impacts associated with the works are presented in *Table 3.8c*. Installing barriers close to the PMEs in operation could achieve a further noise reduction of up to 2 dB(A), depending on the percentage of mobile plant operating on site and the possibility to locate barriers effectively.

Implementing this measure together with the use of quiet plant on site, NSR N5 (Village House, north of Tsz Tin Tsuen) would be protected during the daytime construction period. However, noise exceedances and cumulative noise impacts due to concurrent roadworks and building works were still predicted at NSRs N4 (Po Tong Ha), N7 (Siu Hang Tsuen), N16 (Vertical Interim Housing Development, Area 29), N20 (Castle Peak Hospital) and N23 (Yau Tze Tin Memorial College) during examination periods and N27 (Village extension area north of Po Tong Ha). Further control measures to reduce the noise impacts are considered necessary.

Restriction of Plant Usage On-site During Critical Construction Stages

In general, the percentage of time that the noisy equipment is in operation may need to be controlled so as to reduce the noise emissions during critical construction stages. In this assessment, restriction on PME usage has been tested by limiting the operating time of PMEs to 50% (i.e. PMEs in operation for 15 minutes within a 30 minutes time slot), with a reduction in noise emission by 3 dB(A) could be achieved. The proposed reduction of the operating time of PMEs to 50% is considered feasible and would still meet the intended project implementation programme.

Table 3.8d presents the prediction results based on this mitigation measures. A

further noise reduction of 3 dB(A) in addition to the previous recommended measures could be achieved by limiting the usage of PME on critical areas. The noise impact at all the identified NSRs from construction works could be mitigated to comply with the daytime construction noise criteria with the implementation of quiet plant, barriers and limiting the usage of operating PME on site.

In addition, regular monitoring at the NSRs will be required during different construction phases. This will enable the Contractor to have early warning and provide necessary action to reduce noise emissions at specific areas if the assessment criteria are approached. The effectiveness of on-site control measures could also be evaluated through the monitoring exercise. The monitoring requirement will be addressed in *Section 3.9*. All the recommended mitigation measures should be incorporated into the EM&A programme for implementation during construction.

Proposed widening of Tsing Lun Road in Phase 1

The above mentioned mitigation measures were also used to mitigate the noise impact at the selected NSRs during the construction for the widening of Tsing Lun Road in Phase 1. *Table 3.8e* gives a summary of the predicted noise levels for all the different mitigation measures.

Referring to the results, noise impacts of 1 dB(A) and 4 dB(A) were still predicted at N22 (Siu Hong Court) and N23 (Yau Tze Tin Memorial College) during examination periods respectively. Further limiting the operating time of PME to 25% should be considered and careful time scheduling of the construction activities before the widening works proceed is required to reduce the noise impacts.

Results indicated that with the implementation of all the recommended mitigation measures, noise exceedance of 1 dB(A) was still predicted at N23 (Yau Tze Tin Memorial College) during examination periods. The critical activity found to cause the noise exceedance was excavation during roadwork construction and thus scheduling of construction activities to avoid the undertaking of excavation works during examination periods is required. The proposed scheduling of activities would still meet the intended project implementation programme and it was also agreed by the Project Proponent that they would follow the recommended mitigation measures.

A summary of the proposed noise mitigation measures for affected NSRs during construction phase is given in *Table 3.8f*.

Table 3.8b Mitigated Construction Noise Level (dB(A)) - General Construction Works (With the Use of Quiet Plant)

NSR	Description	Max. PNL - site formation for road works (dB(A))	Max. PNL - roadworks and drainage works (dB(A))	Max. PNL - site formation for housing site (dB(A))	Max. PNL - superstructure construction (dB(A))	Predicted Cumulative Noise Level during Phase 1[3] (dB(A))	Predicted Cumulative Noise Level during Phase 2 [4] (dB(A))	Critical Construction Stage/Activity causing noise exceedance
N2	Planned SH at Site 1	-/57	-/61	-/57	-/58	-	61/63	-
N3	Planned Educational Use at Site 1A	-/58	-/62	-/57	-/58	-	61/64	-
N3	Planned Educational Use at Site 1A (during examination periods)	-/58	-/62	-/57	-/58	-	61/64	-
N4	Po Tong Ha	69[1]/65[2]	73/69	75/57	**76**/58	**76**/**77**	66/69	Phase 1 - formwork & reinforcement works during building construction
N5	Village House (north of Tsz Tin Tsuen)	51/73	54/**76**	50/60	51/61	53/56	73/**76**	Phase 2 - levelingworks during roadwork construction
N6	Tsz Tin Tsuen	54/65	57/68	54/64	55/65	57/59	68/70	-
N7	Siu Hang Tsuen	75/56	**79**/60	61/68	62/69	75/**79**	69/69	Phase 1 - excavation works during roadwork construction;
N11	Kei Lun Wai	52/52	55/55	52/64	53/65	55/58	65/65	
N16	Vertical Interim Housing Development (Area 29)	**76**/49	**80**/52	55/66	56/67	**76**/**80**	67/67	Phase 1 - site formation & leveling works during roadwork construction
N17	Goodrich Garden and Blossom Garden	63/47	67/51	53/61	54/62	63/67	62/62	-
N18	Siu Hin Court	56/46	60/50	50/60	51/61	57/60	61/61	-
N19	Existing low-rise residential buildings next to Castle Peak Hospital	62/47	65/51	53/63	54/64	62/65	64/64	-
N20	Castle Peak Hospital	54/48	57/51	51/**68**	52/**69**	56/58	69/69	Phase 2 - site formation, formwork & reinforcement works during building construction
N21	Tuen Mun Government School	48/49	51/53	47/57	48/58	51/53	59/59	-
N22	Siu Hong Court	48/57	52/61	49/68	50/69	52/54	69/69	
N23	Yau Tze Tin Memorial College	48/61	51/65	49/66	50/67	51/54	68/69	
N23	Yau Tze Tin Memorial College (during examination periods)	48/61	51/65	49/**66**	50/**67**	51/54	**68**/**69**	Phase 2 - site formation, formwork & reinforcement works during building construction
N24	San Hing Tsuen	47/59	50/63	47/57	48/58	50/52	62/64	-
N24A	Village House (south of San Hing Tsuen)	47/68	51/71	48/61	49/62	50/53	69/72	-

NSR	Description	Max. PNL - site formation for road works (dB(A))	Max. PNL - roadworks and drainage works (dB(A))	Max. PNL - site formation for housing site (dB(A))	Max. PNL - superstructure construction (dB(A))	Predicted Cumulative Noise Level during Phase 1[3] (dB(A))	Predicted Cumulative Noise Level during Phase 2 [4] (dB(A))	Critical Construction Stage/Activity causing noise exceedance
N25	Approved Section 16 Application of Housing Development, north of Road D7	-/64	-/67	-/54	-/55	-	64/68	
N27	Village extension area north of Po Tong Ha	56/73	60/**77**	54/56	55/57	59/61	73/**77**	Phase 2 - levelling works during roadwork construction

Note :
(1) Predicted Noise Level for construction works in Phase 1
(2) Predicted Noise Level for construction works in Phase 2
(3) Cumulative noise impacts from Site formation for Roadworks + Building works / Roadworks + drainage & utility works + Superstructure construction
(4) Cumulative noise impacts from Site formation for Roadworks + Superstructure construction / Roadworks + drainage & utility works + Superstructure construction

Table 3.8c Mitigated Construction Noise Level (dB(A)) - General Construction Works (With the Use of Quiet Plant and Barriers)

NSR	Description	Max. PNL - site formation for road works (dB(A))	Max. PNL - roadworks and drainage works (dB(A))	Max. PNL - site formation for housing site (dB(A))	Max. PNL - superstructure construction (dB(A))	Predicted Cumulative Noise Level in Phase 1 [3] (dB(A))	Predicted Cumulative Noise Level in Phase 2 [4] (dB(A))	Critical Construction Stage/Activity causing noise exceedance
N2	Planned SH at Site 1	-/57	-/60	-/57	-/57	-	60/62	-
N3	Planned Educational Use at Site 1A	-/58	-/61	-/57	-/57	-	61/62	-
N3	Planned Educational Use at Site 1A (during examination periods)	-/58	-/61	-/57	-/57	-	61/62	-
N4	Po Tong Ha	69[1]/65[2]	71/67	75/57	75/57	**76**/**76**	66/68	Phase 1 - site formation and superstructure for building construction
N5	Village House (north of Tsz Tin Tsuen)	51/73	53/75	50/60	50/60	53/55	73/75	
N6	Tsz Tin Tsuen	54/65	56/67	54/64	54/64	57/58	68/69	-
N7	Siu Hang Tsuen	75/56	**77**/59	61/68	61/68	75/**77**	68/68	Phase 1 - excavation during roadwork construction;
N11	Kei Lun Wai	52/52	54/54	52/64	52/64	55/56	64/64	-
N16	Vertical Interim Housing Development (Area 29)	**76**/49	**78**/51	55/66	55/66	**76**/**78**	66/66	Phase 1 - site formation and excavation during roadwork construction
N17	Goodrich Garden and Blossom Garden	63/47	65/49	53/61	53/61	63/65	61/61	-
N18	Siu Hin Court	56/46	58/48	50/60	50/60	57/59	60/60	-

NSR	Description	Max. PNL - site formation for road works (dB(A))	Max. PNL - roadworks and drainage works (dB(A))	Max. PNL - site formation for housing site (dB(A))	Max. PNL - superstructure construction (dB(A))	Predicted Cumulative Noise Level in Phase 1 [3] (dB(A))	Predicted Cumulative Noise Level in Phase 2 [4] (dB(A))	Critical Construction Stage/Activity causing noise exceedance
N19	Existing low-rise residential buildings next to Castle Peak Hospital	62/47	64/50	53/63	53/63	62/64	63/63	-
N20	Castle Peak Hospital	54/48	56/50	51/**68**	51/**68**	56/57	**68**/**68**	Phase 2 - site formation, formwork and reinforcement works during building construction
N21	Tuen Mun Government School	48/49	50/51	47/57	47/57	51/52	58/58	-
N22	Siu Hong Court	48/57	50/60	49/68	49/68	52/53	68/68	-
N23	Yau Tze Tin Memorial College	48/61	50/63	49/66	49/66	51/53	67/68	
N23	Yau Tze Tin Memorial College (during examination periods)	48/61	50/63	49/**66**	49/**66**	51/53	**67**/**68**	Phase 2 - site formation, formation and reinforcement works for building construction
N24	San Hing Tsuen	47/59	49/61	47/57	47/57	50/51	61/63	-
N24A	Village House (south of San Hing Tsuen)	47/68	50/70	48/61	48/61	50/52	69/70	
N25	Approved Section 16 Application of Housing Development, north of Road D7	-/64	-/66	-/54	-/54	-	64/66	
N27	Village extension area north of Po Tong Ha	56/73	59/**76**	54/56	54/56	59/60	73/**76**	Phase 2 - excavation during roadwork construction

Note :
(1) Predicted Noise Level for construction works in Phase 1
(2) Predicted Noise Level for construction works in Phase 2
(3) Cumulative noise impacts from site formation for roadworks + building works / Roadworks + drainage & utility works + superstructure construction
(4) Cumulative noise impacts from site formation for roadworks + superstructure construction / Roadworks + drainage & utility works + superstructure construction

Table 3.8d *Mitigated Construction Noise Level (dB(A)) - General Construction Works (With the Use of Quiet Plant and Barriers, and Limiting PME Usage on Site)*

NSR	Description	Max. PNL - site formation for road works (dB(A))	Max. PNL - roadworks and drainage works (dB(A))	Max. PNL - site formation for housing site (dB(A))	Max. PNL - superstructure construction (dB(A))	Predicted Cumulative Noise Level during Phase 1[3] (dB(A))	Predicted Cumulative Noise Level during Phase 2[4] (dB(A))	Critical Construction Stage/Activity causing noise exceedance
N2	Planned SH at Site 1	-/54	-/57	-/54	-/54	-	57/59	-
N3	Planned Educational Use at Site 1A	-/55	-/58	-/54	-/54	-	58/59	-
N3	Planned Educational Use at Site 1A (during examination periods)	-/55	-/58	-/54	-/54	-	58/59	-
N4	Po Tong Ha	66[1]/62[2]	68/64	72/54	72/54	73/73	63/65	-
N5	Village House (north of Tsz Tin Tsuen)	48/70	50/72	47/57	47/57	50/52	70/72	-
N6	Tsz Tin Tsuen	51/62	53/64	51/61	51/61	54/55	65/66	-
N7	Siu Hang Tsuen	72/53	74/56	58/65	58/65	72/74	65/65	-
N11	Kei Lun Wai	49/49	51/51	49/61	49/61	52/53	61/61	-
N16	Vertical Interim Housing Development (Area 29)	73/46	75/48	52/63	52/63	73/75	63/63	-
N17	Goodrich Garden and Blossom Garden	60/44	62/46	50/58	50/58	60/62	58/58	-
N18	Siu Hin Court	53/43	55/45	47/57	47/57	54/56	57/57	-
N19	Existing low-rise residential buildings next to Castle Peak Hospital	59/44	61/47	50/60	50/60	59/61	60/60	-
N20	Castle Peak Hospital	51/45	53/47	48/65	48/65	53/54	65/65	-
N21	Tuen Mun Government School	45/46	47/48	44/54	44/54	48/49	55/55	-
N22	Siu Hong Court	45/54	47/57	46/65	46/65	49/50	65/65	-
N23	Yau Tze Tin Memorial College	45/58	47/60	46/63	46/63	48/50	64/65	-
N23	Yau Tze Tin Memorial College (during examination periods)	45/58	47/60	46/63	46/63	48/50	64/65	-
N24	San Hing Tsuen	44/56	46/58	44/54	44/54	47/48	58/60	-
N24A	Village House (south of San Hing Tsuen)	44/65	47/67	45/58	45/58	47/49	66/67	-

NSR	Description	Max. PNL - site formation for road works (dB(A))	Max. PNL - roadworks and drainage works (dB(A))	Max. PNL - site formation for housing site (dB(A))	Max. PNL - superstructure construction (dB(A))	Predicted Cumulative Noise Level during Phase 1[3] (dB(A))	Predicted Cumulative Noise Level during Phase 2[4] (dB(A))	Critical Construction Stage/Activity causing noise exceedance
N25	Approved Section 16 Application of Housing Development, north of Road D7	-/61	-/63	-/51	-/51	-	61/63	
N27	Village extension area north of Po Tong Ha	53/70	56/73	51/53	51/53	56/57	70/73	

Note :
(1) Predicted Noise Level for construction works in Phase 1
(2) Predicted Noise Level for construction works in Phase 2
(3) Cumulative Noise impacts from site formation for roadworks + building works / Roadworks + drainage & utility works + superstructure construction
(4) Cumulative Noise impacts from site formation for roadworks + superstructure construction / Roadworks + drainage & utility works + superstructure construction

Table 3.8e ***Summary of Predicted Noise Levels for different Mitigation Measures - Proposed widening of Tsing Lun Road***

NSR	Description	Max PNL - without mitigation measures	Max PNL - Use of Quiet Plant	Max PNL - Use of Quiet Plant with Barriers	Max PNL - Use of Quiet Plant with Barriers and limiting the usage of operating PME to 50%	Max PNL - Use of Quiet Plant with Barriers and limiting the usage of operating PME to 25%	Critical Construction Activity causing noise exceedance
N22	Siu Hong Court	85	81	79	76	73	-
N23	Yau Tze Tin Memorial College	78	74	72	69	66	-
N23	Yau Tze Tin Memorial College (during examination periods)	78	74	72	69	66	Excavation during roadwork construction

Table 3.8f *Proposed noise mitigation measures during construction phase*

Affected NSR	Proposed noise mitigation measures at nearby construction sites	Funding Agent / Implementation Agent / Maintenance Agent
Construction Phase 1		
N4, N7 and N16	Use of quiet plant with barriers and limiting the usage of operating PME to 50%	TDD/Contractor/Environmental Team
Construction Phase 2		
N3 (during examination periods)	Use of quiet plant	TDD/Contractor/Environmental Team
N5	Use of quiet plant with barriers	TDD/Contractor/Environmental Team
N20	Use of quiet plant with barriers and limiting the usage of operating PME to 50%	TDD/Contractor/Environmental Team
N23 (during normal periods)	Use of quiet plant	TDD/Contractor/Environmental Team
N23 (during examination periods)	Use of quiet plant with barriers and limiting the usage of operating PME to 50%	TDD/Contractor/Environmental Team
N24A	Use of quiet plant	TDD/Contractor/Environmental Team
N27	Use of quiet plant with barriers and limiting the usage of operating PME to 50%	TDD/Contractor/Environmental Team
Proposed widening of Tsing Lun Road		
N22	Use of quiet plant with barriers and limiting the usage of operating PME to 25%	TDD/Contractor/Environmental Team
N23 (during normal periods)	Use of quiet plant with barriers and limiting the usage of operating PME to 50%	TDD/Contractor/Environmental Team
N23 (during examination periods)	Use of quiet plant with barriers and limiting the usage of operating PME to 25% during roadwork construction and scheduling of construction activities to avoid excavation works during examination periods is required	TDD/Contractor/Environmental Team

3.8.2 *Mitigation Measures for Road Traffic Noise*

The assessment in *Section* 3.7.2 indicates that the areas adjacent to the proposed distributor road and the proposed widening section of Tsing Lun Road without mitigation will be affected by road traffic noise which exceed the EIAO-TM road traffic noise criteria. Mitigation measures will be necessary to alleviate the noise impacts. *Table* 3.8*g* outlines the recommended mitigation measures to tackle the noise impacts, the location of the proposed measures and the NSRs likely to be protected by the measures. *Figures* 3.8*a* and 3.8*b* show the proposed mitigation measures at different

areas of concern. Predicted noise levels with the implementation of suggested measures are shown in *Tables 3.8h* to *3.8l*. Breakdown showing the contribution in noise levels by existing and new roads is given in *Annex D*. A sample model output from *HFANoise* is given in *Annex E*.

The mitigation measures were recommended in such a way to demonstrate a workable scenario to minimise the impact of traffic noise based on the Preferred Development Option of the Study Area and the traffic forecasts. It was considered that the direct technical remedies proposed on the new distributor road and the widening section of Tsing Lun Road were practical, feasible to be implemented, and effective to reduce the level of noise impact at NSRs. In case residual noise impacts were identified after all the direct technical remedies were exhausted, further investigations to explore alternatives or options for reducing the residual impacts should be carried out, especially during the detailed design stage.

As the proposed developments will be divided into two main stages, the recommended measures for road traffic noise should be implemented prior to the operation at each development.

Existing Sensitive Uses

Mitigation measures in the form of roadside cantilever barrier of 5 m high and vertical barrier of 1 m high along the new distributor road and roadside cantilever and vertical barriers of 5 m high at various sections of the proposed widened Tsing Lun Road have been proposed. Sensitive uses at N4 (Po Tong Ha), N5 (Village house, north of Tsz Tin Tsuen), N6 (Tsz Tin Tsuen), N7 (Siu Hang Tsuen) and N27 (Village extension area north of Po Tong Ha) would be protected with the recommended measures. Location of the proposed mitigation measures are shown in *Figure 3.8a.*

For NSR N22 (Siu Hong Court), the predicted noise impacts would be mainly caused by the proposed widening of Tsing Lun Road. Implementation of the recommended measures has reduced the noise level at lower floors. A maximum reduction of 8 dB(A) was predicted. However with its close proximity to Tsing Lun Road, this NSR would still experience residual noise impacts of up to 5 dB(A) (refer to noise level of façade 364 at middle floor). Noise reduction in the range of 3-5 dB(A) were achieved at NSR N26 (Rezoning area south of San Hing Tsuen - façade no. 950) after implementing a 5 m high roadside cantilever barrier (about 100 m in length) along Road D7 to protect the future residential development at the rezoning area south of San Hing Tsuen. However, noise levels at middle and top floors still exceeded the EIAO-TM criterion.

As there are no emergency vehicle access within Site 2, Tsing Lun Road and Road D7 are the only roads accessible to the western and northern façades of the tower blocks located closest to the roundabout. For fire safety requirements, these two roads could not be enclosured as these will impede external rescue and fire-fighting operation by Fire Services aerial ladders. Therefore, the provision of full enclosures on Tsing Lun Road and Road D7 are not considered to be feasible.

As a result, roadside cantilever and vertical barriers of 5 m high at various sections of the proposed widened Tsing Lun Road are proposed to protect N22 (refer to *Figure 3.8a*). In addition, owing to the existing footbridge and bus bay, the option of using one continuous noise barrier in front of Siu Hong Court is not considered feasible. For façade 381 of N22 (Siu Hong Court), although a maximum noise exceedance of 7 dB(A) was predicted at lower floor, the noise impact predicted at this façade was mainly due to the traffic on the existing Tsing Lun Road.

For NSR N26 (Rezoning area south of San Hing Tsuen), it was tested that a buffer distance of at least 25 m from the proposed Road D7 would be required for the noise levels to meet the EIAO-TM criterion. It is therefore recommended that a buffer distance of at least 25 m with the 5 m cantilever barrier on Road D7 should be adopted for the future development and investigations during the design stage for the development of this area would be required to test the effectiveness of adopting suitable building layout to reduce the angle of exposure to the roadways. As advised by the Planning Department, the incorporation of a 25 m buffer zone along the proposed Road D7 to protect future residents of the proposed "R(E)" zone near San Hing Tsuen is considered acceptable as the presence of the 400kV pylon and the LRT reserve in the vicinity already constrains the development.

Reviewing the vertical profile of the new distributor road, the gradient is greater than 1% in most places. *Figure 3.8c* shows the vertical alignment of the proposed distributor road. As the southern section of the distributor road has a number of road junctions and due to the gradient of the road, maintenance of a low noise surfacing road will be difficult. For this reason, the effective application of low noise road surfacing on the new distributor road to control noise emission is precluded and will not be considered further in this assessment.

Other direct mitigation meausres, such as screening by noise tolerant buildings, providing setback of buildings and revising the building orientation, will involve demolition and construction of buildings and thus are not considered practical for mitigating noise impacts for existing sensitive uses. Moreover, as addressed in *Section* 2.3.2, the selection of the Preferred Development Option was the result of an evaluation process which has already taken consideration of alternative land use arrangement and alternative alignment of the proposed Road D7.

Provision of mitigation measures to protect other NSRs including N16 (Vertical Interim Housing Development, Area 29), N17 (Goodrich Garden and Blossom Garden) and N19 (Existing low-rise residential buildings next to Castle Peak Hospital) are considered limited. Firstly, these NSRs are located close to road junctions, the opportunity to provide direct technical remedies is restricted by engineering factors such as sight line requirement and road safety. The implementation of noise abatement measures to protect these NSRs was limited. Only a 20 m long roadside barrier could be installed on the proposed distributor road adjacent to the Vertical Interim Housing Development at Area 29. Such length of roadside barrier is considered to be ineffective for reducing noise impact. *Figure 3.8d* shows the sight line constraints for direct technical remedies at Tuen Mun Area 29.

Secondly, noise contribution from the new road is comparatively lower, and the NSRs would be impacted mainly due to the noise from existing roads, such as N11 (Kei Lun Wai), N17 (Goodrich Garden and Blossom Garden) and N19 (Existing low-rise residential buildings next to Castle Peak Hospital).

For NSR N23 (Yau Tsz Tin Memorial College), the predicted noise impacts would be mainly caused by the traffic on the proposed widening section of Tsing Lun Road and the new roundabout junction. Since window insulation and air-conditioning have already been implemented at N23, this NSR is considered to be less sensitive to noise. It is recommended that the window insulation installed at the College should be checked and confirmed that it meets the criteria given in the EIAO-TM, i.e. Type I window for less than 10 dB(A) exceedance over standard.

Fire Safety Requirements

As advised by the Fire Services Department, in order to ensure that their operations would not be impeded by the provision of direct mitigation measures, such as noise enclosures and noise barriers, the following requirements should be followed during the detailed design of the project to follow through:

- the proposed noise barriers should under no circumstances cause obstruction to the emergency vehicular access for nearby buildings and thereby impede external rescue and fire-fighting operation by Fire Services aerial ladders;
- the proposed noise barriers should under no circumstances cause obstruction to the direct access for fire appliances to nearby development/areas/villages; and
- the proposed noise barriers should under no circumstances cause obstruction to direct access and free operation of outlet of fire hydrant and its ground control valve cover. In all cases, no obstruction of any kind will be permitted within the space of 1.5 m around the ground valve cover or within a distance of 1 m from any hydrant outlet.

Table 3.8g ***Mitigation Measures for Road Traffic Noise***

Proposed Mitigation Measures	Location	NSR Benefitted
Along Proposed Road D7		
5m roadside cantilever barriers (reflective) [A total length of about 135m]	starts from 51m north of CH300 to 18m south of CH500 *(Figure 3.8a refers)*	N7 (Siu Hang Tsuen)
About 280m in length of a semi-enclosure	adjacent to Site 1 and starts from 30m north of CH500 to 21m north of CH800 *(Figure 3.8a refers)*	N2 (Planned SH at Site 1)
1m roadside vertical barriers (reflective) [A total length of about 714m]	starts from 60m south of CH900 to 39m west of CH1600 *(Figure 3.8a refers)*	N3 (Planned Educational Uses at Site 1A), N4 (Po Tong Ha) and N27 (Village extension area north of Po Tong Ha)
5m roadside cantilever barrier (absorptive) [A total length of about 354m on southbound of Road D7]	starts from 39m west of CH1600 to 45m east of CH1900	N5 (Village house, north of Tsz Tin Tsuen) and N6 (Tsz Tin Tsuen)
5m roadside cantilever barrier (absorptive) [A total length of about 100m on northbound of Road D7]	starts from 45m east of CH1800 to 45m east of CH1900 *(Figure 3.8a refers)*	N26 (Rezoning area south of San Hing Tsuen)
Along Proposed widening section of Tsing Lun Road		
Various lengths of 5m cantilever and vertical barriers (absorptive and reflective)	Along specific locations of the proposed widening section of Tsing Lun Road *(Figure 3.8a refers)*	N8(Planned PRE at Site 2), N22 (Siu Hong Court) and N23 (Yau Tze Tin Memorial College)

Table 3.8h *Mitigated Road Noise Levels ($L_{10,1\text{-}hr}$ dB(A)) for Existing NSRs*

NSR	Description	Facade no.	Lower Floor	mPD Level	Middle Floor	mPD Level	Top Floor	mPD Level
N4	Po Tong Ha	600	66	28.5	67	31.5	69	34.5
		601	64	24.5	65	27.5	66	30.5
		605	61	17.7	62	20.7	62	23.7
N5	Village House (north of Tsz Tin Tsuen)	983	65	10.0	66	13.0	68	16.0
		984	63	10.0	64	13.0	65	16.0
		345	64	10.5	66	13.5	69	16.5
N6	Tsz Tin Tsuen	975	65	9.6	65	12.6	65	15.6
N7	Siu Hang Tsuen	664	66	16.3	68	19.3	70	22.3
		665	61	16.3	62	19.3	64	22.3
		675	65	23.7	65	26.7	66	29.7
		981	64	22.5	65	25.5	66	28.5
N11*	Kei Lun Wai	679	65	8.0	65	11.0	65	14.0
		951	**76**(76.3)	8.0	**76**(76.3)	11.0	**76**(76.3)	14.0
N16	Vertical Interim Housing Development (Area 29)	954	**77**	21.1	**77**	60.3	**75**	94.4
		955	**77**	21.1	**77**	60.3	**75**	94.4
		956	**76**	21.1	**76**	60.3	**74**	94.4
		688	**75**	21.1	**75**	60.3	**74**	94.4
N17*	Goodrich Garden and Blossom Garden	656	**78**(77.5)	28.0	**76**(75.3)	67.2	**73**(72.5)	136.2
		650	**76**(75.7)	25.7	**75**(74.5)	64.9	**73**(72.7)	112.7
N19*	Existing low-rise residential buildings next to Castle Peak Hospital	645	**74**(73.7)	17.4	**74**(73.6)	20.4	**74**(73.6)	24.0
		660	**80**(80.2)	18.0	**80**(80.0)	21.0	**80**(79.7)	24.0
		661	**77**(76.6)	18.0	**77**(76.6)	21.0	**77**(76.5)	24.0
N22	Siu Hong Court	961	66	13.0	68	55.0	68	97.0
		957	69	13.0	69	55.0	70	97.0
		371	70	13.0	**74**	55.0	**72**	97.0
		364	**73**	12.6	**75**	54.6	**73**	96.6
		355	69	12.0	**72**	54.0	70	96.0
		346	67	22.2	**72**	64.2	70	106.2
		381*	**77**(76.8)	22.2	**74**(73.6)	64.2	**72**(71.4)	106.2
N23	Yau Tsz Tin Memorial College	590	**67**	14.2	**67**	21.0	**71**	31.2

NSR	Description	Facade no.	Lower Floor	mPD Level	Middle Floor	mPD Level	Top Floor	mPD Level
N24A	Village House (south of San Hing Tsuen)	677	53	10.5	56	16.5	61	22.5
N26	Rezoning area south of San Hing Tsuen	950	67	10.5	69	16.5	70	22.5
N27	Village extension area north of Po Tong Ha	844	64	10.6	65	13.6	66	16.6
		851	66	18.5	68	21.5	70	24.5
		854	65	17.5	66	20.5	68	23.5
		855	61	11.5	62	14.5	62	17.5

* Noise impacts dominated by traffic on existing roads
( )Noise level contributed from existing roads.

Planned Residential Uses

Mitigated noise levels with the proposed noise abatement measures fore planned residential developments are presented in *Tables 3.8i* to *3.8k*. The building block layouts in each of the planned housing sites have been consulted with the relevant government departments, including Planning Department and Housing Department. For Site 1, semi-enclosure of length of approximately 280 m was proposed along the section of the proposed distributor road adjacent to Site 1 to screen out traffic noise. Noise reduction achieved was up to 11 dB(A) for NSR at middle floors (façade 611). With the proposed semi-enclosure in place, all the predicted noise levels were within the EIAO-TM standard, i.e. 70 dB(A). The design of the semi-enclosure should meet all the sight line and traffic safety requirements.

Table 3.8i ***Mitigated Road Noise Levels ($L_{10,1\text{-}hr}$ dB(A)) for Site 1, SH (N2)***

Facade no.	No. of Storeys	Ground mPD Level	Lower Floor	mPD Level	Middle Floor	mPD Level	Top Floor	mPD Level
611	26	37.1	60	42.1	64	67.3	64	109.3
612	26	37.1	65	42.1	68	67.3	68	109.3
613	26	37.1	66	42.1	68	67.3	68	109.3
621	26	37.1	60	42.1	65	67.3	64	109.3
622	26	37.1	61	42.1	66	67.3	66	109.3
631	26	37.1	61	42.1	66	67.3	65	109.3
632	26	37.1	59	42.1	64	67.3	66	109.3
641	26	37.1	62	42.1	68	67.3	66	109.3
642	26	37.1	57	42.1	63	67.3	64	109.3
651	26	37.1	67	42.1	70	67.3	68	109.3
652	26	37.1	57	42.1	62	67.3	64	109.3
653	26	37.1	68	42.1	70	67.3	69	109.3

Table 3.8j *Mitigated Road Noise Levels ($L_{10,1\text{-}hr}$ dB(A)) for Site 2, Public Rental Estate (N8)*

Facade no.	No. of Storeys	Ground mPD Level	Lower Floor	mPD Level	Middle Floor	mPD Level	Top Floor	mPD Level
711	33	10.0	68	15.0	72	54.2	72	101.8
991	33	10.0	66	15.0	70	54.2	70	101.8
992	33	10.0	64	15.0	70	54.2	70	101.8
712	33	10.0	69	15.0	71	54.2	71	101.8
993	33	10.0	67	15.0	67	54.2	69	101.8
994	33	10.0	68	15.0	66	54.2	68	101.8
995	33	10.0	65	15.0	67	54.2	68	101.8
996	33	10.0	65	15.0	69	54.2	69	101.8
721	33	10.0	69	15.0	73	54.2	72	101.8
722	33	10.0	69	15.0	69	54.2	69	101.8
731	41	6.9	67	11.9	69	51.1	69	121.1
732	41	6.9	62	11.9	64	51.1	68	121.1
886	41	6.9	54	11.9	55	51.1	58	121.1
751	41	7.0	48	12.0	65	51.2	69	121.2
761	41	7.0	64	12.0	67	51.2	70	121.2
762	41	7.0	67	12.0	67	51.2	66	121.2
763	41	7.0	54	12.0	57	51.2	59	121.2
771	41	9.0	59	14.0	59	53.2	61	123.2
772	41	9.0	61	14.0	62	53.2	63	123.2

For the building blocks at Site 2 located close to the roundabout junction, some of the sensitive façades were protected by the 5 m cantilever barriers previously proposed for low-rise existing development and the 5 m cantilever barriers proposed along the widened Tsing Lun Road. A maximum noise reduction of 7 dB(A) was predicted at façades 712 at lower floor. Residual noise exceedances in the range of 1 to 3 dB(A) were predicted at façades 711, 712 and 721 at middle and top floors. As these façades are close to the roundabout junction and facing Tsing Lun Road directly, application of direct technical remedies is considered limited. In addition, provision of podium for the building blocks of this site is not feasible given the type and nature of housing development.

For façades 911, 992, 993, 994, 995 and 996, predicted noise levels were mitigated to within the EIAO-TM standard. It is therefore recommended that façades at assessment point locations 711, 712 and 721 should be designed as blank façades to further reduce noise impacts.

For façades facing away from the proposed distributor Road D7, such as façades 886, 763 and 771, no noise exceedance was predicted. This is because noise impacts at building blocks with these façades could be screened by the adjacent buildings and by the commercial/car-park block, potential noise impacts on these building blocks would thus be minimal.

In view of the residual impacts at the two tower blocks located close to the roundabout at Site 2, further mitigation measures, such as options for the use of blank façades or internal building design may need to be considered to reduce the noise impacts level at affected receivers. In cases all the direct mitigation measures have been exhausted, the use of noise insulation and installation of air-conditioning system should be implemented, as the last resort, to protect the affected NSRs.

Residential blocks at Site 3 are located quite close to the distributor road. Since single aspect block design was adopted for those residential blocks close to the junction and other screening structures such as car park and commercial centre have been incorporated into the design, further control measures for the building blocks of this site are considered limited. Reasons for not adopting other direct mitigation measures and the advantages of using single aspect block in building designs are addressed in *Section 3.7.2* under *Planned Residential Uses* for Site 3. Residual noise exceedance of 1 dB(A) was predicted at some of the façades (façade nos. 811, 812, 831 and 832). However these exceedances were found to be contributed mainly from existing roads. Noise levels at other façades were mitigated to within the EIAO-TM criterion.

Table 3.8k *Mitigated Road Noise Level ($L_{10,1\text{-}hr}$ dB(A)) for Site 3, PSPS (N14)*

Facade no.	No. of Storeys	Ground mPD Level	Lower Floor	mPD Level	Middle Floor	mPD Level	Top Floor	mPD Level
500	32	22.0	70	27.0	70	66.2	69	111.0
501	32	22.0	68	27.0	66	66.2	64	111.0
502	32	22.0	68	27.0	67	66.2	65	111.0
503	32	22.0	58	27.0	61	66.2	61	111.0
504	32	22.0	67	27.0	69	66.2	68	111.0
505	32	22.0	52	27.0	56	66.2	56	111.0
811*	39	22.0	69	27.0	71(69.0)	66.2	71(69.1)	130.6
812*	39	22.0	68	27.0	71(68.0)	66.2	70	130.6
813	39	22.0	61	27.0	67	66.2	66	130.6
814	39	22.0	61	27.0	66	66.2	65	130.6
821	39	22.0	54	27.0	60	66.2	60	130.6
831*	39	22.0	69	27.0	71(68.2)	66.2	71(68.4)	130.6
832*	39	22.0	70	27.0	71(69.6)	66.2	71(69.9)	130.6
841	41	14.4	68	19.4	69	72.6	69	128.6
842	41	14.4	68	19.4	69	72.6	69	128.6
344	41	14.4	65	19.4	67	72.6	67	128.6
861	41	12.0	43	17.0	61	70.2	63	126.2

* Noise impacts dominated by traffic on existing roads
( )Noise level contributed from existing roads.

Planned School Sites and G/IC Sites

For the planned schools at Site 1A (Schools 3 and 4), noise levels were mitigated to meet the EIAO-TM criteria after the proposed mitigation measures have been

implemented (semi-enclosure adjacent to Site 1 and 1 m high vertical barriers along specific sections of Road D7).

Regarding the planned G/IC developments at Site 6 (Façade 700), in view of the noise exceedance at the western part of this site (assessed at 10 m from the road kerb of Road D7), it is considered not suitable for noise sensitive development, such as residential premises, without substantial mitigation measures.

Table 3.8l ***Mitigated Road Noise Levels ($L_{10,1\text{-}hr}$ dB(A)) for Schools and G/IC Sites***

School	Facade no.	Ground mPD Level	1/F	mPD Level	3/F	mPD Level	6/F	mPD Level
N3	531	18.0	62	23.8	63	30.6	65	40.8
N3	541	22.0	59	27.8	60	34.6	61	44.8
N15 (G/IC Site 6)	700	15.0	80	20.8	81	27.6	80	37.8

Table 3.8m below gives a summary of the constraints for the development of each planned site.

Table 3.8m ***A summary of development constraints for each planned site***

Site Ref.	Description	Constraints
1 (N2)	Planned SH at Site 1 *(Figure 3.7l refers)*	• A podium structure of 13.5 m high • A setback distance of at least more than 40 m from the proposed Road D7
2 (N8)	Planned PRE at Site 2 *(Figure 3.7n refers)*	• Consideration of using Blank façades at the two blocks located close to the Roundabout and Road D7 • A 2 storey commercial centre with a 4 storey car park block fronting the proposed widened Tsing Lun Road
3 (N14)	Planned PSPS at Site 3 *(Figure 3.7o refers)*	• Single aspect design for building blocks located close to road junctions • A podium structure of 2 level car park • A 3 level commercial centre block fronting local access roads
N26	Rezoning area south of San Hing Tsuen	• A buffer distance of at least 25 m from the proposed Road D7 recommended (with the 5 m high and 100 m long cantilever barrier on northbound of Road D7 in place)
LRT Reserve (not confirmed)	Proposed alongside the alignment of the proposed Road D7	• If confirmed to be built, a separate EIA Study need to be conducted before work proceeds

3.9 INDIRECT TECHNICAL REMEDIES

Implementation of indirect technical remedies (ITR) such as window insulation and air-conditioner installation should only be considered as the last resort to combat

residual noise impact at existing uses upon exhaust of all feasible direct technical remedies.

In order to carry out an estimation of the number of dwellings eligible for ITR, a comparison of noise levels between prevailing year and that of future year with direct mitigation measures applied has been conducted. The traffic forecast used for the prevailing year is 2001 (morning peak hour traffic flow) while that for future year is 2021 (morning peak hour traffic flow). *Table 3.9a* presents the traffic forecast data for the Year 2001.

Three criteria have to be met in order for a dwelling to be eligible for implementing ITR. The three criteria are

- the predicted overall noise level from the new road together with other traffic noise in the vicinity must be above 70 dB(A)$L_{10\ (peak\ hour)}$;
- the predicted overall noise level is at least 1.0 dB(A) more than the prevailing traffic noise level, i.e. the total traffic noise level existing before the works to construct the road were commenced; and
- the contribution to the increase in the overall noise level from the new road must be at least 1.0 dB(A).

A summary of the results is presented in *Table 3.9b*. Block locations of VIH at Area 29 and Siu Hong Court are shown in *Figures 3.9a* and *3.9b*. The building blocks where detailed noise assessment are carried out to test their eligibility for providing ITR are highlighted in the figures. For VIH at Area 29, detailed noise assessment for Blocks 4, 5, 6, 8 and 9 are carried out and results are shown in *Annex F*. For Blocks 1, 2 and 3, noise assessment were also carried out and there were no exceedances in the noise levels except for Block 1. However the exceedances were mainly due to the contribution from existing roads and therefore are not eligible for window insulation and air-conditioning.

However, it is recommended that should circumstances change for the proposed development, other practicable direct mitigation measures should be explored and ITR should only be proposed as a last resort.

Table 3.9a ***Traffic Forecasts for the Year 2001, AM Peak Hour***

Road	From	To	2-way Traffic Flow (veh/hr)	Percentage of Heavy Vehicles (%)	Speed (km/hr)
Proposed Distributor Road	Ming Kum	Site 3 & 4 Access	1055	12.2	50
	Site 3 & 4 Access	Site 1 Access	N/A	N/A	N/A
	Site 1 Access	Village Overflow Access	N/A	N/A	N/A
	Village Overflow Access	Hong Po/Tsing Lun Road	N/A	N/A	N/A
Tsing Lun Road	Lam Tei	Site 2 Access	818	33.6	50
	Site 2 Access	Tsing Chung Koon Road	808	44.2	50
	Tsing Chung Koon Road	Tsun Wen Road	381	42.2	50
Tsun Wen Road	Proposed Distributor Road	Leung Wan Street	710	35.6	50
	Leung Wan Street	Tsing Lun Road	908	44.2	50
Ming Kum Road	Proposed Distributor Road	Leung Tak Street	1298	19.8	50
	Leung Tak Street	Tsing Tin Road	467	29.1	50

Table 3.9b *Estimation of dwellings eligible for ITR - Existing Sensitive Uses*

NSRs	Approximate no. of dwellings	Estimated No. of Dwellings Eligible for Indirect Technical Remedies	Location
VIH at Area 29			
Block 4	1008	36	refer to *Annex F1* for details
Block 5	1008	269	
Block 6	1008	223	
Block 8	1008	402	
Block 9	672	224	
Total		**1154**	
Siu Hong Court			
Block K	248	31	refer to *Annex F2* for details
Block P	248	39	
Block Q	248	112	
Block R	248	69	
Total		**251**	

For planned uses, a preliminary estimation of the number of dwellings requiring further mitigation has also been conducted. The results are presented in *Table 3.9c*.

Table 3.9c *Estimation of dwellings eligible for ITR - Planned Uses*

NSRs	Estimated no. of dwellings	Estimated Percentage of Dwellings Protected	Estimated Percentage of Affected Uses	Estimated no. of Dwellings Requiring further mitigation
Planned Uses				
Site 2	5184	97%	3%	161(if blank façades are not considered)

For Site 2, it is recommended that options for the use of blank façades and internal building design should be further explored to reduce the noise impacts level at affected receivers. ITR in the form of window insulation and air conditioning would be required as a last resort upon exhausting the above mitigation measures.

3.10 ENVIRONMENTAL MONITORING AND AUDIT REQUIREMENTS

Noise arising from construction activities during the construction phase will impact upon nearby NSRs as assessed in *Section 3.7*. The primary noise source include the use of PME such as excavator, lorry, loader, bulldozer grader, mobile crane and poker vibrator. The construction noise standards given in EIAO-TM will be exceeded at some of the representative NSRs without implementing any noise mitigation measures.

It is anticipated that if the suggested mitigation measures described in *Section 3.8.1* can be successfully applied, the noise levels experienced by the affected receivers will be reduced to within the noise standards.

Noise monitoring requirements have been recommended in the EM&A Manual in order to ensure compliance with the noise standards. It is recommended that noise monitoring should be conducted as part of the EM&A programme during the construction period of the project at N3 (Planned Educational Uses at Site 1A), N4 (Po Tong Ha), N5 (village house, north of Tsz Tin Tsuen), N7 (Siu Hang Tsuen), N16 (Vertical Interim Housing development, Area 29), N20 (Castle Peak Hospital), N22 (Siu Hong Court), N23 (Yau Tze Tin Memorial College), N24A (Village House, south of San Hing Tsuen) and N27 (Village extension area north of Po Tong Ha) and at additional locations where considered necessary, in agreement with the EPD.

Apart from the above, the Project Proponent shall deposit to the Director of Environmental Protection (DEP), at least 6 months before the operation of the project, a monitoring plan for the purpose of assessing the accuracy of traffic noise predictions by comparing the project noise impact predictions with the actual impacts. The monitoring plan shall contain monitoring locations, monitoring schedules, methodology of noise monitoring including noise measurement procedures, traffic counts and speed checks, and methodology of comparison with the predicted levels. At least three monitoring locations at the noise sensitive receivers shall be proposed. At least three sets of measurement for each monitoring location shall be conducted and the monitoring shall be done within the first year of operation of the project. Monitoring shall be conducted in accordance with the deposited monitoring plan unless with prior justification. Monitoring details and results including the comparison between the measured noise levels and the predicted levels shall be recorded in a report to be deposited with the DEP within one month of the completion of the monitoring. The report shall be certified by the Project Proponent before deposit with the DEP.

3.11 CONCLUSIONS

3.11.1 *Construction Phase*

Noise during the construction phase of the project would impact on the surrounding environment. Unmitigated construction activities associated with the Project would cause exceedances of daytime construction noise standards stipulated in the EIAO-TM at NSRs located close to the work sites. Noise exceedances in the range of 1-9 dB(A) have been predicted, and critical noisy construction activities identified were site formation works, road construction and building construction.

Adequate control measures would be required for general construction works to meet the EIAO-TM construction noise standards. Mitigation measures including the use of quiet plant, installing noise barriers and reducing the percentage of time of noisy equipment in operation were recommended to be included as part of the Action Plan of the EM&A programme. With the implementation of quiet plant, barriers and limiting the usage of operating PME to 50% on site, noise impact at all the identified NSRs from construction works could be mitigated to comply with the daytime construction noise criteria.

Noise impact of 1 dB(A) and 4 dB(A) were still predicted at N22 (Siu Hong Court) and N23 (Yau Tze Tin Memorial College during examination periods) during the construction for the widening of Tsing Lun Road in Phase 1. This is due to their close

proximity to the proposed widening section of Tsing Lun Road. Further limiting the operating time of PME to 25% should be considered and careful time scheduling of the construction activities before the construction works proceed is required so as to reduce the noise impacts.

With the implementation of all the recommended mitigation measures, noise exceedance of 1 dB(A) was still predicted at N23 (Yau Tze Tin Memorial College) during examination periods. The critical activity found to cause the noise exceedance was excavation during roadwork construction and thus scheduling of construction activities to avoid the undertaking of excavation works during examination periods is required. *Table 3.8f* gives a summary of the proposed mitigation measures for affected NSRs during construction phase.

Regular monitoring of noise at NSRs would be required during the construction phase of the project, as part of the EM&A programme, in order to ensure the environmental performance of the works through the implementation of the Action Plan.

3.11.2 *Operational Phase*

Road traffic noise impact is a key environmental issue for the proposed development. Based on the worst case traffic forecasts for the year 2021, noise impacts would be likely at most of the identified existing and planned NSRs. Direct technical remedies (cantilever and vertical barriers) on the proposed distributor road and Tsing Lun Road have been recommended in order to reduce the identified impacts.

Noise abatement measures have also been proposed at the housing sites to further reduce noise nuisance from road traffic. At Sites 1, 2 and 3, podia of appropriate scale, screening structures including multi-storey car park and commercial centres are recommended. Noise semi-enclosure is also suggested to maximise the screening potential with regard to traffic noise from the new distributor road. For Site 3, single aspect design has been used for the building blocks to mitigate traffic noise.

Even with the proposed direct mitigation measures in place, there would still be residual noise impacts at the planned sensitive uses. Options for the use of blank façades and internal building design for Site 2 may need to be further explored to reduce the noise level at affected receivers.

In cases where the direct technical remedies were exhausted, the use of noise insulation and installation of air-conditioning system should be considered, as the last resort, to protect the affected NSRs. However, it is recommended that should circumstances change for the proposed development, other practicable direct mitigation measures should be explored and ITR should only be proposed as the last resort. *Table 3.8m* gives a summary of the constraints for the development of each planned site. *Tables 3.9b* and *3.9c* show the estimated number of existing and planned dwellings that would be eligible for ITR.

As suitable acoustic louvers, silencers, dampers and noise absorptive lining will be provided for the proposed sewage pumping station at Site 2 and as the proposed PTIs in Sites 2 and 3 will be covered and located under the proposed commercial centres, noise impacts from these fixed noise sources would be minimal.

Rail noise from the West Rail will be sufficiently screened by the residential towers of Siu Hong Court and, hence planned sensitive uses within Tuen Mun Area 54 would not be impacted by rail noise of West Rail.

A semi-quantitative noise assessment has been conducted for the not yet confirmed LRT extension in Tuen Mun Area 54, assessment results indicated that for NSRs at a distance of 25 m from the LRT track, noise exceedances of 2 dB(A) and 12 dB(A) were predicted during daytime and night time respectively. As such, track side barrier should be considered at positions with insufficient horizontal buffer between the LRT track and the nearby NSRs. Detail noise assessment is recommended during the detailed design stage after the LRT development is confirmed.

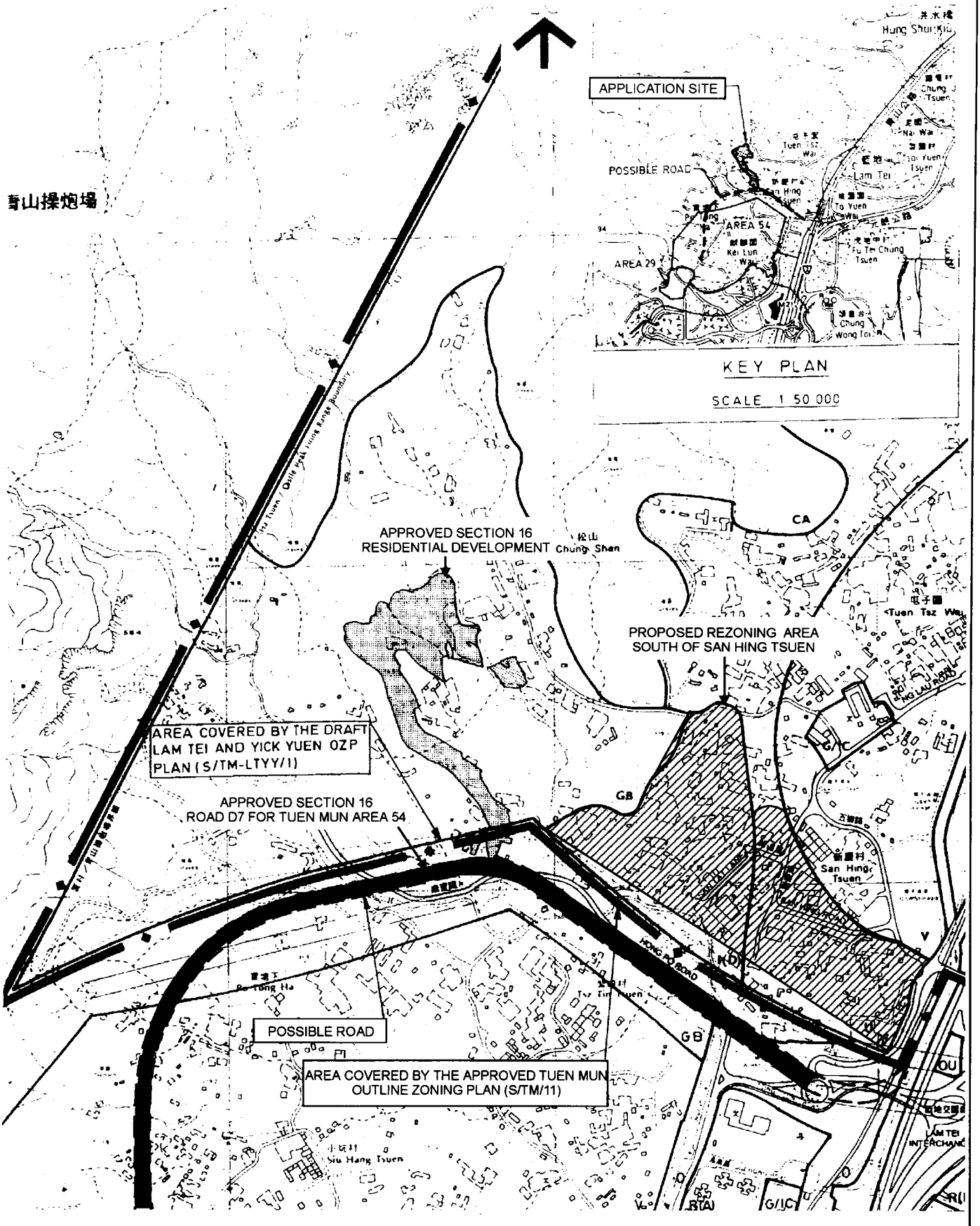


FIGURE 3.3a

LOCATION OF THE APPROVED SECTION 16 HOUSING DEVELOPMENT NORTH OF ROAD D7 AND THE REZONING AREA SOUTH OF SAN HING TSUEN

FILE: C1707z38
DATE: 21/06/99

Environmental Resources Management

ERM

FIGURE 3.3b

NOISE MEASUREMENT LOCATION

FILE: C1707_8
DATE: 04/12/98

Environmental Resources Management

ERM

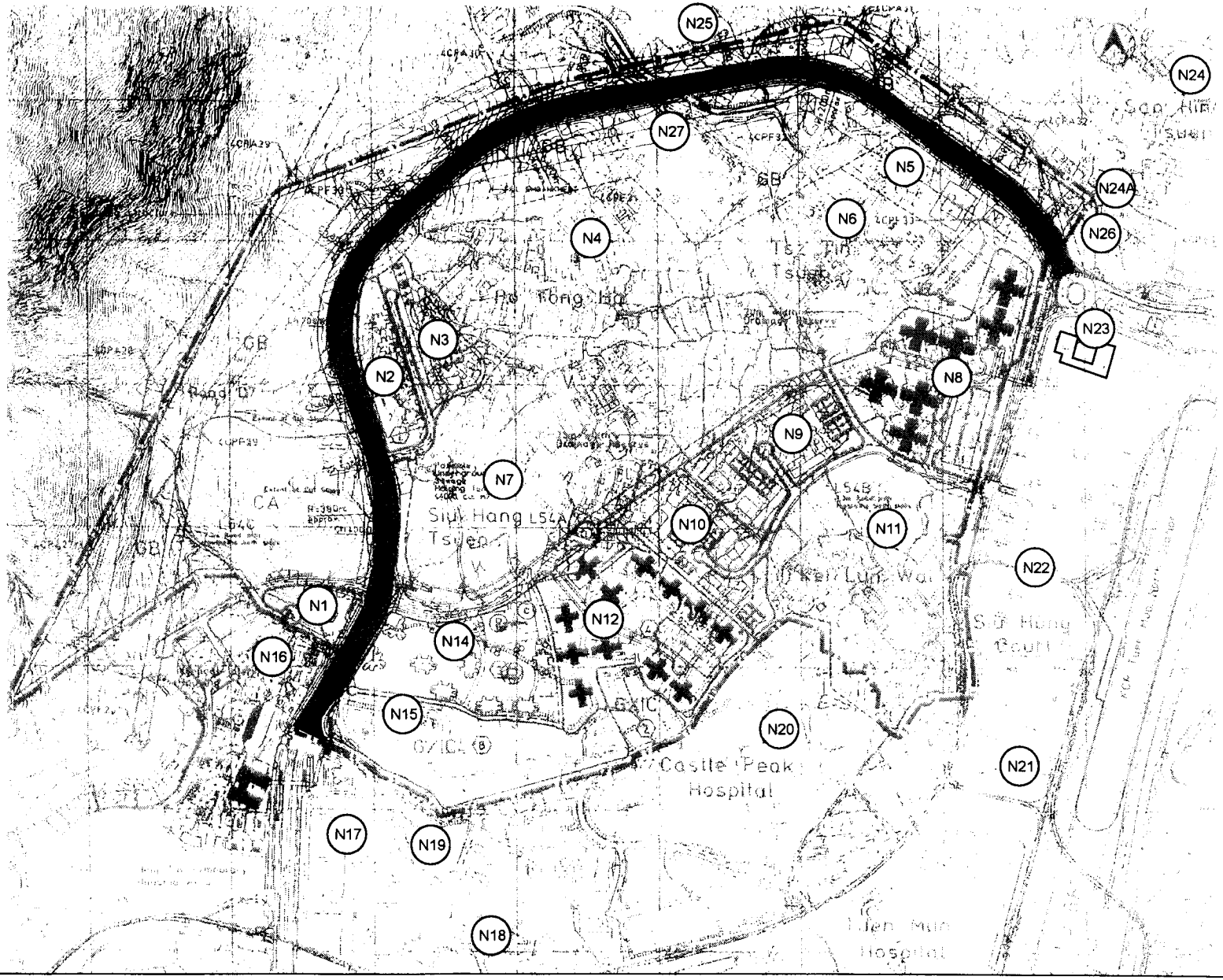


FIGURE 3.4a

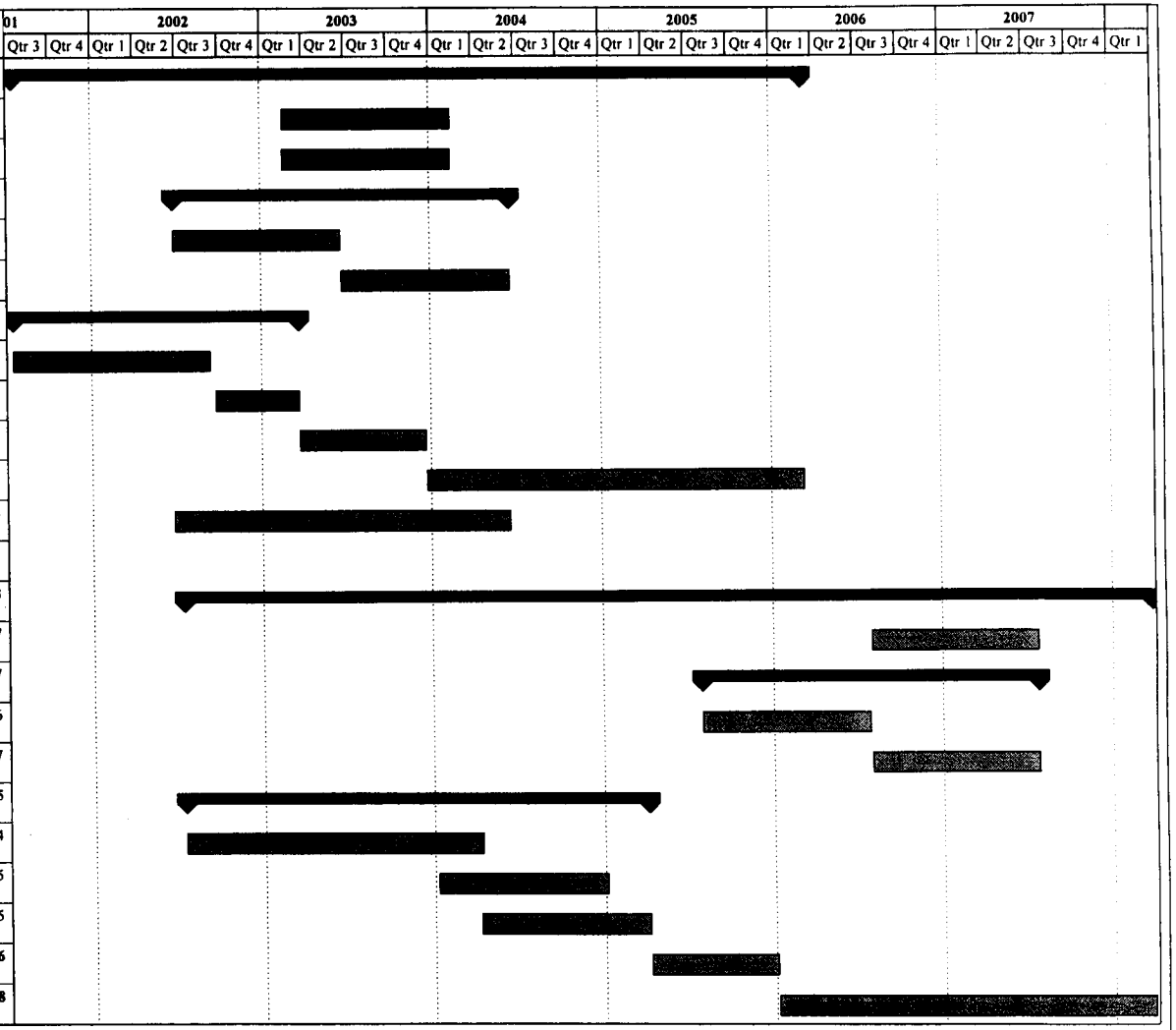
IDENTIFIED NOISE SENSITIVE RECEIVERS

FILE: C1707/C1707w6
DATE: 20/10/98

Environmental Resources Management

ERM

ID	Task Name	Start	Finish
1	**Construction Work Packages - Site 1**	**Mon 16/07/01**	**Mon 13/03/06**
2	***Village Improvements***	Tue 18/02/03	Mon 16/02/04
3	***Slope Drainage & Hazard Mit'n Measures***	Tue 18/02/03	Mon 16/02/04
4	***Road D7 (Part), Drain, Sewer/Water Mains***	**Tue 25/06/02**	**Mon 21/06/04**
5	Earthworks Zone 1, 2, 3, 4 & 6	Tue 25/06/02	Mon 23/06/03
6	Roadworks, Drains and Utilities	Tue 24/06/03	Mon 21/06/04
7	***Site Formation Works***	**Mon 16/07/01**	**Mon 24/03/03**
8	Preparation for Archaeological Survey and Archaeological Rescue Work	Mon 16/07/01	Thu 12/09/02
9	Earthworks Zone 5 and Clearance	Tue 24/09/02	Mon 24/03/03
10	***Piling Works for Site 1***	**Tue 25/03/03**	**Mon 22/12/03**
11	***Housing Development at Site 1***	**Tue 23/12/03**	**Mon 13/03/06**
12	***Road Junction Improvement***	**Tue 25/06/02**	**Fri 18/06/04**
13			
14	**Construction Work Packages - Sites 2, 3 and 4**	**Mon 15/07/02**	**Thu 27/03/08**
15	***Village Improvements***	Mon 31/07/06	Fri 27/07/07
16	***Road D7 (Remainder), Drain and Landscape***	**Mon 01/08/05**	**Fri 27/07/07**
17	Earthworks Zones 7 to 10C	Mon 01/08/05	Fri 28/07/06
18	Roadworks, Drains and Utilities	Mon 31/07/06	Fri 27/07/07
19	***Site Formation Works***	**Mon 15/07/02**	**Thu 07/04/05**
20	Preparation for Archaeological Survey and Archaeological Rescue Work	Mon 15/07/02	Thu 15/04/04
21	Earthworks Zones 11 to 18A	Fri 09/01/04	Thu 06/01/05
22	Drains and Utilities	Fri 09/04/04	Thu 07/04/05
23	***Piling Works for Housing Sites 2, 3 & 4***	**Fri 08/04/05**	**Thu 05/01/06**
24	***Housing Developments at Sites 2, 3 & 4***	**Fri 06/01/06**	**Thu 27/03/08**



Project: Planning & Development Study of Potential Housing Site in Area 54, Tuen Mun
Date: 14/04/99

Task Summary

FIGURE 3.5a Proposed Construction Programme for Tuen Mun Area 54

FIGURE 3.6a

TRAFFIC FORCAST FOR THE YEAR 2021, AM PEAK HOUR

FILE: C1707Z10
DATE: 17/12/98

Environmental Resources Management

ERM

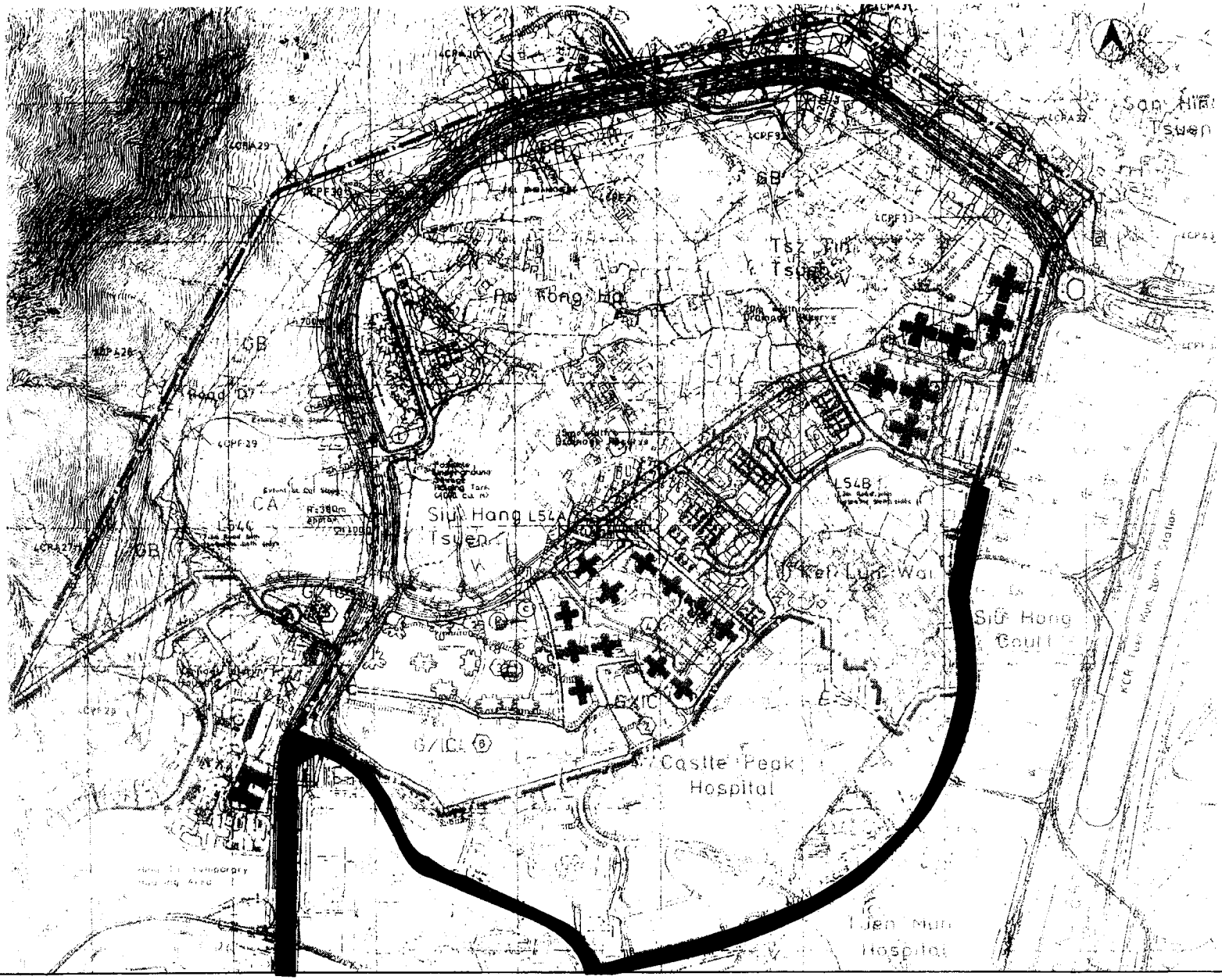


FIGURE 3.6b

LOCATION OF "EXISTING" ROAD

FILE: C1707Z9
DATE: 17/12/98

Environmental
Resources
Management

ERM

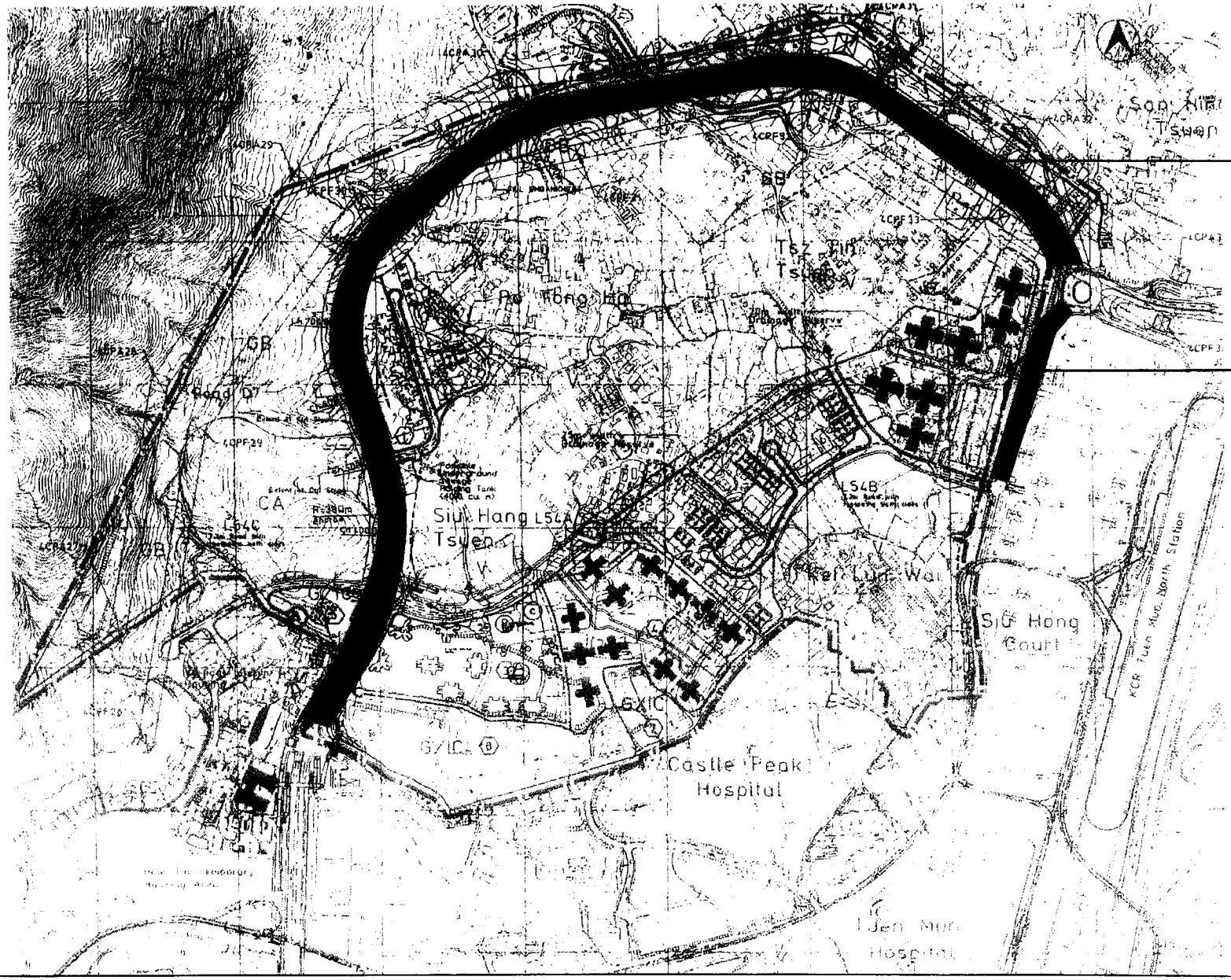


FIGURE 3.6c

LOCATION OF "NEW" ROAD

FILE: C1707/C1707Z8
DATE: 02/12/98

Environmental Resources Management

ERM

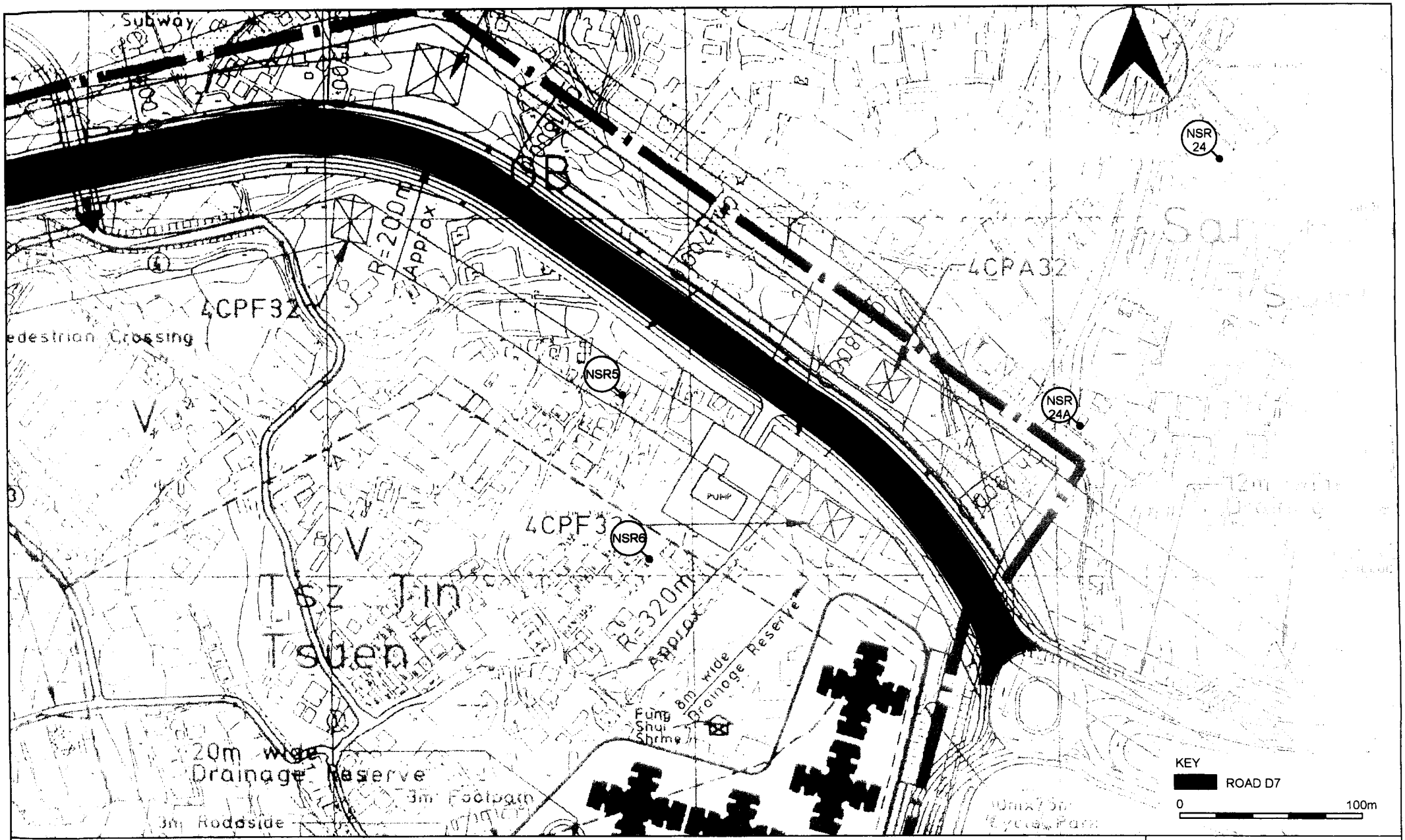


FIGURE 3.7a

LOCATION OF NSRs IN CONSTRUCTION PHASE

Environmental Resources Management

ERM

FILE: C1707_1
DATE: 03/12/98

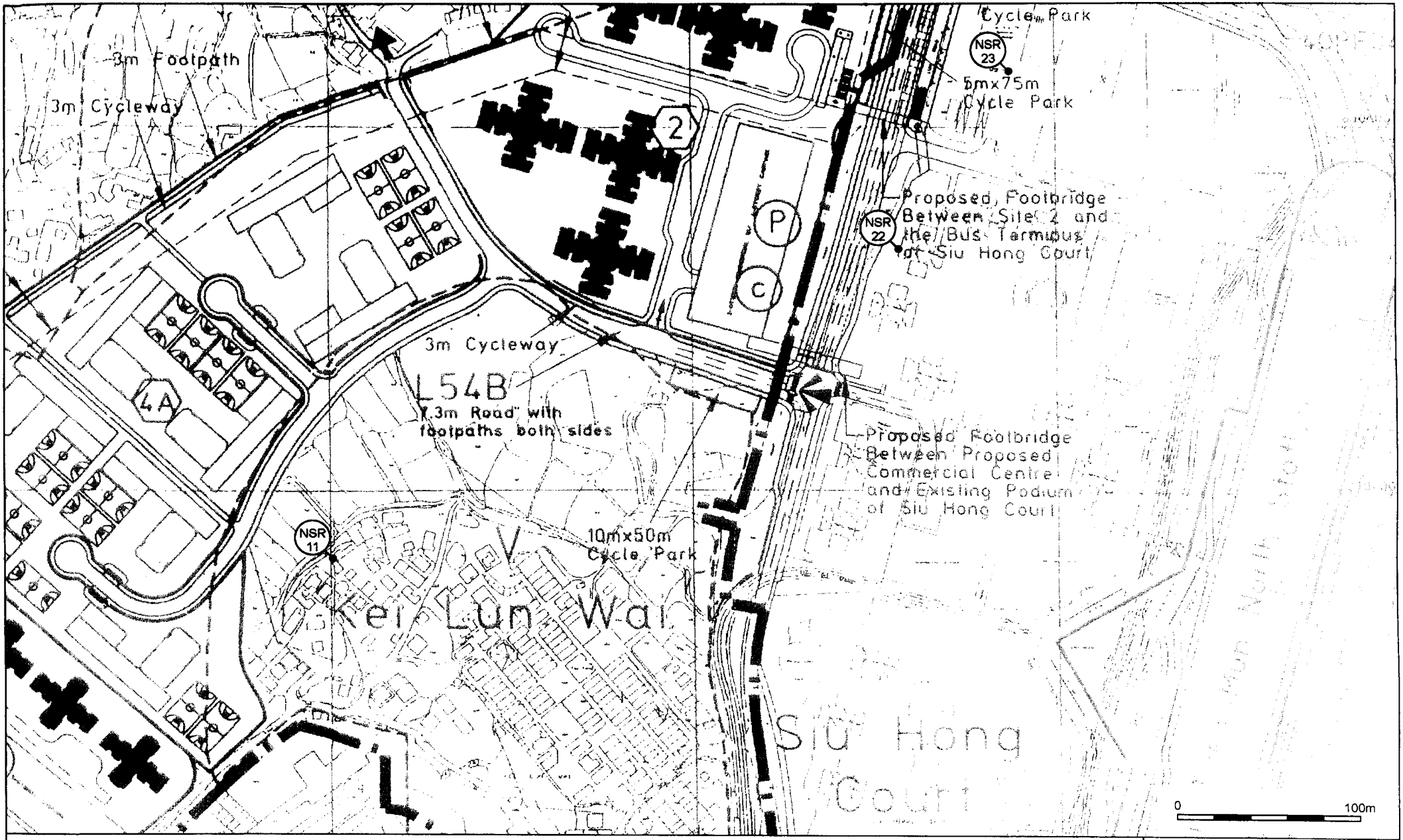


FIGURE 3.7b

LOCATION OF NSRs IN CONSTRUCTION PHASE

FILE: C1707_2
DATE: 03/12/98

Environmental Resources Management

ERM

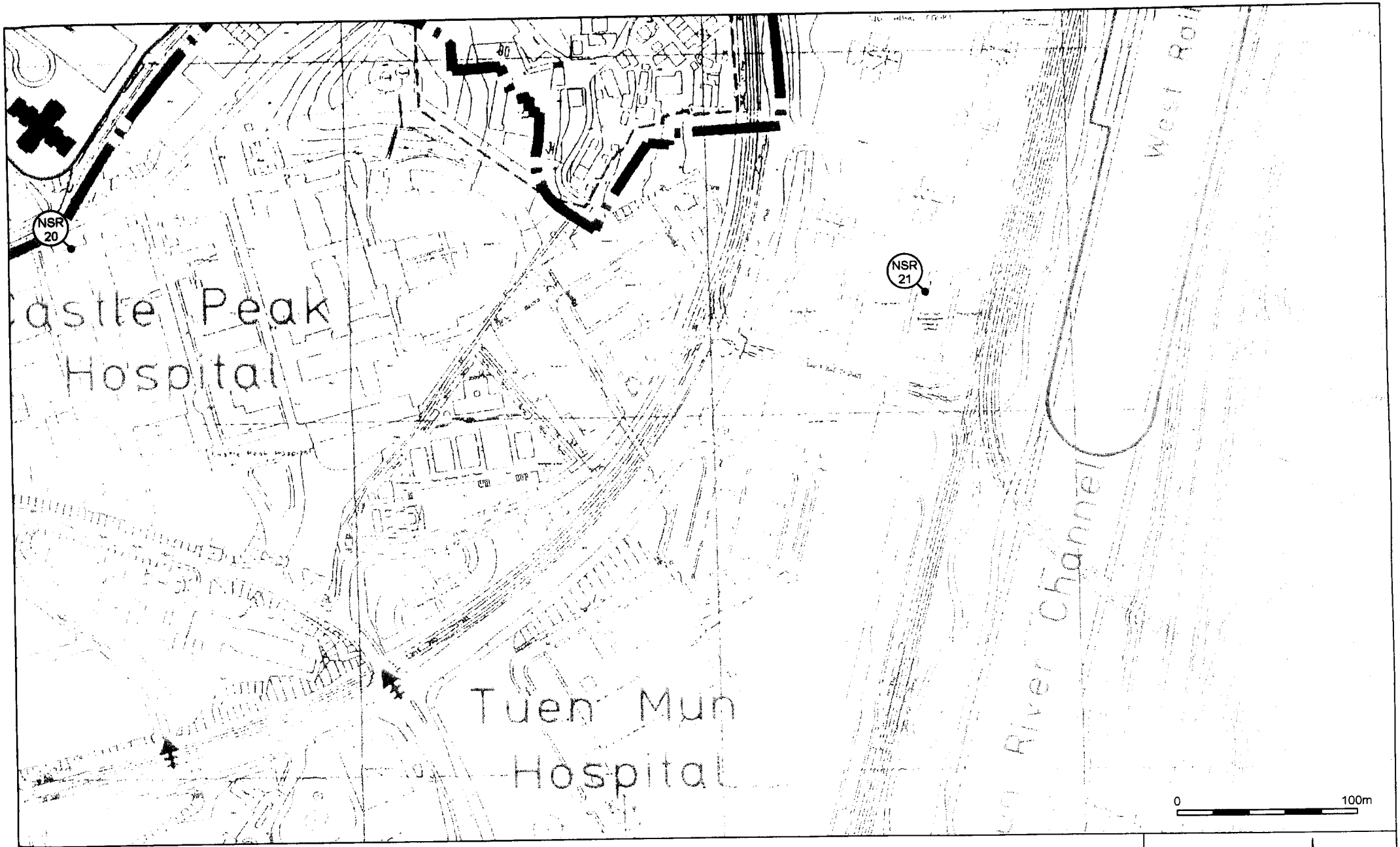


FIGURE 3.7c

LOCATION OF NSRs IN CONSTRUCTION PHASE

Environmental Resources Management

ERM

FILE: C1707_3
DATE: 03/12/98

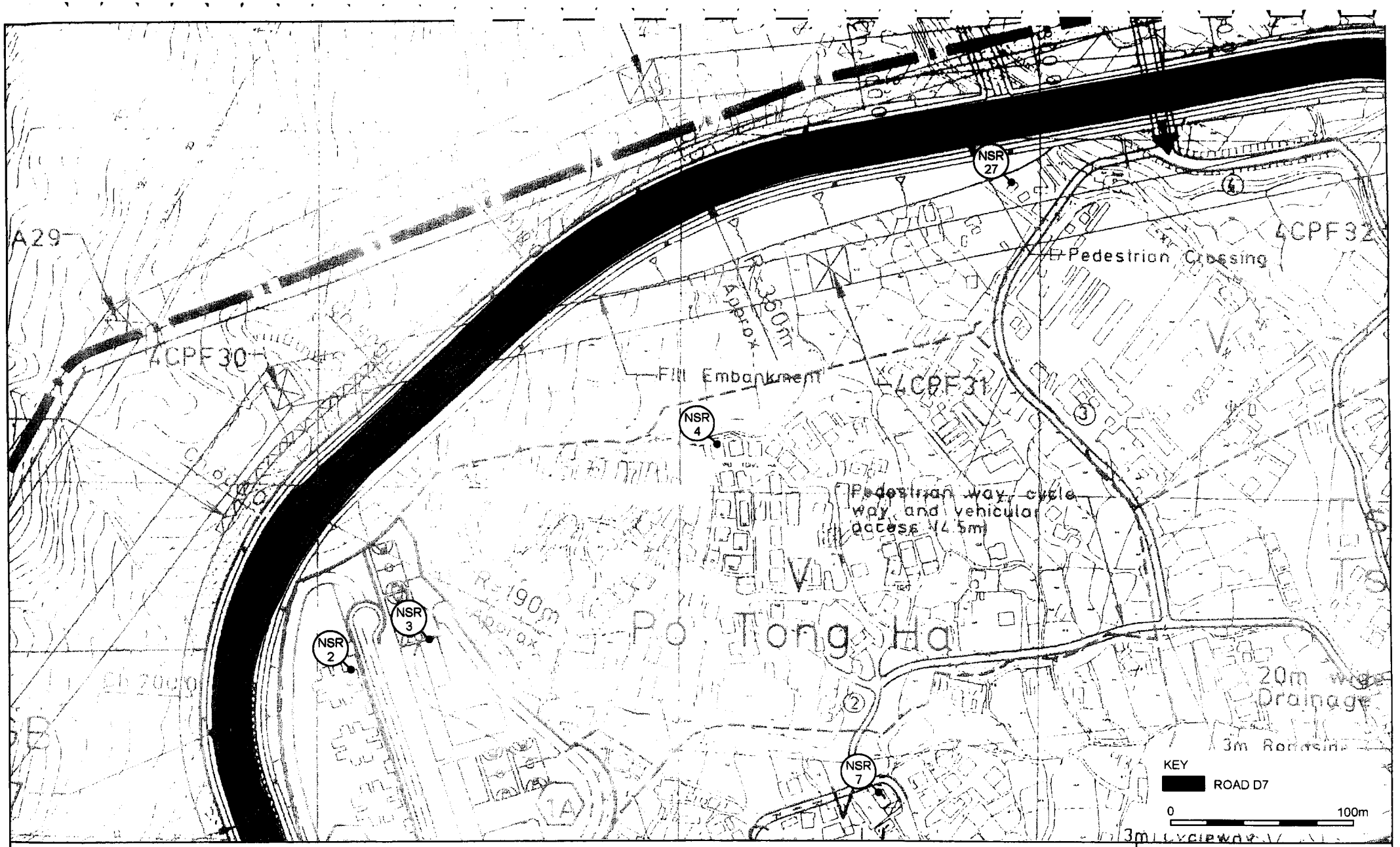


FIGURE 3.7d

LOCATION OF NSRs IN CONSTRUCTION PHASE

FILE: C1707_4
DATE: 03/12/98

Environmental Resources Management

ERM

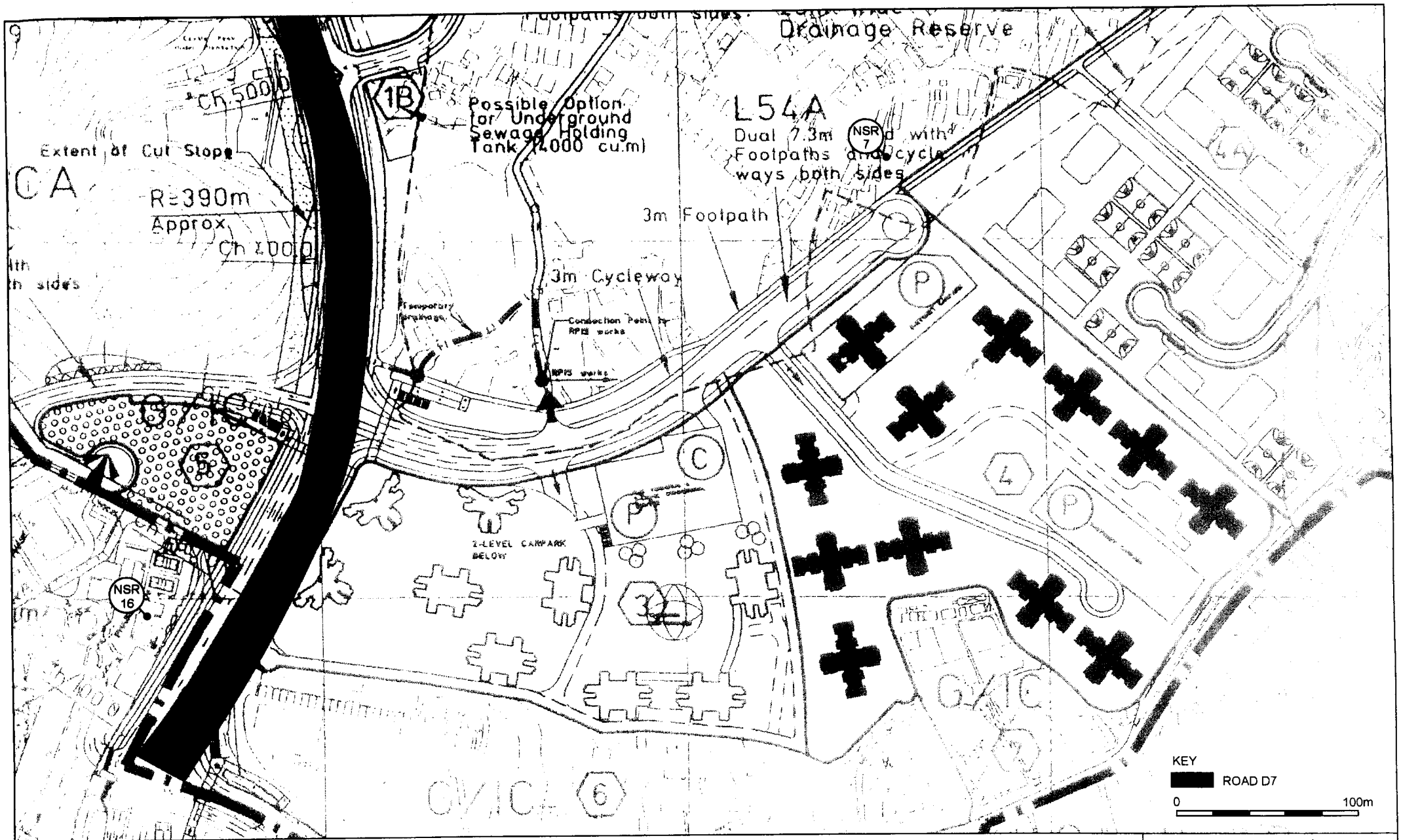


FIGURE 3.7e

LOCATION OF NSRs IN CONSTRUCTION PHASE

Environmental Resources Management

ERM

FILE: C1707_5
DATE: 03/12/98

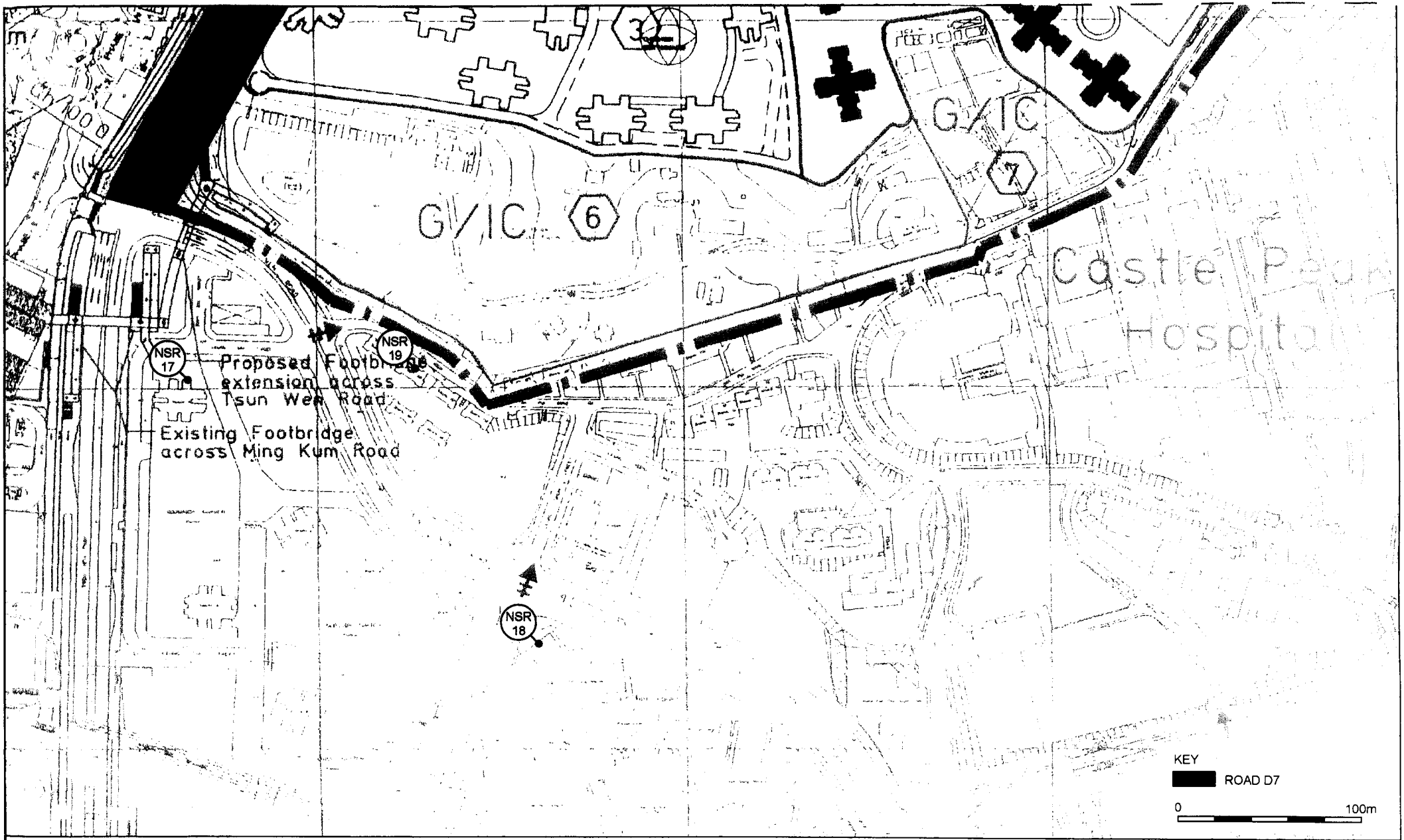


FIGURE 3.7f

LOCATION OF NSRs IN CONSTRUCTION PHASE

FILE: C1707_6
DATE: 03/12/98

Environmental Resources Management

ERM

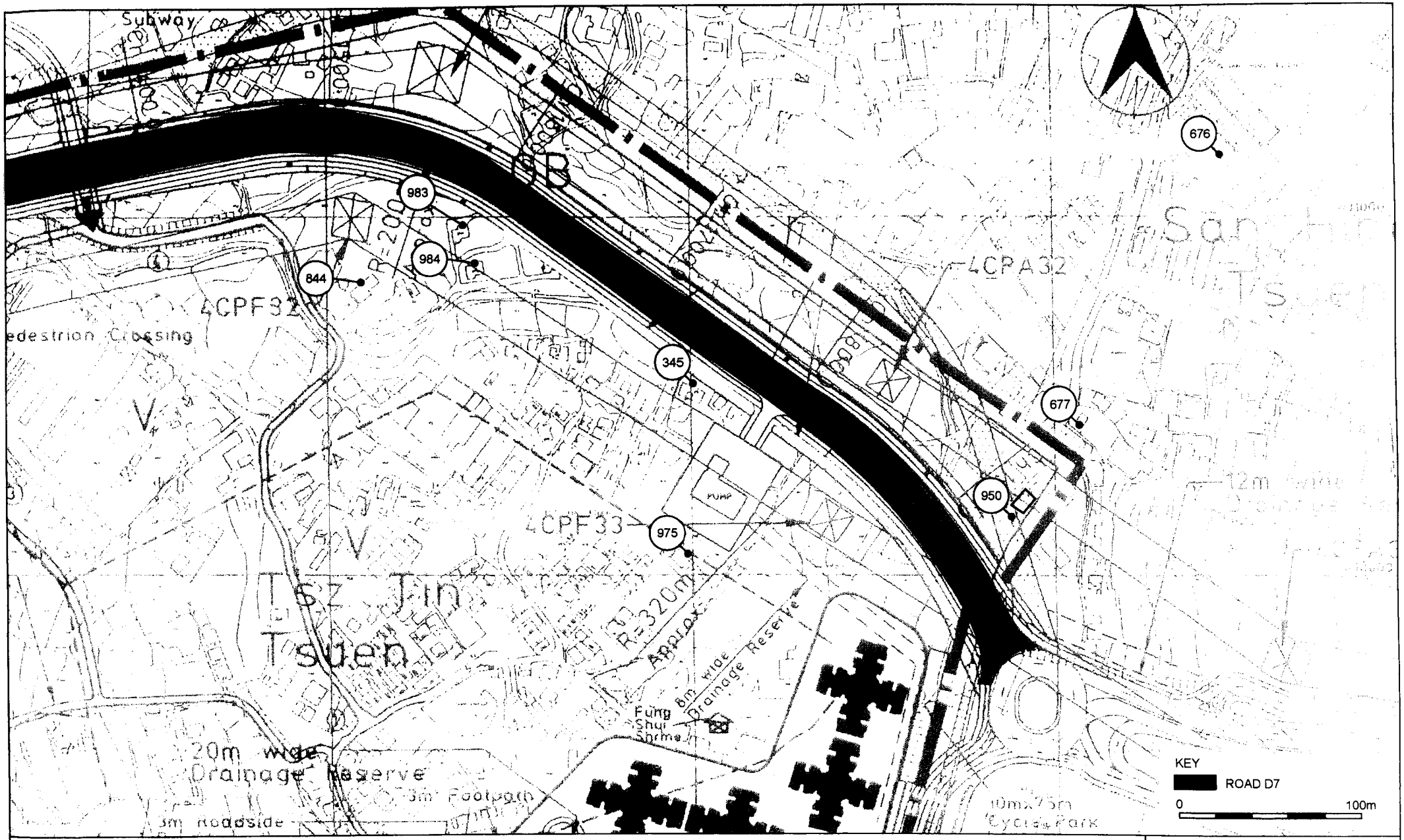


FIGURE 3.7g

LOCATION OF NSRs IN OPERATIONAL PHASE

FILE: C1707_1e
DATE: 03/12/98

Environmental Resources Management

ERM

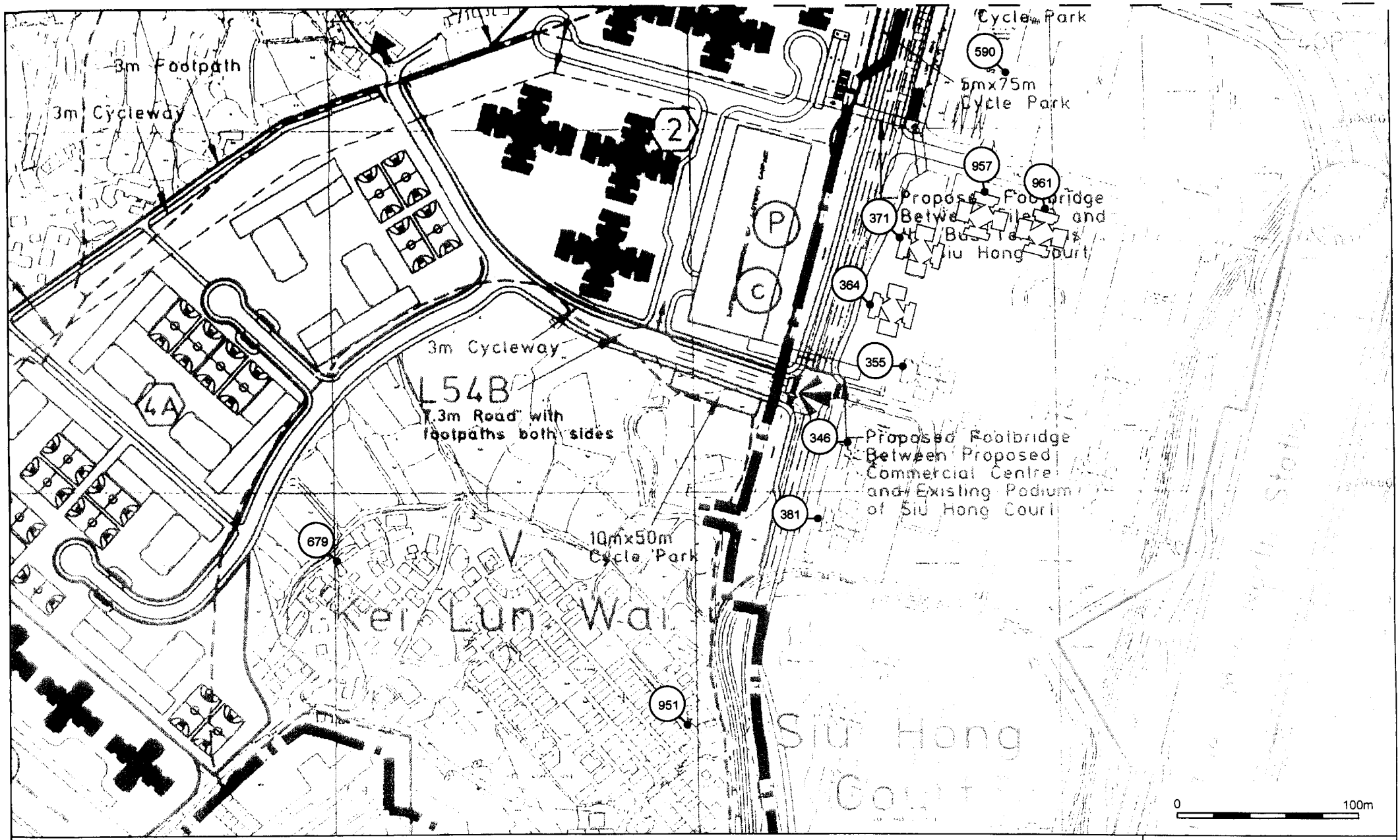


FIGURE 3.7h

LOCATION OF EXISTING NSRs IN OPERATIONAL PHASE

FILE: C1707_2a
DATE: 03/12/98

Environmental Resources Management

ERM

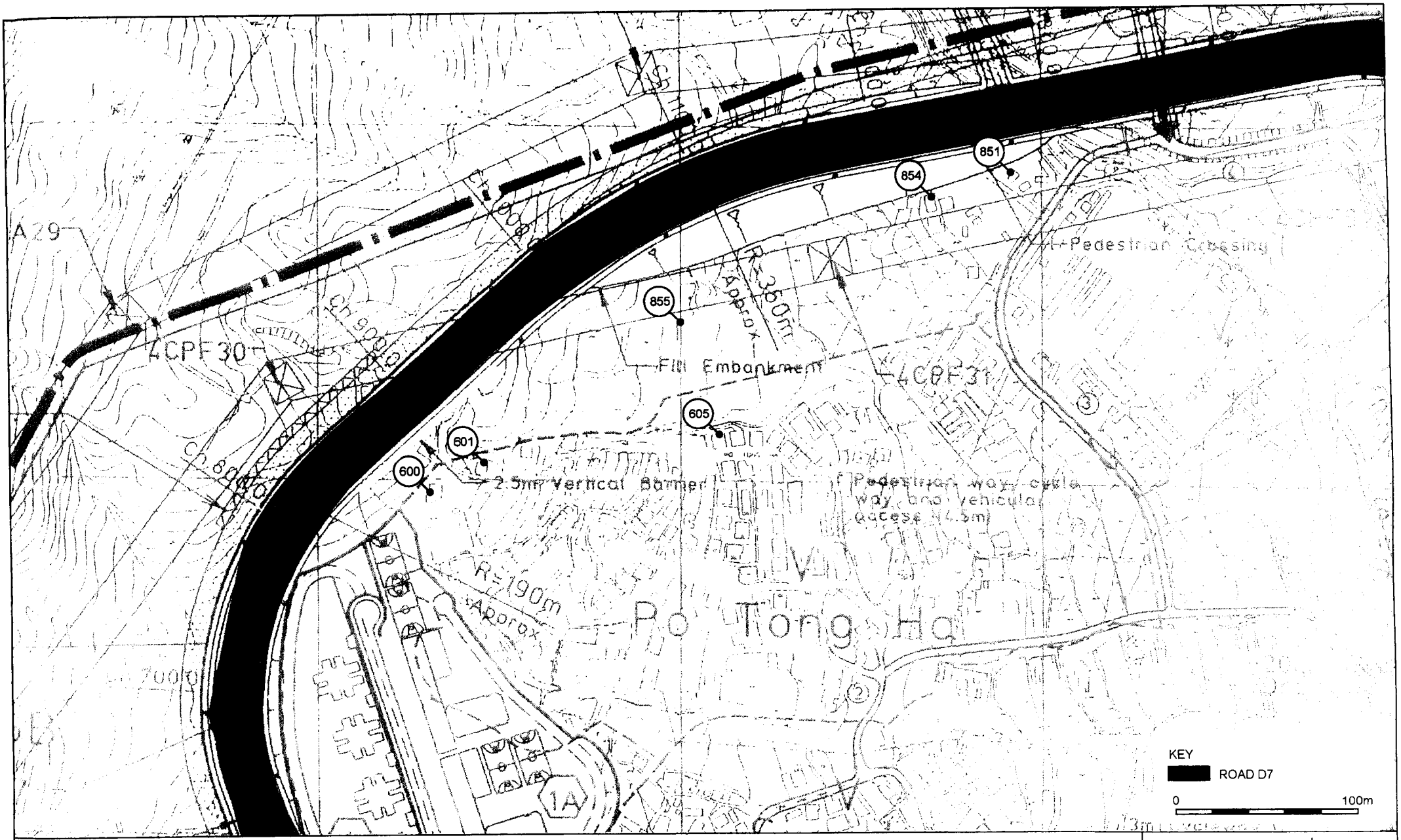


FIGURE 3.7i

LOCATION OF EXISTING NSRs IN OPERATIONAL PHASE

FILE: C1707_4a
DATE: 03/12/96

Environmental Resources Management

ERM

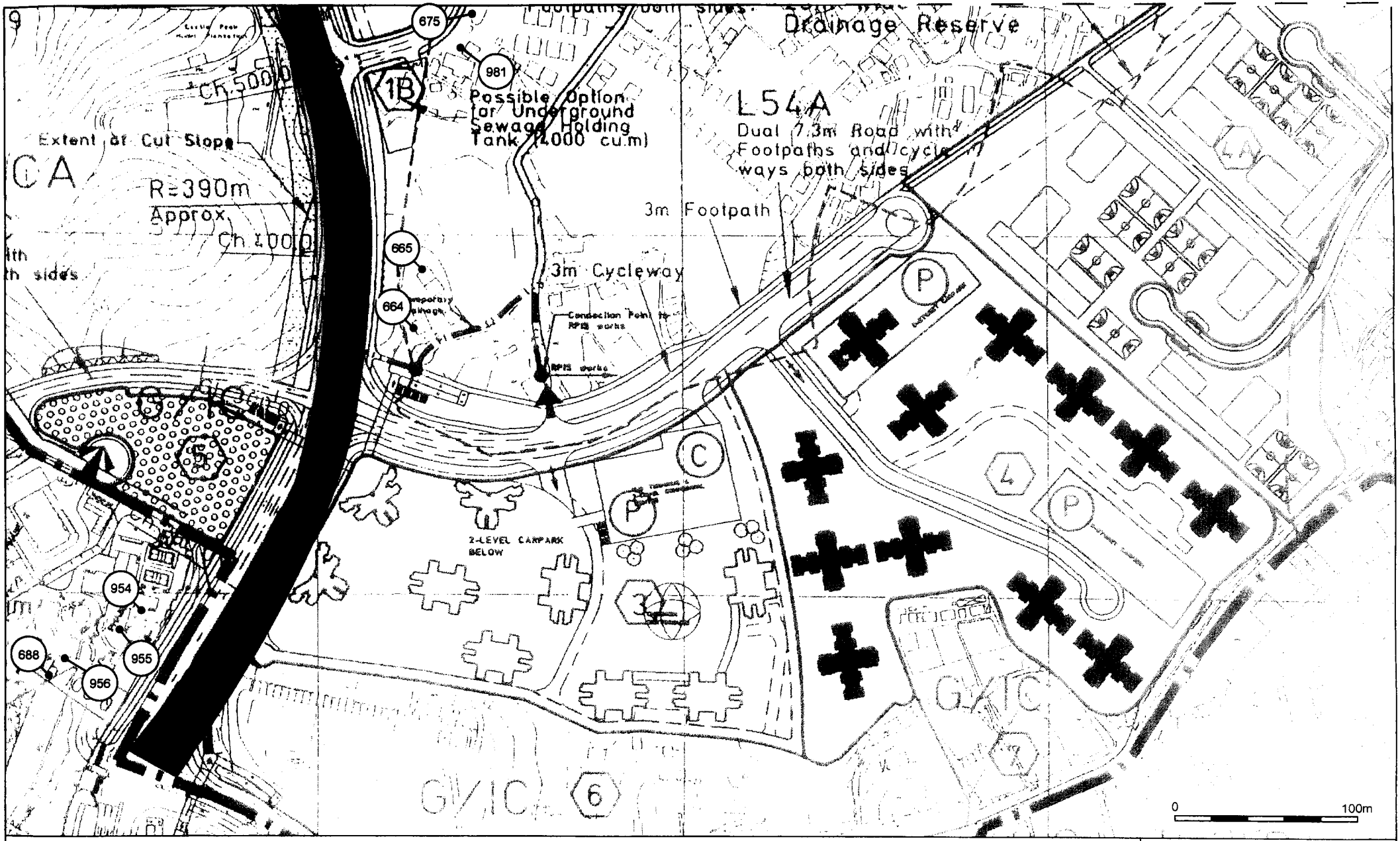


FIGURE 3.7j

LOCATION OF EXISTING NSRs IN OPERATIONAL PHASE

FILE: C1707_5a
DATE: 03/12/98

Environmental Resources Management

ERM

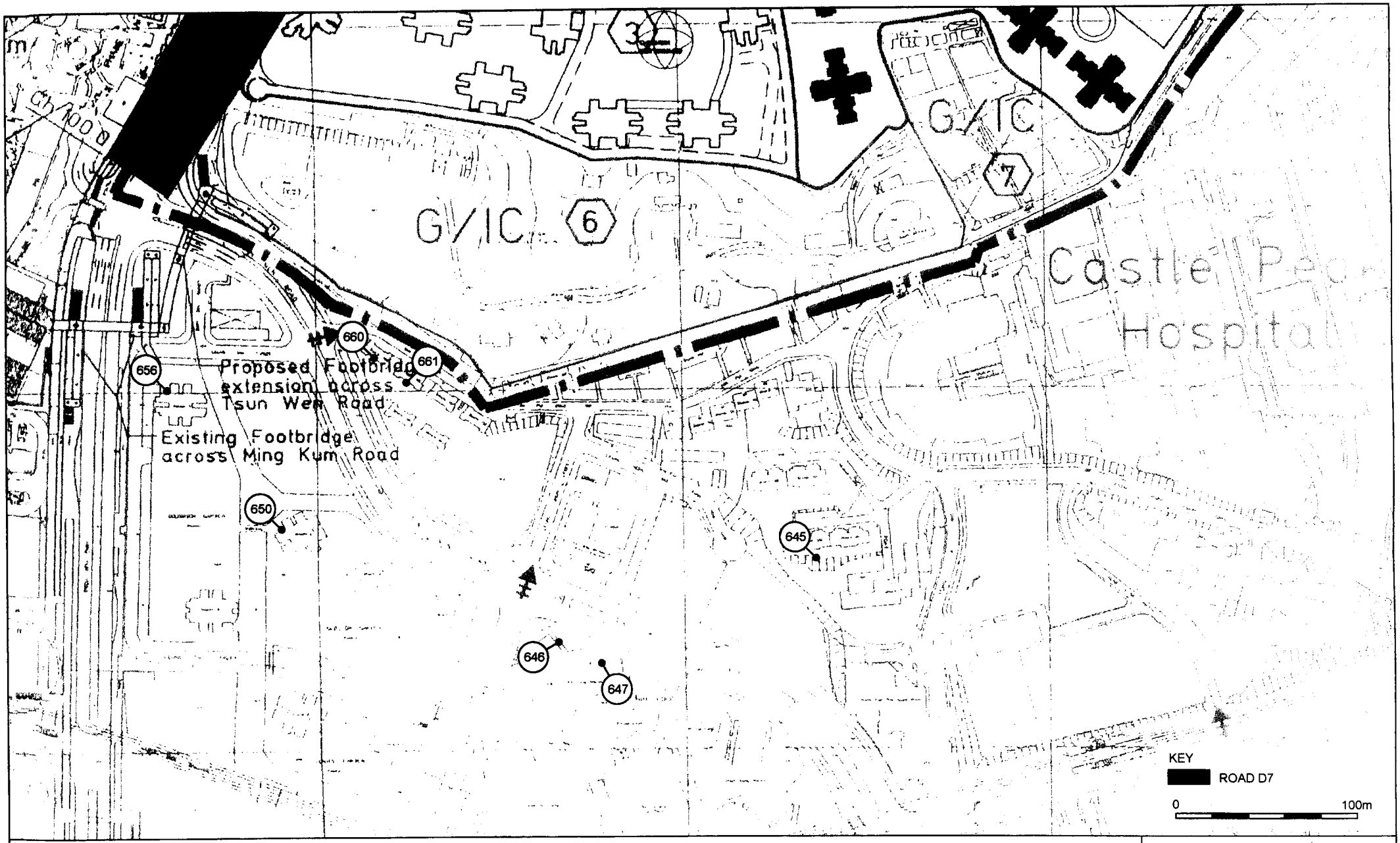


FIGURE 3.7k

LOCATION OF EXISTING NSRs IN OPERATIONAL PHASE

Environmental Resources Management

ERM

FILE: C1707_6a
DATE: 03/12/98

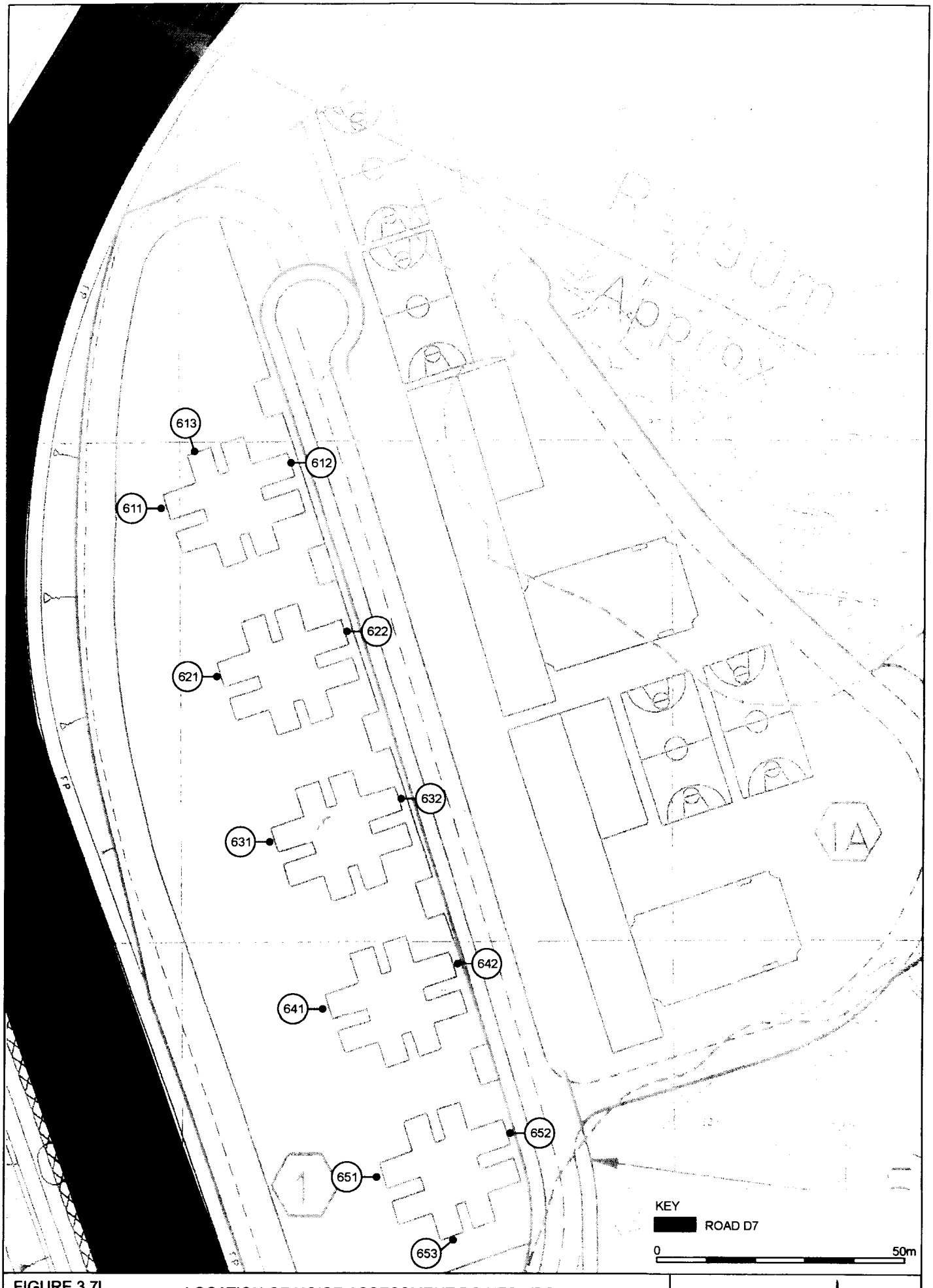


FIGURE 3.7I

LOCATION OF NOISE ASSESSMENT POINTS AT SITE 1

Environmental Resources Management

ERM

FILE: C1707y1
DATE: 03/12/98

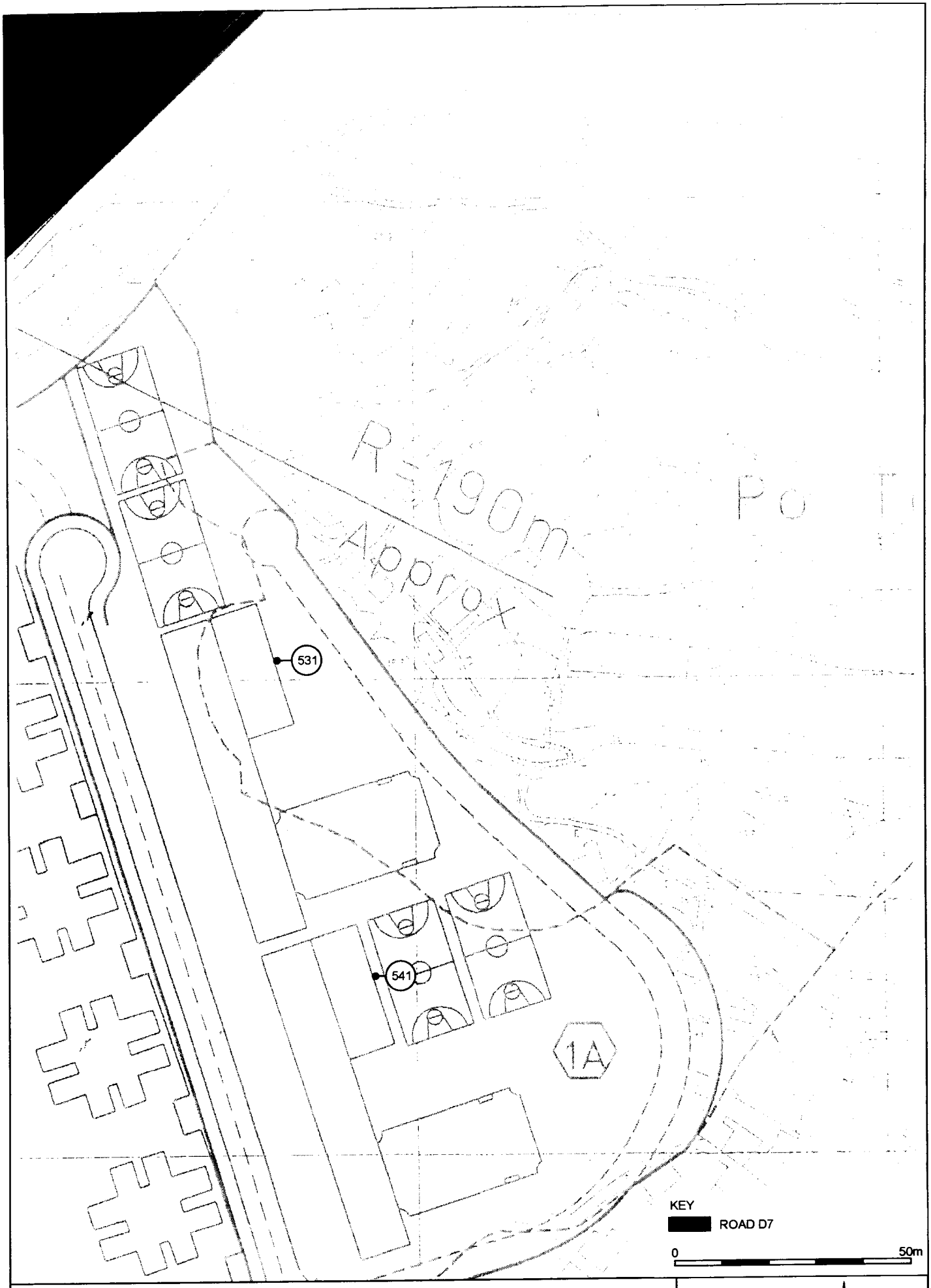


FIGURE 3.7m LOCATION OF NOISE ASSESSMENT POINTS FOR PROPOSED SCHOOLS AT SITE 1A

Environmental Resources Management

ERM

FILE: C1707y
DATE: 03/12/98

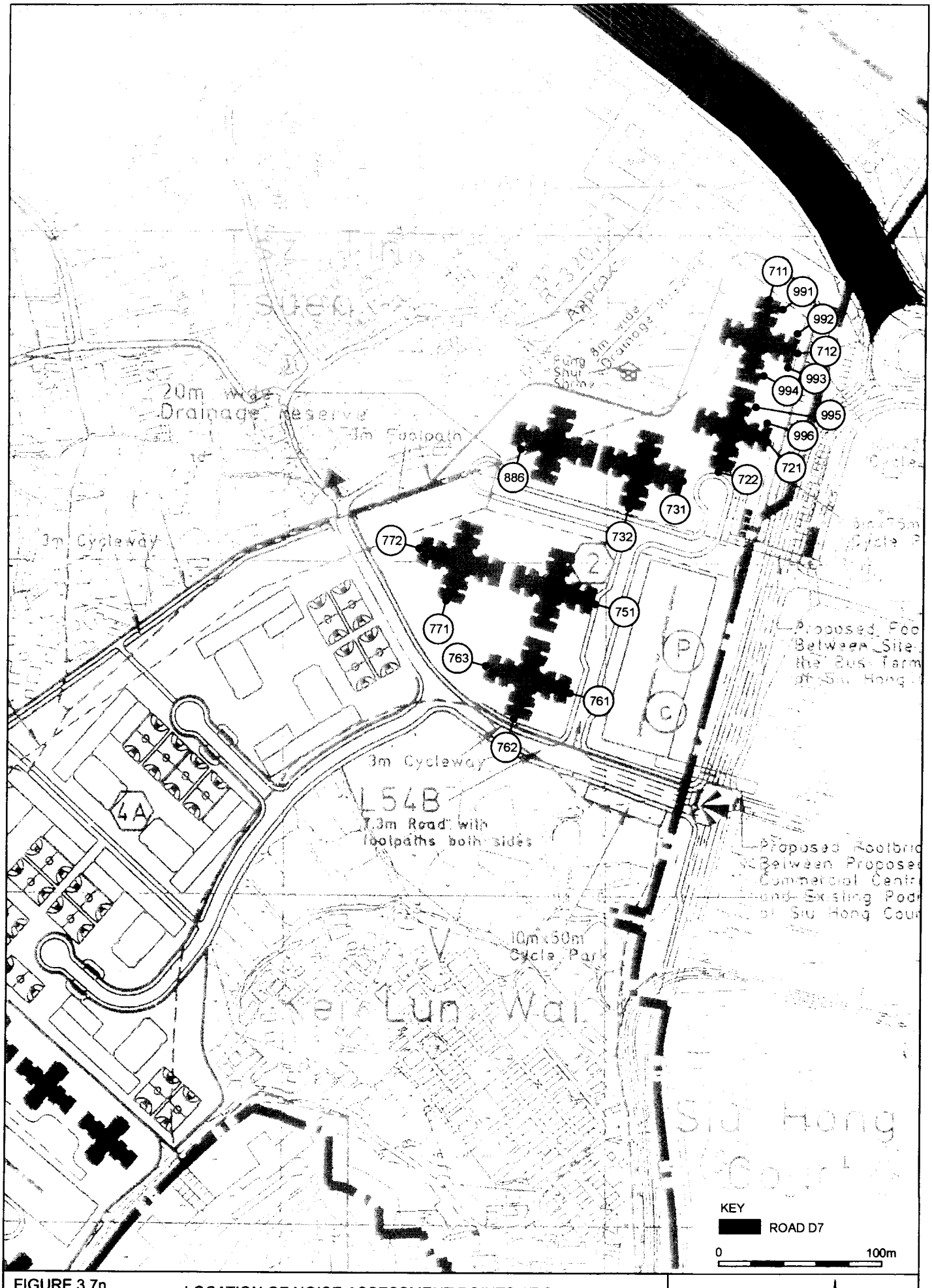


FIGURE 3.7n LOCATION OF NOISE ASSESSMENT POINTS AT SITE 2

FILE: C1707z4
DATE: 03/12/98

Environmental Resources Management

ERM

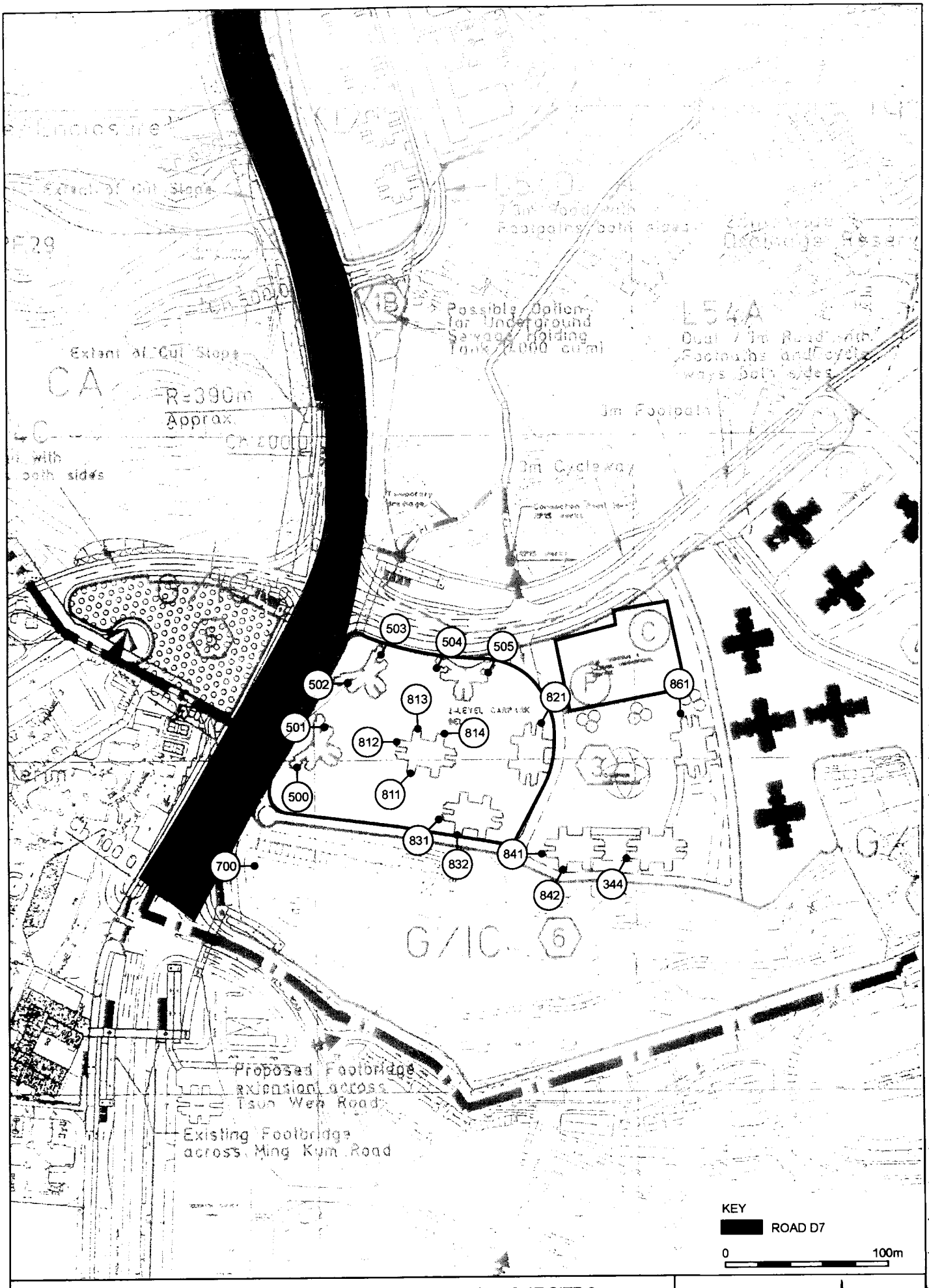


FIGURE 3.7o LOCATION OF NOISE ASSESSMENT POINTS AT SITE 3

Environmental Resources Management

ERM

FILE: C1707z2
DATE: 01/04/99

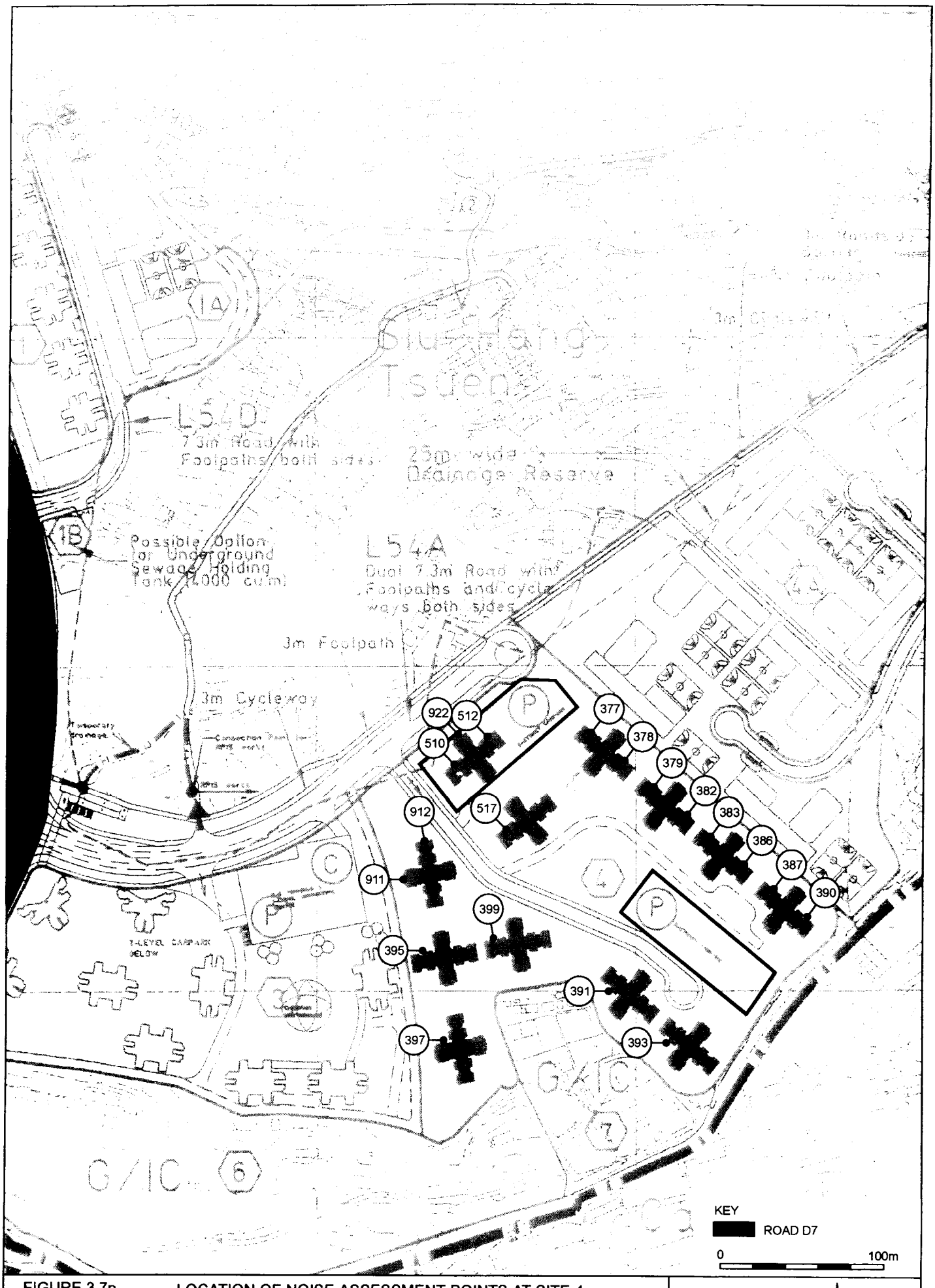


FIGURE 3.7p LOCATION OF NOISE ASSESSMENT POINTS AT SITE 4

FILE: C1707z1
DATE: 01/04/99

Environmental Resources Management

ERM

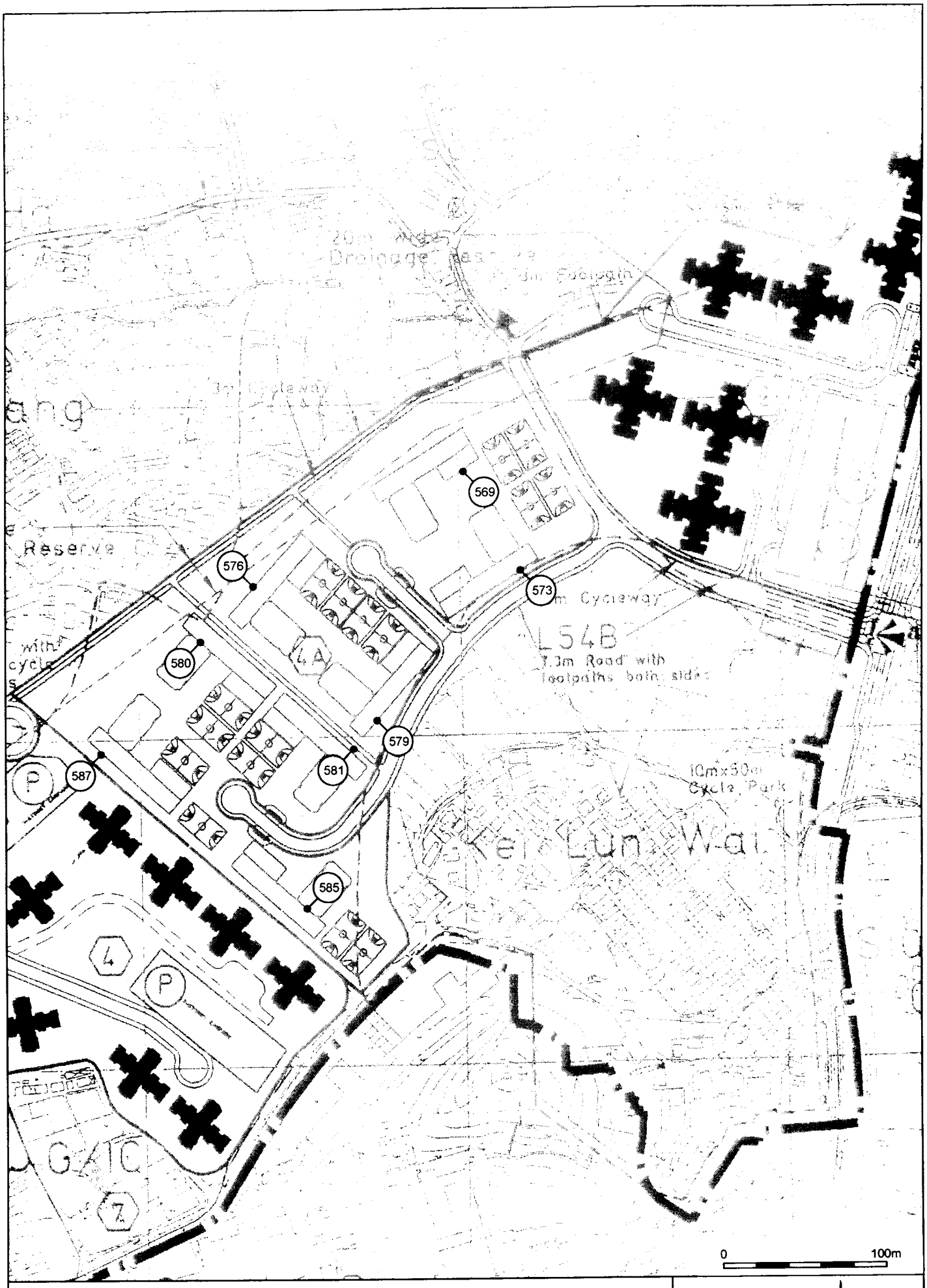


FIGURE 3.7q LOCATION OF NOISE ASSESSMENT POINTS FOR PROPOSED SCHOOLS AT SITE 4A

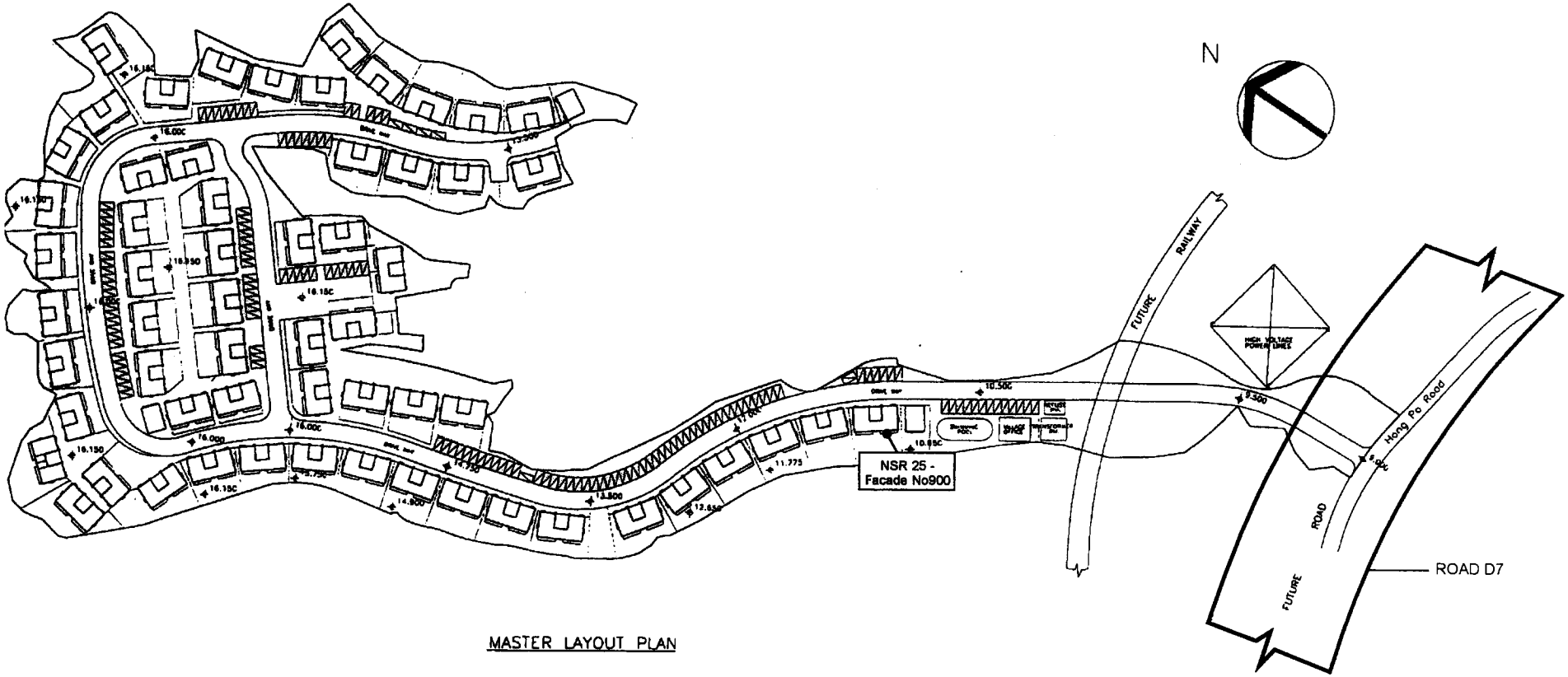
FILE: C1707z3
DATE: 03/12/98

Environmental Resources Management

ERM

TOTAL NO. OF HOUSE : 123

TOTAL NO. OF CARPARK : 144



MASTER LAYOUT PLAN

NOT TO SCALE

FIGURE 3.7r

MASTER LAYOUT PLAN FOR THE HOUSING DEVELOPMENT LOCATED NORTH OF ROAD D7

FILE: C1707_15

DATE: 24/03/99

Environmental Resources Management

ERM

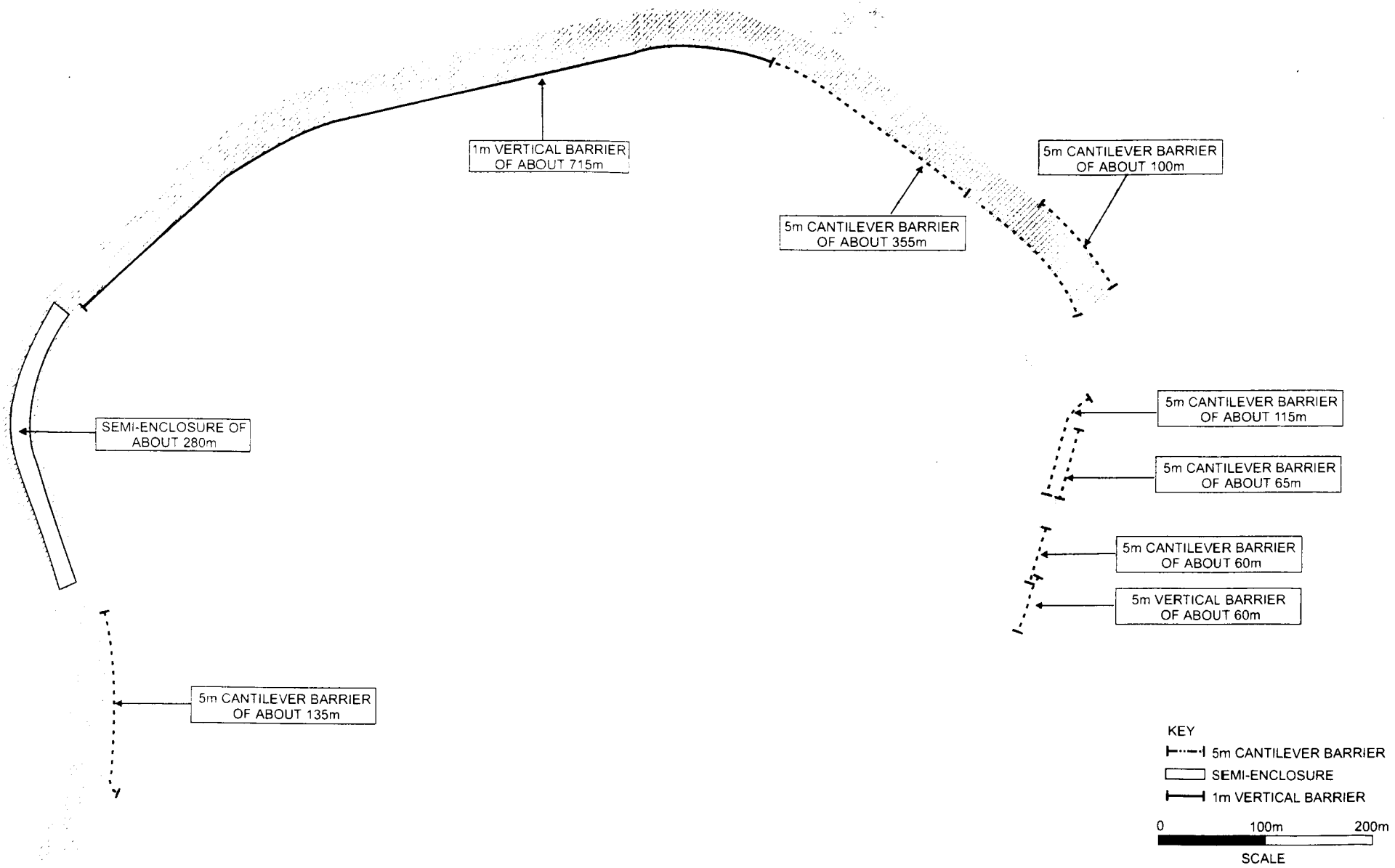


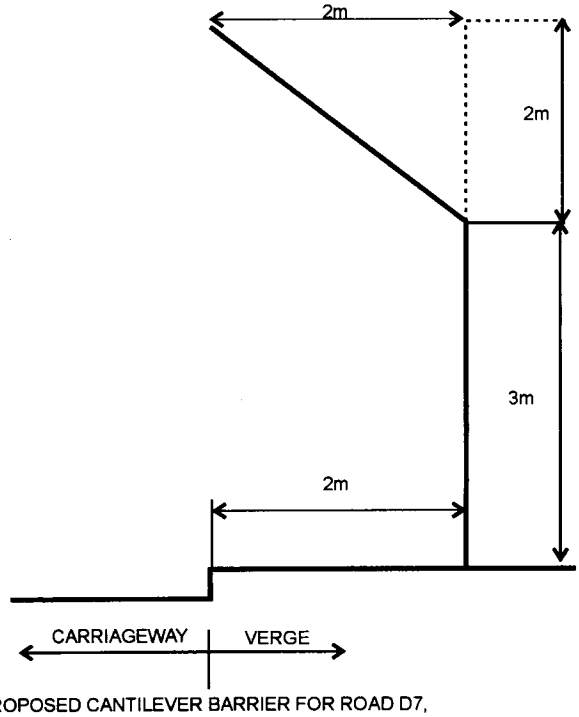
FIGURE 3.8a

NOISE MITIGATION MEASURES PROPOSED FOR SIU HANG TSUEN SITE 1 AND VILLAGE EXTENSION AREA NORTH OF PO TONG HA

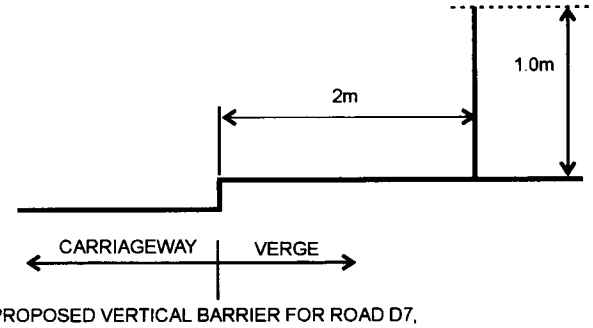
FILE C1707J35
DATE 13/06/99

Environmental Resources Management

ERM



PROPOSED CANTILEVER BARRIER FOR ROAD D7,
TUEN MUN AREA 54



PROPOSED VERTICAL BARRIER FOR ROAD D7,
TUEN MUN AREA 54

Note: that the dimensions of the noise barriers proposed in this assessment are subject to detailed design when suitable equivalent configurations may be considered to be more appropriate.

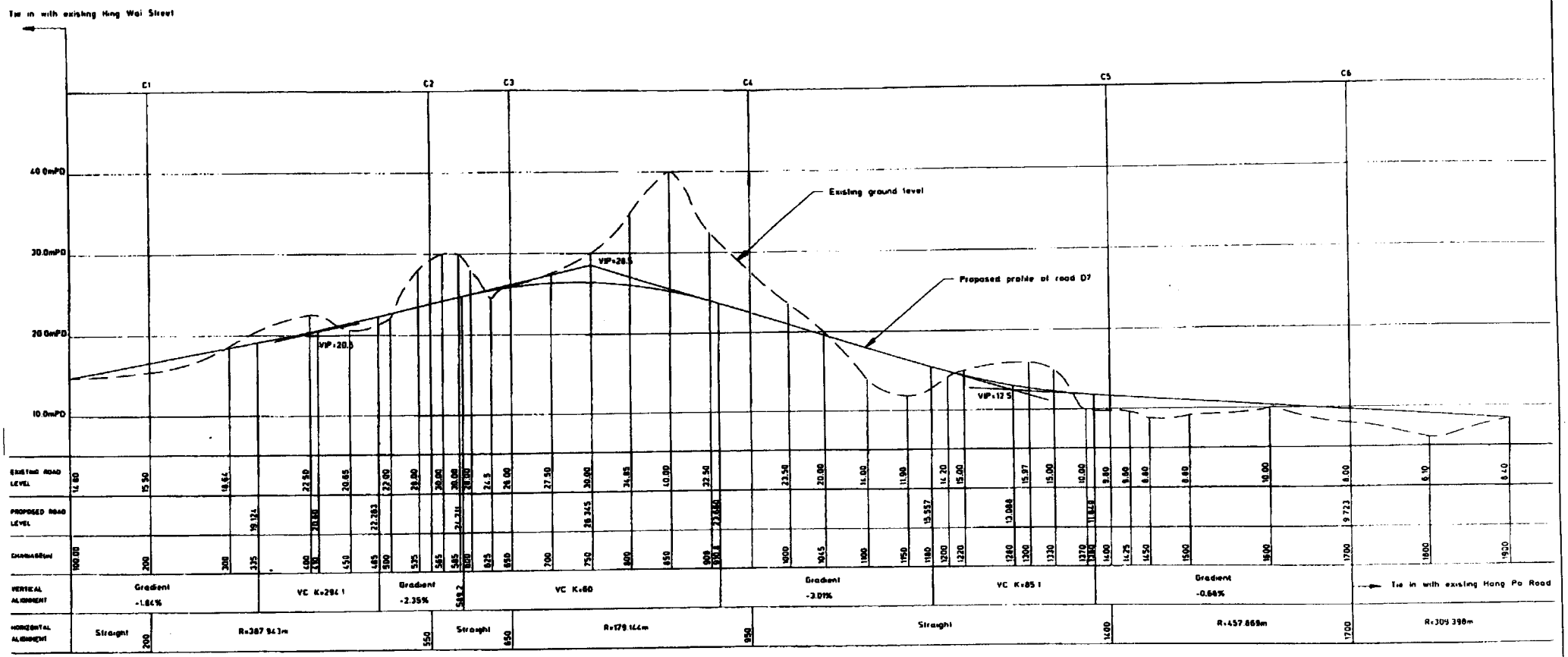
FIGURE 3.8b

TYPICAL CROSS SECTIONS OF CANTILEVER BARRIERS & VERTICAL BARRIER RECOMMENDED FOR ROAD D7 AND WIDENING SECTION OF TSING LUN ROAD, TUEN MUN AREA 54

Environmental Resources Management

ERM

FILE: C1707z7
DATE: 07/12/98



Notes:

1 Level refer to Principal Datum (P.D.) unless shown otherwise

2 Chainages are given in metres along HCL

FIGURE 3.8c

VERTICAL ALIGNMENT OF PROPOSED DISTRIBUTOR ROAD D7

FILE: C1707z22
DATE: 23/02/99

Environmental Resources Management

ERM

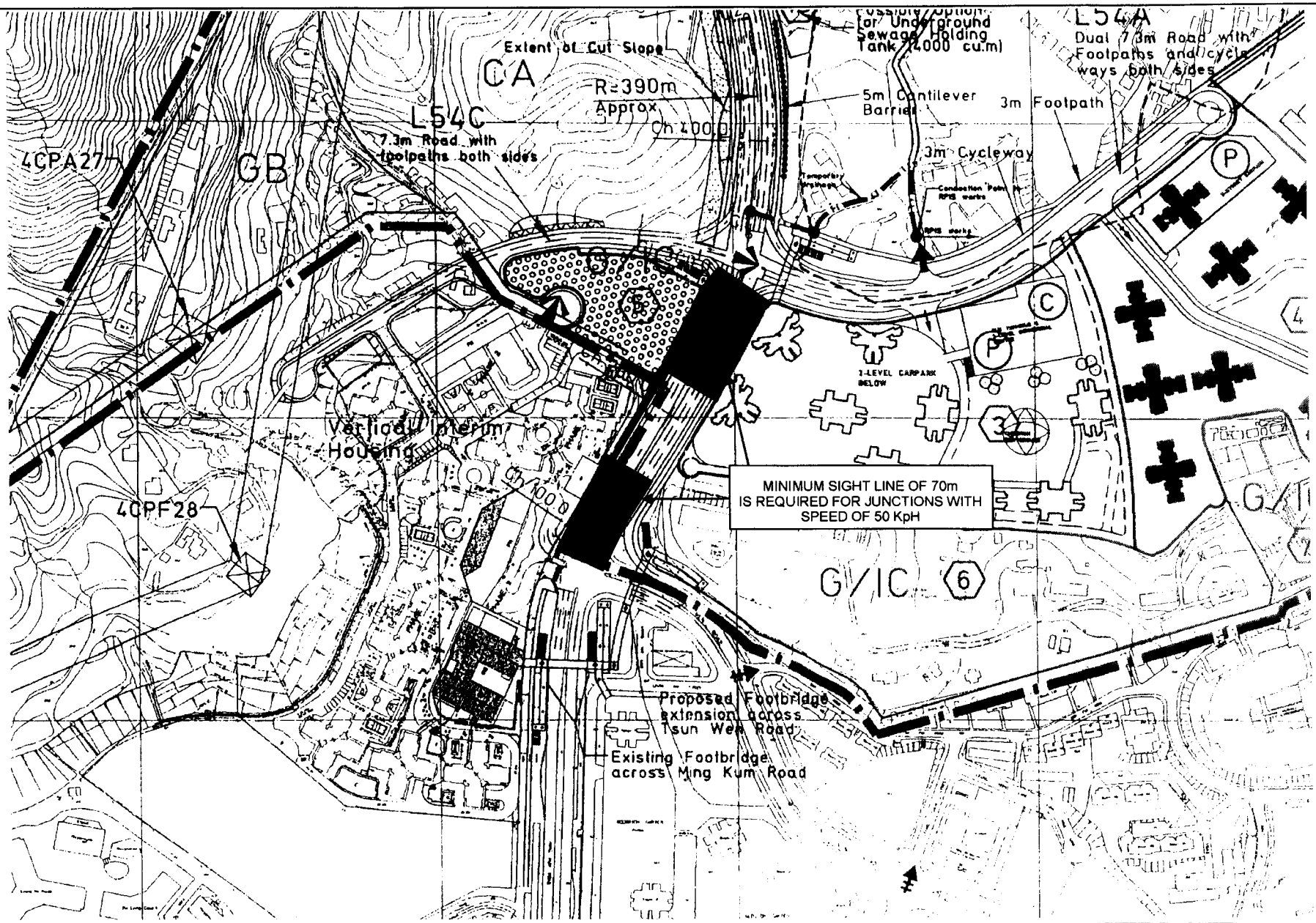


FIGURE 3.8d

SIGHT LINE CONSTRAINTS FOR DIRECT TECHNICAL REMEDIES AT TUEN MUN AREA 29

FILE: C1707Z11
DATE: 18/12/98

Environmental
Resources
Management

ERM

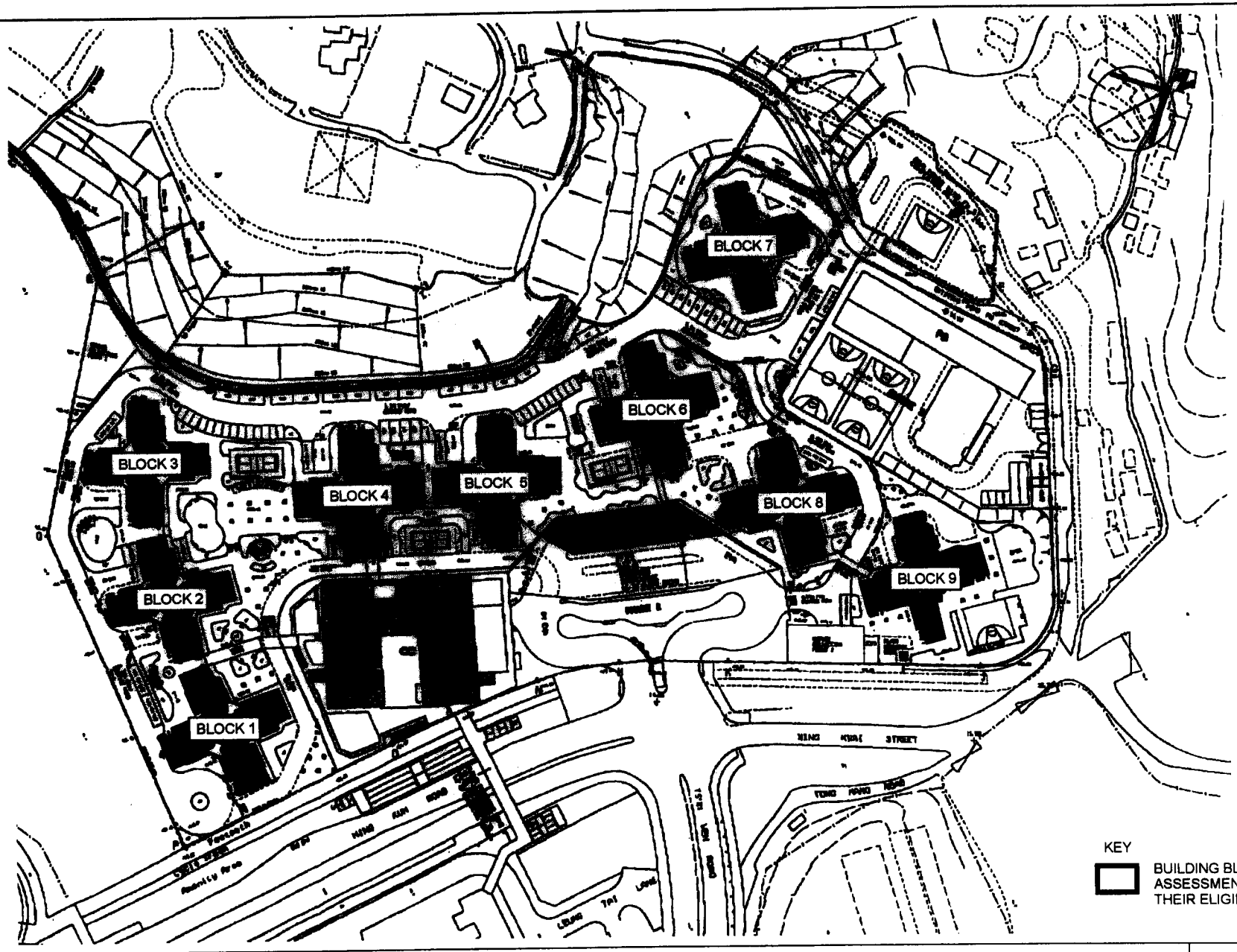


FIGURE 3.9a

LAYOUT PLAN OF AREA 29

Environmental Resources Management

ERM

FILE: C1707z25
DATE: 11/08/99

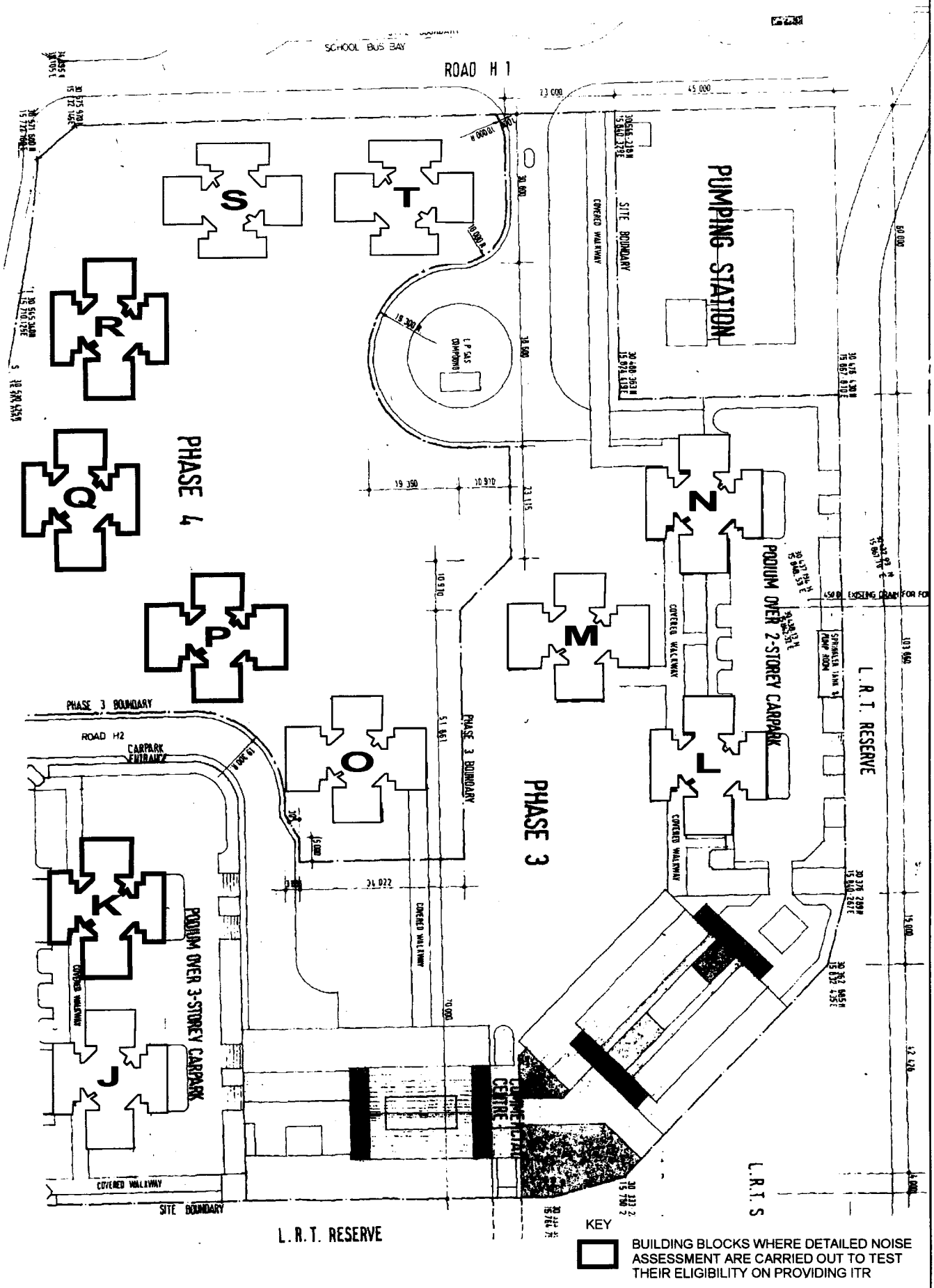


FIGURE 3.9b

LAYOUT PLAN OF SIU HONG COURT

Environmental Resources Management

ERM

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