



**Territory Development Department
NT East Development Office**

TSEUNG KWAN O DEVELOPMENT

CONTRACT F

GRADE SEPARATED INTERCHANGE T1/P1/P2

Environmental Impact Assessment (EIA) Study

Executive Summary

August 1999

Maunsell Consultants Asia Ltd.

in association with
Enpac Limited
Hassell Limited
(Ref.: 60195/EXECSUM)

EXECUTIVE SUMMARY

1. INTRODUCTION

- 1.1 The Tseung Kwan O Feasibility Study of Opportunity for Further Development (TKOOFD), completed in 1990 and endorsed by the then LDPC for implementation, identified amongst other infrastructure works the widening of Road P2¹ between Roads D1¹ and D2¹ and the construction of a grade separated road junction T1/P1/P2¹. The TKO Town Centre Traffic Review (1997) has also confirmed that the capacity of the existing roundabout would be exceeded by 2001 because of increasing traffic flows. Therefore, Project Manager/NT East of Territory Development Department further commissioned Maunsell Consultants Asia Limited under Agreement No. CE 13/90 to undertake the design of Contract F - Grade Separated Interchange T1/P1/P2 (hereinafter called the "Project"). Figure 1-1 shows the location of the Study Area.
- 1.2 Road P2 is one of the primary distributor roads in Tseung Kwan O. Construction of P2 is being implemented in stages in line with the development of the New Town. Road T1 is the major access to Tseung Kwan O via Tseung Kwan O Tunnel and the road junction. The southern portion of Tseung Kwan O New Town is developing and population is increasing. The resulting increase in traffic will overload the existing road system. It is therefore necessary to upgrade the existing at-grade interchange at Roads T1/P1/P2 junction to a grade-separated interchange, and to widen the section of Road P2 between Roads D1 and D2.
- 1.3 The proposed works have been identified as a designated project under Schedule 2, Part I (A.1) of the EIA Ordinance, so an Environmental Permit is required prior to the construction and operation of the Project. Since the proposed works are likely to have adverse impacts on the environment, the Study Brief requires an Environmental Impact Assessment (EIA) Study to determine the nature and extent of environmental impacts arising from the construction, operation of the proposed road alignment and all related activities taking place concurrently.
- 1.4 The EIA Study has been carried out based on information available at the time. Relevant reports and drawings to the Project have been reviewed and findings have been incorporated where appropriate in this EIA Report. For examples, the findings of the EIA Studies on *Widening and Improvements of Wan Po Road*, *Tseung Kwan O Feasibility Study of Opportunities for Further Development (TKOOFD)*, and *Tseung Kwan O Development, TKO Town Centre North - Roads, Bridge & Subway* have been reviewed and incorporated in this study.
- 1.5 In accordance with the requirements of the EIA Study Brief, the EIA covers the following aspects of impact assessment:
- Construction noise and air quality impacts
 - Traffic noise and vehicle emissions impacts
 - Visual and landscape impact
 - Land use impact

¹ T1 - Tseung Kwan O Tunnel Road; P1 - Wan Po Road; P2 - Po Shun Road; D1 - Po Hong Road; and D2 - Po Lam Road North

- 1.6 The assessment results have been used as the basis for the evaluation of their respective impacts arising from the proposed Project on both existing and planned sensitive developments, as well as for the identification of locations where the acceptable criteria limits are exceeded and appropriate mitigation measures are required.

2. PROJECT CHARACTERISTICS

- 2.1 The Contract comprises mainly the upgrading of the existing at-grade interchange at Roads T1/P1/P2 junction to a grade separated interchange and the widening of the section of Road P2 between Roads D1 and D2.

- 2.2 The proposed construction works comprise the following main activities:

Road Works: construction of flexible pavement comprising sub-base, road-base, base-course, and wearing course, road kerbs, and all associated drainage and landscaping works.

Bridges: construction of bridge foundations, piers, bridge deck, and associated earthworks, drainage and landscaping works.

Subway & Retaining Walls: construction of a pedestrian subway and extension of two existing pedestrian/cyclist subways and construction of conventional inverted - T retaining walls.

Figure 2-1 shows the limit of proposed road works, and Figure 2-2 shows a preliminary construction programme for the improvement works. According to this programme, the works would commence in October 2000 and complete by March 2003.

3. ENVIRONMENTAL SETTING

3.1 Existing Sensitive Receivers

In accordance with the Study Brief, noise sensitive receivers (NSRs) and air sensitive receivers (ASRs) within 300 m and 500 m, respectively, of the proposed road alignment have been identified for impact assessment. Sensitive receivers include On Ning Garden, Chung Ming Court, Hau Tak Estate, Sheung Tak Estate, King Lam Estate and others) which are close to the Project alignment. Site surveys reveal that the existing NSRs in the Study Area are mainly high-rise residential developments and educational institutions. The local ground levels of these NSRs are mostly located below the junction level except for Hong Sing Garden, Haven of Hope Sanatorium and a church located on the hill to the west of the junction. Representative noise and air sensitive receivers have been identified within the Study Area and are depicted in Figures 3-1 and 3-2, respectively.

3.2 Future Sensitive Receivers

According to the Outline Zoning Plan No. S/TKO/6, the study area at the T1/P1/P2 junction is zoned for residential, government/institutional, commercial as well as open-space uses. For the purpose of this EIA study, the latest available building layouts have been obtained and consolidated from relevant previous studies and government departments. Future and planned receivers include a Commercial/Residential 'C/R' site in 38b (381 & 382) that are sensitive to noise and air quality, and a DO and G/IC site in Area 45, which is noise-tolerant. Figures 3-1 and 3-2 also show the future and planned noise and air sensitive receivers.

4. CONSTRUCTION NOISE

- 4.1 Construction of the proposed infrastructure works is likely, if unmitigated, to produce high noise levels exceeding 75 dB(A) Leq(30-min) at the existing NSRs. The predicted construction noise levels at the worst-affected receiver is in the range of 83-87 dB(A) at CM4. The noisiest single activity at any given receiver is expected to be the construction of retaining walls, which requires the use of an excavator and dump trucks.
- 4.2 The potential impacts can be mitigated through proper implementation of noise control measures, including the use of silenced equipment, suitable siting of equipment, and use of mobile noise barriers. In particular, the use of acoustic enclosures and curved/inverted-L noise barriers (located close to the noise source) are considered feasible and appropriate, especially in front of KL7 and CM4. It is anticipated that use of the above measures would reduce the impacts from construction works and resulting noise levels to be within the criteria specified in the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM). A full enclosure has been proposed in front of King Lam Estate and Chung Ming Court. It is recommended that the construction of these barriers should be completed within 6 months after works commencement in order to screen sensitive building facades from construction noise to further reduce the noise levels at the receivers.
- 4.3 Since the sensitive facades affected by this Project are not the same as those affected by the MTRC alignment construction, cumulative noise impact at the NSRs is virtually negligible. Furthermore, given that all of the mitigation measures as mentioned above are being properly implemented in both projects, the cumulative noise levels should still comply with the noise criteria since the affected sensitive facades by the two projects are not likely to overlap.

5. CONSTRUCTION DUST

- 5.1 Excavation, back filling and other earthworks and the haulage of materials on-site and off-site are likely to give rise to considerable construction dust impacts on the adjacent sensitive receivers. These receivers include Hong Sing Garden, Verbena Heights, On Ning Garden, Chung Ming Court, King Lam Estate, Sheung Tak Estate, and especially the outdoor sitting-out and recreational areas located in close proximity to the junction. Computer model calculations have shown that dust concentrations at the nearby existing receivers, especially the open space in Areas 24, 25, 40 and 45, are expected to exceed the EIAO-TM dust criteria and the Air Quality Objectives in respect to TSP. Dust suppression measures in the form of good housekeeping, frequent watering of the dusty areas, providing wheel-washing facilities at site exit(s) and covering of materials on trucks with tarpaulin sheeting, are necessary to reduce the impacts. It is anticipated that the EIAO-TM dust criteria and Air Quality Objectives can be achieved by the implementation of these dust suppression measures.
- 5.2 In anticipation of the construction of the MTRC TKO Extension in the vicinity of the Study Area, a comprehensive impact assessment has been carried out to quantify the amount of dust to be generated from the construction of the alignment. The cumulative impacts of this Project and MTRC alignment construction at two of the representative locations (ON2 & SC1) have been assessed. Assuming a worst-case scenario, the results shows that there would be significant exceedance at the ASRs that are close to the MTRC alignment and the roadwork (i.e. Chung Ming Court, On Ning Garden and King Lam Estate) if no dust suppression measures are applied. Dust suppression measures including the use of water sprays, blast nets and canvas covers, wind barriers and enclosures, wheel-washing, and paved haul roads within the site, etc. were recommended in the *Tseung Kwan O Extension: Final Detailed Environmental Impact Assessment*. The previously proposed dust suppression measures in this Project together with those mitigation measures recommended in the MTRC Report, will greatly minimize the impact. The mitigated cumulative impacts at the representative locations are predicated to comply with the AQO. Overall, the cumulative impact after implementation of the above recommended dust suppression measures should be reduced to within AQO standards.

6. ROAD TRAFFIC NOISE

- 6.1 Road traffic noise is a key environmental issue during the operation phase of this Project. Computer models, using the highest traffic flows within 15 years after opening of the roads to traffic, predict that the majority of noise sensitive facades close to the T1/P1/P2 junction will be exposed to noise levels exceeding the criteria specified in the EIAO-TM. Due to engineering constraints, traffic sight-line and height restriction problems, barrier segments, partial enclosures as well as full enclosure have been examined for effectiveness. The following mitigation measures are considered effective and are thus recommended for implementation:

- a full enclosure of about 120m along Po Shun Road in front of King Lam Estate and Chung Ming Court;
- a 5m vertical barrier, about 265m long on Slip Road A;
- an absorptive, 5.5m high inverted L-shaped barrier, about 155m long on Slip Road C; and
- Low noise road surfacing (LNRS) on the new segment of Road P2.

- 6.2 Figure 6.1 shows the locations of these noise mitigating measures.
- 6.3 The recommended noise mitigation measures are effective in reducing the new road contributions at all the NSRs to below 70 dB(A). For those NSRs with noise levels exceeding 70 dB(A), the dominant noise sources are contributed by other existing roads outside this Project. In fact the traffic noise from new roads contribute less than 1 dB(A) to the overall noise levels. Hence, indirect mitigation has also been considered at the affected NSRs. The assessment for eligibility of sound insulation shows that none of the NSRs are eligible for provision of indirect measures as either the new roads would not contribute more than 1.0 dB(A) to the overall noise levels, or the predicted overall noise level is no more than 1.0 dB(A) higher than the prevailing traffic noise level at these receivers.
- 6.4 The total number of dwellings where the predicted noise levels would exceed 70 dB(A) is estimated to be 2605, and the total number of classrooms where the noise levels would exceed 65 dB(A) is estimated to be 135, if no mitigation measures are provided. While the relevant noise criteria cannot fully be met, the proposed direct technical remedies on the new roads would, to some extent, minimise the noise impact at the NSRs and would reduce the total number of affected dwellings by about 835. In addition to the 835 dwellings being in full compliance with the stipulated noise criteria of 70 dB(A), a total of about 2690 dwellings and 130 classrooms are estimated to benefit from the proposed noise mitigation scheme by 1-22 dB(A) noise reduction. Table 6.1 shows the number of dwellings protected and/or benefited from the proposed mitigation measures.

Table 6.1 Number of Sensitive Units Benefiting from Mitigation Measures

Sensitive Development	Number of Noise Sensitive Receivers Exceeding the EIAO-TM noise criteria in 2000 and 2006			Number of Noise Sensitive Receivers Benefiting from Mitigation Measures (i.e. ≥ 1 dB(A) Reduction)
	Prevailing (2000)	Unmitigated (2006)	Mitigated (2006)	
Residential Dwellings	1590	2605	1770	2690
Classrooms	135	135	135	130

7. VEHICLE EMISSIONS

Computer model calculations using the worst traffic scenario in terms of vehicle emissions have shown that no adverse impacts on air quality will result from the use of the new roads and the proposed noise mitigation measures. As a result, mitigation measures are not considered necessary.

8. LANDSCAPE AND VISUAL

- 8.1 The recent development on the reclamation of TKO New Town is an area dominated by high rise residential areas and transport corridors. In general, the local landscape quality of the study area is medium to high. The medium quality of the high-rise residential areas are juxtaposed with the dominating and low quality transport corridors and the good high quality landscape afforded by the local parkland, hillsides and tree planted slopes.
- 8.2 The proposed works are generally confined to being within areas already occupied by the existing road infrastructure or use the current slip roads at the interchange. However, there are two localised impacts to the existing landscape, namely:
- a slight adverse impact to the local residential high-rise estates of King Lam Estate, Hau Tak Estate and On Ning Garden, and;
 - a significant adverse impact to the planned open space between On Ning Garden and the proposed interchange.
- 8.3 The proposed works will cause a number of impacts to the existing visual context. They are, however, limited and localised to the following:
- parts of On Ning Garden and Hau Tak Estate;
 - planned open space at Areas 45 and 59; and
 - pedestrians along Road P2.
- 8.4 The source of the major impacts is the high level slip roads between T1 and P2 (i.e. Bridge A), together with the Bridge B becoming a dominating feature in a number of views. The noise mitigation measure cause additional effects, particularly along Road P2.
- 8.5 As the landscape and visual are confined to areas already occupied by existing road infrastructure their impact is in effect localised. In addition to this, mitigation measures using fast growing exotic tree species on cut slopes and in Area 40 are proposed to provide quick vegetative screening of the works for potential park users and residents. Consideration of the design of hard element are also proposed to reduce the overall landscape and visual impact of the works. The impact is therefore considered acceptance with mitigation measures.

8.6 Mitigation Measures

- retention of all existing roadside planting, where possible;
- dense tree and shrub planting on any new cut slopes to create a landscape buffer zone and visual screen. Tree species used should be fast growing exotic species such as *Eucalyptus* and *Casuarina* to provide a quick screen with slower growing native species such as *Aleurites*, *Celtis*, *Machilus* and *Mallotus* used to provide the long-term vegetative cover and screen;
- re-instatement of street tree planting where it is required to be removed;
- transplantation of street tree planting within or in the vicinity of site, where it is regard to be removed, where possible;
- dense screen tree and shrub planting in the planned Open Space at Area 40. This plant will help screen the impact of the spilt level interchange from On Ning Garden, Hau Tak Estate and the future park users in Area 40 open space. Plants used in this area should be a mix of fast growing *Eucalyptus* and *Casuarina* species mixed with the slower growing native species of *Aleurities*, *Celtis* and *Mallotus*. Ornamental flowering shrubs should be used as an edge to the screen planting to provide seasonal display;
- dense tree and shrub planting in all roadside amenity areas within the interchange. Native tree species should be used in these areas, species should be selected for their form, resistance to pollutants and ease of maintenance, typical species would include *Michelia* and *Aleurities*;
- dense tree and shrub planting to screen all retaining walls and noise barriers/enclosure where possible;
- consideration of the design of, and hard materials finishes to, all elevated sections of road, particularly those section, together with their piers, in the planned Open Space at Area 40 in conjunction with advice from Advisory Committee on the Appearance of Bridges and Associates Structures (ACABAS);
- consideration of the materials used to enhance the existing streetscape while maintaining consistency;
- consideration of the design of subway tubes and portals for consistency with the existing subways on or adjacent to the site and in conjunction with advice from ACABAS; and
- consideration of noise barrier design to create elements that are integrated within the scheme and the surrounding landscape, and incorporating the advice from ACABAS.

The above mitigation measures will need to be further developed in detailed design stage.

9. LAND USE

The proposed Road P2 falls wholly on government land and adjoining private land or structures are unlikely to be affected by the proposed works. The proposed alignment options have avoided interference with the existing and planned land uses. The adverse effect of any public works related to the proposed Road P2 alignment would be kept to the minimum. The study concludes that the proposed Grade Separated Interchange T1/P1/P2 will have no significant land use impact.

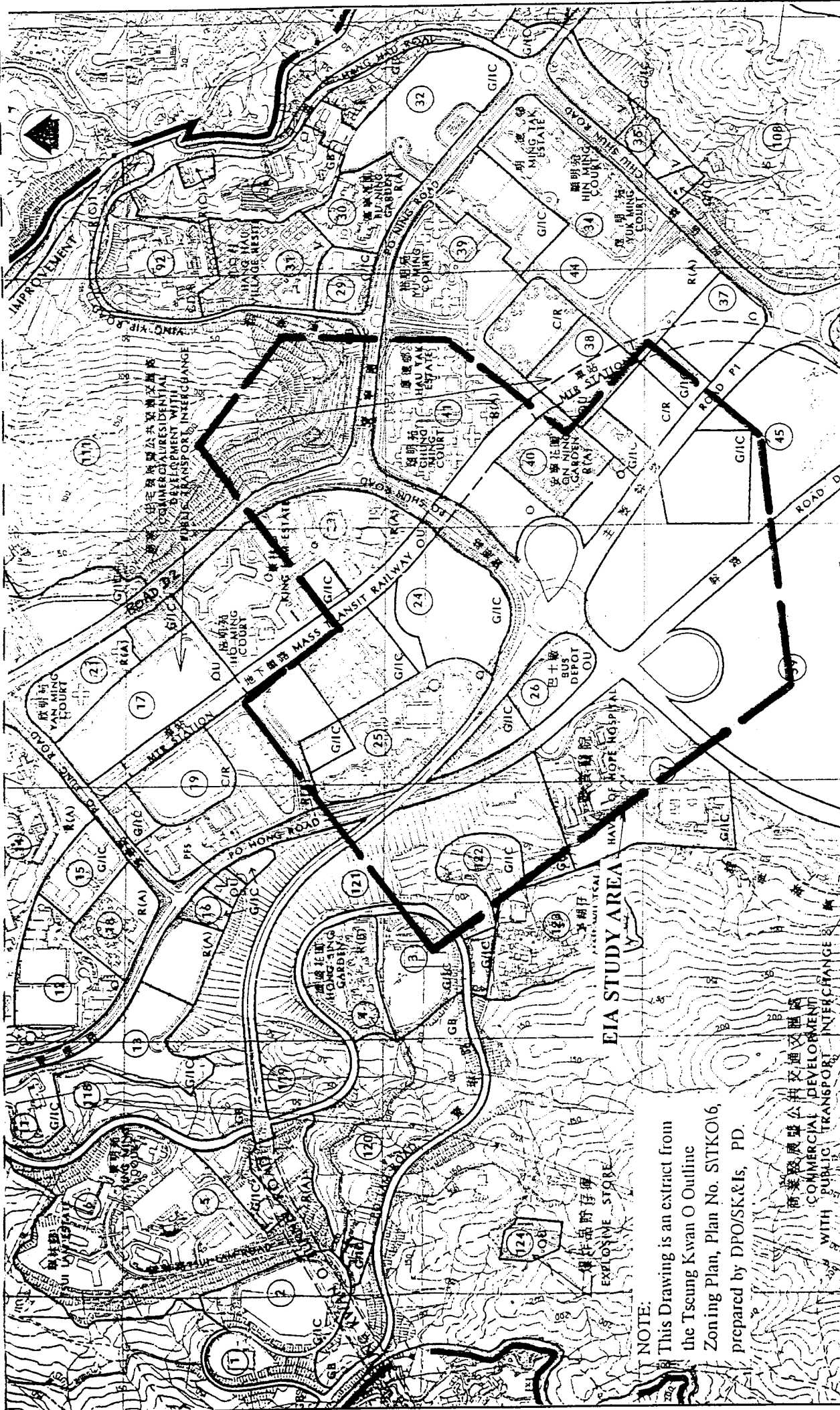
10. ENVIRONMENTAL MONITORING AND AUDIT

An environmental monitoring and audit (EM&A) programme has been proposed to ensure that the construction impacts of the project are kept within the EIAO-TM criteria. In view of the close proximity of the Improvement works to the identified sensitive receivers, an EM&A programme monitoring dust, noise, waste management and visual & landscape is considered necessary during the construction period. To further verify the effectiveness of the proposed noise mitigation measures, operation noise monitoring has also been incorporated.

An Environmental Monitoring and Audit Manual detailing the monitoring schedules and requirements is included in a separate document. This will be the basis for carrying out relevant monitoring and auditing procedures during the construction and operation period.

11. CONCLUSION

Environmental impacts, such as noise, air quality, landscape and visual, and land use arising from this Project have been assessed, and suitable mitigation measures have also been recommended. According to the assessments, the residual impacts all comply with the EIAO-TM requirements.

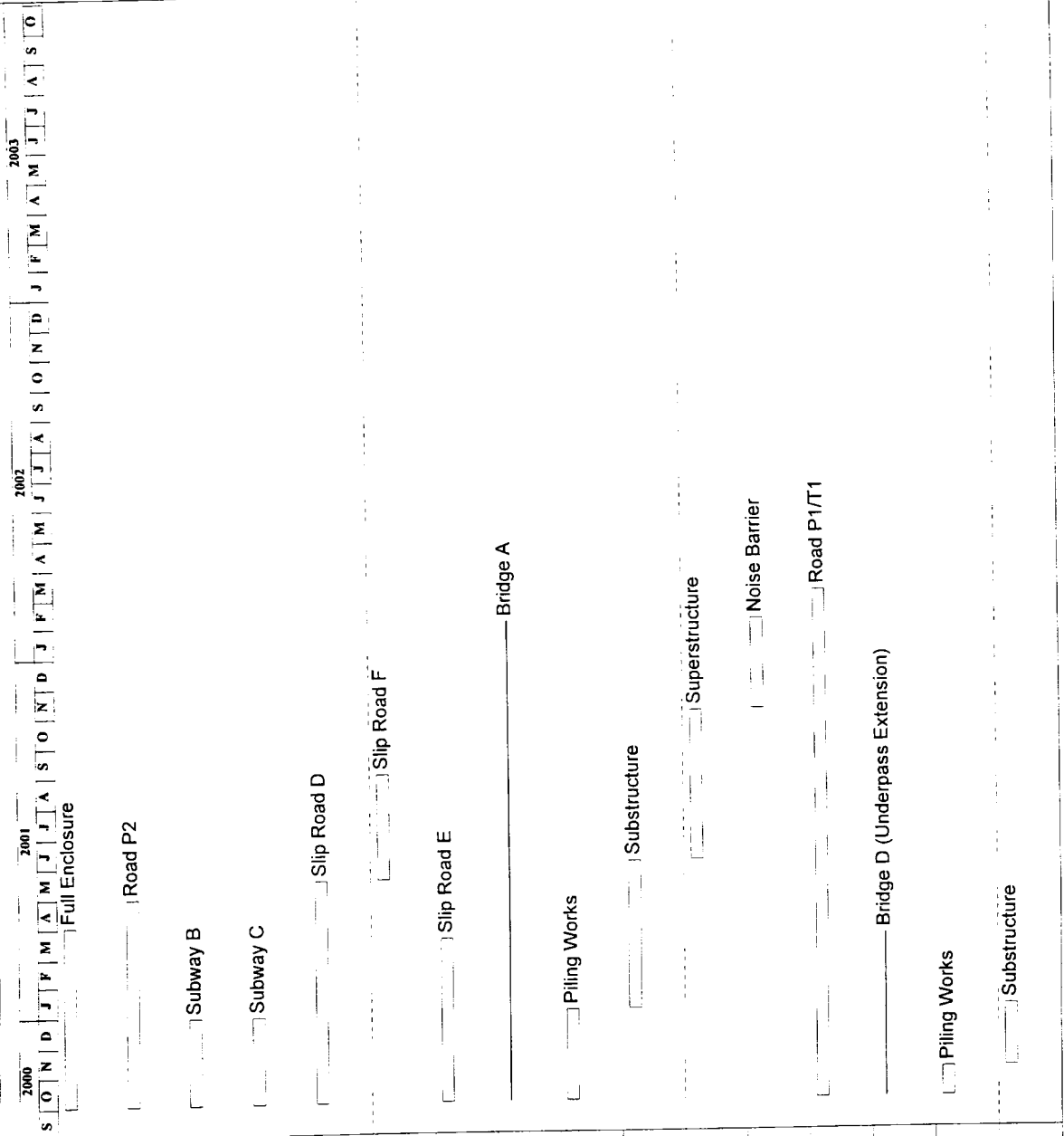


NOTE:
 This Drawing is an extract from
 the Tseung Kwan O Outline
 Zoning Plan, Plan No. S/TKO/6,
 prepared by DPO/ISK&Is, PD.

商業發展區
 公共交通交匯處
 COMMERCIAL DEVELOPMENT
 WITH PUBLIC TRANSPORT INTERCHANGE

TSEUNG KWAN O DEVELOPMENT CONTRACT F GRADE SEPARATED INTERCHANGE T1/P1/P2		
LOCATION OF STUDY AREA		
CHECKED 審核	APPROVED 批准	茂盛亞洲工程顧問有限公司
DATE 日期	APRIL 99	DRG. NO. 1.1 圖紙編號

Act ID	Description
1000	Full Enclosure
1010	Road P2
1020	Subway B
1030	Subway C
1040	Slip Road D
1050	Slip Road F
1060	Slip Road E
1070	Bridge A
1080	Piling Works
1090	Substructure
1100	Superstructure
1110	Noise Barrier
1120	Road P1/T1
1170	Bridge D (Underpass Extension)
1180	Piling Works
1190	Substructure

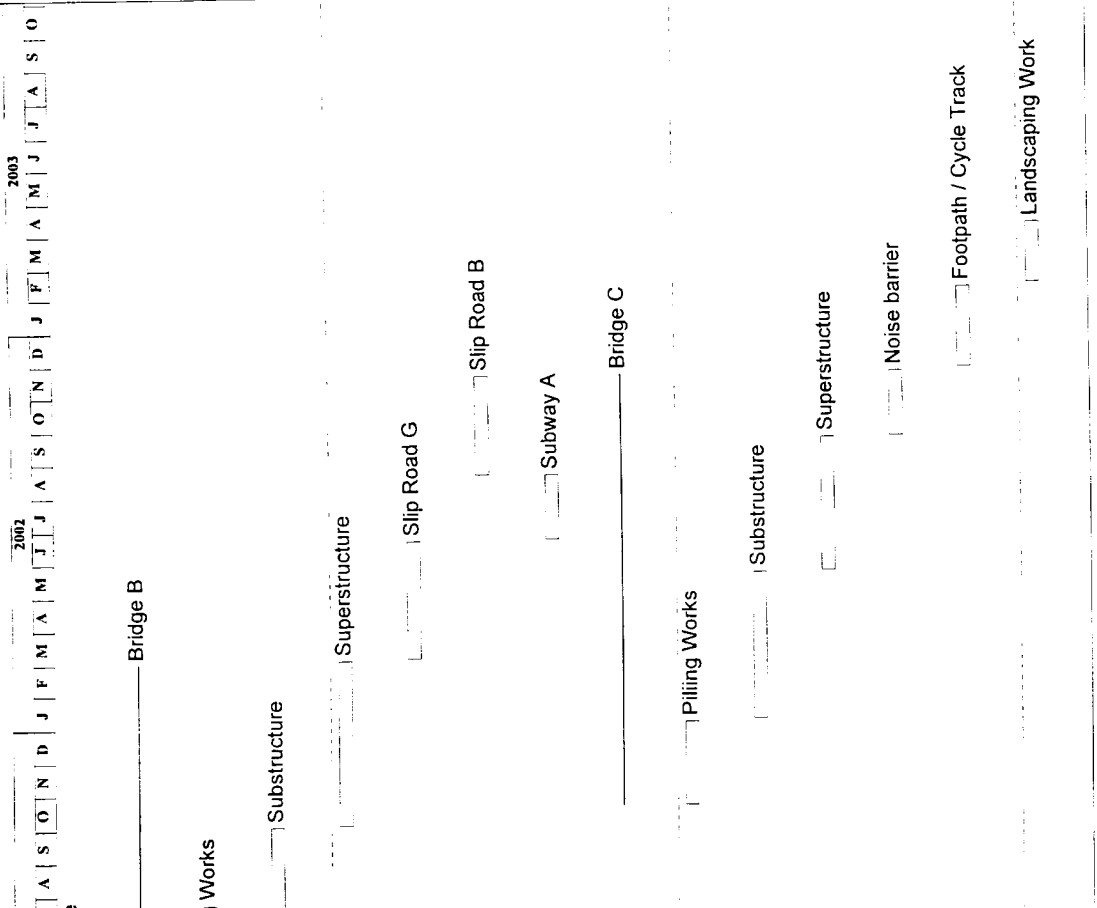


Early bar
 Progress bar
 Critical bar
 Summary bar
 Start milestone point
 Finish milestone point

Start date	22JAN99
Finish date	31MAR03
Data date	22JAN99
Run date	06JUL99
Page number	1A
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Figure 2-2 Preliminary Construction Programme

Act ID	Description
1200	Superstructure
1210	Bridge B
1220	Piling Works
1230	Substructure
1240	Superstructure
1250	Slip Road G
1260	Slip Road B
1270	Subway A
1280	Bridge C
1290	Piling Works
1300	Substructure
1310	Superstructure
1315	Noise barrier
1320	Footpath / Cycle Track
1330	Landscaping Work



Start date	22JAN99
Finish date	31MAR03
Data date	22JAN99
Run date	06JUL99
Page number	2A
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Figure 2-2 Preliminary Construction Programme

<input type="checkbox"/>	Early bar
<input type="checkbox"/>	Progress bar
<input type="checkbox"/>	Critical bar
<input type="checkbox"/>	Summary bar
<input type="checkbox"/>	Start milestone point
<input type="checkbox"/>	Finish milestone point



LEGEND

[Symbol] Designation of NSR

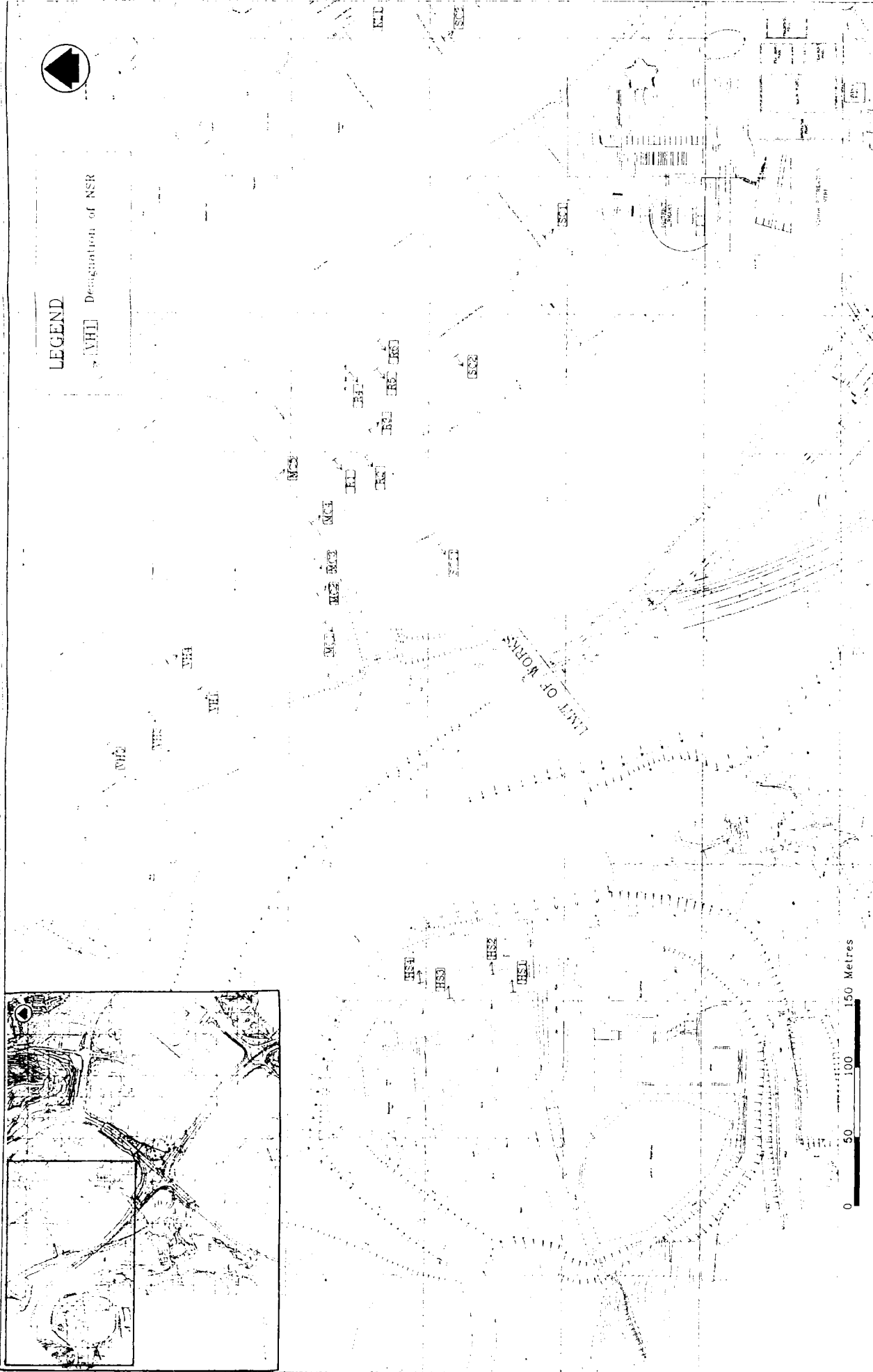


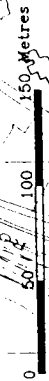
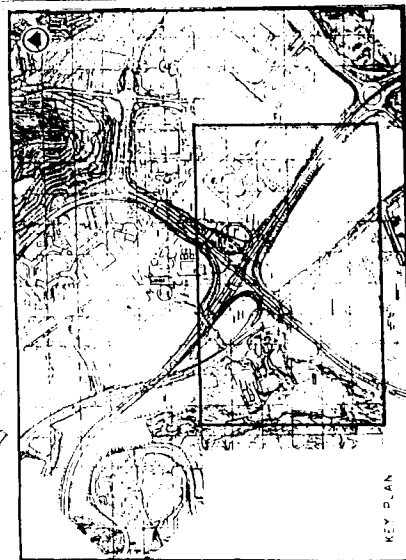
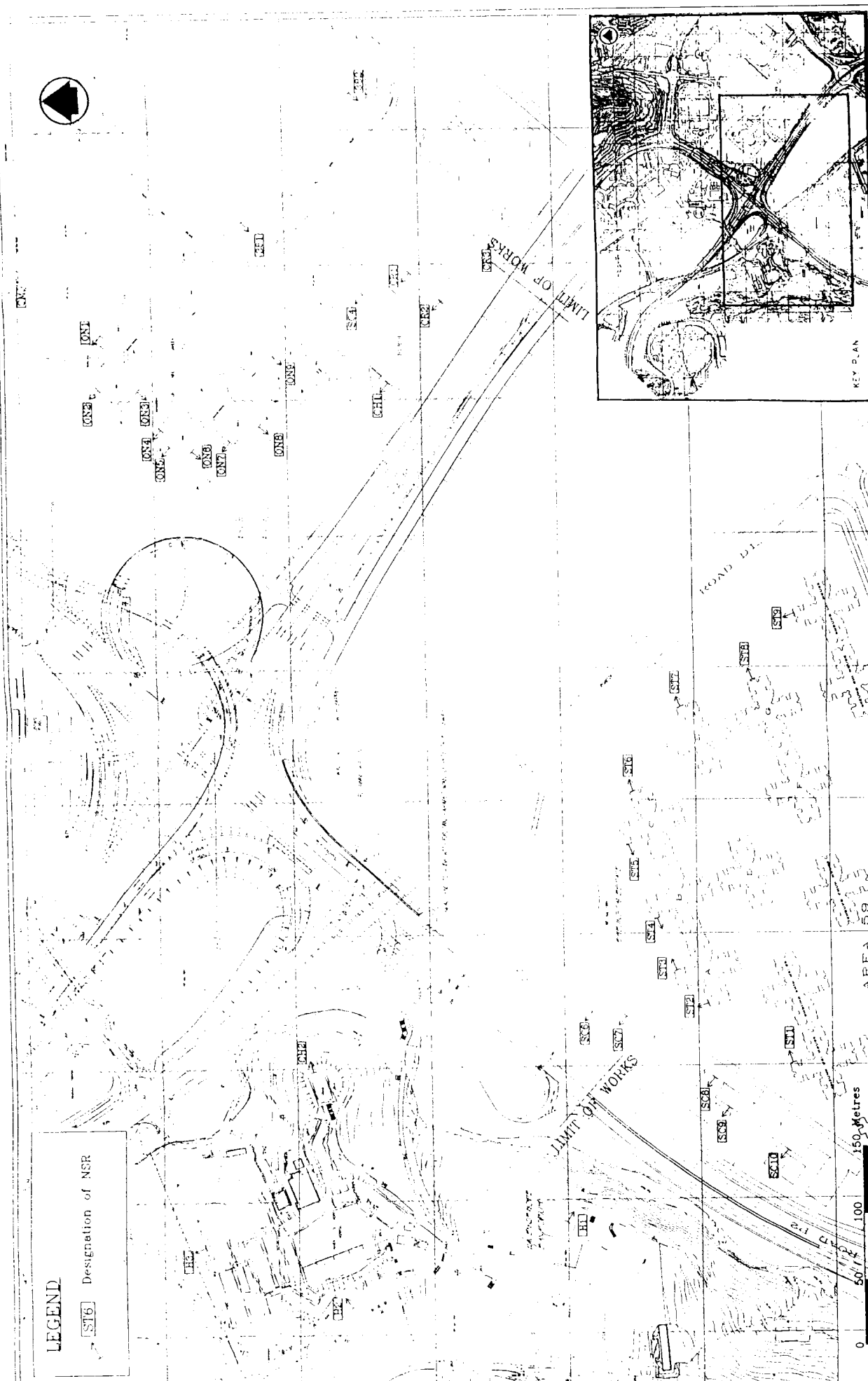
FIGURE NC 3-1 TSEUNG KWAN SHI DEVELOPMENT CONTRACT F. GRADE SEPARATED INTERCHANGE T. 1/P.2

LOCATIONS OF REPRESENTATIVE NOISE SENSITIVE RECEIVERS (SHEET 1 OF 3)

FIGURE NO	3-1
DATE	APRIL 1999
AS SHOWN	

LEGEND

[ST6] Designation of NSR



AREA 59
WASHING TANK

TSEUNG KWAN O DEVELOPMENT CONTRACT F GRADE SEPARATED INTERCHANGE T1/P1/P2

FIGURE NO

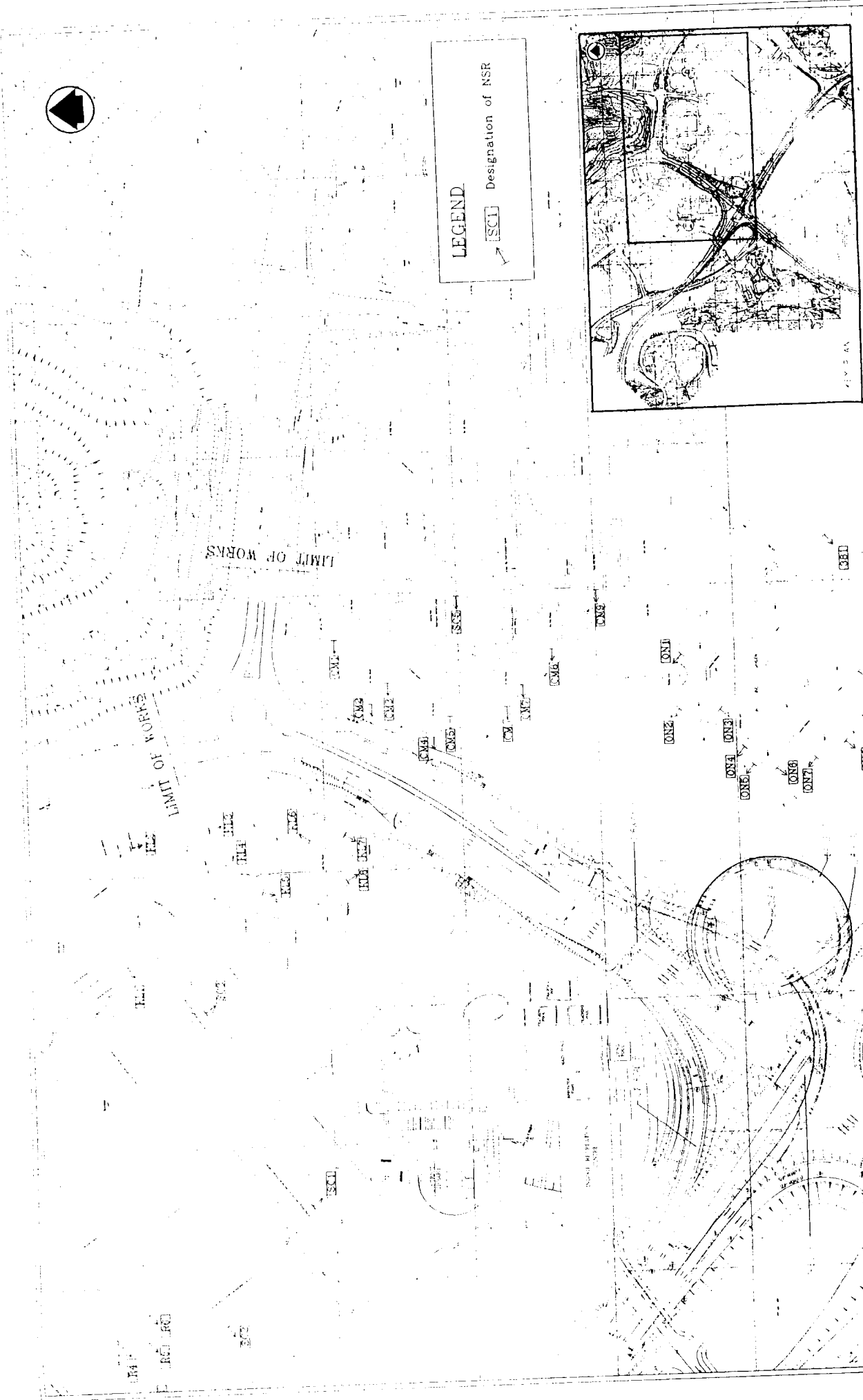
3-1

LOCATIONS OF REPRESENTATIVE NOISE SENSITIVE RECEIVERS (SHEET 2 OF 3)

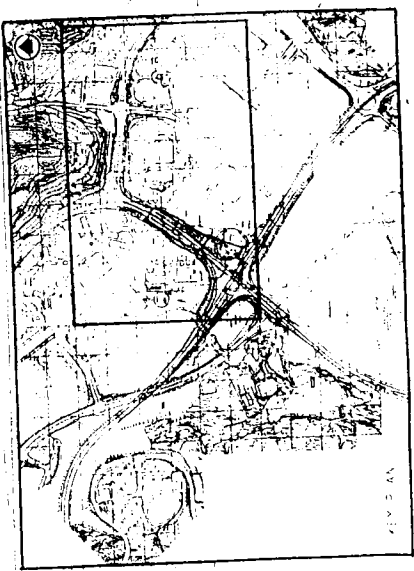
SCALE
AS SHOWN

DATE
MAY 1999

Mansell



LEGEND
 [NSR] Designation of NSR



Maunsell
 REV. NO. 3-1
 DATE APRIL 1999
 AS SHOWN

TSEUNG KWAN C DEVELOPMENT CONTRACT F GRADE SEPARATED INTERCHANGE TWP.P.02

LOCATIONS OF REPRESENTATIVE NOISE SENSITIVE RECEIVERS (SHEET 3 OF 3)



Dispositions of the

Code	Description
0001	Western Theatre
0002	Public Siting, Caravan, 2 sites
0003	Water, Clay Tower, 5
0004	Secondary Storage, 10 items
0005	Open Space, in Area 10
0006	Open Space, in Area 12
0007	Walls, Along the Jar, etc.
0008	Western A. Primary School
0009	Swimming Pool, in Area 11

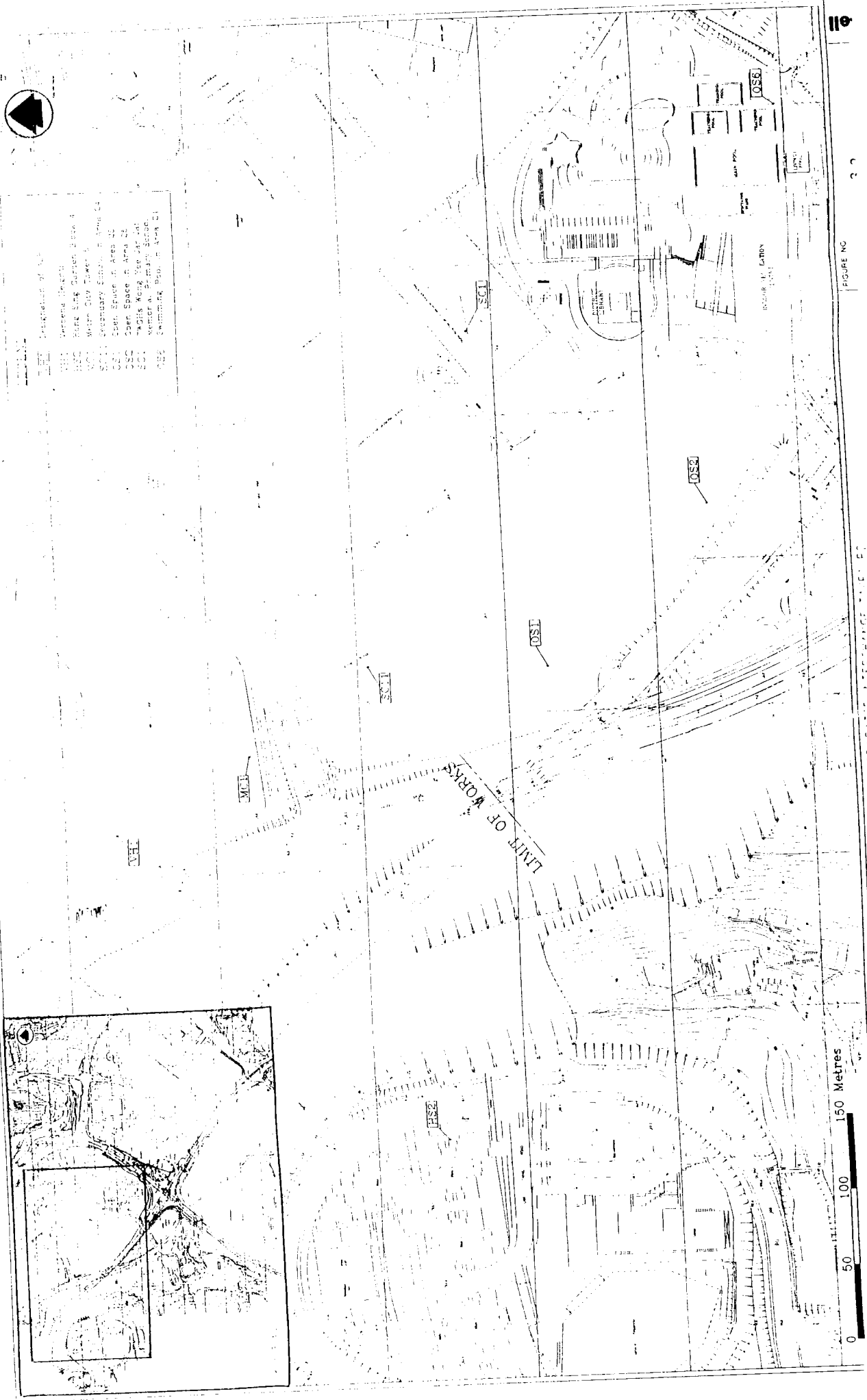


FIGURE NO. 3.7

ISEUNG KWAN G DEVELOPMENT CONTRACT F GRADE SEPARATED INTERCHANGE T1/P1/P2

RECOMMENDED MITIGATION MEASURES

