Territory Development Department
South West N.T. Development Office

North Lantau Development

Appendices

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Territory Development Department
South West N.T. Development Office

North Lantau Development

Appendices

NORTH LANTAU DEVELOPMENT STUDY

FINAL REPORT

VOLUME 2 : APPENDICES

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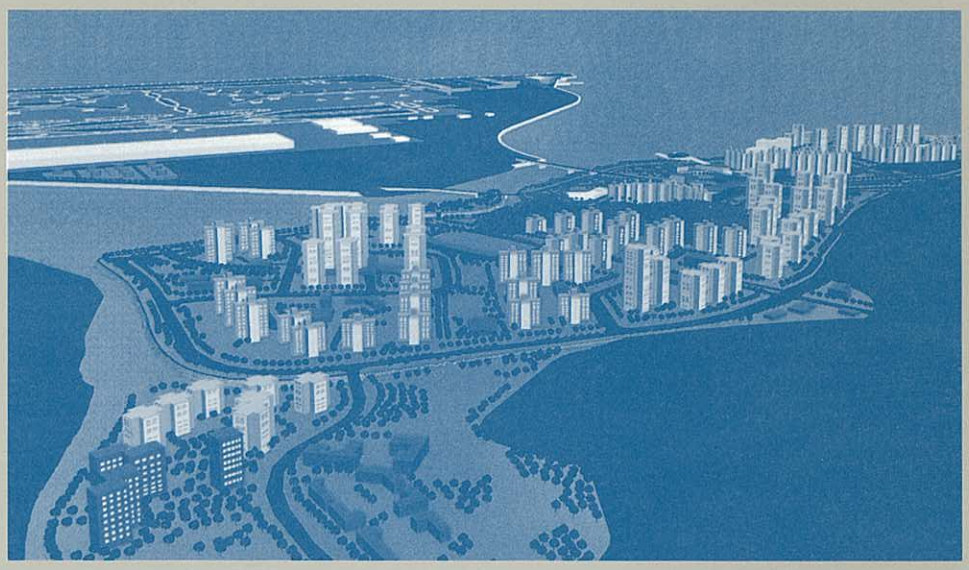

Appendix A

The Study Brief

AGREEMENT NO CE 19/90

NORTH LANTAU DEVELOPMENT

BRIEF

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Agreement No CE 19/90

North Lantau Development

Brief

1. INTRODUCTION

1.1 General

This Brief is to be read in conjunction with the Memorandum of Agreement, the General Conditions of Employment of Engineering and Associated Consultants for Investigation, Design and Construction Projects ("the Conditions"), any Special Conditions, the Schedule of Fees with the Schedule of General Instructions to Consultants and any other detailed instructions issued by the Director's Representative.

1.2 Scope of the Study

1.2.1 The first part of the Project for which the Consultants are to undertake and perform the duties mentioned in the Memorandum of Agreement is to study the planning and development of an area generally referred to as the North Lantau Study Area and make proposals for implementation of the Works in phases.

1.2.2 The Study Area is shown on the attached plan no. SW 3001. It covers Tung Chung Valley, Tai Ho Wan and the coastal strip of North Lantau from near Sham Shui Kok in the east to Sham Wat Wan in the west. The coastal waters to the north are included up to and including the Brothers, but excluding the site for the new airport. The southern limit of the Study Area is the Country Park boundary and, further east, the main ridge line separating North Lantau from Discovery Bay. The scope of the Study will extend beyond these boundary limits for the purposes of considering interfaces with adjacent developments and the wider impacts of the Study Area developments.

1.2.3 During the term of the Study or at some later time, the Consultants may be required to proceed to the Design Stage (and possibly subsequent Stages) for all or part of the Works necessary to implement the Project. The Consultants should note that no representation or warranty of whatsoever nature is given that this work will be given to them. The Employer expressly reserves the right to carry out any subsequent work contemplated in this Agreement by its own forces or third parties. The Consultants shall not be entitled to compensation or payment should this occur.

2. BACKGROUND TO THE STUDY

2.1 Port and Airport Development Strategy (PADS)

2.1.1 The proposed new Chek Lap Kok airport and its high capacity road and rail connections produce requirements and pressures for urban development on Lantau. The Port and Airport Development Strategy (PADS) study showed how such development could support the port and airport and contribute towards satisfying strategic requirements for housing and industrial land.

2.1.2 Three strategic purposes for the Study Area were identified in PADS :-

(a) To accommodate an airport support community for airport-related activities and airport and ancillary workers' housing.

(b) To accommodate the airport road and rail transport links.

(c) To accommodate strategic land use requirements for housing and industry.

2.2 Development Statements

2.2.1 Development Statements were prepared by Planning Department for North Lantau and Lantau Port Peninsula (North East Lantau) to provide an appropriate context for the detailed planning, engineering feasibility, traffic and transport, and environmental studies needed to implement PADS in the Study Area.

2.2.2 A development study is now proposed for North Lantau with the objectives and requirements as outlined in sections 3 and 4 of this Brief.

3. OBJECTIVES OF THE STUDY

3.1 General

3.1.1 To plan a comprehensive urban development which will as far as is practicable ensure that the requirements of PADS for residential, commercial and industrial developments to be located within the Study Area are met, and to investigate the feasibility of further expansion.

3.1.2 To formulate proposals on the traffic and transport requirements in the Study Area.

3.1.3 To establish the engineering feasibility, programme and costs of implementing the development of the Study Area and develop proposals for construction.

3.1.4 To assess the environmental impacts of the development of the Study Area and make recommendations for suitable pollution control and mitigation measures.

3.2 Preliminary Report Stage

The following duties for the Study shall be carried out within the Preliminary Report Stage:-

3.2.1 To prepare a Recommended Outline Development Plan in the scale of 1:5000 for the requirements of PADS within the Study Area which shall show the main land uses and traffic and transport requirements in sufficient detail to allow progression to detailed planning and design.

3.2.2 To prepare as an integral part of the Recommended Outline Development Plan a Master Landscape Plan to serve as a guide for detailed planning and design of development.

3.2.3 To recommend the type and scale of residential, office, commercial and industrial developments to complement the operation of the new airport and to meet the Territory's strategic needs.

3.2.4 To examine the environmental, visual, social and other planning issues in the Study Area and make proposals as to how these may be resolved in the context of the Recommended Outline Development Plan.

3.2.5 To assess the long term and short term environmental impacts of the proposals and to determine the extent to which pollution control and mitigation measures will need to be applied.

3.2.6 To accommodate the principal road and rail transport links connecting the airport with the urban areas of Kowloon, Hong Kong and the New Territories and to provide for proper integration of their proposed alignments and those of district and local distributor roads with the future land uses.

3.2.7 To accommodate the railway stations and a railway depot, and to provide for proper integration of these facilities with the future land uses.

3.2.8 To recommend environmentally acceptable sites for potentially hazardous installations including water treatment works and LPG storage depot (if LPG instead of town gas is to be used for domestic fuel), and to liaise with the airport master plan consultants on their site selection for aviation fuel storage.

3.2.9 To recommend a rural hinterland strategy with a view to minimizing the impact of urban development and to enhance the recreational and landscape value of the rural hinterland.

3.2.10 To examine the number of village settlements (with population estimates) which will be cleared due to development and/or unacceptable aircraft noise and to identify village resite areas on Lantau.

3.2.11 To recommend strategies for proper integration/segregation of the Study Area with the rest of Lantau particularly the coastal area of South Lantau, Discovery Bay, Mui Wo, Tai O and Sham Wat.

3.2.12 To investigate the feasibility of future expansion of urban development in the Study Area and develop appropriate proposals to allow the work to proceed.

3.2.13 To develop proposals for the provision of land and associated infrastructure.

3.2.14 To determine the engineering feasibility and practicability of the formation and servicing requirements of the development and make proposals for the construction of the Project.

3.2.15 To recommend optimum solutions to interface issues with other development projects in the vicinity of the Study Area.

3.2.16 To prepare comprehensive development programmes of coherent and practical implementation packages for the Study Area, which should tie in with the programme for the opening of the new airport and other requirements under PADS.

3.2.17 To provide revenue and expenditure estimates and forecasts for the comprehensive development programme.

3.3 First Phase of Development

In so far as the first phase of development is concerned, the Consultants shall carry out the following duties in addition to those stated in Clause 15(A) of the Conditions:-

3.3.1 To prepare 1:1 000 scale layout plans and outline engineering designs for the first phase of development for proceeding immediately to detailed design.

3.3.2 To prepare gazettal plans for the first phase works for statutory action under the Foreshore and Seabed (Reclamations) Ordinance, the Roads (Works, Use and Compensation) Ordinance and the Crown Lands (Resumption) Ordinance.

The first phase of development is more fully described in para. 4.5.1.

4. REQUIREMENTS OF THE STUDY

4.1 Planning Study

As part of the Preliminary Report Stage, the Consultants shall carry out a Planning Study to produce a plan which will provide, as far as is practicable, for a balanced development of housing, employment and community facilities at the end of each stage of development and on completion of the whole development. The plan for the Study Area shall be in the form of a Recommended Outline Development Plan (RODP) covering the requirements of PADS, accompanied by a report and any other plans, diagrams or illustrative materials. The RODP shall allow for the possibility of future expansion of urban development in the Study Area.

4.1.1 Existing Uses within the Study Area

The Consultants shall carry out a study of the existing land/marine uses within the Study Area with a view to identifying any planning issues/opportunities that would arise in implementing the proposed development.

4.1.2 Recommended Outline Development Plan

4.1.2.1 The Recommended Outline Development Plan shall show transportation networks and land use zonings for areas to be set aside for residential, commercial, industrial, GIC facilities, public open space and all other land requirements. The land use zonings shall be in accordance with Hong Kong practice and planning standards. The Consultants shall carry out studies to determine the housing mix for residential development, the requirements of airport-related industrial and commercial land and the general industrial land requirement. Findings of the Territorial Development Strategy Review and the Study of Industrial and Commercial Enterprises that Need Relocation with the Airport shall be taken into account.

4.1.2.2 Provision shall be made for urban developments in Tung Chung and Tai Ho to accommodate a population of 200,000 by 2011 with about 30% in HOS/PSPS, 50% in private and 20% in public rental housing. The Consultants shall also examine the desirability of a post-2011 development for an additional 60 000 people in the Study Area taking into account detailed investigation of the various planning, environmental and engineering factors involved.

4.1.2.3 Provision shall be made for airport-related commercial developments in the Study Area. They shall be able to accommodate office, hotel and convention/exhibition facilities which complement the operation of the airport.

4.1.2.4 The Consultants shall review and make provision for the PADS' suggestion to locate about 5 000 hotel rooms near the airport and to have some hotel accommodation ready at airport opening.

4.1.2.5 The RODP shall set aside adequate land to accommodate the off airport-related industries which comprise activities indirectly involved in the operation of the airport and the movement of passengers and goods by air, together with other industrial activities which may benefit from proximity to the airport.

4.1.2.6 Provision shall be made for forming industrial land on reclamation along the coast from Sham Shui Kok to Tung Chung. The industrial land would contain a mix of general industry (excluding special uses requiring deep water access) and warehousing. The implementation of the reclamation should be in the form of packages which shall be flexible enough to react to market demand for industrial land. In this connection, the Consultants shall :-

(a) advise how the territory-wide demand for general industrial land can best be met in the Study Area;

(b) establish the extent of and limitations on industrial development opportunities;

(c) recommend the sequence/phasing of the implementation of industrial land deveopment;

(d) investigate the advantages and possibility of the Hong Kong Industrial Estates Corporation developing the industrial land in the form of an industrial estate (not necessarily limited to special industries); and

(e) investigate other appropriate land uses eg science park and office park for the reclamation area.

4.1.2.7 The RODP shall indicate appropriate locations for the following :

- a railway depot
- ferry/public piers
- aviation fuel storage site and delivery/handling facilities
- landfill site or refuse transfer station
- sewage treatment works

- water treatment works

- service reservoirs

- major utility installations.

4.1.2.8 The RODP shall include utility reserves and major foul water sewerage and stormwater drainage networks.

4.1.3 Master Landscape Plan

4.1.3.1 As an integral part of the planning study, a Master Landscape Plan (MLP) for the Study Area shall be prepared. The MLP shall be geared towards high-quality design in urban and rural development in order to contribute to promoting the image of Hong Kong.

4.1.3.2 The MLP shall be accompanied by a report (which may form part of the Recommended Outline Development Plan) together with all supporting plans, diagrams and other materials.

4.1.3.3 Two models shall be prepared. The first model at a scale of 1:5000 should cover the whole Study Area and, where necessary, its vicinity. The second model should cover only Tung Chung area. The second model shall be of a larger scale to be determined by the Director's Representative. These models should illustrate the planning and landscaping proposals and the anticipated urban form. This shall include roads, footpaths, building blocks and open space treatment.

4.1.3.4 The MLP shall cover the following aspects :

(a) Urban Design : The plan shall indicate the urban form concept in terms of building height, open space, location of buildings/site coverage and pedestrian/vehicle circulation and justify these recommendations. Urban design principles shall be applied and where there is a conflict between urban design objectives and engineering design objectives, all options shall be studied and systematically evaluated. Development control criteria shall be established in the MLP and included in the RODP.

(b) Open Space : The plan shall indicate the landscape framework of open space and amenity areas, showing active and passive recreation areas, pedestrian precincts, civic features, hard and soft landscape treatment including an outline of plant type. Consideration shall also be given to utilizing the recreational and educational potential of the archaeological and historical sites in the Study Area by proper integration into the open space system.

(c) Roads and Footpaths : The plan shall show treatment of planting along roads and footpaths. Proposals shall include dimensions, cross-sections and other necessary diagrams. The design of the road and footpath network shall aim at a high degree of pedestrian/vehicle segregation at ground level. The need for provision of cycle tracks shall also be considered.

(d) Landscape costs and a landscape development programme shall be specified.

4.1.4 Sites for Potentially Hazardous Installations (PHIs)

4.1.4.1 The Consultants shall identify environmentally acceptable sites for water treatment works.

4.1.4.2 The Consultants shall recommend a preferred option for the supply of domestic fuel. If LPG is adopted as domestic fuel, environmentally acceptable sites for LPG storage shall be identified.

4.1.4.3 The feasibility of using underground cavern storage shall be investigated.

4.1.5 Site for Aviation Fuel Storage

The Consultants shall in consultation with the airport master plan consultants recommend suitable site(s) for aviation fuel storage and delivery/handling facilities.

4.1.6 Rural Hinterland Strategy

The Consultants shall recommend a rural hinterland strategy with a view to having proper conservation and development control on the urban fringe area. The strategy shall aim at enhancing the landscape and recreational potential of the urban fringe area.

4.1.7 Possibility of Further Urban Expansion

The Consultants shall carry out a study to investigate and to confirm the feasibility and desirability of further expanding the urban developments up to 260,000 population level without compromising the general quality of living environment in the Study Area. The Consultants shall take into account the constraints imposed by the final NEF25 contour, capacity of transport infrastructure, engineering and environmental factors, and the broader strategic development objectives to be considered in the Territorial Development Strategy Review.

4.1.8 Development Implications on the Rest of Lantau

The Consultants shall examine the relationship of the RODP proposals with the rest of Lantau, particularly the South Lantau coastal area, Discovery Bay, Mui Wo, Tai O and Sham Wat, and the need and feasibility of providing transport links to the south of Lantau and a link westward along the coast to Sham Shek Tsuen.

4.1.9 Other Issues

The Consultants shall also consider the following issues :

(a) the early provision of village resite areas on Lantau to accommodate the existing villages affected by the development;

(b) the need for the provision of a hospital taking into account the future population in the proposed development, the regional needs of Southwest New Territories and the emergency services requirements of the new airport;

(c) the need and feasibility of providing a China/Macau Ferry Pier and the necessary land base supports in the Study Area;

(d) the need and feasibility of early provision of road connection between Sham Wat and Tung Chung to compensate for the loss of sea access due to airport reclamation;

(e) the provision of recreation footpaths leading from population centres to Country Parks; and

(f) the possible conservation of archaeological and historical sites within the Study Area.

4.2 Engineering Feasibility Study

As part of the Preliminary Report Stage, the Consultants shall carry out an Engineering Feasibility Study which shall comprise the following aspects :

4.2.1 Site Investigations

Assemble, assess and interpret all site investigation data (both land and marine) available from previous studies or contained in the Geotechnical Information Unit of the Civil Engineering Services Department. The Consultants shall identify any further site investigation works that are required for the purposes of the Study. These works, if required, shall be carried out either by the Geotechnical Control Office (GCO) term contractor through arrangement with the Director's Representative or under individual contract to be supervised by the Consultants.

4.2.2 Geotechnical Study

In consultation and agreement with GCO, carry out a geotechnical study of the Study Area. The geotechnical study shall identify all potential geotechnical problems and recommend solutions which shall include preliminary designs if necessary, taking due account of environmental aspects and land use proposals.

4.2.3 Fill and Borrow Areas

4.2.3.1 Investigate the possible use of excess material arising from the excavation of Chek Lap Kok Island for airport construction, if any, in land formation and reclamation works.

4.2.3.2 Assemble, assess and interpret necessary information required for the identification of land and marine borrow areas in and around the Study Area. Previous studies have identified Tai Ho Wan hill (which separates Pak Mong from Tai Ho), Wong Kung Saddle (between Tai Ho Wan and Mui Wo) and the ridge immediately south of Tung Chung as potential land borrow areas. Sources of marine fill have been identified at Deep Bay/Urmston Road. The Consultants shall evaluate the appropriateness of these as sources of fill taking into account traffic and environmental impacts. The Consultants shall identify and recommend the use of other borrow areas where necessary.

4.2.3.3 A preliminary design of land borrow areas shall be prepared which should aim at balancing cut and fill requirements. All suitable fill excavated from borrow areas shall be used for formation and reclamation works within the Study Area. The Consultants shall make recommendations on the use and disposal of top soil and unsuitable materials.

4.2.3.4 Consideration shall be given to the use of the land borrow areas for subsequent urban developments. Where such use is not desirable they shall be formed and landscaped for uses compatible with the surroundings.

4.2.3.5 The Consultants shall maintain close liaison with the government's Fill Management Committee and the Chek Lap Kok airport master plan consultants in the identification of sources of fill.

4.2.4 Formation and Reclamation

4.2.4.1 Recommend, taking account of the findings of the Planning Study (see Section 4.1) and the Environmental Impact Assessment Study (see Section 4.3), the extents of formation and reclamation within the Study Area.

4.2.4.2 Recommend, taking account of the findings of the geotechnical study and land use proposals, the type and design of seawalls to retain the reclamation.

4.2.4.3 Recommend, taking account of the findings of previous studies, the general profile and levels of the formation and reclamation. The Consultants shall study and recommend measures to mitigate the possible effects of settlement in reclamation areas and assess the rate of the settlement. The seawards limits of reclamations and land drainage requirements shall be taken into account in making the recommendations.

4.2.4.4 Study and recommend the method and sequence of the formation and reclamation works including excavation, transport and disposal of unsuitable materials within the development areas and borrowing, transport and deposition of fill. The potential problems in the transport of fill over and across the Airport Railway and North Lantau Expressway for the reclamation of the area along the North Lantau coast should be investigated and solutions recommended.

4.2.4.5 Assess and determine the quantities of mud arising from reclamation works and the likely timescale for the disposal of such mud. The Consultants shall, in consultation with the Fill Management Committee, examine possible engineering uses of marine mud, including the backfilling of marine borrow areas and the formation of reclamation areas for future development. The Consultants shall establish a disposal strategy if suitable uses for mud cannot be identified. Results of the Backfilled Mud Anchor Trials should be taken into account in formulating proposals.

4.2.5 Land Drainage

4.2.5.1 Assemble and assess the land drainage proposals contained in previous studies to cater for run-offs generated by the natural catchments behind the proposed development.

4.2.5.2 Recommend a stormwater drainage network which should cater for run-offs generated from the entire natural catchments even though in many areas water is normally intercepted by the Shek Pik Reservoir scheme. It should be assumed that the Shek Pik in-takes could be either blocked or could overflow in severe storms.

4.2.5.3 Recommend measures to arrest land refuse from being let into the sea.

4.2.5.4 Submit stormwater drainage layout drawings for the Study Area and, where necessary, its vicinity. The drawings shall be drawn to a scale of 1:1000 or as approved by the Director's Representative.

4.2.5.5 In the design of nullahs and the form of the stormwater drainage system the Consultants shall take into account the Chek Lap Kok airport master plan and the Territorial Land Drainage and Flood Control Strategy Study. The Consultants shall maintain close liaison with the appropriate bodies responsible for these projects.

4.2.6 Sewage Treatment and Disposal

4.2.6.1 Recommend, taking account of proposals contained in previous studies, a sewage treatment and disposal method to serve the first phases of development of both the Study Area and the new airport. The possible use of a treatment works together with a submarine outfall discharging treated effluent to the waters of the Pearl Estuary to the north-west of the new airport should be examined. The site recommended for the treatment works should be such that the works could be enlarged to cater for the ultimate developments in the Study Area and the new airport.

4.2.6.2 The possible use of underground caverns for sewage treatment facilities should be examined.

4.2.6.3 The sewage treatment and disposal proposal recommended should take account of water quality objectives for salt water flushing purposes.

4.2.6.4 The sewage treatment and disposal proposal recommended should allow for the eventual diversion of flows to the oceanic outfall proposed under the Sewage Strategy Study.

4.2.6.5 The Consultants shall submit sewerage layout drawings for the Study Area and, if necessary, its vicinity. The drawings shall be drawn to a scale to be approved by the Director's Representative.

4.2.6.6 In determining the location of sewage treatment works and outfall as well as the level of treatment required the Consultants shall take into account the Chek Lap Kok airport master plan and the Sewage Strategy Study. The Consultants shall maintain close liaison with the appropriate bodies responsible for these projects.

4.2.7 Water Supply

4.2.7.1 Make provision for waterworks installation which shall includes a fresh water supply system and a salt water flushing system to be designed by the Water Supplies Department (WSD). The installation may include a treatment works near Siu Ho Wan together with service reservoirs, pumping stations, trunk and distribution mains.

4.2.7.2 Make due allowance in the siting of water treatment works which are Potentially Hazardous Installations (PHIs). The off-site risks imposed by these installations should be given due consideration in formulating land use proposals.

4.2.7.3 Consideration should be given to the feasibility and cost benefits of incorporating the site formation works for all or some of the waterworks installations as an integral part of the overall borrowing and formation activities associated with the development of the Study Area.

4.2.7.4 The Consultants shall liaise closely with WSD regarding supply arrangements for the airport and the Study Area.

4.2.8 Utilities

4.2.8.1 Determine, in consultation with Hong Kong Telephone Co. Ltd. and China Light and Power Co. Ltd., the layout of trunk mains within the Study Area and the location of principal plant installations. The first phase of the development shall include service reservations from the boundary of the Study Area to the boundary of the airport site to permit the timely commissioning of the airport complex.

4.2.8.2 Investigate, in consultation with Hong Kong and China Gas Co. Ltd., the viability of providing a gas supply to the Study Area. A layout for trunk mains and the location of principal plant installations shall be established in the Study if appropriate.

4.2.8.3 The Consultants shall consider the use of joint utility reserves of suitable size, independent of the carriageways of main roads.

4.2.8.4 The Consultants shall, in consultation with utility undertakers, determine the supply arrangements and requirements for the Study Area.

4.2.9 Waste Disposal

4.2.9.1 Review, taking account of the scale of development currently proposed on Lantau, the long term solid waste disposal strategy which provides for waste generated on Lantau to be barged to a strategic landfill site in the New Territories. Allowance shall be made for wastes requiring special handling and disposal provision.

4.2.9.2 Identify, if necessary, sites for landfill or refuse transfer stations or proper incineration facilities within the Study Area taking into account results of previous studies. The Consultants shall recommend the ultimate capacity of the sites identified. In particular, consideration should be given to the use of Siu Ho Wan which is one of the sites identified in the early 1980s as a potential strategic landfill site. The potential aviation hazard due to bird strike shall be taken into account in selecting any landfill sites.

4.2.9.3 Consider the possible use of underground caverns for refuse transfer stations.

4.2.9.4 Investigate the possibility of a single facility to serve the new airport and the Study Area.

4.2.10 Temporary Works Area

4.2.10.1 Recommend suitable area(s) within the Study Area to accommodate construction workers, plant and rock crushing activities (if required), and make proposals for the necessary land reservations.

4.2.10.2 Identify the extent of advance works to be carried out if necessary to make the areas available and appropriate for use including provision of temporary infrastructure and facilities for sewage treatment and refuse disposal. A programme shall be suggested for such works. The Consultants shall liaise closely with the Project Management Consultant (see para. 6.3) on matters relating to possible common use of the facilities by other airport-related projects.

4.2.11 Staging Area

4.2.11.1 The Lok On Pai Desalter site has been identified as a Staging Area for the new airport and its related projects on Lantau. Each project will be allocated an area within the desalter site for its own use. The Consultants shall:-

(a) recommend the size and location of such an area for use by the Project;

(b) determine the facilities to be provided in the area; and

(c) advise on other requirements in connection with the use of the area.

4.3 Environmental Impact Assessment Study

As part of the Preliminary Report Stage, the Consultants shall carry out an Environmental Impact Assessment (EIA) Study for the proposed development in the Study Area. The findings of the EIA Study shall be reflected in the Recommended Outline Development Plan, the Master Landscape Plan, the layout plans for the first phase of development and where appropriate, in recommendations for suitable control or mitigation measures for incorporation in appropriate contracts or operational procedures.

4.3.1 Existing Environmental Situation

The Consultants shall assess the existing environmental situation in the Study Area which shall include the following aspects :

(a) the physical characteristics of the Study Area and their surroundings in terms of land, water, climate, archaeological and historical remains, land use and landscape character;

(b) the ecological characteristics and their surroundings including habitats, communities and species, flora and fauna;

(c) the human activity patterns including demographic aspects, employment structure, recreational aspects, transport and mariculture;

(d) infrastructure services including electricity, gas, water, sewerage, solid waste disposal, and telecommunications;

(e) social and community services including health services facilities, finance, education, housing and emergency services such as fire and ambulance;

(f) fung shui;

(g) the air pollution dispersion capability of the Study Area and the airshed in which the Study Area is located;

(h) existing levels of environmental pollution including air pollution, water pollution, sediment quality, noise and the presence of chemical and solid wastes;

(i) any other relevant environmental issues; and

(j) the relevant baseline monitoring/survey required for the assessment.

4.3.2 Environmental Impacts of the Development

The Consultants shall assess the potential environmental impacts of the proposed development of the Study Area on the construction and operation of the new airport and on the whole Lantau. The following aspects shall be considered :

4.3.2.1 Air Pollution

(a) the air quality impacts due to industrial developments and traffic by the use of atmospheric dispersion models to be agreed with the Environmental Protection Department (EPD);

(b) the odour problems, if any; and

(c) recommendations as to how the adverse air pollution impacts may be mitigated including the imposition of controls and development constraints.

4.3.2.2 Noise Pollution

(a) an assessment of noise due to industrial development and traffic generated within the Study Area; and

(b) recommendations as to how adverse noise impacts identified may be mitigated for all existing, committed and planned noise sensitive land uses likely to be affected.

4.3.2.3 Water Pollution

(a) the effects of the proposed reclamation on the hydraulics and water quality of the neighbouring waters by the use of the WAHMO suite of mathematical models or other suitable methods/models to be agreed with EPD/CESD and recommendations on how adverse impacts may be mitigated including modifications/constraints on the scale and shape of reclamations, diversion of all discharges out of sensitive water bodies, etc; and

(b) the effects of wastewater arising from the proposed development and the need for the pretreatment of industrial effluents and the provision of adequate sewerage and sewage treatment facility for proper disposal of all wastewaters.

4.3.2.4 Waste Disposal

(a) the quantity and quality of different types of solid waste (including mud) disposal options, their timing of disposal and the impact arising; and

(b) the question of chemical waste arising, if any, from any industrial or chemical processes.

4.3.2.5 Adverse Ecological Impact

(a) an assessment of the loss of habitats, species, flora and fauna; and

(b) recommendation on mitigation measures.

4.3.3 Land Uses within the Study Area

The Consultants shall consider the following in deriving land uses/activities within the Study Area :

(a) the environmental implications of the existing and proposed land uses taking into consideration the existing environmental constraints within the Study Area as well as the potential constraints imposed by the adjacent developments which include at least the new airport, the North Lantau Expressway and the Airport Railway;

(b) the environmental impacts of any land uses or activities that are likely to cause emission or discharge or risk;

(c) the environmental/risk impacts of any land uses or activities that involve the process/storage/transport/ disposal of hazardous substances or chemicals;

(d) the visual impact of the proposed development;

(e) the provision of infrastructure including roads, fresh/salt water supply systems, sewage treatment and sewerage systems and their associated environmental impacts;

(f) the provision of utility services including water, power, gas and telephone etc., and their associated environmental impacts;

(g) the environmental implication of the transport and traffic arrangement within the Study Area;

(h) the existence of water gathering grounds within the Study Area; and

(i) any other relevant environmental factors.

4.3.4 Environmental Impacts during Construction and at Different Stages of Development

The assessment of impacts shall include, but not necessarily be limited to, the following :

(a) the method of construction and the effect of development of the Study Area in stages shall be analysed with respect to air/dust, noise, waste and water pollution;

(b) the impacts of dust and noise producing processes, plant, vehicles and machinery on adjacent air and noise sensitive receivers shall be assessed;

(c) the location, volumes and method of acquisition of local construction materials or services such as borrow areas, quarries, water supply, infrastucture requirements, housing, transportation and the like shall be evaluated;

(d) the impacts of construction activities on the aquatic environment should be considered including effects of dredging, reclamation, mud disposal, jetty, berth, intake, outfall and seawall construction and effects from silty runoff on water quality and circulation;

(e) the land and marine access requirement shall be evaluated including the environmental impacts related to the transportation of borrow material, as well as dredging and maintaining marine access;

(f) the impacts arising from disposal of wastes, including unsuitable dredged material, marine mud, construction waste, refuse, chemical (hazardous) waste and wastewater, shall be assessed;

(g) the socio-economic impacts, if any, related to the displacement of existing villages, temples and their fung shui implications shall be identified;

(h) the interruption to natural physical process such as water gathering grounds, stream or tidal flows and groundwater systems shall be assessed;

(i) the impacts on flora and fauna and derive measures for resiting and relocation; and

(j) the impacts on existing archaeological and historical sites within the Study Area.

4.3.5 Sewage Treatment Works

The Consultants shall carry out a detailed examination of the environmental aspects of the operation of the sewage treatment works, including any possible effects on the operation of the airport, problems of odour, sludge disposal and the capacity of receiving waters to accept the flows at the level of treatment proposed. A full hydraulic and water quality study of the receiving waters shall also be carried out using the WAHMO suite of mathematical models or other suitable methods/models to be agreed with EPD/CESD. The Consultants shall determine the model test scenarios and be responsible for the interpretation of test results. The WAHMO model runs shall be carried out by EPD/CESD. The Consultants shall also collect field data on currents, tidal movements, temperature, salinity, dissolved oxygen etc. where necessary.

4.3.6 Potentially Hazardous Installations (PHIs)

The Consultants shall when required carry out hazard assessment study/studies in recommending suitable sites within the Study Area for PHIs. Control and mitigation measures should be recommended where appropriate.

4.4 Transport and Traffic Study

As part of the Preliminary Report Stage, the Consultants shall:-

4.4.1 Assess the traffic generated and attracted by the development within the Study Area for the three design years 1997, 2001 and 2006 and explore a range of possible self-containment scenarios for all prospective major landuse activities in the Study Area. Estimates shall identify the sources of traffic from amongst the major land uses.

4.4.2 Estimate the daily and peak hour demand for internal and external public transport services generated and attracted by the proposed development.

4.4.3 Estimate the daily and peak hour traffic forecasts within the Study Area road network for the design years 1997, 2001 and 2006 resulting from the new developments and natural growth of traffic. This output should highlight the adequacy/inadequacy of the planned road system including major interchanges/junctions to handle the additional traffic generated as a result of the proposed developments. Outline proposals for remedial measures required to rectify identified deficiencies shall be made.

4.4.4 Estimate the peak hour traffic turning movements at all major junctions of the Study Area road network for the design years 1997, 2001 and 2006. The Consultants shall identify critical junctions and recommend measures with suitable layouts to increase their capacity.

4.4.5 Carry out a preliminary feasibility assessment of any additional transport infrastructure requirements as recommended within the Study Area for the design years 1997, 2001 and 2006, including the connections to the external transport linkages.

4.4.6 For longer term traffic assessment beyond 2006, sensitivity tests shall be carried out to assess the adequacy of the recommended transport infrastructure to handle traffic generated from the expanded development in the Study Area. Results of PADS shall be taken into consideration.

4.4.7 Investigate and formulate transport options for the proposed development area in terms of :

(a) public transport plans and recommend a preferred public transport development plan (for bus, GMB, ferry, railway system and other transport modes or a combination of the modes) most suitable for the type of development and travel characteristics;

(b) network requirements which shall show all internal roads/junctions and capacities, major pedestrian and cyclist routes and public transport facilities including termini, interchanges, priority measures, and reserves as appropriate.

4.4.8 Assess the traffic impact of the proposed developments upon the external transport linkages for the design years and make recommendations for improvement if necessary.

4.4.9 Assess the demands on public transport services in the design years and make detailed recommendations on how and when these demands shall be accommodated. These shall include traffic management measures, public transport priority measures where necessary and facilities for public transport operations.

4.4.10 Assess the traffic impact of earth-moving activities during construction which shall include borrowing, transportation of fill to reclamation, and recommend measures to overcome the problems.

4.4.11 Use the Transport Strategy Study for 2006(TSS 2006) and PADS for the determination of boundary conditions.

4.4.12 Consider the requirements for goods vehicle parking in particular.

4.5 Development Programme

4.5.1 Development Phasings and Work Packages

4.5.1.1 A tentative programme of development of the Study Area is shown on Appendix 1. The Consultants shall examine the programme and make recommendations as necessary on the number of phasings and their timings of implementation.

4.5.1.2 The Consultants shall identify and recommend the works, in the form of work packages, that should be included in each phase of development. These work packages shall include, but not necessarily be limited to, site clearance, statutory gazettals, site formation, reclamation, infrastructure requirements for provision of land and forecasts of land production and population build-up.

4.5.1.3 The Consultants shall prepare a computerized Development Programme ("DP") for each phase of development. The software to be used is developed by the Territory Development Department and a copy of it shall be provided free of charge to the Consultants by the Director's Representative.

4.5.1.4 The Consultants shall also prepare a computerized Master Development Programme ("MDP") for each phase of development in a format compatible with that used by the Government. The Consultants shall submit the DP and MDP with details in a format and frequencies to be advised by the Director's Representative.

4.5.1.5 The Consultants must take into account government procedural requirements to avoid being over-optimistic in the preparation of the above programmes.

4.5.1.6 The first phase of development must be complete around airport opening in early 1997. It shall accommodate about 20 000 residents together with open space and supporting government, institutional and community facilities. The housing mix should aim at 50% at public rental with the remaining split evenly between HOS/PSPS and private housing. The size and mix of flats to be provided should be assessed.

4.5.1.7 It may be necessary to include part or all of the following within the first phase of development :-

(a) village resite housing;

(b) hotel and other commercial development;

(c) airport-related industries;

(d) coastal industrial development;

(e) sewage treatment works; and

(f) refuse transfer station.

4.5.1.8 In identifying sites suitable for the first phase of development the Consultants shall take particular account of land tenure (as most of the low-lying land in the Study Area is in private ownership) and the need to deal with affected villages together with burial grounds and fung shui matters. The Consultants shall make due allowance in the programme for the treatment of these matters.

4.5.1.9 Utilities' service reservations from the Study Area to the boundary of the airport site shall be made available at an appropriate time to allow completion and commissioning of the airport utilities' requirements by 1 July 1995.

4.5.1.10 The Consultants shall plan all subsequent phases of development to allow for a rapid build-up of population after airport opening in order to achieve a viable community with a full range of facilities and to contribute patronage to the Airport Railway.

4.5.1.11 As a broad target, the planning of the subsequent phases should aim at an annual build-up of 10,000 new residents from 1997 to 2006 with an increasing level of provision of HOS/PSPS and private housing. The population growth from 2006 to 2011 could accelerate to about 16,000 a year to reach the ultimate housing mix as stated in para. 4.1.2.2.

4.5.2 Cost Estimates

4.5.2.1 Prepare forecasts of annual expenditures by package and contract from commencement to completion, together with a summary of annual commitments. The expenditure forecasts shall include land acquisition cost estimates.

4.5.2.2 The Consultants shall submit the expenditure forecasts with details in a format and frequencies to be advised by the Director's Representative.

4.5.2.3 The expenditure forecasts shall be reflected where appropriate in the DP and MDP prepared by the Consultants.

4.5.2.4 Estimate potential revenues from sales of land.

5. INPUTS TO THE STUDY

Findings of all previous and current studies relevant to this Study shall be taken into acoount. These studies include, in particular, the following :-

5.1 Previous Studies

5.1.1 'PADS Development Statement No. 3 North Lantau' undertaken by the Planning Department, specified the development requirements for an airport support community and other residential and industrial developments on North Lantau.

5.1.2 'North Lantau Development Investigations Stage I and Stage II' (1980) which examined the location, level and optimum extent of land which could be formed to implement the alternative schemes with or without the airport and identify means of disposal of unsuitable materials.

5.1.3 'North Lantau Development Investigations Further Studies Phase 1 and Phase 2' (1983) which re-assessed the long term potential for development on North Lantau.

5.1.4 Assessment on potential land requirements for special industries under the expanded Consultancy Study on Tuen Mun Area 38 undertaken by the Department of Industry.

5.1.5 'A Study of the Potential Use of Underground Space' (SPUN) which explored the potential and use of underground caverns in Hong Kong.

5.1.6 'Ports and Airport Development Strategy (PADS) Study' undertaken by Strategic Planning Unit, Lands and Works Branch.

5.1.7 'Water Quality and Hydraulic Model Studies' (WAHMO) which studied the effects of all the proposed urban reclamations on harbour waters, in respect of currents, scouring, navigation and general water quality.

5.1.8 'Sewage Strategy Study' which developed a strategy for the treatment and disposal of Hong Kong's sewage taking into account Territorial development up to and beyond 2001.

5.1.9 'Marine Sources of Fill Study' which determined the possible locations and volumes of sands, within Territorial waters, with potential for use as fill for the planned harbour reclamations.

5.1.10 'South Lantau Coast Planning and Development Study' which formulated a development strategy to guide developments in South Lantau.

5.1.11 'Second Comprehensive Transport Study' (CTS-2) undertaken by the Transport Department.

5.1.12 'Balanced Development in Hong Kong's New Towns' undertaken by the Town Planning Office.

5.1.13 'Rural Planning and Improvement Strategy' undertaken by the Planning Department.

5.1.14 'PADS Development Statement No. 2 Lantau Port Peninsula' undertaken by the Planning Department.

5.1.15 'Geotechnical Area Studies Programme' undertaken by the Geotechnical Control Office.

5.1.16 'Territorial Land Drainage and Flood Control Strategy Study' undertaken by the Drainage Services Department.

5.1.17 LDPC paper 'Development Assumptions for North Lantau' prepared by the Planning Department.

5.2 Current Studies

5.2.1 'Territorial Development Strategy Review' being undertaken by the Planning Department.

5.2.2 The South West New Territories Sub-regional Planning Statement Review being undertaken by the Planning Department will provide information on peripheral planning issues to this Study.

5.2.3 'Investigation of marine sand and gravel for use in reclamation and building works' (SEAMAT) being undertaken by the Geotechnical Control Office.

5.2.4 'Study of Industrial and Commercial Enterprises that Need Relocation with the Airport' (SICENRA) being undertaken by the Planning Department.

5.2.5 'Airport Railway Feasibility Study' being undertaken by the Highways Department will consider the transportation aspects of the railway, the preliminary location and design of stations and depot,and the possible loop or spur lines for Tung Chung and Tai Ho.

5.2.6 Detailed design of 'North Lantau Expressway' being undertaken by the Highways Department will determine the alignments of the expressway and the airport railway on Lantau and the arrangement of interchanges to serve the Study Area.

5.2.7 'Back-filled Mud Anchor Trial Study' (BMAT) being undertaken by the Geotechnical Control Office in liaison with the Marine Department will identify the effect on anchorage areas of backfilling with marine mud.

5.2.8 Study being undertaken by China Light and Power for the development of gas turbine plant on Lantau.

5.2.9 Study being undertaken by China Light and Power to identify a site for a large thermal power station.

5.2.10 'Airport Master Plan Study' being undertaken by the Civil Aviation Department will define the requirements of the airport and the land to be reserved for long term expansion.

5.2.11 'Lantau Port Peninsula Development Feasibility Study' being undertaken by the Civil Engineering Services Department.

5.2.12 A study being undertaken by the Geotechnical Control Office to develop an overall strategy for the management of the Territory's fill resources.

5.2.13 An enhancement exercise to the WAHMO Mathematical Models being undertaken by the Civil Engineering Services Department.

5.2.14 'Transport Strategy Study for 2006' (TSS 2006) being undertaken by the Transport Department.

5.2.15 'Geological Survey of Hong Kong' being undertaken by the Geotechnical Control Office.

5.2.16 'Ma Wan Channel Improvement Study' being undertaken by the Marine Department.

5.2.17 'Water Supply Studies' being undertaken by the Water Supplies Department.

6. WORK PROGRAMME, STUDY MANAGEMENT AND REPORTING REQUIREMENTS

6.1 Report and Outline Work Programme

6.1.1 The Study shall be completed within a period of 17 months.

6.1.2 Within one month of the Study commencing, 40 copies of an Inception Report shall be submitted to the Director's Representative for his approval. The Inception Report shall consist of at least the following :

6.1.2.1 The methodology for the various items of the Study.

6.1.2.2 A work programme, with major work tasks identified and briefly described. The work tasks shall include, amongst others, the supply of information to others by the key dates shown on Appendix 2. The critical activities in the programme shall be clearly defined.

6.1.2.3 A schedule of submission of reports, technical papers and plans necessary to fulfil the requirements of the Study.

6.1.3 40 copies of a report on the Study progress shall be submitted to the Director's Representative monthly. The report should indicate progress against work programme.

6.1.4 100 copies of a Draft Final Report shall be submitted to the Director's Representative within 15 months of commencement of the Study, subject to the necessary instructions of the Director's Representative. The Draft Final Report shall contain all materials specified in this Brief and Clause 15(A) of the Conditions and other data as may be required by the Director's Representative. A period of one month shall then be allowed for circulation of the Draft Final Report.

6.1.5 100 copies of the Final Report, together with 160 copies of the Executive Summary, shall be submitted to the Director's Representative within one month of the receipt of comments on the Draft Final Report. The Final Report shall contain a summary of comments on the Draft Final Report and the Consultants' responses thereto.

6.2 Control of Study

6.2.1 Director's Representative

The Director's Representative for this Project as defined in the Conditions will be the Project Manager of the South West NT Development Office, Territory Development Department.

6.2.2 Study Management

During the course of the study the Consultants shall report directly to the Director's Representative and all work shall be submitted to him for his initial approval. Where required information is not available by a specified date, the Consultants will be directed by the Director's Representative as to the appropriate assumptions to be made in the light of information available at that time. In addition to their duties specified in the Conditions, the Consultants shall be required to attend meetings as required by the Director's Representative to discuss matters related to the Study.

6.3 New Airport Works Project Management

Government has engaged a Project Management Consultant ("PMC") for the overall co-ordination, programming and monitoring of all airport-related projects including the proposed development in north Lantau. The PMC will as part of their duties :

(i) co-ordinate and advise on the provision of essential utilities required for the construction and operation of the projects; and

(ii) advise on the requirements and provision of common facilities, such as batching plant, access, storage areas, workers accommodations, berthing piers, etc, required for the construction of the projects.

The Consultants shall if required provide all necessary information to the PMC and take into consideration the advice of (i) and (ii) above in formulating development proposals for the Study Area.

6.4 Liaison

The Consultants shall maintain all necessary liaison and consultation with all relevant government departments, the PMC and other relevant parties throughout the course of the Study. The Director's Representative shall be involved in such discussions where possible. Correspondence with other government departments and relevant parties shall be copied to the Director's Representative and to all other departments who are likely to be affected.

6.5 Steering Group/Working Group

6.5.1 A Steering Group will be formed under the direction of the Director of Territory Development to provide guidance to the Consultants on all policy matters and to consider all the major recommendations from the Consultants.

6.5.2 In addition, inter-departmental Working Groups will be formed to provide general and technical guidance to the Consultants in their tasks required by this Brief, to facilitate the exchange of information and to monitor progress.

6.5.3 The Consultants' Director in charge of the Study (or his delegate to be approved by the Director's Representative) together with one or more of his professional staff will be required to attend meetings of the Steering and Working Groups. The Consultants shall provide secretarial services as may be required by the Director's Representative.

6.6 Study Outputs and Reporting Requirements

6.6.1 Unless otherwise specified the Consultants shall supply the Director's Representative up to 100 copies of all reports and other supporting documents as may be required during the Study.

6.6.2 The Consultants shall also supply the Director's Representative with 2 copies each of film transparency (positive) of the RODP, MLP and other drawings produced for the Study.

6.6.3 The Consultants shall submit to the Director's Representative at the end of the Study two sets of full documentation of the transport model developed in the Study. Documents to be submitted shall include full details of the model, computer programmes in the form of source listings together with disc(s)/tape(s), methods/procedures of calibration, and user's manual/instruction to enable the model to be tested, run or modified in future. All workfiles shall also be submitted on completion of the Study.

6.6.4 The Consultants shall submit to the Director's Representative at the end of the Study computer disc(s) containing data for the DP and MDP prepared in the Study.

6.7 Supply of Computer

6.7.1 If instructed by the Director's Representative, the Consultants shall arrange for the provision of a maximum of four computers and peripheral equipment, to a specification agreed by the Director's Representative, and arrange for the supply and installation of such at a Government office in Hong Kong for the purpose of this Agreement. The computer and peripherals, after the installation and passing any acceptance tests specified shall be handed over and become the property of Government.

7. DESIGN, CONTRACT, CONSTRUCTION AND COMPLETION STAGES

7.1 General

7.1.1 The Director's Representative may at any time in writing direct Consultants to proceed to any or all of the above Stage, in order to construct the Works contemplated with the Project.

7.1.2 The Employer reserves the right not to proceed with the Design, Contract, Construction and Completion Stages for any part or phases of the works contemplated in the Project.

7.1.3 The Consultants' attention is drawn to para 1.2.3 of the Brief.

7.1.4 No assurance is given by the Employer in respect of Works which have been commissioned, that the Works will proceed from one Stage to another, or that they will be appointed to carry out that Stage or further Stages. The Consultants' attention is drawn to Clause 14(B) of the Conditions.

7.1.5 The time for completion for any Stage shall be determined accorrding to the need to comply with the programme listed in Appendix 1 or any revision.

7.1.6 In the event that this Agreement goes beyond the Preliminary Report Stage, the Director's Representative may from time to time give instructions and directions on how to proceed in those subsequent Stages.

7.1.7 Notwithstanding anything contained in Clause 11(D) of the Conditions, in the event that all or part of the Project is undertaken by other consultants, contractors or other parties, then the Employer, consultants, contractors and any third party authorised by the Employer may use all drawings, designs, plans, specification, bills of quantities or other documents matters or things produced by the Consultants free of charge.

7.2 Design and Contract Stages

7.2.1 At the start of the Design and Contract Stages for each contract, at time and in a format to be agreed with the Director's Representative, the Consultants shall submit a Design Statement. The Statement shall cover the scope of the work to be included in the contract, design parameters to be used, land required for the contract, interaction with any other contracts, the issues requiring resolution either by the Director's Representative or by other agencies.

7.2.2 All drawings and documents required for the purpose of tender invitation shall be submitted in draft form to the Director's Representative at least 2 months before the date agreed for the publication of the invitation to tender.

7.2.3 The Consultants shall prepare and supply sufficient copies of documents and drawings for the purpose of calling for tenders and also one set of film transparencies of the general layout drawings for each contract to the Director's Representative.

7.2.4 The Consultants shall prepare and supply all necessary drawings, documents and presentation materials required for various statutory and Government procedures in connection with the Project. These procedures shall include, but not necessarily be limited to, the following :-

(i) Roads (Works, Use and Compensation) Ordinance;
(ii) Crown Lands Resumption Ordinance;
(iii) Foreshore and Seabed (Reclamations) Ordinance; and
(iv) Advisory Committee on the Appearance of Bridges and Associated Structures (ACABAS).

7.2.5 The Consultants shall having regard to the anticipated method of construction aim to encourage the use of plant likely to be available economically in choosing the particular type of design for the Project.

7.2.6 The Consultants shall carry out and complete all architectural and landscape design work as advised by the Director's Representative.

7.2.7 The Consultants shall carry out the design of any electrical and mechanical works as advised by the Director's Representative, including all lighting, but excluding public highway lighting to be designed by the Highways Department, signing, traffic control and surveillance facilities necessary for the efficient operation of all planned road scheme.

7.2.8 The Consultants shall ensure that environmental and pollution prevention measures are given prime importance in the design of the Project. Particular emphasis should be placed on measures to reduce noise and dust levels during construction.

7.2.9 The Consultants shall provide necessary programmes (on Timeline or other software to be advised by the Director's Representative) and estimates with details in a format and frequencies to be advised by the Director's Representative. These information shall be updated at regular intervals during the Construction Stage of the Project.

7.2.10 The Consultants shall submit to the Director's Representative, during the Contract Stage, two full sets of design calculations including a statement of the standards, procedures and codes of practice adopted. They shall be accompanied by a design certificate certifying that the calculations have been checked by another qualified independent designer in the Consultants employ and that the drawings conform to the design calculations. The standard form of "Certificate of Design Processes and Checking of Design" set out in the CE Manual shall be used for this purpose unless otherwise agreed by the Director's Representative.

7.2.11 The Consultants shall prepare revised design calculations in respect of design changes made during the Construction Stage of the Project. Such calculations shall be submitted to the Director's Representative prior to certifying completion of the Works.

7.3 Construction Stage

7.3.1 The Consultants' duties referred to in Clause 15(D) (iii) of the Conditions with respect to supervising and directing the execution of Works shall include inter alia the recruitment of Resident Site Staff. This will also include the employment of landscape sub-consultants and other specialist sub-consultants, as required.

7.3.2 For the guidance of all grades of the site establishment, the Consultants shall prepare a resident site staff manual giving details on authorities, duties, responsibilities and contract management and works supervision procedures.

7.3.3 In respect of any contract for the supply and installation of either electrical and mechanical equipment or traffic control and surveillance equipment, the Consultants shall ensure that a full set of installation drawings and manuals is supplied by the contractor before expiry of the contract period.

7.3.4 Testing procedures for site acceptance tests of electrical and mechanical equipment, supplied as part of the Project, shall be agreed with the Electrical and Mechanical Services Deparetment prior to the test being carried out. Such tests shall, wherever possible, be carried out in the presence of representatives of the Electrical and Mechanical Services Department.

7.4 Variations and Other Commitments

7.4.1 The value of a variation to the contract works or other expenditure commitment for the purposes of Clause 18 of the Conditions is $200,000.00 or 10% of the contingencies whichever is the lower.

7.4.2 All variations to the contract works shall be covered by a variation order in a form to be agreed by the Director's Representative.

7.4.3 The Director's Representative shall advise the Consultants of his approval or otherwise under Clause 18 of the Conditions within 28 days of receipt of submission. The reasons for non-approval, which may include insufficiency of supporting information provided with the submission, will be provided to the Consultants at the same time. If, because of the need for consultation or referral elsewhere, the Director's Representative is unable to give his decision within the period stated then he shall inform the Consultants immediately. Under such circumstances a revised period shall be agreed between the Director's Representative and the Consultants.

7.4.4 Under Clause 19(c) of the Conditions, the Consultants shall report all claims to the Director's Representative within 14 days of their receipt. The Director's Representative shall provide the Employer's views to the Consultants within 28 days of receipt of the Consultants' principles of assessment of a claim.

7.4.5 Under Clause 19(d) of the Conditions the Consultants shall report all delays to the Director's Representative within 14 days of the delay being identified. The Director's Representative shall provide the Employer's views to the Consultants within 28 days of receipt of the Consultants' assessment of extension of time.

7.5 As-Constructed Drawings

7.5.1 The Consultants shall ensure that the "as-constructed" film drawings are immediately prepared as and when the respective parts of the Works have been certified complete.

7.6 Completion Stage

7.6.1 The Consultants shall :

(a) determine contractor's claims, if any, and finalize contractor's accounts.

(b) submit to the Director's Representative a full set of "as-constructed" film transparency drawings showing in full detail the Works as actually carried out together with all relevant records including final design calculations within a period to be agreed by the Director's Representative.

(c) provide one complete set of 35mm size microfilms (Silver) with image on microfilm aperture card of 186mm x 83mm and in roll form of 35mm x 30.5m per reel with roll container of size 97mm x 96mm x 44mm, required for all as-constructed drawings. Details such as project title, drawing number, etc. shall be typed on the aperture card.

(d) submit all site records with proper classification/indexing system to enable easy retrieval of information within a period to be agreed by the Director's Representative.

(e) in relation to all electrical and mechanical and traffic control and surveillance equipment carry out a detailed inspection of the installations with the contractor and the relevant Government departments one month prior to expiry of the defects liability period. The Consultants shall ensure that the contractors carry out promptly all necessary repairs to defects identified.

7.7 Progress Reports

7.7.1 Throughout the Project period the Consultants shall submit to the Director's Representative progress reports at monthly intervals on all aspects of their works in relation to the MDP. The reports should include amongst other things a list of those parts of the works the execution of which are behind the MDP together with proposals to expedite progress, so as to bring them back on schedule. Updated expenditure forecasts should also be included in the reports.

7.8 Financial Management

7.8.1 At 3 months intervals or at other such intervals as required by the Director's Representative a report on current and forecast expenditures shall be submitted to the Director's Representative in a form to be agreed by him. Updated estimates of the cost of the Works shall be submitted as and when required by the Director's Representative.

7.8.2 The Consultants shall closely monitor progress and expenditures on any contract and shall advise the Director's Representative immediately if there is any likelihood of the approved contract sum being exceeded. To allow sufficient time to obtain the necessary approval and to make funds available, the Consultants shall give the Director's Representative at least four months notice in writing of the need to increase the approved contract sum to meet contractual or other payments and shall provide all necessary supporting information. Except that if the need cannot be foreseen so far ahead, then the Consultants shall give as much advance notice as is possible under each circumstances. The following information shall be provided:

(a) Full details of the proposed net increase broken down into the following categories :

(i) Price fluctuation payment under the contract. An arithmetical derivation based on the projected percentage and the estimated final effective value of work done is required.

(ii) Additional works and savings arising from the bills of quantities items and variation orders. Reasons shall be given for increases and decreases in the earlier estimates.

(iii) Claims from the contractor. This shall be the Consultants' estimate of the amounts which will be certified for payment.

(b) An assessment of increase in consultancy fees and site staff costs resulting from possible extension of contract period and the recruitment of additional site staff.

(c) A revised forecast on monthly expenditures in respect of contract payments, consultancy fees and site staff costs.

8. GENERAL

8.1 Design Standards

For the purpose of this Study, design and planning standards which are in current use by Government departments shall be adopted. Should instances arise where appropriate standards do not exist or where modification to existing standards appears desirable, the Consultants shall submit proposals to the Director's Representative for approval.

8.2 Government Circulars and Technical Memoranda

The Consultants shall comply with all relevant circulars and technical memoranda as directed by the Director's Representative.

8.3 Design Memorandum

The Consultants shall submit 30 copies of a Design Memorandum stating the design criteria that shall be used in future detailed design. This Design Memorandum is to cover all aspects of the North Lantau development.

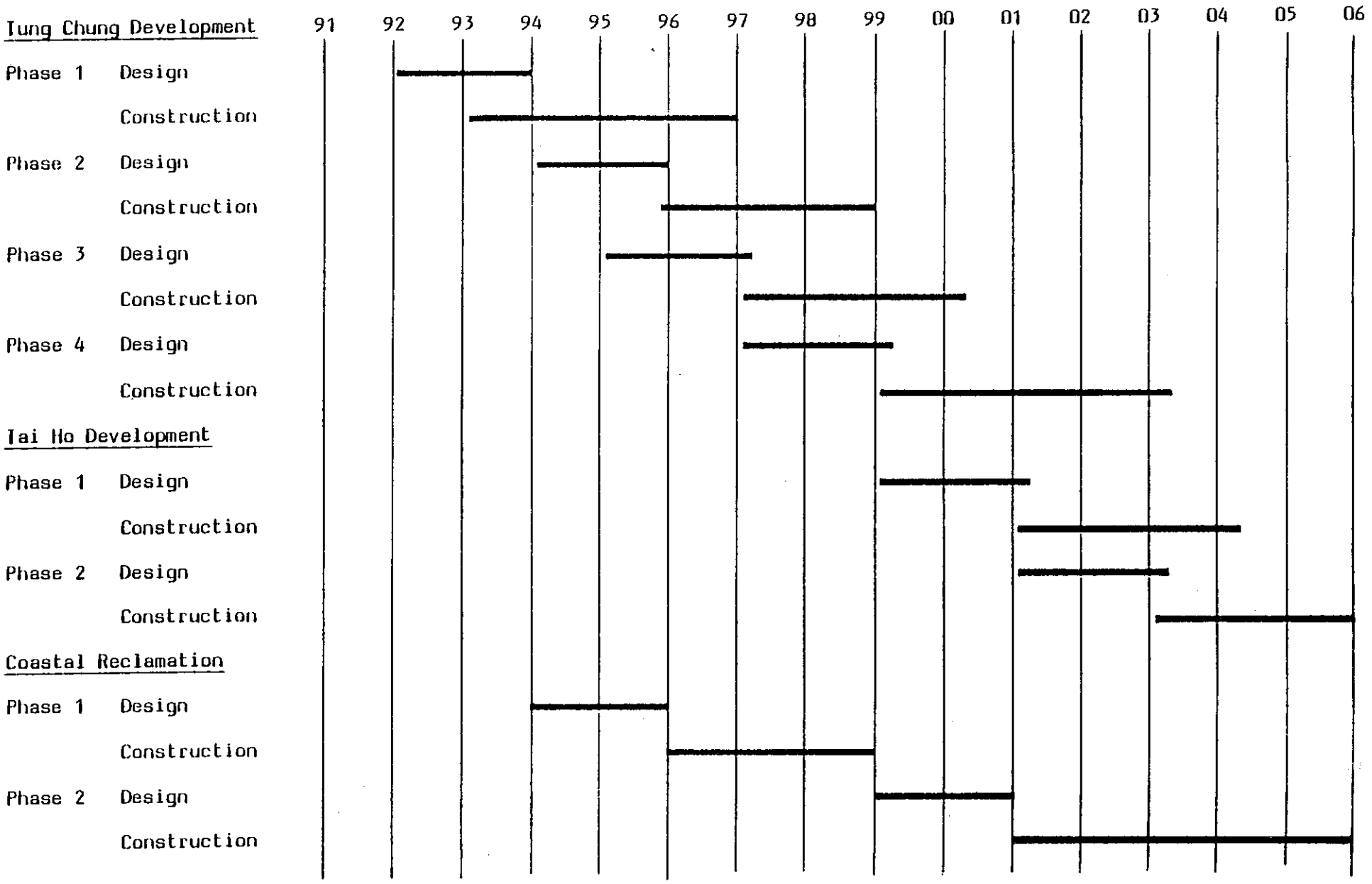
8.4 Consultants' Office

The Consultants shall maintain an office in Hong Kong under the control of a Resident Director who shall be responsible for the Study. He shall have adequate authority and sufficient professional, technical and administrative support staff in all relevant disciplines to ensure progress to the satisfaction of the Director's Representative.

8.5 Documents

A copy of any relevant Government documents and manuals not already available from the Government Publications Office, drawings and plans, together with one matt film transparency of any drawings and plans published by the Planning Department and the Buildings and Lands Department and relevant to the Study will be supplied free of charge to the Consultants when requested. A charge may be made for additional copies, if these are required.

APPENDIX 1 - TENTATIVE DEVELOPMENT PROGRAMME

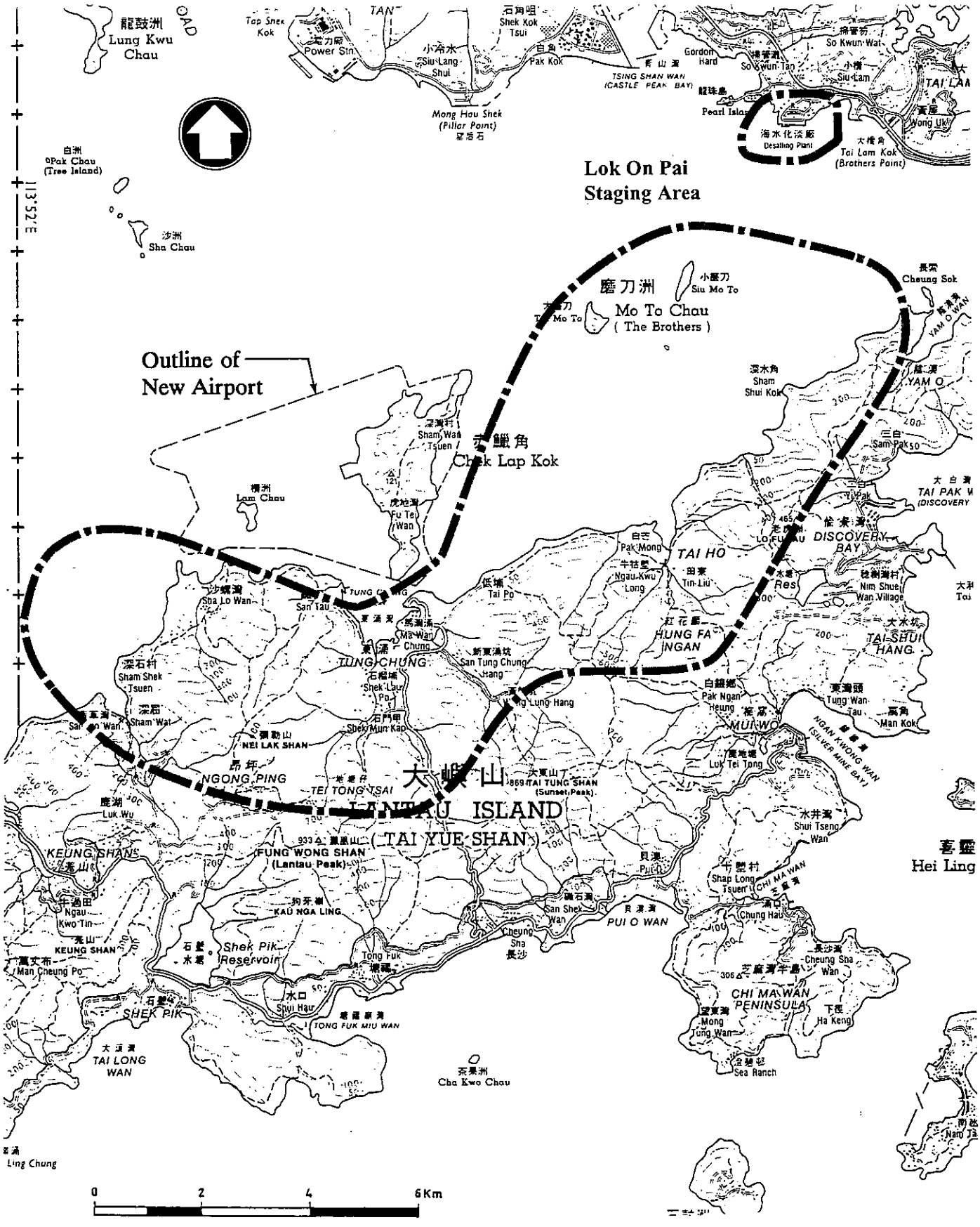


APPENDIX 2

KEY DATES FOR THE SUPPLY OF INFORMATION TO OTHERS

	Key Dates	Information To Be Supplied
(i)	31 October 1990	Core area for the first phase of development.
(ii)	2 January 1991	Land drainage proposals (including location of crossing points and flow quantities) where they cross the Tai Ho section of the North Lantau Expressway; Necessity and programme (if applicable) for early reclamation of Tai Ho Wan and Siu Ho Wan for development; and Suggested sites for aviation fuel storage.
(iii)	4 February 1991	Access arrangement from Tung Chung community to new airport.
(iv)	28 February 1991	Location of access point from North Lantau Expressway and Airport Railway (domestic service) to Tung Chung community; and Preliminary land requirement plans for the first phase of development.
(v)	31 May 1991	Finalized locations for railway stations (at Tung Chung and Tai Ho) and depot; and Finalized alignments of railway spurs or loops in Tung Chung and Tai Ho.

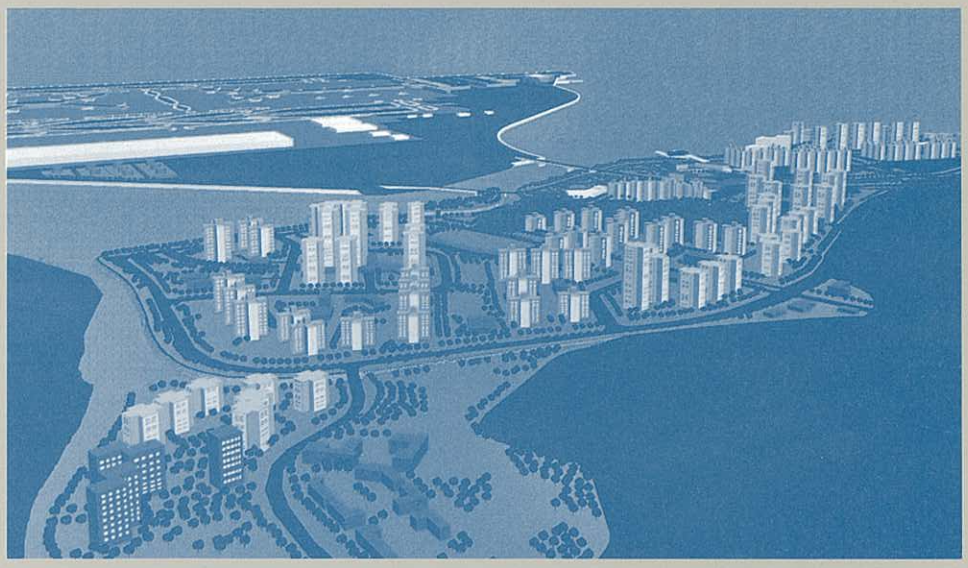
(vi)	30 June 1991	Land requirement plans and cost estimates for the first phase of development; Land drainage proposals (including location of crossing points and flow quantities) where they cross the Tung Chung section of the North Lantau Expressway; and Implementation programme for advance works if these are necessary.



Legend :

Study Area Boundary

North Lantau Development



Appendix B

Supporting Documents Produced For This Study Consultation Arrangements, and Study Organization

APPENDIX B

SUPPORTING DOCUMENTS PRODUCED FOR THIS STUDY CONSULTATION ARRANGEMENTS, AND STUDY ORGANIZATION

B1. Topic Reports

No.	Title & Issue Date	Synopsis of Contents
TR1	Plan Objectives and Study Parameters Issued 1/10/90 Revised 22/10/90	Sets out the methodology to be used in formulating and evaluating the Initial Concept Plans and RODP. It covers socio-economic and policy assumptions including population aspects, subsequently used in TR7, TR8 and TR11.
TR2	Environmental Studies Issued 1/10/90 Comments and Responses 29/10/90	This document sets out the methodology used in the Environmental Studies and examines existing conditions. Data subsequently used in TR10, TR18 and TR20 and as input to the RODP.
TR3	Constraints and Opportunities Issued 15/10/91 Comments and Responses 01/11/90	In identifying constraints and opportunities for development, this report presents a wide range of basic data relating to geology, topography, geotechnical, seabed conditions, landscape, villages etc. Data subsequently used in TR7 and TR8 and WP10.
TR4	Broad Area for First Phase Development Issued 31/10/90 Revised 30/11/90	This paper identifies in broad terms the areas to be developed by 1997 for the First Phase. This data is refined in TR8 and TR17.
TR5	Basic Input Assumptions and Transport Modelling Process Issued 19/11/90 Revised 1/12/90	This paper sets out the key inputs used in transport modelling, identifies the type of model, land use and network assumptions. It reviews inputs from TSS and PADS. Sets out data to be used in WP15 and TR19.
TR6	Self Containment Analysis Issued 10/12/90 Revised 03/01/91	The report assesses the proportion of trips generated by the New Town which will both begin and end on North Lantau. It puts forward a recommended Self Containment assumption subsequently used in TR19 and WP15.

No.	Title & Issue Date	Synopsis of Contents
TR7	Initial Concept Plans Issued 31/12/90 Revised 29/01/91 Comments and Responses 29/01/91	This report illustrates four Initial Concept Plans, based on the development requirements for residential, commercial, industrial, G/IC and open space, and infrastructure. It provides landuse budgets for Key Years.
TR8	Preferred Concept Plan and Land Requirements for First Phase (and Annexes) Issued 12/03/91 Comments and Responses 17/04/91	This document contains the Preferred Concept Plan as developed from the four Initial Concepts. It shows how the Initial Concepts were evaluated (against the criteria given in TR1) taking into account transport and environmental assessment, and indicates where First Phase Development will occur.
TR9	Design Memorandum Issued 29/06/91 Revised 03/10/91	This report sets out all the guidelines and criteria required for detailed design. It covers engineering, planning and landscape issues. Design standards are illustrated as appropriate.
TR10	Environmental Assessment Issued 28/05/91 Revised 25/07/91 Comments and Responses 25/07/91	This report assesses the likely impacts on the environment of the development in terms of Air, Noise, Water, visual, waste ecology and landuse. It proposes mitigation measures subsequently used as input to TR17, TR18 and TR20.
TR11	Draft Recommended Outline Development Plan Issued 07/06/91 Comments and Responses 20/08/91 Explanatory Statement (Addendum) 30/08/91	The Draft RODP is given in this paper; it refines the Preferred Concept Plan given in TR8. This Plan was designated Interim for endorsement pending decisions on rail station layouts and rail form. The RODP in its final form is given in the Draft Final Report.
TR12	Finalized station and Depot locations and Alignments for Railing (Revised) Issued 31/10/91	This report describes the proposed station and depot locations and rail alignment. It compares the impact and cost of a depressed or elevated local line through Tung Chung, recommending the former which was adopted. The initial version was withdrwan without wider circulation.

No.	Title & Issue Date	Synopsis of Contents
TR13	Development Proposals and Cost Estimates For First Phase Not Issued : Deleted from programme	This report was deleted. Information can be found in papers relating to the first phase detailed design, construction programmes, tender documents cost estimates etc. Also in in TR21 'Development Programme'.
TR14	Master Landscape Plan Issued 25/09/91 (General Circulation) Revised - 11/01/91 Comments and Responses 31/10/91	This document elaborates on the landscape elements of the RODP. It includes a 1:5000 scale plan setting out landscape design proposals and guidelines for the major land uses and suggests treatments to ameliorate environmental impacts. It contains plans indicating the overall urban design concept for the New Town.
TR15	Rural Hinterland Strategy Issued 01/08/91 Revised 23/10/91 Comments and Responses Issued 23/10/91	This report provides a framwework for planning and development control of the urban fringe areas. It covers the requirements for conservation and recreation, allocates areas to appropriate land uses, puts forward concepts for hinterland development and indicates paths and other links between the New Town and the Country Park.
TR16	Village Concept Plans 24/07/91 Revised 25/09/91 Comments and Responses 25/09/91	This report indicates which villages require to be located and recommends resite areas. It sets out development plans for the retained villages.
TR17	First Phase Layout plans Issued 22/11/91	This document contains the Consultants layouts for the first phase, and a description of the planning considerations taken into account. A summary of the landuse proposals for this phase is also given.
TR18	Environmental Impacts from Construction of First Phase Issued 24/09/91 Revised 7/10/91 Comments and Responses 7/10/91	This report establishes the environmental impacts of the First Phase both during and after construction. It recommends mitigation measures. Further information can be found in TR20.

No.	Title & Issue Date	Synopsis of Contents
TR19	Transportation and Highway Systems Issued 25/07/91 Revised 30/09/91 Comments and Responses 21/09/91	This report describes the overall transport plan for the New Town, including the road network, the Public Transport arrangements, and other transport issues. It also tests the impact of the North Lantau Development on other parts of Lantau.
TR20	Environmental Development Manual Issued 31/01/92 Revised 20/03/92 Comments and Responses 20/03/92	This report sets out the likely environmental impacts of the later phases of the New Town during construction and in operation. It recommends appropriate mitigation measures. It addresses how environmental impacts can be monitored and audited.
TR21	Development Programme Draft Issued 20/01/92 Revised Draft 26/03/92 Comments and Responses 24/03/92	This report sets out the anticipated development programme for the New Town in terms of Construction Phases and Contract Packages. A comprehensive costing exercise indicates expected public expenditure by item and year.
B2.	**Working Papers**	
WP1	Land and Marine Use Inventory Issued 15/10/90	This paper provides comprehensive data on existing land tenure and use (including SSSI's and historic monuments) and marine uses (fishing, piers, etc).
WP2	Transport Issues Issued 23/10/90 Comments and Responses 14/11/90	This document presents the results of consultations with relevant Government Departments and other bodies (e.g. utility companies) covering general concerns, standards to be employed and constraints.
WP3	Initial Land Formation Options and Sources of Fill Issued 19/11/90 Comments and Responses 17/12/90	WP3 identifies and makes a preliminary evaluation of potential formed land requirements for initial development scenarios and associated fill material demands and sources of supply.

No.	Title & Issue Date	Synopsis of Contents
WP4	Preliminary Alignment of Railway at Tai Ho Wan Not Issued ; Deleted from Programme	Progress on final railway alignment was provided very quickly thus negating the need for this preliminary paper.
WP5	Waste Disposal Options Issued 21/1/91 Revised 14/03/91 Comments and Responses 14/03/91	This paper identifys and makes a preliminary assessment of possible landfill sites in the Study Area and examines potential sites for the Refuse Transfer Station. Particular reference is made to barging waste to WENT or other mainland landfills. See also Design Memorandum DM2.
WP6	Land Drainage Options for Tung Chung and Proposals for Tai Ho Section of NLE Issued 29/10/90 Revised 22/2/91	WP6 sets out proposals for reconciling long term drainage requirements with the NLE design, with special reference to waterway crossings. Used as input to NLE design. Subsequently updated in WP11.
WP7	Suggested Sites for Aviation Fuel Storage Issued 2/1/91	WP7 reviews potential ground level and underground storage sites for aviation fuel taking into account hazards and constraints on development. Needed as input to Airport Master Plan Study. This method of supplying aviation fuel to the New Airport is still not finally resolved (mid December) 1991. See also Position Paper presented to DPC 14/3/91.
WP8	Suggested Siting for Sewage Treatment Works and Outfall Issued 9/11/90 Revised 30/11/90	This paper recommends a suitable siting for the Sewage Treatment Works and the preferred point of discharge of the outfall. It takes into account environmental factors and long and short term requirements together with the results of WAHMO tests. See also Technical Note TN2 (08/03/91) and Design Memorandum DM1 (12/2/91).
WP9	Access Arrangements for Tung Chung to Airport Not Issued; Deleted from Programme	This paper which was to consider options for local access in the context of airport layout and routing of principal road/rail access was deleted. The work is covered in Topic Report TR19.

No.	Title & Issue Date	Synopsis of Contents
WP10	Geotechnical Design Report Issued 10/07/91 Revised Pages	This paper sets up a data base including all available and newly obtained information on geotechnical issues. A number of amended pages (marked 'revised') were issued following comments and these should be in any copy referred to.
WP11	Final Land Drainage Proposals for North Lantau Development Issued 14/08/91 Revised 30/10/91 Comments and Responses 18/10/91	WP11, sets out the preferred means of dealing with the interface between NLE design and large scale land drainage requirements. It reviews the work carried out in WP6 and recommends a final drainage scheme. See also Technical Note TN9 (Revised).
WP12	Village Studies Issued 30/10/90	This paper documents the results of village studies including assessments of the existing situation, expansion requirements and the need for re-siting some villages.
WP13	Preliminary Programme and Broad Costs for First Phase Issued 30/11/90 Revised 14/01/91	This paper shows the initial programme and costing of works required for the First Phase. See also TR7 (First Phase Development Plans) and TR21 (Development Programme).
WP14	Construction Support Facilities for New Airport and North Lantau Projects Issued 15/11/90 Revised 20/12/90	This paper puts forward a layout for Construction Support Facilities to support First Phase New Town Developments and NLE construction. The suggested site was subsequently reduced in size. Reference should be made to first phase detailed design documents.
WP15	The Lantau Transport Model Issued 6/3/91 Comments and Responses 17/04/91	This paper presents the methodology used in developing a transport model for Lantau, and sets out the assumptions used. See also TR19.
WP16	Industrial Development for North Lantau Issued 06/03/91 Revised 17/04/91 Comments and Responses 17/04/91	WP16 examines the demand for Industrial Development on North Lantau. See also the SICENRA report, and later work done as part of the Study of Airport Related Activities (SARA). This later work modifies the initial findings. Refer also to TR11.

No.	Title & Issue Date	Synopsis of Contents
WP17	Land Formation Strategy Issued 31st January 1992 Revised 28/03/92 Comments and Responses 28/03/92	This paper examines the need, timing and type of land formation required in each phase of the New Town Development. It reviews the quantities and sources of full required, the potential use of PFA for fill and the requirement for land borrow areas.

B3. Technical Notes (Contents Self Explanatory)

Title		Issue Date
TN1	Landscape Issues	19/02/91
TN2	Sewage Treatment Levels and Outfall Location	08/03/91
TN3	Air Quality Assessment Initial Wind Tunnel Study Findings	12/03/91
TN4	Sensitivity Tests on Impacts of Transport Links to Other Part of Lantau	28/03/91
TN5	The Sea Channel	10/04/91
TN6	Chek Lap Kok Knoll	08/05/91
TN7	The Utility Reserve	26/04/91
TN8	Tai Ho Wan Interchange	31/05/91
TN9	Artificial Lake at Pak Mong (Draft)	31/05/91
TN10	Projected Road Transport Infrastructure and Capacity on North Lantau	11/06/91
TN3	Air Quality Assessment Details of the Wind Tunnel Study (Revised)	12/06/91
TN11	Socio-Economic Studies	29/06/91
TN9	Artificial Lake at Pak Mong (Revised)	08/07/91
TN12	Form of Primary Access Over Sea Channel	13/09/91
TN13	Preliminary Assessment of Risk from the Proposed Gas Reception and Pressure Reduction Station	04/09/91
TN14	Dredged Mud Disposal	04/09/91
TN15	Tung Chung to Siu Ho Wan Sewage Transfer	01/11/91
TN16	External Links to Tung Chung	21/02/92
TN16	External Links to Tung Chung (Revised)	06/04/92

B4. Supplementary Reports (Contents Self Explanatory)

Title		Issue Date
SR1	Survey of Airport Employees Income and Social Characteristics	22/03/91
	Air Quality Survey	10/02/91
	Background Noise Survey	14/03/91

B5. Design Memorandum (Contents Self Explanatory)

	Title	Issue Date
DM1	Sewage Treatment and Disposal Facilities; Outline Design	12/02/91
DM1	Comments and Responses	17/04/91
DM2	Waste Transfer Station and Waste Disposal Arrangements: Outline Design	14/06/91

B6. Progress Reports

	Issue Date
Number 1 - 20	August 1990 - March 1992

B7. Stage Reports

Inception Report	31/08/90
Final Comments and Responses on Inception Report	05/10/90
Draft Final Report	03/01/92
Comment and Responses on Draft Final Report	05/03/92
Draft Executive Summary	05/03/92
Final Report (Draft)	05/03/92
Final Report	15/05/92
Final Executive Summary	18/04/92

B8. Consultation Arrangements

Within Government, Consultation on the Study progress was at two main levels, namely Steering Group and Working Group (by discipline). For final approval the reports were presented to Policy and Co-ordinating Committee's, namely the Development Planning Committee (DPC), the Airport Development Committee (ADSCOM), the Environmental Pollution Advisory Committee (EPCOM), and the Airport Consultation Committee (ACC). The membership (by designation) of the Steering and Working Groups is given in this Appendix together with the Terms of Reference for each group.

B8.1 Steering Group

Membership

Chairman	:	DTD	-	Dr. K F Nip OBE JP
Vice Chairman	:	PM/SWNT, TDD	-	Mr. T D Armour JP
Members	:	CE/SWNT, TDD	-	Mr. S M N Abbabil
		Representatives of:		WB (NAWD)
				PELB
				Plan D
				HD
				TD
				EPD
				BLD (NA)
				CAD
				CESD (NA)
				CNTA
				HyD (NLL)
				(AR)
				TB)
				ESB)
				FB)
				AFD)
				MD)
				ID) as required
				CESD (FMC))
				RHKPF)
				WSD)
				MTRC)
				Other Consultants)
		Consultants (Mott MacDonald Hong Kong Limited) in attendance as required		
Secretary	:	SE/SWNT, TDD		

Draft Terms of Reference

a) To keep the progress of all activities related to the Study under review.

b) To guide the Consultants on policy aspects of the Study and to consider and resolve any differing opinions arising from the Study.

c) To ensure close liaison and to facilitate the timely exchange of information between the Consultants and various Government Departments and consultants engaged in associated studies.

d) To set up, as necessary, ad hoc groups to consider and report on specific issues.

e) To consider comments/recommendations from Working Groups on technical papers and reports on major issues.

f) To consider comments from other parties on the Draft Final Report and to give guidance to the Consultants as to any revisions necessary in preparing the Final Report.

g) To report to LDPC/DPC/NAWC, as appropriate, on matters which require guidance and generally on progress.

Frequency of Meetings

Bimonthly.

B8.2 Engineering Working Group

Membership

Chairman	:	PM/SWNT, TDD	- Mr. T D Armour	
Members	:	CE/SWNT, TDD	- Mr. S M N Abbabil	
		SE2/SWNT, TDD	- Mr. P H Yau	
		Representatives of:	WB (NAWD)	
			Plan D	
			EPD	
			HD	
			BLD (NA)	
			HyD (NLL)	
			(AR)	
			CESD (NA)	
			WSD	
			DSD	)
			CAD	)
			DO/Is	)
			TD	)
			AFD	)
			CESD (GCO)	)
			(FMC)	) as required
			(PW)	)
			MD	)
			HyD (NT)	)
			MTRC	)
			Other Consultants	)
		Consultants (Mott MacDonald Hong Kong Limited) in attendance as required		
Secretary	:	Consultants		

Terms of Reference

a) To keep the programme and methodology of all activities related to the engineering aspects of the Study under review.

b) To provide general and technical guidance to the Consultants in their tasks required by the Brief, including agreement of standards and design criteria.

c) To facilitate liaison and passage of information.

d) To identify issues on which Steering Group guidance is required.

e) To consider the Consultants' technical papers and reports.

f) To consider the development programme including phasings and work packages.

g) To co-ordinate and resolve the engineering work and interface issues with other relevant studies in the vicinity of the Study Area.

Frequency of Meetings

As required.

B8.3 Planning Working Group

Membership

Chairman	:	GTP/NT, Plan D	-	Mr. E C W Lo
Members	:	PM/SWNT, TDD	-	Mr. T D Armour
		DPO/L & Is, Plan D	-	Mr. J C W Leung
		Representatives of:	CAD	
			TD	
			EPD	
			DO/Is	
			BLD (NA)	
			(LA)	
			HyD (NLL)	
			(AR)	
			HD	
			ESB	)
			ID	)
			MD	)
			AFD	)
			RSD	) as required
			MTRC	)
			RHKPF	)
			CESD (GCO)	)
			Other Consultants	)
		Consultants (Mott MacDonald Hong Kong Limited) in attendance as required		
Secretary	:	Consultants		

Terms of Reference

a) To keep the programme and methodology of all activities related to the planning aspects of the Study under review.

b) To provide general and technical guidance to the Consultants in their tasks required by the Brief, including agreement of planning, urban design and landscaping concepts and standards.

c) To facilitate liaison and passage of information.

d) To identify issues on which Steering Group guidance is required.

e) To consider the Consultants' technical papers and reports.

f) To consider planning briefs and layouts.

g) To co-ordinate and resolve the planning work and interface issues with other relevant studies in the vicinity of the Study Area.

Frequency of Meetings

As required.

B8.4 Traffic and Transport Working Group

Membership

Chairman	:	GE/PAD, TD	-	Mr. A H C Pang
Members	:	PM/SWNT, TDD	-	Mr. T D Armour JP
		DPO/L & Is, Plan D	-	Mr. J C W Leung
		Representatives of: WB (NAWD)		
		CAD		
		HyD (NLL)		
		(AR)		
		MTRC		
		ESB	)	
		TB	)	
		DO/Is	)	
		RHKPF	)	as required
		HyD (NT)	)	
		Other Consultants	)	
		Consultants (Mott MacDonald Hong Kong Limited)		in attendance as required
Secretary	:	Consultants		

Terms of Reference

a) To keep the programme and methodology of all activities related to the traffic and transport aspects of the Study under review.

b) To provide general and technical guidance to the Consultants in their tasks required by the Brief, including agreement of traffic and transport standards and design criteria.

c) To facilitate liaison and passage of information.

d) To identify issues on which Steering Group guidance is required.

e) To consider the Consultants' technical papers and reports.

f) To co-ordinate and resolve the traffic and transport work and interface issues with other relevant studies in the vicinity of the Study Area.

Frequency of Meetings

As required.

B8.5 Environmental Impact Working Group

Membership

Chairman	:	PEPO/EA, EPD	-	Mr. W J Farrell
Members	:	PM/SWNT, TDD	-	Mr. T D Armour JP
		DPO/L & Is, Plan D	-	Mr. J C W Leung
		Representatives of:	CAD	
			HyD (NLL)	
			(AR)	
			AFD	
			DO/Is	
			MD)	
			CESD (NA))	
			RSD)	as required
			MTRC)	
			Other Consultants)	
		Consultants (Mott MacDonald Hong Kong Limited) in attendance as required		
Secretary	:	Consultants		

Terms of Reference

a) To keep the programme and methodology of all activities related to the environmental aspects of the Study under review.

b) To provide general and technical guidance to the Consultants in their tasks required by the Brief, including agreement of standards and operating procedures.

c) To facilitate liaison and passage of information.

d) To identify issues on which Steering Group guidance is required.

e) To consider the Consultants' technical papers and reports and the acceptability of the Consultants' conclusions and recommendations.

f) To co-ordinate and resolve the environmental work and interface issues with other relevant studies in the vicinity of the Study Area.

Frequency of Meetings

As required.

B9. The Study Team

The Study Team comprised Mott MacDonald Hong Kong Ltd, in association with Shankland Cox, Wilbur Smith and Associates, and EBC Hassell Ltd.

Project Management

R J Whalley - Director in Charge
J Figueiras - Planning Director

Project Management

J H Ebden - Project Manager
P K Tse - Engineering Co-ordinator
S V Jones - Environmental Co-ordinator

Planning Group

I Andrews - Group Manager
J Jessamine
H I Absalom
M Harrison
G Rex
K Nicholson
B Wong
S Chan

Engineering Infrastructure Group

D Mepham - Group Manager
P Larentis
R Henes
D England
K J White
A Grant
Y C Koo
W H Kwan
D Ross
R Szeto

Transport Planning Group

L K Carpenter - Group Manager
M Clark
J Wheway
S Chow

Environmental Planning Group

T J Peirson-Smith - Group Manager
A F Watker
N J Duijm
D Smith
D Dudgeon
R A Cox
D Melville
R T Cortlett

Specialist Advisors

M Alexander - Marine Operaitons
G W Lovegrove - Geotechnical Engineering
J Land - Dredging and Spoil Disposal

Specialist Sub-Consultants

Chesterton Petty - Land Valuation (G Moffoot)
Netherlands Organisation for Applied Scientific Research (TNO) - Air Quality Modelling
Enpac - Noise Assessments and Air Quality Baseline Survey
ERL Asia - Hazard Assessment

Draughting

Jim Tse
Thomas Wai

Graphics

Leung Wing-tak
Wong Ka-man

North Lantau Development

Appendix C

Consumer Expenditure Analysis

APPENDIX C

CONSUMER EXPENDITURE ANALYSIS

C1 Introduction

Commercial provision comprises retail floorspace, offices and hotels. This Appendix outlines the method used in calculating the amount and distribution of retail floor space for the New Town.

C2 Retail Floorspace Requirements

The requirements for retail floorspace have been established by using an expenditure-based method in which household expenditure patterns are related to retail floorspace through sales. All calculations have been carried out in constant 1990 prices, assuming that the relationship between potential turnover and retail sales per square metre remains constant over time.

Table C1 presents the average annual sales per square metre for retail floorspace in Hong Kong for the following retail activities:

- o food, which includes foodstuffs, alcoholic drinks and tobacco, all restaurants; and
- o non-food, which includes clothing, footwear and allied products, consumer durables and other consumer goods.

Sales have been updated to 1990 prices using the Consumer Price Index Report published by Census and Statistics Department.

Table C1 Average Annual Retail Sales per m^2 NFA (1990 Prices)

Retail Activity	Total Annual Sales (HK$M)	Total Net Floor Area (m^2)	Average Sales/m^2 Net Floor Area
Foodstuffs	75,013.60	2,477,065.00	30,283.20
Non-foodstuffs	118,017.00	2,412,558.00	48,917.70

Source: "Survey of Wholesale, Retail and Import/Export Trades, Restaurants and Hotels", Census and Statistics Department, 1988.
Consumer Price Index, October 1990.

An analysis of household expenditure patterns allows an estimate to be made of the potential retail expenditure likely to be generated by new town residents.

Household expenditure patterns vary according to household income levels and housing type. The household expenditure on retail goods has therefore been estimated for three categories of housing:

- o Public Rental;
- o Home Ownership Scheme; and
- o Private.

Expenditure patterns are based on data provided by Census and Statistics Department amended to allow for an assumed 10 per cent of household income allocated to savings Commodities/services have been reclassified into : convenience goods, comparison goods, and retail services (Table C.2).

Table C2 Expenditure Pattern by Tenure

Tenure	Convenience Goods (%)	Comparison Goods (%)	Services (%)	Others(1) (%)
RS	51.1	10.7	10.2	28.0
HOS	35.7	9.6	9.2	45.5
R1	30.0	12.0	11.4	46.6
R2	30.0	12.0	11.4	46.6
R3	30.0	12.0	11.4	46.6
R4	20.0	12.9	12.7	54.4

Source : Census and Statistics Department, Consultants' Estimates.

Note (1) Includes expenditure on housing, fuel and light, transport and vehicles, and savings.

The mean household income and number of households for each housing type has been applied to the typical expenditure patterns to derive total potential expenditure in the New Town on retail goods. Total potential expenditure on convenience and comparison goods and retail services is presented in Table C3 for each design year. This expenditure has then been converted into retail cross floor area based on the current relationship between expenditure/turnover and an assumed efficiency rate of 75 percent.

Table C3 Requirements for Retail Floorspace by Tenure by Design Year

Tenure	Aggregate Monthly Expenditure - Retail Goods and Services (HK$)				Retail GFA (m^2)			
	1997	2001	2006	2011	1997	2001	2006	2011
RS	7885362	23247567	41825669	65999529	3794	11185	20124	31755
HOS	16569750	49070023	81451224	142064923	7826	23177	38472	67101
R1	13581745	51457154	158670948	284428238	6206	23512	72501	129962
R2	2837128	12073212	25857952	45101079	1296	5517	11815	20608
R3	3510315	11198669	31993472	55802567	1604	5117	14619	25498
R4	5178731	16521277	47199627	102899126	2264	7224	20637	44991
Total	49563031	163567902	386998892	696295463	22990	75732	178167	319915

Source : Consultants' Estimates

The relative remoteness of North Lantau from major centres of population means that there is unlikely to be substantial leakage to other areas of expenditure on convenience goods (i.e. principally the "food" category of goods) although there will be some to the airport by airport employees dining in canteens, etc. For consumer durables, leakage is likely to be more pronounced in the early years of the development when residents will travel to the urban area. For the purpose of calculating retail floorspace, however, it has been assumed that all retail expenditure generated by the town's residents that may be spent in shopping facilities outside the town would be balanced by retail expenditure attracted into the town. It is also assumed that retail expenditure by airport passengers in North Lantau is limited and will instead be spent on-airport, in airport or other hotels and in the traditional shopping areas of the Territory rather than in the New Town. Similarly, although facilities in North Lantau may serve population in the rest of Lantau, this possibility has not been specifically accounted for in the analysis. Such expenditure would however contribute to the commercial viability of the shopping centres in the new development area.

C3 Distribution of Retail Floorspace

The demand for commercial floorspace will be accommodated in a hierarchy of centres based on population catchments and the types of comodities/services being sold. Three types of centres are proposed : a Town Centre at Tung Chung serving the entire North Lantau Development of some 200,000 persons; two District Centres at Tung Chung and Tai Ho each serving a minimum population of 50,000 persons; and local centres distributed throughout residential areas. The Town Centre will provide predominantly comparison (durable) goods shopping together with a wide range of ancilliary services and the office/hotel complex providing airport-related commercial floorspace. The Town Centre will also function as a local/district centre as well as providing for the day-to-day needs of people living nearby. The District Centres provide primarily convenience goods with a limited range of durable goods and services. Local centres will provide only convenience goods and very limited services.

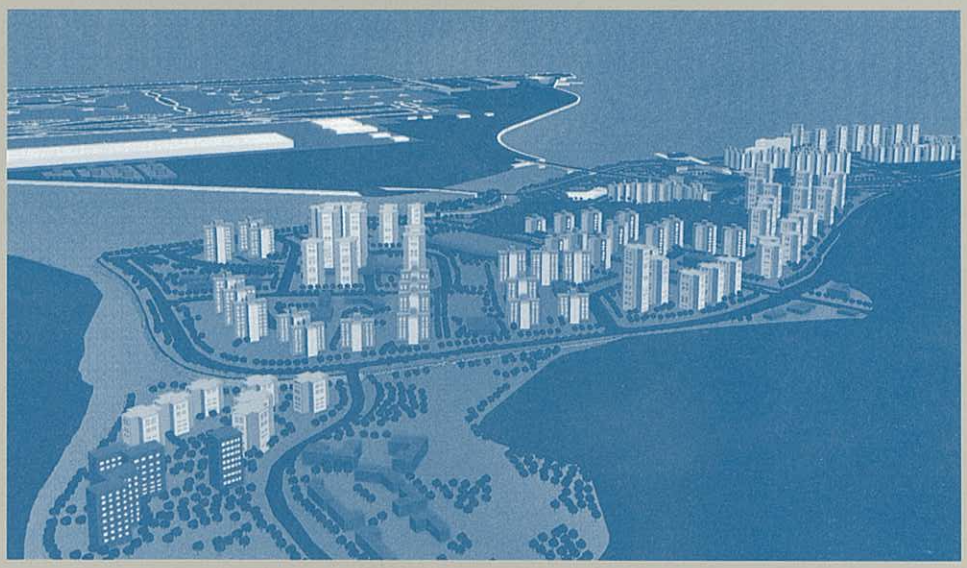
The distribution of commercial floorspace by centre is indicated in Table C4. Net floor area has been converted into gross floor area using an efficiency rate of 75 percent.

Table C4 Distribution of Retail Floorspace by Centre

Centre	Convenience Goods		Comparison Goods		Services		Total m^2 GFA
	%	m^2 GFA	%	m^2 GFA	%	m^2 GFA	
Local	70	148,647	15	7,375	15	8,759	164,781
District	15	31,853	25	12,292	25	14,599	58,744
Town	15	31,853	60	29,500	60	35,037	96,390
Total	100	212,353	100	49,167	100	58,395	319,915

Source : Consultants' Estimates

North Lantau Development



Appendix D

Concept Plan Evaluation

APPENDIX D

CONCEPT PLAN EVALUATION

D1 Introduction

The methodology used in the evaluation of the four Initial Concept Plans is explained in Section 7.5 of this report. The following Tables D1 to D5 present the relative performance of each Initial Concept Plan against the agreed revised goals and objectives for North Lantau Development. These revised goals are presented in Table 7.2 of the main report.

D2 Evaluation by Goals

Goal A - Cost and Convenience in Use

Goal A had the overall aim of ensuring that the pattern of development should achieve a coherent and economical distribution of land uses in relation to transport networks and provide the basis for an efficient new town. Within this goal, six objectives were defined relating to : demand for vehicular movement (Objective A1); use of public transport (Objective A2); accessibility for local residents (Objective A3); disturbance from traffic (Objective A5); provision for an economical distribution of centres (Objective A6); and compatibility of land use at the town/Airport interface (Objective A7). Objective A4 as originally defined in TR1 relating to ease of pedestrian movement is considered too detailed to be evaluated at this stage of the study.

Many of the objectives associated with this goal relate to transport issues. A number of transport tests were conducted to determine the implications of the Concept Plans on transport conditions. The evaluation is for the year 2011 although conditions for earlier years were reviewed to ensure the plans were workable.

The evaluation reflected certain key assumptions on future transport conditions. These were that:

- o there will be an airport railway operating from airport opening; and
- o the airport passenger terminal is to the east of the runways.

The implications on the Concept Plans of changing these assumptions are discussed under Goal E : Flexibility.

Table D1 presents a summary of the performance of the Concept Plans against Goal A - Cost and Convenience in Use.

In terms of demand for vehicular movement (Objective A1) and traffic disturbance (Objective A5), there were no significant differences in the performance of the Concept Plans. The principal differences related to use of public transport (Objective A2), local accessibility (Objective A3), the economical distribution of centres (Objective A6) and Airport/town interface (Objective A7).

The results of the transport model tests clearly demonstrated that, in order to provide adequate local accessibility, two interchanges were required off the NLE in Tung Chung and the air cargo village should not be located at Siu Ho Wan. Concept Plans 1 and 2 therefore performed better than Concept Plans 3 and 4 in this regard.

Table D1 Goal A : Cost and Convenience in Use

Objective/Criteria	Initial Concept Plan				Notes
	1	2	3	4	
A1 Distribute land use activity to minimise demand for vehicular movement					No significant differences.
Location of air cargo village	CLK South	CLK South	Siu Ho Wan	Siu Ho Wan	
Daily pcu hours ('000s)	57	53	56	55	
Daily pcu kms ('000s)	2698	2521	2616	2593	
A2 Distribute land use to maximise use of public transport, especially rail transport					Two stations in Tung Chung with more industry in Siu Ho Wan has the best rail usage, but a one station concept could be modified to improve rail usage
Number of NLD rail stations	3	2	2	3	
Percentage of daily NLD person trips by					
- rail	40%	36%	35%	43%	
- bus	33%	35%	37%	29%	
- other	27%	29%	29%	28%	
Number of daily NLD rail passengers ('000s)	232	218	195	263	
A3 Provide maximum accessibility for local residents to places of employment, services and other facilities					Two Tung Chung interchanges are required and air cargo village should not be at Siu Ho Wan
Number of NLD interchanges	3	3	2	2	
Number of the eight approaches to the two full interchanges with volume - capacity ratio of:					
- less than 0.85	7	7	4	6	
- less than 1.00	8	8	6	7	
A5 Minimise disturbance to development area from traffic between Airport/Airport related uses and New Town residential area					All Concepts Plans have been developed to minimise through traffic in residential areas
Amount of daily Airport/Airport-related traffic passing through, as opposed to around, residential areas	0	0	0	0	
A6 Provide opportunity for an economical distribution of centres					Westward movement of station in Tung Chung would enlarge population catchment of centre
- No. of stations	3	2	2	3	
- population within walking distance of centres					
- Tung Chung	31,000	60,000	28,000	32,800	
- Tai Ho	30,000	50,000	33,000	50,000	
A7 Ensure compatibility of land uses at the town/airport interface					
- separation of industrial and residential uses	Poor	Poor	Fair	Fair	Affected by location and width of drainage channel.
Rank	2	1	4	2	
Comment Concept Plan 2 performs best overall as it comprises: the air cargo village at Chek Lap Kok South, two interchanges on the NLE at Tung Chung; one rail station at Tung Chung modified to include feeder bus services. Performance of the Concept Plan would, however, be considerably improved through greater separation of residential and industrial uses at the town/Airport interface.					

The relative performance of the Concept Plans is less clear, with respect to public transport usage and the economical distribution of centres. On the one hand, the provision of two LAL stations in Tung Chung provides better public transport usage. On the other hand, provision of one station encourages the concentration of commercial and retail activities and would improve the chances of attracting higher-order facilities to the New Town given that it is in a new and relatively remote development area. Moreover:

- patronage of a single station could be considerably enhanced through provision of feeder bus services and a westward movement of the station so that it was more centrally located in its population catchment; and

- the LAL line is capable of extension into the Airport in all concepts and these additional stations could be added as and when required.

On balance, Concept Plan 2 performed best against Goal A as it combined the most advantageous features. Where the Concept Plan could clearly be improved was in the physical separation of potentially conflicting land uses at the New Airport/New Town interface.

Goal B - Environmental Quality

Goal B had the overall aim of ensuring that the proposals should achieve a high quality urban environment and minimise the impact on the natural environment. Within this goal, seven objectives had been defined relating to : disturbance to natural landscape features and ecological systems (Objective B1); amount and impact of air, water and noise pollution (Objectives B2, B3 and B4, respectively); visual character of the development (Objectives B5 and B6); and the provision of recreational opportunities in the development areas and the rural hinterland (Objective B9).

The evaluation concluded that there would be only small localised differences between the Concept Plans for Objectives B2 (air pollution) and B4 (noise pollution). There would, however, be significant noise impacts from the NLE and the New Airport. A major issue was thus the type of amelioration measures to be adopted, particularly in Tai Ho and Tung Chung. Mitigation of noise impacts from the NLE would be possible so that no sensitive uses would be subject to noise levels in excess of those set out in the HKPSG. In developing the Preferred Concept Plan there was also potential to apply mitigation to further reduce noise impacts.

The location of the drainage channels was the key difference between the Concepts as these affect water quality, ecology, visual and recreational objectives. Concept Plans 3 and 4 (with the sea channel) scored highly due to improved water quality and separation between the residential areas and the ecologically important areas around San Tau. The sea channel also offered visual and recreational opportunities. The wider sea channel in Concept Plan 3 performed better than the narrower channel in Concept Plan 4 but the water quality and hydraulic studies have shown that either channel would be acceptable. Concept Plan 3 performed less well for landscaping due to the need to remove part of the Tung Chung and Pak Mong knolls.

Table D2 summarises the overall evaluation for Goal B - Environmental Quality and ranks the Concepts. Concept Plan 3 performs best followed by Concept Plans 4, 2 and 1 in that order.

Table D2 Goal B : Environmental Quality

Objective		Initial Concept Plan			
		1	2	3	4
B 1	**Minimise disturbance to natural landscape features and ecological systems**	See C 3	Impacts from water quality as for Concept Plan 1. Residential areas to the west of Tung Chung will impact on the wetlands and marine ecology in San Tau No segregation of urban areas and ecologically sensitive areas in San Tau/Sha Lo Wan with loss of portion of natural coastline	Improved water quality will reduce impact on wetlands in San Tau Impact on wetlands around Pak Mong Loss of Ma Wan and portion of Pak Mong knolls to residential development	As for Concept Plan 3 except that impacts to Pak Mong reduced and Ma Wan knoll retained
B 2	**Minimise amount and impact of air pollution**	Medium impact from industry across the Airport boundary Medium impact from NLE on Town Park	Greatest impact from industry across Airport boundary Least impact from NLE on Town Park Movement of NLE to north east will reduce impact on the Tung Chung residential areas	Least impact from industry across the Airport boundary Least impact from NLE due to location of Town Park and distribution of residential uses Vent shafts from NLE tunnel ventilation will tend to concentrate pollutants in Tung Chung	Least impact from industry across the Airport boundary Location of Town Park across NLE will increase impact
B 3	**Minimise amount and impact of water pollution**	Negative impacts in East Tung Chung Bay Long drainage channel will have poor water quality and will impact on ecologically sensitive areas in San Tau/ Sha Lo Wan	Some flushing in East Tung Chung Bay during the wet season Potential poor water quality in the western channel will impact on the Sha Lo Wan/San Tau areas	Wide channel maximises flushing in East Tung Chung Bay Most likely to have good water quality in channels	Narrow sea channel will give some flushing to East Tung Chung Bay Likely to have good water quality in the drainage channels

Table D2 Goal B : Environmental Quality (Cont'd)

Objective		Initial Concept Plan			
		1	2	3	4
B 4	**Minimise impact of noise on sensitive uses**	At-grade expressway and railway have major impact but medium impact from roads other than the NLE Medium impact from industry and across the Airport boundary	Distribution of residential uses reduces the impact from the NLE and the railway Greatest impact from industry and across the Airport boundary	Depressed NLE and railway have least impact but the overall impact is large due to distribution of residential uses. Greatest impact from roads other than the NLE Least impact from industry and across the Airport boundary	NLE and railway have major impact. Least impact from roads other than the NLE. Least impact from industry and across the Airport boundary
B 5	**Provide opportunities for an attractive visual character to the development area**	Retains knolls of south Chek Lap Kok, Tung Chung and Tai Ho Wan No segregation between Airport and Town	As for Concept Plan 1 Segregation between Airport and town by drainage channel	Part of Tung Chung and Pak Mong knolls removed As for Concept Plan 2 with greater separation	As for Concept Plan 1 Separation less that Concept Plan 3 due to narrower channel
B 6	**Provide opportunity for attractive visual gateway for Hong Kong**	Town park is adjacent to NLE corridor	Limited opportunities for parkway development	Allows greatest combination of design elements but NLE in tunnel	NLE passes through Town Park
B 9	**Maximise recreational opportunities in development areas and rural hinterland**	Less opportunity to develop waterfront areas	Some opportunity for development of waterfront areas but limited due to channel width	Wide channel offers significant development opportunities Loss of Ma Wan and portion of Pak Mong knolls	As for Concept Plan 3 but opportunities not so great due to channel width
Rank		4	3	1	2
Comment		**Location and width of drainage channels at Tung Chung is key difference between the Concept Plans as this affects water quality, ecology, visual and recreational objectives. Concept Plan 3 therefore performs best.**			

Goal C - Cost Effectiveness

Goal C aimed to ensure that the development proposals would achieve a high level of cost-effectiveness in the use and deployment of resources. Within this goal, three objectives were defined relating to : capital cost of development (Objective C1); generation of revenue from land sales (Objective C2); and return on public investment (Objective C3).

Table D3 presents a summary of the performance of the Concept Plans against this Goal.

Land acquisition displayed no significant differences between the Concept Plans at Phase I or at the full development stage, post 2011. However it should be noted that major cost variations occurred between the Concept Plans as a consequence of the phasing of development at Phase II and III. The cost of drainage also did not vary significantly between the Concept Plans although, if the drainage costs were expressed in cost per development area, Concept Plan 4 appeared to be the most cost effective whilst Concept Plan 3 appeared to be the worst.

The most significant differences in the cost of the Concept Plans occurred in respect of reclamation and transport infrastructure. Concept Plan 3 reflected the cheapest total reclamation cost since it had the least area but it was also the cheapest Concept Plan in terms of reclamation cost per hectare.

The cost of providing road and rail infrastructure did not reveal significant differences between Concept Plans 1 and 4. Concept Plans 2 and 3 were, however, markedly different with the most notable cost being that due to the proposed tunnel access under the sea channel to Chek Lap Kok making Concept Plan 3 the most expensive in terms of transport infrastructure costs.

Table D3 Goal C : Cost Effectiveness

Objective/Criteria	Initial Concept Plan				Notes
	1	2	3	4	
C1 Minimise capital cost of development (HK$ M)					
Land Aquisition total for all phases	2006	1996	2036	2043	No significant differences
Reclamation total	3428	3479	2965	3407	
Dredging and Filling	2835	2931	2096	2532	
Seawalls	593	548	609	615	Most sensitive to location of vertical seawall
Land for industrial development	953	953	861	1132	Refer Table 2.2
Land Drainage	1575	1536	1543	1502	No significant differences
Highways Total	1075	855	1307	1073	
Elevated Structure	206	312	330	340	
Tunnels	26	0	392	27	
LAL Station	320	160	160	320	
Total Cost	9356	9111	9048	9301	Including 894 for common costs
C2 Maximise opportunities to generate revenue from land sales (HK$M)					Provision of more land for low-density residential development in the head of the valley at Tung Chung (Concept Plan 2) results in higher revenues. Allocation of some high density residential development to Tai Ho results in lower revenues (Concept Plan 3)
Residential					
Phase I	706	706	706	706	
Phase II	2104	2198	2062	2014	
Phase III	3851	3945	3816	3851	
Phase IV	6602	6602	6277	6602	
Commercial					Revenue from commercial development is constant for each Concept Plan
Phase I - IV	2090	2090	2090	2090	
Industrial					Cargo village at Chek Lap Kok South results in higher revenues (Concept Plans 1 and 2)
Phase I	1225	1225	915	1050	
Phase II	1111	1111	1050	1050	
Phase III	998	998	875	875	
Phase IV	761	761	700	700	
Rail depot	664	664	664	664	
Total revenues (HK$M) 2011	20,112	20,300	19,155	19,602	
C3 Secure early and reasonable return on public investment - revenues minus costs (HK$M) (see test for principal exclusions) (exclude NLE and WSD facilities)	10,756	11,189	10,107	10,301	See Figure TR8-6 for comparison of costs and revenues by phase.
RANK	2	1	4	3	
Comments	Above figures limited to notable differences between Concept Plans. The Preferred Concept should aim for : limited seaward reclamation off Tai Po and Siu Ho; a more northerly alignment of NLE/ARL at Tai Po; bridge crossing for Airport access corridors and depressed LAL crossing of corridor; high density residential development concentrated at Tung Chung with lower density housing at the head of the valley; cargo village and business park at Chek Lap Kok South.				

In terms of the revenue flow from potential land sales, Concept Plan 2 was the best followed by Concept Plans 1, 4 and 3 in that order. Revenues from commercial development were constant and the differences occurred as a result of the location and amount of industrial and residential development. Those plans with the cargo village at Chek Lap Kok South (Concept Plans 1 and 2) ranked more highly. The opportunity to develop more land for low-density housing at the head of the valley at Tung Chung resulted in higher revenues in Concept Plan 2.

In terms of a comparison of costs and revenues, the New Town exhibits a typical profile in which initial infrastructure and land acquisition costs are high and potential revenues lag behind capital costs in the early phases. Concept Plan 2 performed best as revenues were both highest and capital costs lowest in this concept.

The Preferred Concept Plan was priced using the same unit costs as the elements of the nearest equivalent in the Initial Concept Plans and there was an apparent saving in Concept Plan 2 of approximately 6 percent against the next cheapest. The cost/revenue profile could be further improved by incorporating Option B for industrial development in the Preferred Concept Plan (that is with the cargo village and business park at Chek Lap Kok South, and the industrial park at Siu Ho Wan over the Railway Depot). This would result in a cost saving over the cheapest concept (Concept Plan 3) of 35 per cent.

Goal D - Programming

Goal D aimed to ensure that the development in the New Town would be capable of easy implementation. Within this goal, four objectives were defined. These related to : risk of delay to programme targets (Objective D1), implementation of self-contained packages (Objective D2), disturbance to existing and new development in subsequent construction stages (Objective D3) and environmental impacts from construction on existing and new development (Objective D4).

Table D4 presents a summary of the performance of the Concept Plans against the Goal.

In terms of the risk of delay to the programme targets (Objective D1) and ability of the development to be implemented in self-contained packages (Objective D2), all Concept Plans performed equally.

There would, however, be different environmental impacts during construction of the development according to the phasing of the Concept Plans (Objectives D3 and D4). In terms of water quality, Concept Plan 1 performed worst and could lead to unacceptable conditions in the embayment at Tung Chung. Conversely, Concept Plan 3 would perform best in this regard. In terms of noise and air quality, Ma Wan Chung would suffer the worst impacts in Concept Plan 2 owing to its later relocation under this concept. Overall, Concept Plan 3 performed best followed by Concept Plans 4, 2 and 1 in that order.

Goal E - Flexibility

Goal E sought to ensure that planning proposals would be able to respond to changes and be able to function in a self-contained manner at various levels of population build-up. Within this goal, four objectives were defined. These relate to the ability of the plan to function effectively at each stage of development (Objective E1), non-construction or delay of the airport railway (Objective E2), flexibility to accommodate additional population or employment (Objective E3), and the ability to function effectively with changes to design assumptions (Objective E4).

Table D4 Goal D - Programming

Objective/Criteria	Initial Concept Plan				Notes
	1	2	3	4	
D1 Minimise risk of delay to programme targets - potential for programming delays to Phase I	All Concept Plans perform equally				No one Concept Plan is any more likely to incur programme delays than any of the others
D2 Development to be capable of being implemented in self-contained packages - potential development in stages related to population and employment projections	Most capable	Most capable	Least capable	Least capable	Concept Plans which concentrate both residential and industrial development at Tung Chung/Chek Lap Kok South perform best
D3 Minimise environmental disturbance at each construction phase					
- impact of reclamation phasing on water quality	Most impact	Medium impact	Least impact	Medium impact	Concept Plan 1 could lead to unacceptable water quality at Tung Chung Bay at least until pollutant loads from Ma Wan Chung removed following its relocation
- impact on water quality due to dredging and spoil disposal	Least impact				
- air and noise impacts on existing villages and completed development during construction	Least impact	Most impact	Medium impact	Least impact	
		Most impact	Least impact	Least impact	In Concept Plan 2, redevelopment of Ma Wan Chung not completed until 2006 and so subjected to impact from construction of New Town and New Airport for over 10 years
Rank	Equal	Equal	Equal	Equal	
Comment	Concept Plans 3 and 4 perform best in terms of environmental disturbance at each construction phase although Concept Plans 1 and 2 are most able to be implemented as self-contained packagtes.				

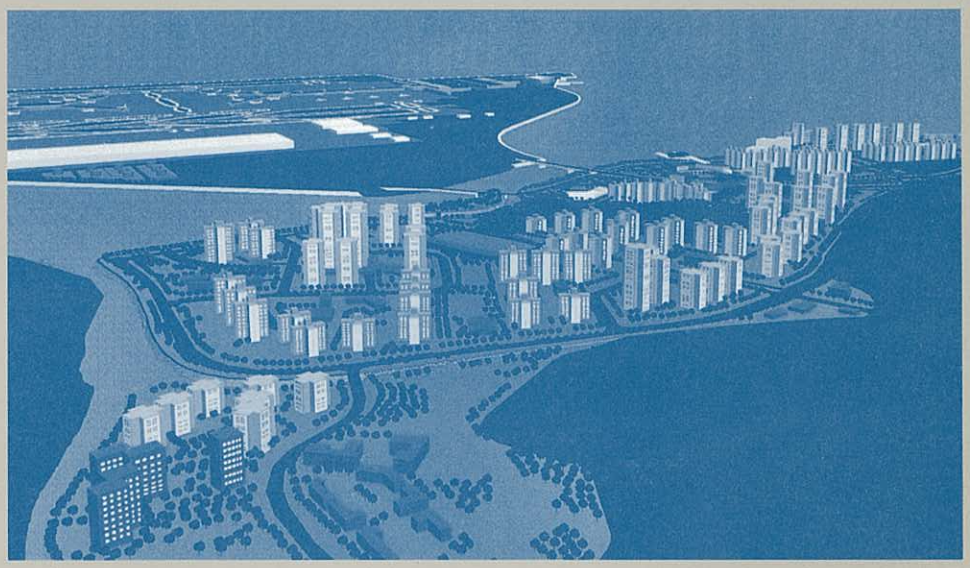
Within the overall constraints in North Lantau, the Concept Plans were flexible to respond to changing circumstances and accommondate additional urban development upto the capacity of external strategic transport links. External factors could, however, have a significant impact on the plans. These include: a decision not to implement or to significantly delay the ARL; a southward shift of NEF 25 contour; and the non-availability of land for industrial development at Chek Lap Kok South.

Table D5 presents a summary of the performance of the Concept Plans against this Goal.

Table D5 Goal E : Flexibility

Objective/Criteria	Initial Concept Plan				Notes
	1	2	3	4	
E1 Ensure plan can function effectively at each stage of development					The distributor road should be in place around 2006 to serve as an alternative route to the Airport when serious congestion occurs.
Highest volume-capacity ratio expected for:					
- combined external Lantau links					
o 2011	0.9	0.9	1.0	1.0	
o 2006	0.9	0.9	0.9	0.9	
o 2001	1.0	1.0	1.0	1.0	
- NLE east of Tai Ho Wan					
o 2011	0.9	1.0	1.0	1.0	
o 2006	0.9	0.9	1.0	1.0	
o 2001	0.7	0.8	0.8	0.8	
- Primary airport access					
o 2011	0.8	0.8	0.8	0.8	
o 2006	0.7	0.7	0.7	0.7	
o 2001	0.5	0.6	0.5	0.6	
E2 Minimise impact on plan of a decision not to construct or significantly delay the Airport Railway as a separate public rail service					Substantial delay or non-implementation of ARL could limit development capacity of North Lantau
- degree of concentration of early development	Concentrated development	Concentrated development	Dispersed development	Dispersed development	
E3 Flexibility to accommodate additional population or employment beyond levels forecast for 2011					There is little spare external capacity to accommodate post 2011 development levels.
Amount of hourly capacity (in pcus) in 2011 available on:					
- NLE east of Tai Ho Wan	400	200	-	-	
- combined external Lantau links	800	800	500	400	
E4 Ensure plan can function effectively with changes to design assumptions	All Concept Plans perform equally				Changes to delineation of 25 NEF contour, location of airport terminal and availability of land for industrial development at Chek Lap Kok South could have a fundamental impact on the plans.
Rank	Equal	Equal	Equal	Equal	
Comment	Very little difference in the performance of the Concept Plans as flexibility has been planned into the Concept Plans				

North Lantau Development



Appendix E

Key Environmental Issues

APPENDIX E

ENVIRONMENTAL ASSESSMENT

E1 INTRODUCTION

This Appendix contains key detailed technical quantitative and qualitative existing environmental conditions (i.e. baseline). In addition, this Appendix contains details of the extent and severity of environmental impacts resulting from of the construction and operation of all development phases. This Appendix also details mitigation recommendations to reduce the scale of negative construction and operational impacts and details any residual impacts.

E2 BASELINE CONDITIONS

E2.1 Baseline Water Quality

Water quality in the North Western Waters is influenced by pollutant loads from the urban areas, discharges conveyed by the Pearl River, pollutants from local catchments mainly via streams and nullahs, and industrial and domestic effluent from existing sewage outfalls.

On a flood tide, water from the Victoria and Western Harbours discharges via the Ma Wan Channel into the North Western Waters bringing a pollutant load mainly derived from domestic and industrial effluent. During the ebb tide the flows from the Pearl River, and to a degree Deep Bay, influence water quality. Locally derived loads and especially the effluent discharged via the Pillar Point Outfall also affect water quality.

Water quality data from the following sources have been analysed:

- summary statistics of 1989 water quality as reported in Marine Water Quality in Hong Kong, 1991. These are shown in Table E1.
- raw data from relevant EPD sampling stations were provided by EPD for a 30 month period. These were analysed to give the seasonal data shown in TR10 (Revised).
- sampling stations were monitored by Pollution Control Division (PCD) of CESD. Data from these stations were presented in TR10 (Revised).
- sampling stations were monitored by EPD for spring and neap tides in the wet and dry seasons to give data for the calibration and validation of the Enhanced WAHMO models.

The summary data show that the North Western waters are generally well oxygenated in both surface and bottom layers. In the Urmston Road the mean value of DO in the surface layer is reported to be 87% (compared with 92% for North Lantau), with bottom layer mean values of 81% for Urmston Road and 80% for North Lantau. Biochemical oxygen demand within North Western waters ranged between 0 and 1.6 mg/l with a mean value of 0.6 mg/l.

Seasonal data indicated that dissolved oxygen concentrations are usually higher during the wet season than in the dry. Average suspended solid concentrations show less distinct seasonal variation although some of the concentrations are lower in the wet season.

Seasonal variations are, however, apparent in the oxidised nitrogen values. Average wet season values are two or three times those of the dry season reflecting the pollutant load transported by the Pearl River, as well as the flushing of stream beds and nullahs during the wet season.

Table E1 Summary Statistics of 1989 Water Quality of North Western Waters (Annual Means)

Determined	Urmston Road	Tuen Mun	Lantau North
Temperature (°C), surface	23.0	22.9	22.9
bottom	22.4	22.4	22.4
Salinity (ppt), surface	25.7	28.7	28.9
bottom	29.3	30.0	30.0
D.O. (%Satn), surface	87.0	84.5	91.8
bottom	80.9	79.1	80.3
pH	8.30	8.34	8.41
Secchi Disc (m)	1.2	1.5	1.5
Turbidity (NTU)	13.8	10.1	9.5
S.S. (mg/l)	12.6	11.1	9.7
BOD_5 (mg/l)	0.5	0.6	0.6
Inorganic N (mg/l)	0.418	0.298	0.304
TN (mg/l)	0.737	0.653	0.600
PO_4 - P (mg/l)	0.028	0.025	0.024
TP (mg/l)	0.051	0.052	0.044
Chlorophyll - a (μg/l) surface	1.7	2.3	2.0
E.coli (no./100ml)	467	327	33

Source : Marine Water Quality in Hong Kong, EPD, 1990.

Note : 1. Except as specified, data presented are depth averaged data.
2. Data presented are annual means except for E.coli data which are annual geometric means.

Seasonal influences in oxidised nitrogen are also apparent from the data reported by PCD at Tung Chung. Dry season values are only a fraction of those recorded in the wet season (>0.4 mg/l). Chlorophyll-a concentrations also increase during the wet season with correspondingly high values for dissolved oxygen.

In order to protect Hong Kong's marine and coastal waters, it is the Government's intention to implement the recommendations of the Sewage Strategy Study. Effluent will be collected from large areas of Kowloon and Hong Kong and will ultimately be disposed of via a long sea outfall into the Lema Channel. In conjunction with this, the North Western Waters (and all remaining Water Control Zones which have not yet been declared) are scheduled to be gazetted in March/April 1992. Discharges to the receiving waters will then not only be controlled by the recently enforced Water Pollution Control Ordinance Section 21 'Technical Memorandum on Effluent Standards' but also by the Water Quality Objectives, promulgated under the Sewage Strategy Study. Under the Sewage Strategy Study, all Beneficial Uses were assigned to this water body with particular attention paid to preserving marine and beach water quality.

The effect of implementing the Sewage Strategy Study proposals should be a reduction in pollutant loads and consequently an improvement in water quality. The time frame for such an improvement does however, depend on many factors and should not be perceived as providing instantaneous results. In addition, the pollutant loads transported by the Pearl River will still dominate the quality of the North Western Waters especially during the ebb tide.

E2.2 Baseline Sediment Quality

The existing sources of sediment data have been reviewed together with data collected as part of the baseline studies. Data collection was coordinated with the North Lantau Expressway Study to avoid any overlap, and to maximise the data set.

Sediment samples were collected from the locations shown on Figure 8.2. Table E2 shows the results of the sediment sampling together with the criteria used for assessing the level of contamination.

Levels of contamination are within the standards proposed in the Contaminated Spoil Management Study except for two samples of Cadmium where levels of 2.2 mg/kg and 1.1 mg/kg were recorded. The former of these located between the southern tip of Chek Lap Kok and the North Lantau coast is higher than the action levels recommended under the Contaminated Spoil Management Study. The area of apparent contamination is isolated and may well be a result of sampling error. It has been recommended that additional samples be taken in the same area to prove the results of the previous sampling.

Table E2 Sediment Sample Results and Assessment Criteria

	Pollutant concentration (mg/kg)										
	Zn	Cu	Ni	Pb	Cd	Cr	Hg	TKN	TP	COD	Organic Matter (%)
Sample No (a)											
SS1	25	4	4	11	0.2	5	<0.01	160	2	3300	1.3
SS2	22	4	3	10	0.2	3	<0.01	110	4	1700	1.1
SS3	24	3	3	10	0.3	2	0.05	130	5	2400	1.5
SS4	42	8	15	35	2.2	6	0.17	280	9	5300	2.5
SS5	89	15	16	34	0.8	10	0.16	670	18	19000	3.8
SS6	120	29	21	49	0.6	18	0.32	890	29	20000	4.2
SS7	120	29	22	44	0.8	18	0.27	920	28	17000	4.1
SS8	130	31	21	48	0.6	18	0.27	860	41	17000	4.2
SS9	100	30	17	41	0.6	15	0.14	1300	23	31000	3.6
SS10	96	21	18	34	0.8	13	0.16	670	8	27000	3.5
SS11	110	25	19	41	0.6	17	0.23	900	9	25000	4.0
SS12	110	8	19	36	0.6	18	0.19	830	32	28000	3.3
ES1	43	20	16	41	0.9	18	0.10	640	6	14000	2.9
ES2	70	28	24	58	0.9	23	0.10	1100	3	21000	2.9
ES3	69	28	19	47	0.8	19	0.14	850	4	22000	3.0
ES4	78	34	22	52	0.7	23	0.14	680	3	30000	2.9
ES5	69	35	23	55	0.8	25	0.11	840	10	21000	3.3
ES6	72	37	25	56	0.8	26	0.11	1100	5	22000	3.2
ES7	78	41	25	61	0.8	28	0.12	1100	9	21000	2.9
ES8	71	34	25	55	1.0	28	0.14	650	12	18000	4.0
ES9	79	39	25	60	0.8	26	0.13	1100	8	19000	3.4
ES10	10	8	4	16	0.2	5	0.17	190	18	3900	1.1
ES11	79	31	22	56	0.9	25	0.18	830	7	19000	3.1
ES12	70	22	23	50	1.0	23	0.10	930	7	17000	2.6
ES13	60	17	19	38	1.1	20	0.05	570	7	18000	3.1
ES14	68	48	24	53	0.7	28	0.10	940	4	26000	3.0
ES15	20	8	5	24	0.2	7	0.03	110	5	1400	1.3
Study Area Mean Value	71	24	18	41	0.7	17	0.14	720	12	17400	3.0
Assessment Criteria (b)											
Trigger Levels	150	55	35	65	1.0	50	0.8				
Action Levels	200	65	40	75	1.5	80	1.0				

Note: (a) Samples collected for the North Lantau Development Study are labelled SS
Samples collected for the North Lantau Expressway are labelled ES

(b) Proposed Trigger and Action Levels for Hong Kong Sediments, Contaminated Spoil Management Study

E2.3 Baseline Air Quality

In order to determine the significance of the predicted air quality data for the NLD area during the operational and construction phase, it was necessary first to establish the background levels of air pollution in the Study Area.

Background levels for air pollution would usually be established from air quality monitoring, preferably over a period of several years. However no long term data are available for the NLD Area and the assessment of background levels has been based on the territorial air pollution model developed for Port and Airport Development Study (PADS). Site data have also been collected for one week to calibrate the mathematical model.

Predicted Air Quality

The PADS emission database was developed for 1986 for nitrogen oxides (NO_x), sulphur dioxide (SO_x) and respirable suspended particulates (RSP) and includes emissions from:

- o power stations;
- o transportation and traffic;
- o industry; and
- o domestic sources.

The PADS predictions have been revised to take recent developments into account as follows:

(a) the industrial emissions have been reviewed following the introduction of new regulations on low sulphur fuel. Impacts of SO_2 from area sources have been reduced to 45% of the original levels;

(b) background levels of carbon monoxide (CO) and volatide organic carbons (VOC) were not included in the PADS model. These have been calculated from the ratios between emission factors of VOC, NO_x and RSP for traffic and the PADS area source traffic emission of RSP and NO_x;

(c) the emissions from Castle Peak Power Station (CPPS) were reviewed to include extensions since 1986 and the proposed Black Point Power Station (BPPS); and

(d) the input data for PADS have been reviewed and corrected.

The background on Tung Chung, Tai Ho Wan and one location midway between those locations, at 400 m height, was calculated for 36 wind directions, using the US EPA PAL DS model (PADS TR13). Figures E1 to E3 show the background for NO_x, SO_2 and RSP. For each wind direction a representative yearly averaged wind speed has been used. The maximum background concentrations are summarised in Table E3.

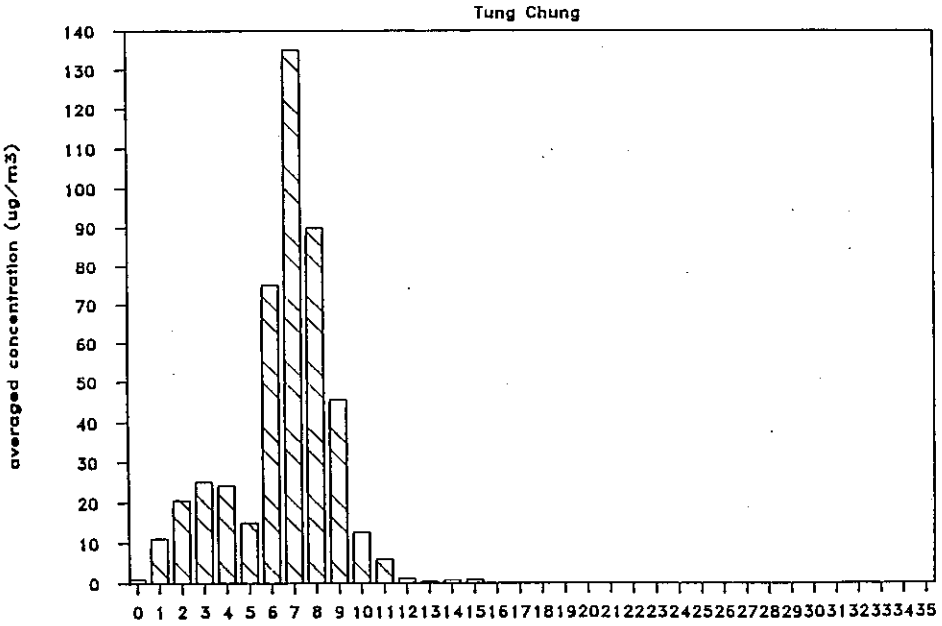


Figure E1
NOx Background Concentration

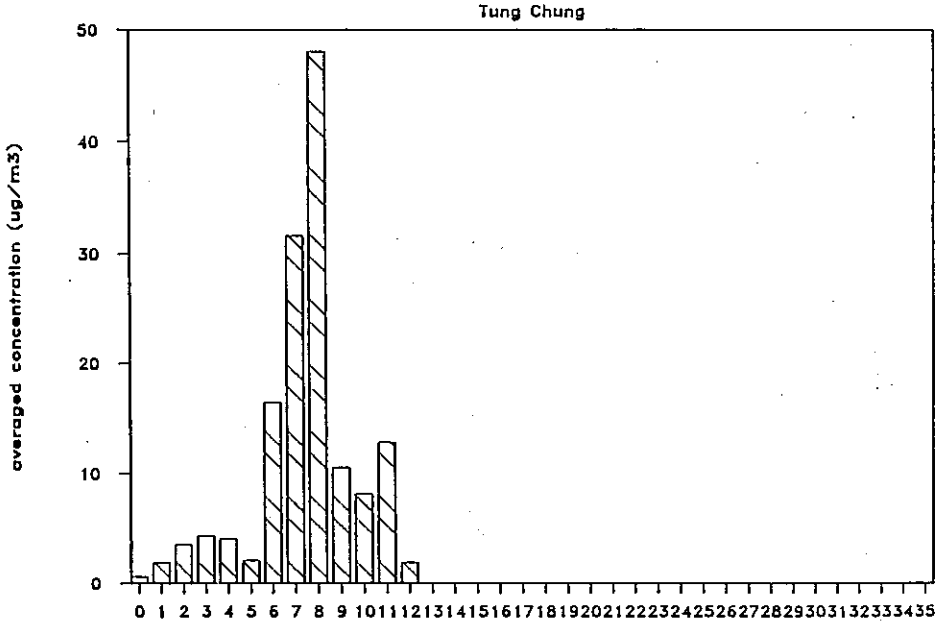


Figure E2
SO_2 Background Concentration

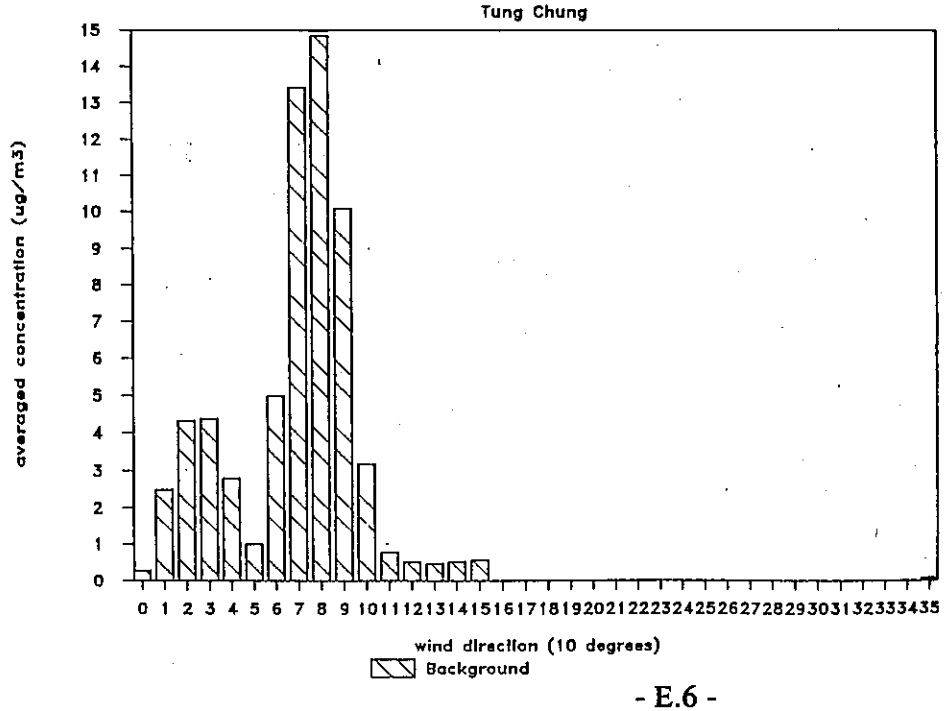


Figure E3
RSP Background Concentration

Table E3 Maximum Yearly Averaged Background Air Pollutants Concentrations in the NLD Area (Averaging time : 1 hour)

	Tung Chung ($\mu g/m^3$)	Tai Ho Wan ($\mu g/m^3$)
Sulphur dioxide	50	60
Nitrogen oxides (NO_2 - equivalent)	135	150
Nitrogen dioxide	80	80
Carbon monoxide	25-135	30-150
Volatile organic carbons	15-70	15-75
Non-RSP particulates > 10μm	< 1	< 1
Respirable suspended particulates (10 μm)	15	20
Total suspended particulates	15	20
Ozone	80	80

Source: Consultants' Model Testing

The calculated concentration from the CPPS/BPPS is very low at sea level, due to plume rise at the wind velocity used. However, in order to estimate the potential impact of Castle Peak power stations the dispersion model was applied to calculate concentrations at the slopes of mountains on Lantau at a height of about 400m. At this height it was predicted that the impact from the power stations would be considerable. It is understood that this issue will be considered by the Consultants for the proposed Black Point Power Station.

The main contribution to background concentrations is urban/industrial sources in other parts of the Territory and the power stations at Tsing Yi and Lamma Island.

Air Quality Monitoring

In addition to this predictive assessment of background air quality a short-term one week continuous monitoring assessment was carried out at one site within the NLD Area at Tung Chung, measuring NO_2, NO, SO_2, CO, TSP and wind speed and direction. The results have been presented in a study report entitled, "North Lantau Air Quality Survey".

There are obvious limitations associated with this short-term monitoring but the overall results indicated that the measured pollutant levels at the site were all very low as can be seen from Table E4.

Table E4 Measured Air Quality at Tung Chung

Pollutant	Concentration in $\mu g/m^3$ (ppm in bracket)		
	Weekly Average	Max 24-Hour	Max Hourly *
NO_x	(0.021)	(0.046)	(0.32)
NO	11 (0.009)	31 (0.025)	331.7 (0.27)
NO_2	24 (0.012)	40 (0.021)	94.2 (0.05)
CO	282 (0.25)	418 (0.36)	1639.9 (1.43)
TSP	50	72	-
SO_2	2.6 (0.001)	11 (0.004)	104.8 (0.04)

Source : Consultants Assessment

Note * The monitored maximum hourly values are for a very short period only, and maximum monitored values are not comparable with the calculated mean values presented in Table E4.

The Hong Kong Air Quality Objectives (AQO) for CO stipulate that the CO concentration when averaged over any 24 hours shall not exceed 8.7 ppm and the concentration at any one hour shall not exceed 26.2 ppm. The measured hourly values are far below the 1-hour and 8-hr standards.

There are currently no guideline levels for NO and NO_x. For NO_2 the AQO guidelines are 0.16 and 0.08 ppm for the hourly and the 24-hr average NO_2 concentrations respectively. Assuming that $[NO_2] = [NO_x] - [NO]$ in ppm, the maximum hourly NO_2 concentration was 0.05 ppm and the maximum 24-hr average concentration was 0.027 ppm, both of which are well below the standards.

The AQO also stipulates that the 24-hour average concentration of TSP shall not exceed 260 $\mu g/m^3$. The daily average levels measured indicate that the existing levels are well below this standard although no night time data was collected.

Guidelines for the SO_2 concentration in air are 0.31 ppm, and 0.13 ppm for the hourly average and 24-hr average respectively. The measured levels were well below the standards.

The results have been compared with other EPD air quality monitoring stations in Hong Kong at Sham Shui Po, Kwai Chung, Central/Western and Tsuen Wan during the same period. The results for SO_2, NO_2 and TSP were well below the EPD station concentrations. NO_2 accounted for about one sixth and TSP only was about one half of that measured at EPD stations during the same period.

E2.4 Baseline Noise Environment

The Study Area presently features a quiet and rural environment. Main noise sensitive receivers are low-rise dwellings, mainly two to three storeys high, and a few village schools and temples scattered over several villages.

The main noise source in the area is local community background noise, including noises from TV, radio, people, dogs barking, etc. However, the noise environment varies slightly across the NLD Area. For example, traffic noise is an important component of the background noise in the daytime near Tung Chung Road and marine traffic noise is significant

near the shoreline. Localized noise sources, for example school children at play, affect the background noise level.

A baseline noise survey was carried out between January and February 1991 to characterize the existing noise environment by identifying the main noise sources and measuring the background noise levels and the temporal variation in noise within the NLD Area. The results have been documented in "Background Noise Survey for the North Lantau Development Project". Noise measurements were made at Ma Wan Chung, Sham Wat, Ngau Au, Shek Lau Po, Shan Ha, Tai Po, Sheung Lan Pei, San Tau and at Sha Lo Wan. The survey measured L10(1-hr), Leq(1-hr) and L90(1-hr) in units of dB(A).

In general, the background noise level, expressed in L90(1-hr), was in the range of 25 dB(A) to 45 dB(A). Higher noise levels reaching 50 dB(A) were measured at Ma Wan Chung and Sha Lo Wan while levels as low as 23 dB(A) were measured at Sham Wat. The diurnal trends at most survey locations showed an increase in noise level from dawn (5 am) to midday, then a decrease from dusk (6 pm) to a minimum at night. This corresponded well with the level of activity in these villages. In the very sparsely populated villages such as Sham Wat, Shan Ha, and Tai Po, the background noise levels were consistently low and the diurnal trend was less distinct.

E2.5 Baseline Terrestrial Ecology

The baseline survey was carried out on-foot by field studies coupled with the interpretation of recent aerial photographs to increase the area of coverage and to investigate inaccessible areas.

Woodland

The most important habitats in the Study Area are the upland valley woodlands. The history of these woodlands has undoubtedly been very complex but the exceptionally rich tree flora and the presence of poorly-dispersed plant species of restricted distribution suggest that at least some of these areas have never been completely cleared. However, the extreme difficulty of access which has, presumably, protected these areas from exploitation in the past, also makes biological exploration very difficult and the survey had to rely on interpretation of aerial photographs for some inaccessible areas.

In addition to their rich flora, which includes a whole suite of orchids confined to such sites, these woodlands are likely to be a very important habitat for vertebrates. They are known to be used by migrant birds in winter and probably serve as a protected "base" for carnivores, such as civets, which also feed in the surrounding non-woodland habitats.

In much of the area, particularly north of Ngong Ping, the upland woodlands are in retreat as a result of frequent hill fires. Elsewhere, however, they are advancing. This highlights the role of such relict patches as seed (and, presumably, animal) sources for the natural reafforestation of fire-maintained grassland and shrubland. Secondary woodlands adjacent to relict older woodland are much richer in plant species than in places where seed sources are more distant. Although covering only a few percent of the NLD Area, these upland valley woodlands could form the basis for the eventual reafforestation of the entire upland area, assisted, where necessary, by planting of suitable native species which is discussed in the mitigation section.

Only the larger areas of upland woodland have been mapped individually. The most extensive is probably the largest area of entirely natural woodland in the Territory and thus of unique ecological value. The ground survey revealed the presence of a number of tree

species of restricted distribution in Hong Kong, including Exbucklandia populnea, Lithocarpus corneus, Meliosma squamulata, Sloanea hongkongensis, and an unidentified species of Michelia. The area northeast of Lantau Peak is reputed to be botanically diverse but access by normal means seems impossible and, in any case, it is hard to imagine any threat to it. The area south west of San Tau, which was also investigated, seems to be typical of the valley woodlands in less rugged areas and is clearly in retreat, at present, as a result of grass fires. The other individually mapped areas are based on interpretation of aerial photographs and views from a distance. There are, in addition, dozens of smaller patches, some of which may be of special interest and all of which are of value as seed and animal sources for recolonization of open areas. However, upland areas east of Tai Ho Wan are not considered to be ecologically valuable as there is no upland woodland.

Secondary Woodland and Fung Shui Woodland

Woodland below 300m in the NLD Area is apparently all either young secondary woodland or planted. These areas are important wildlife habitat as a whole but individual areas are not of unique ecological value, as similar woodland can fairly easily be recreated elsewhere.

The largest individual trees in the lowland part of the area are in the small Fung Shui woods and similar areas around villages. These woods are of no special ecological value, consisting largely of economic and/or exotic species, but the presence of large, mature trees make them of considerable value in landscaping. Ideally, they should be preserved for incorporation into parks or other landscape features.

Shrubland and Grassland

As noted, the bulk of the NLD Area is covered in fire-maintained grassland and shrubland and the conservation value of such habitats depends largely on the density and height of tree and shrub cover. The most frequently burned areas, such as the grasslands north of Ngong Ping, are considered to be ecological deserts, supporting relatively few plant or animal species. With protection from fire, however, these grasslands are invaded by shrubs until a species-rich closed shrubland develops and, eventually, secondary woodland. The middle stages of this successional sequence, because of their extent in the area, probably support the majority of North Lantau's current bird and mammal fauna. Because of seasonal migration, an authoritative bird survey would involve at least a year of intensive observation. However, abundant evidence of pangolins was found, suggesting that hunting intensity is low and thus other native mammals are also likely to be common.

Streams and Freshwater Wetlands

Few running waters or wetland in Hong Kong have escaped Man's detrimental influence. Even those streams used for water-supply purposes have been impacted since the transfer of water from hillside watersheds to storage reservoirs via underground tunnels leaves the lower course of many streams almost dry. As stream and river floodplains can constitute important wetland habitats, one impact of such water transfers is to limit the extent of these areas. Only three of the streams of any size in the NLD Area are affected by water transfers. These are Sha Lo Wan Stream, San Tau Stream, Tai Ho Stream. Siu Ho Stream is a smaller stream and drains the least diverse valley in terms of habitat variety.

The largest streams in the area enter the sea at Tung Chung Wan. They have been channelized in their lower course which markedly reduces their ability to support a diverse flora and fauna. These streams, like others in the area, provide irrigation water for agriculture around villages. Where this takes the form of flooded furrows, flooded fields (for water spinach, etc) or paddy (in one field in the Tung Chung Valley), some adaptable species

find the agricultural habitats an acceptable substitute for the natural wetlands which would have constituted the stream floodplain. However, the use of fertilizers and insecticides reduces the habitability of some of these areas, and some of the irrigation waters in the Tung Chung Valley are hypertrophic and almost devoid of life. Similar conditions are found at Sham Wat on the western boundary of the NLD Area. In addition, the fish fauna is characterized by exotic invasive taxa, such as Poeciliidae and Oreochromis mossambicus (tilapia), although a few native species persist.

Elsewhere, at Tai Ho and San Tau, streams flow into the sea with little or no regulation or pollution. Because catadromous species of freshwater animals (mitten crabs, Eriocheir, and shrimps, Macrobrachium) migrate down to the sea to reproduce, these streams are important avenues during the breeding season and should be kept open, if possible so as to maximize biological diversity. In addition, both of these streams have associated areas of wetland containing species of frogs which do not breed in streams (Rana macrodactyla, Rana limnocharis, Kaloula pulchra, etc). Although these three species are not endangered, there are also records of Philautus romeri in the area which is currently known only from Hong Kong. Philautus romeri also occurs on Chek Lap Kok, and with the inevitable destruction of some of the habitat of this species during New Airport construction, due consideration must be given to the maintenance of wetland areas elsewhere along the North Lantau coast. Lowland reaches of streams and associated wetlands are also breeding sites for Odonata (dragonflies and damselflies) which have become increasingly scarce in Hong Kong during recent years (Asahina 1987). Dragonflies were especially well-represented in the lower Tai Ho Valley which appears to be an important breeding site. It should be noted that there is also a wetland area located at Sha Lo Wan which has a diverse species composition. This wetland is a permanent wetland, unlike that at San Tau which is only seasonally inundated. The Sha Lo Wan wetland, therefore, may be an important refuge for vagile species when other wetlands, such as San Tau, dry up.

Above the intake to water-catchment tunnels, most streams in the Study Area are unpolluted and provide valuable habitat for a range of fish, amphibians (including the Hong Kong Newt, Paramesotriton hongkongensis), and invertebrates. A fauna typical of unpolluted streams throughout the Territory was noted, with a characteristic zonation pattern and longitudinal succession of crustaceans (freshwater crabs and shrimps) and fishes. It is possible to travel a relatively short distance within the NLD Area and record a variety of species which tend to be far more dissipated elsewhere in the Territory as a whole. Provided these streams continue to be used as indirect catchments for Shek Pik Reservoir, we do not envisage any threats to their flora and fauna. However, clearing vegetation within these catchments would increase sediment loads in the streams, with detrimental effects on the aquatic biota and the terrestrial environment.

Mangrove

None of the patches of mangrove forest in the NLD Area are sufficiently large or well developed to be of unique importance by itself. However, in total, the mangroves of the area support Hong Kong's entire mangrove flora (except for Heritiera littoralis) and a rich fauna. Moreover, with other planned developments on the North Lantau coast, virtually all the mangrove on Lantau Island may be lost. Therefore, where possible mangrove should be preserved or replaced.

E2.6 Baseline Marine Ecology

The marine ecology baseline survey adopted a classification system based on four broad categories of habitat type as follows:

(i) sheltered inlets/bays;
(ii) boulder shores;
(iii) rocky shores; and
(iv) sandy shores.

These categories provide a generalised measure of habitats specific to certain types of plant and animal communities, and at the same time offer a practical means of identifying the differential impacts that are expected to occur within these communities.

The assessment of marine ecological impacts was based on field investigations of the littoral zone in the Study Area, supported by literature from previous and on going studies in the region.

Littoral Zone

In the Littoral Zone marked seasonal variations in physical conditions (temperature, salinity and turbidity) strongly influenced by run-off from the Pearl River catchment result in corresponding seasonal changes in the distribution of fish and motile species. Many of the benthic sessile organisms are associated with specialised habitats eg. mangrove communities, and there are marked variations in the apparent productivity of the different types of shore line. This arises through differences in nutrient availability and the substrate specific requirements of certain types of organism, in addition to the water quality parameters noted above.

Species diversity in the NLD coastal zone area similarly shows seasonal influences (Richard and Wu 1985) and there are some invertebrate groups that may be under-represented relative to eastern Hong Kong waters as a result of their higher salinity threshold.

Although sediment trace metal concentrations in the Study Area exceed background values for Hong Kong (Mott MacDonald/EPD 1991), there are no point sources of these pollutants in the immediate area, which may be considered as relatively unpolluted.

(i) *Bays and Sheltered Inlets*

Within the Study Area the three principal sites within this category are Siu Ho Wan,Tai Ho Wan, and Tung Chung. From an ecological perspective this habitat type represents the most productive system in the Study Area. This is attributable to:

- the reduced mechanical energy to which animals living on the substrate surface are exposed ie. reduced wave action;
- the increased nutrient availability associated with run off and corresponding increase in food availability;
- sediment particle size composition; and
- the key role played by a limited number of plants and organisms in the maintenance of a broader community as in the case of mangroves.

In terms of general community structure and species composition all sites showed similarities, with the exception of the lower shore area at Tung Chung which was rather more diverse than the other two sites partly due to the presence of eel grass (Zostera nana), and Zoysia beds. The former is more commonly associated with temperate climates and its occurrence in Hong Kong has previously only been reported from Lai Chi Wo in Crooked Harbour (Hodgkiss and Morton 1977), where it has been awarded protection by AFD. As with Mangroves, Zostera sustains a range of detrivourous crustacea and molluscs that utilise the annual leaf fall, feeding directly on the leaves, on the products of decomposition, on epiphytic algaes and on the plants themselves.

The dominant feature of these areas in terms of species composition and degrees of interdependence within the system are the mangrove plants, of which there are five primary species within the Study Area.

The mangroves are central to the maintenance of a broad range of crustaceans and molluscs. Many of these species are detrivores/deposit feeders, feeding either directly on leaf litter or else indirectly on the products of decomposition.

(ii) *Boulder Shores*

Boulder shores are the predominant habitat type in the Study Area, and in general are more limited in both diversity and abundance than the bays and sheltered inlets discussed above. Because of the increased wave action in the slightly more exposed conditions, and the generally harder substrates, animals with holdfast mechanisms, and those such as bivalves for which settlement is substrate specific, tend to proliferate. Prominent among this group are the rock oysters, Saccostria cucullata and the mussels, (eg Perna viridis) although in the case of the latter, distribution is more limited.

On the underside of the cobbles, and within the sediments trapped beneath the stones a broad range of annelid worms, and gastropods occur. A large number of predatory Muricid snails which feed on the rock oyster population are represented among the latter. Crustaceans are represented by species of the Grapsid and Xanthid crabs.

This type of habitat is distributed throughout the Territory and neither it nor the community of plants and animals associated with it are particularly unusual. Many of the species are less specialised due to the nature of the system, and may be able to adapt more readily to a modified coastline.

(iii) *Rocky Shores*

There are a limited number of true rocky shores in North Lantau, this type of shoreline being more common to the exposed southern and easterly shores of the islands. The dominant features of this type of habitat, and the primary determinant of the plant and animal community associated with it, are firstly the mechanical energy of wave action, and secondly the nature of the substrate. This results in the promotion of encrusting organisms, and others with strong holdfast mechanisms. In the context of the NLDS we do not consider this habitat to be of major concern.

(iv) *Sandy Shores*

Sandy and/or coarse grained beaches are also limited in area in North Lantau, and where they do occur it is frequently at the fringes of the bays and inlets. As a result there is a slow succession in species composition from one habitat type to the other. Changes in the infauna occur due to changes in particle size, and the overall density and diversity decreases with

Table E5 Fish Species Common to the NLD Study Area

Common name/type	Specific name
	Ambassis gymnocephalus
Chinese anchovy	Anchoviella chinensis
Cardinal	Apogon quadrifasciatus
Cardinal	Apogon doederlini
Goby	Acentrogobius caninus
Japanese Eel	Anguilla japonica
	Argyrosomus pawak
	Argyrosomus macrocephalus
	Arnoglossus tenuis
	Callionymus richardson
Sole	Cynoglossus puncticeps
Sole	Cynoglossus macrolepidotus
Tongue Sole	Cynoglossus melampetalus
	Chilloscyllium plagiosum
	Conger cinereus
	Clupanodon thrissa
Common blenny	Dasson variabilis
Ray	Dasyatis akajei
Mud grouper	Epinephelus brunneus
Pony fish	Leiognathus brevirostris
Pony fish	Leiognathus ruconius
	Lepidoptrigla japonicus
Snapper	Lutjanus russelli
Snapper	Lutjanus sanguineus
Snapper	Lutjanus argentimaculatus
Sea Bream	Mylio latus
Sea Bream	Mylio berda
Grey mullet	Mugil cephalus
Goby	Oxyurichthys tentacularis
Flathead	Ophichthus cephalozona
	Platycephalus indicus
	Pleuronichthys cornutus
	Polycaulus uranoscopus
	Saurida elongata
Rabbit fish	Siganus fuscessens
Rabbit fish	Siganus oramin
Silver whiting	Sillago sihana
Sole	Solea ovata
Puffer fish	Takifugu oblongus
	Trypauchen taenis

increasing sand fraction due to the reduced nutrient availability. Some of the few beaches that conform to this habitat type in Study Area are at Sha Lo Wan.

Sub-littoral Zone (Near Shore)

(i) *Fish resources*

Fish species common to the intertidal zone in the sheltered bays include the mudskipper Periophthalmus and the goby Boleophthalmus. Both are common to a broad range of sites throughout the region. Of more importance is the role of this habitat in providing nursery areas for the juvenile stages of a range of commercially exploited fish and crustaceans. Although little data is available on either species composition, spawning areas, or the extent to which the resource base is dependant on these areas, evidence would suggest that these areas are important to a number of families, in particular to the genus Lutjanidae (Snappers) and Mylio (Sea Breams).

Important species, the juvenile stages of which have been commonly utilised in the fish culture sites at Ma Wan and Tung Chung, are caught annually for stocking the fish farm cages by local fishermen in the inlets of North Lantau, include the Snapper (Lutjanus argentimaculatus), and the Sea Breams (Mylio latius, M. berda, and Rhadosarga sarda). In addition, within the estuarine areas large numbers of grey mullett (Mugil cephalus) aggregate. The principal fry collection sites for sustaining mariculture operations have in the past, been at Hau Hok Wan, San Tau and Tai Ho Wan on Lantau, and Fu Tei Wan and A Ma Wan on Chek Lap Kok.

The principal concern regarding these commercially fished species is that at the present time, AFD have no routine resource assessment programme for this area. Although, it is understood that AFD have recently surveyed fisherman within the North Lantau/Chek Lap Kok area. The objectives of this survey was to better understand the state of local capture fisheries development, with a view to estimating the production, and the size of the fishing fleet in local waters. However, AFD were not able to provide the results of this survey for this Study. flt is therefore unclear firstly, what the age/size composition of these populations is, relative to existing fishing mortality (catches). Because of this, it is not possible to evaluate the significance to the population as a whole, of increased natural mortality arising from habitat depletion. As far as spawning areas are concerned, it appears that for most of the species common to the Lantau coast, spawning occurs offshore, and the planktonic or post larval stages drift inshore to feed in the bays and inlets during the early part of their lifecycle.

Table E5 provides details of the catch composition recorded during recent trawl surveys (Greiner Maunsell 1991) supplemented by additional details of species occurring in the Study Area derived from previous surveys (Richards and Wu 1985, ERL 1982).

(ii) *Invertebrates/benthic organisms*

An assessment of invertebrate fauna in the NLD study (Greiner Maunsell 1991) area carried out recently as a component of the New Airport study shows a much higher level of species diversity than might be expected in an area subject to the estuarine conditions of the Pearl River.

Of importance in the catches recorded during the survey was the presence of twelve species of the commercially exploited Penaeid shrimp family including Penaeus merguiensis, P. penicillatus, P. monodon, Metapenaeus ensis and M. affinis which are of commerical importance.

Although no data is at present available on the distribution of shrimp catches in this area, previous studies (ERL 1982) have suggested that the area generates approximately 1.0% of the Hong Kong shrimp catch, and a similar proportion of the fish catch. Applying this percentage to the 1989 annual production figures supplied by AFD would indicate a shrimp catch of approximately 40 tonnes/annum. On the basis of our own observations of fishing effort in the area, we would suggest this may significantly underestimate annual shrimp catches in the vicinity of the NLD Study Area.

One of the most unusual benthic animals common to the area between Tai O, Chek Lap kok, and Black Point on the mainland, and one that occasionally appears in the market of the former village, is the prehistoric Horseshoe crab limulid species Tachypleus, the king crab. Not a true crab, two species of Tachypleus occur in the area. T.tridentatus is associated with clean sand flats and specific beaches including Shui Hau on Lantau and Black Point in the New Territories. T. gigas, a larger species is found in the sub littoral zone. Knowledge of its local distribution and biology, including its sensitivity to pollutants is limited, although it should be noted that the limulids occur in relatively few locations on a world wide basis being recorded only in parts of South-East Asia, the Carribean and the US Atlantic coast.

(iii) *Cetaceans*

With a similar but limited geographical distribution the Chinese white dolphin (Sotalia chinensis) is an estuarine species and is generally sited between Chek Lap Kok and Castle Peak. During field investigations for the present study, sitings were made between Yam O and Tai Ho Wan. Little information is available on the population size, but emerging evidence suggests it is limited. There are general concerns that the cumulative effects of the major infrastructure projects proposed within the area may have major adverse effects on the population.

E3 CONSTRUCTION IMPACTS AND MITIGATION

E3.1 Construction Air Quality Impacts and Mitigation

Phase 1

Figures E4 to E6 show the maximum Phase 1 predicted dust levels for 24 hour and 1 hour TSP and for 24 hour RSP for the two cases firstly where there is no mitigation and secondly where there is comprehensive mitigation at source. Air sensitive receivers and groups are presented in Topic Report TR18 (Revised). The Phase 1 mitigation assumed is as follows:-

(a) concrete batching - enclosures and filters;

(b) rock crushing - filters and wet spray systems;

(c) haul road - speed reduction and the alternative of watering (mitigation method A) and surface chemical treatment (mitigation method B); and

(d) loading and unloading - the alternative of watering and chemical wetting agents.

Phase 1 : 24 Hour TSP

The AQO for 24 hour TSP is 260 $\mu g/m^3$. This will be exceeded at all receivers except Pak Mong unless mitigation at source is applied. The largest contribution to the exceedance will be the dust caused by vehicles on haul roads and the contribution from blasting, rock crushing and other activities will be relatively small. Figure E4 shows that there will be no exceedance of the 24 hour TSP objective except at Ma Wan Chung if the assumed mitigation method B is applied.

Phase 1 : 1 Hour TSP

There is no AQO for 1 hour TSP but a level of 500 $\mu g/m^3$ is recommended by EPD. This level is not statutory and has not been included in other Airport Core Projects but has been used in this assessment to give an indication of the short term impacts. The level of 500 $\mu g/m^3$ will be exceeded at all the ASRs whenever reclamation or land formation is proceeding on nearby works sites. The activity which contributes most to the 1 hour TSP levels shown in Figure E5 is blasting. There is little that can be done to limit the dust from blasting except to use the minimum practical charge. The impact from blasting, however, tends to be very short term and only lasts for a short period after the blast. One blast per day is likely for these works.

Phase 1 : 24 Hour RSP

The 24 hour AQO for RSP is 180 $\mu g/m^3$. This will be exceeded for much of the period of construction unless mitigation measures are applied. The mitigation measures would be the same as those used to reduce TSP. Figure E6 shows the maximum predicted levels assuming that these mitigation measures are applied and this indicates that there should be no exceedance of this AQO except at Ma Wan Chung for mitigation methods A or B.

Phase 1 : Other Pollutants

The impacts from pollutants other than dust are shown in Table E6. These have been calculated assuming an asphalt production plant could be at Tung Chung or Tai Ho East. None of these are likely to be significant.

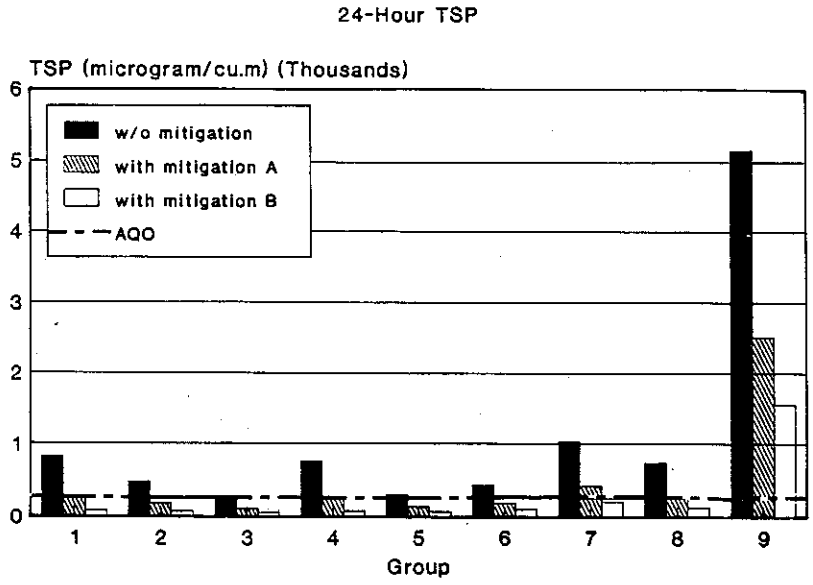


Figure E4
Phase I
Maximum Predicted 24 Hour TSP

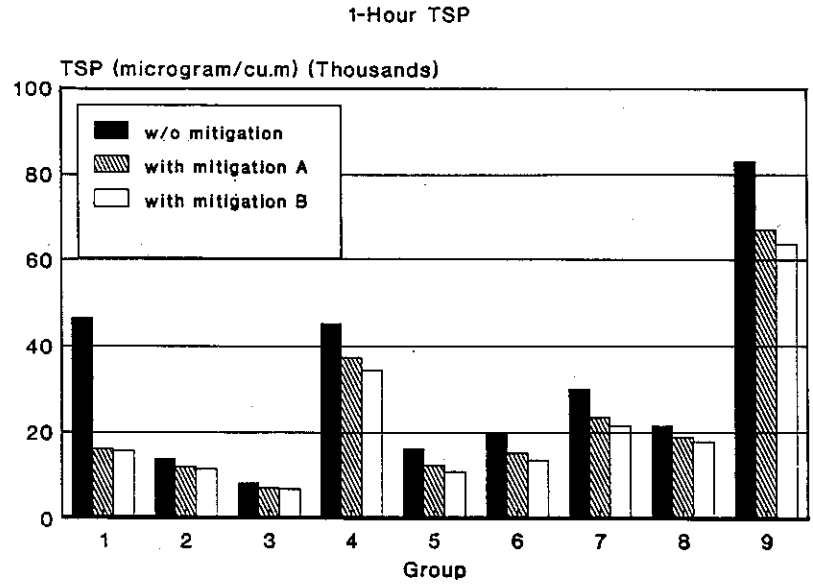


Figure E5
Phase I
Maximum Predicted 1 Hour TSP

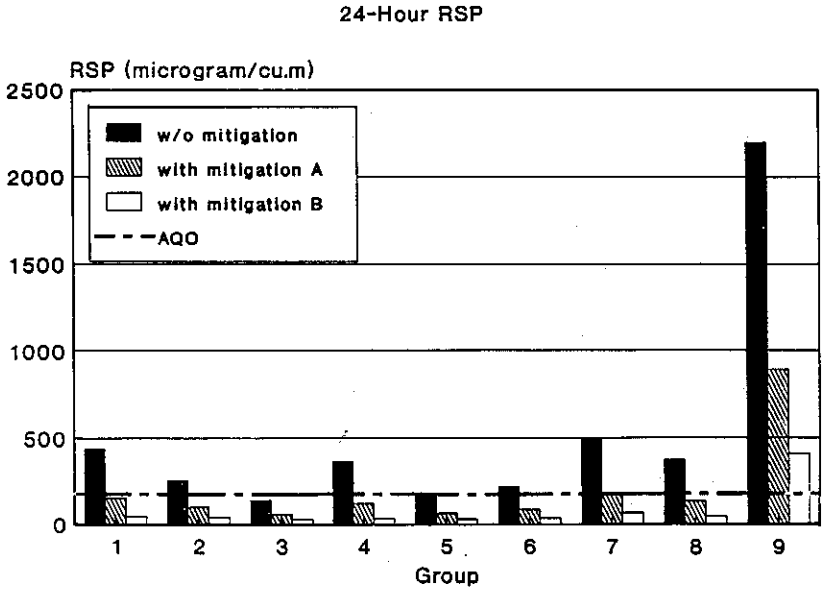


Figure E6
Phase I
Maximum Predicted 24 Hour RSP

Table E6 Maximum level ($\mu g/m^3$) of Gaseous Pollutants at the Worst Affected ASR During Phase 1

	Tung Chung Phase 1 Reclamation						STW at Siu Ho Wan						RTS at Sham Shui Kok					
	24-Hour			1-Hour			24-Hour			1-Hour			24-Hour			1-Hour		
	SO_2	NO_2	CO	SO_2	NO_2	CO	SO_2	NO_2	CO	SO_2	NO_2	CO	SO_2	NO_2	CO	SO_2	NO_2	CO
Maximum Level	0.10	0.03	0.03	0.21	0.05	0.05	0.03	0.01	0.01	0.05	0.01	0.01	0.04	0.01	0.01	0.09	0.02	0.02
Worst ASR	San Keng						Pak Mong						Pak Mong					
Background Level	50	80	25-135	50	80	25-135	60	80	30-150	60	80	30-150	60	80	30-150	60	80	30-150
AQO	350	150	-	800	300	30,000	350	150	-	800	300	30,000	350	150	-	800	300	30,000

Phase 1 : Mitigation

Mitigation methods tested in the Phase 1 assessment are listed in the previous section. Mitigation of dust, particularly from vehicles on haul roads, will be needed to reduce the impact of Phase 1 on the ASRs. The methods of achievement of dust standards should be left to the contractor as methods of working will be his responsibility but the contract should include clauses specifying that strict dust control should be employed. The Engineer should be empowered to direct the contractor to take appropriate measures if dust levels become excessive. The option of mitigating the dust by increasing the Phase 1 contract period is not practical as this contract is on the critical path leading to opening of the New Airport.

Presentation of Phase 2 to Phase 5 Results

The results of the dust modelling for Phase 2 and subsequent construction phases are shown in Figures E7 to E9. The results have been presented in the form of histogram charts showing the impacts from the movements of construction vehicles which is the most important source of dust, while loading and unloading is concluded to have contributed insignificant amounts to all the modelled ASRs. The results show the maximum predicted dust levels each phase for 24 hour and 1 hour TSP and for 24 hour RSP with and without different forms of mitigation compared with the background levels. Air sensitive receiver locations are presented in Topic Report TR20.

The results indicate clearly the extent of dust reduction which could be achieved with different mitigation measures applied. Two types of mitigation measures have been tested as follows:-

- Mitigation 1 - watering of haul roads (50% suppression)
- Mitigation 2 - watering of haul roads and traffic speed reduced from 20 km/hr to 8 km/hr as EPD recommended speed limit on unpaved road (70% suppression).

Phase 2 : 1 Hour TSP

A level of 500$\mu g/m^3$ is recommended by EPD for construction activities. The level is not statutory and has not been included in Airport Core Projects, but has been used in this assessment to give an indication of the worst-case short-term impacts. Figure E7 indicates that the 500$\mu g/m^3$ level will be exceeded at all modelled ASRs in Tung Chung area, without mitigation, whenever construction is proceeding at nearby works sites. With mitigation measures 1 or 2, the modelled ASRs near the construction sites will still receive high TSP levels. ASRs in the Tai Ho area, will receive dust levels below the hourly AQO, without any mitigation requirement.

Phase 2 : 24 Hour TSP and RSP

The 24 hour AQO limits for TSP and RSP are 260$\mu g/m^3$ and 180$\mu g/m^3$ respectively. Without mitigation the modelled ASRs near to the construction sites will be exposed to levels exceeding the AQOs, as indicated on both Figures E8 and E9. With mitigation 1 employed, the levels received will fall below the AQO limit.

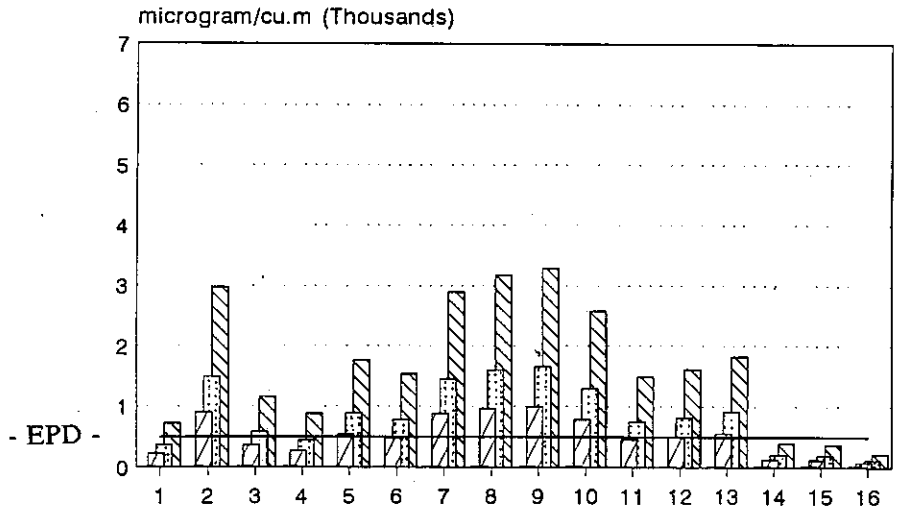


Figure E7
Phase 2
Maximum Predicted 1 Hour TSP

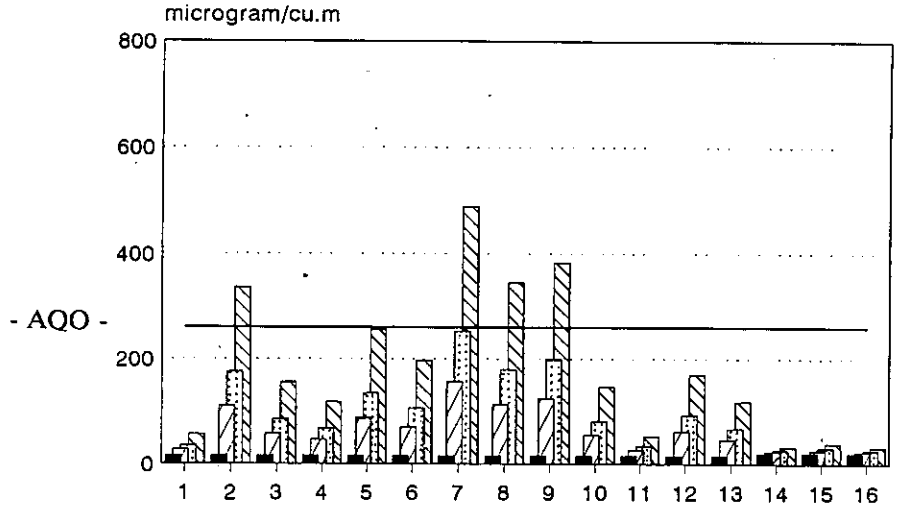


Figure E8
Phase 2
Maximum Predicted 24 Hour TSP

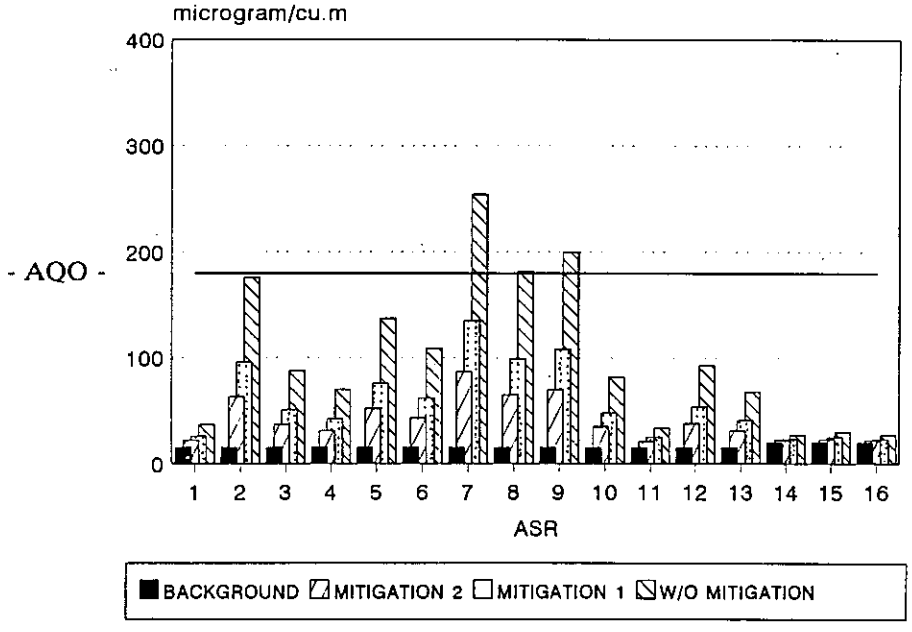


Figure E9
Phase 2
Maximum Predicted 24 Hour RSP

Phase 3 : 1 Hour TSP

The dust level received will be generally lower than in Phase 2, as indicated in Appendix A on Figure E10. The 1-hour dust level will be greatly reduced to 500$\mu g/m^3$ level at all modelled ASRs, with mitigation measures 2 applied, however this can only be achieved with the vehicle speed limited to 8km/hr on all haul roads.

Phase 3 : 24 Hour TSP and RSP

Dust levels predicted are well within the AQO limits even without dust mitigation measures employed, as indicated in on Figures E11 and E12.

Phase 4 : 1 Hour TSP

Figure E13 indicates that without mitigation the 500$\mu g/m^3$ level will be exceeded at all ASRs modelled, especially those in the vicinity of Tai Ho Wan, whenever construction is proceeding at nearby work sites. With mitigation measure 1 modelled ASRs near the construction sites will still receive high TSP levels especially at Tai Ho Wan. With mitigation measure 2 TSP levels will be reduced to below the EPD recommended level at modelled ASRs in Tung Chung although there will still be exceedances in the vicinity of Tai Ho Wan.

Phase 4 : 24 Hour TSP and RSP

Without mitigation the modelled ASRs (11, 12, 13, 14 and 15) near to construction sites in the vicinity of Tai Ho Wan will be exposed to levels exceeding the AQOs, as indicated on Figures E14 and E15. With mitigation 1 employed, the levels received will fall below the AQO limit with the exception of two sites where there will be exceedance of the 24 hour TSP AQO. With mitigation 2 employed such exceedances will be eliminated.

Phase 5 : 1 Hour TSP

The 1 hour dust level received will be lowest of any construction phase as indicated on Figure E16. With mitigation 1 employed almost all exceedances are eliminated with the exception of one site, although this exceedance could be eliminated by a 8km/hr limit on vehicles on all haul roads (mitigation 2).

Phase 5 : 24 Hour TSP and RSP

24 hour dust levels predicted are lower that at any other construction phase and are very much below the AQO, as indicated on Figures E17 and E18.

Mitigation Methods for Phase 2 and Subsequent Construction Phases

Mitigation of dust, particularly from vehicle movements on unpaved haul roads, will be needed to reduce the impact on the ASRs for Phase 2 and subsequent construction phases.

Two methods of mitigation should be considered. These are:-

- o those relating to design and methods of construction; and (as indicated in the previous section)
- o those relating to suppression of dust during construction.

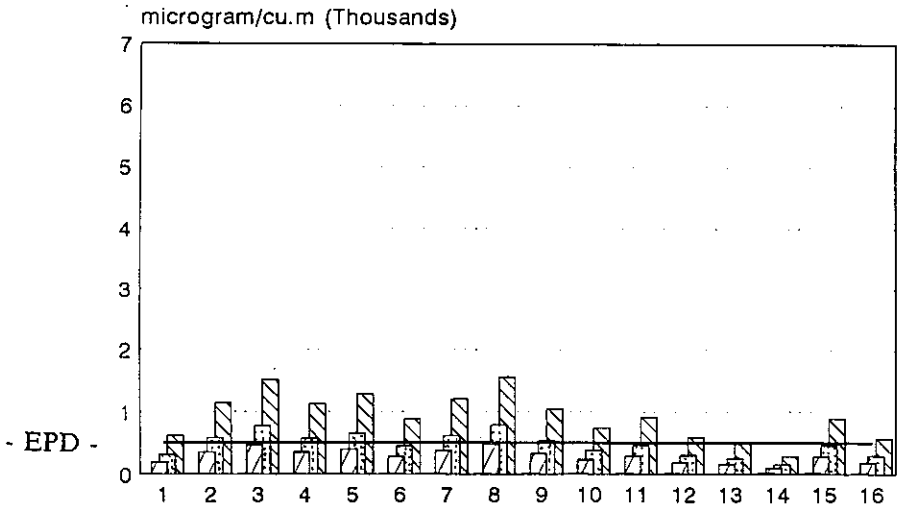


Figure E10
Phase 3
Maximum Predicted 1 Hour TSP

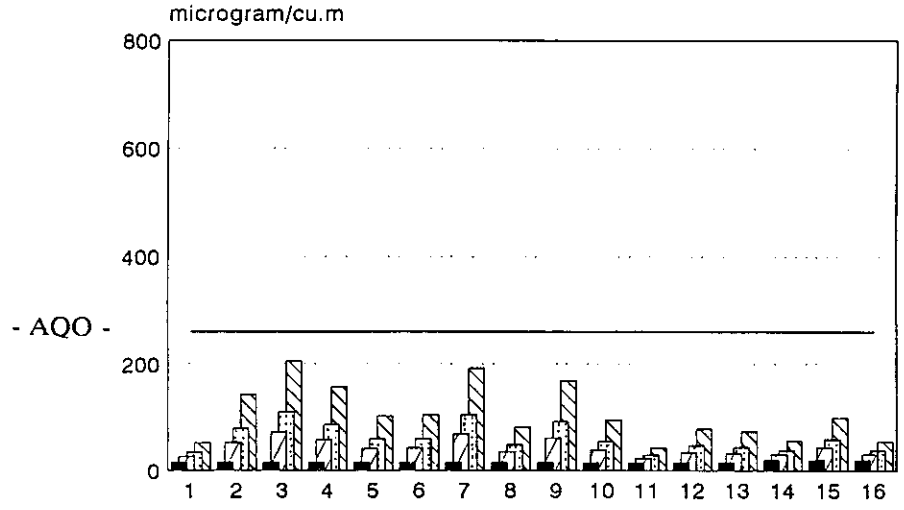


Figure E11
Phase 3
Maximum Predicted 24 Hour TSP

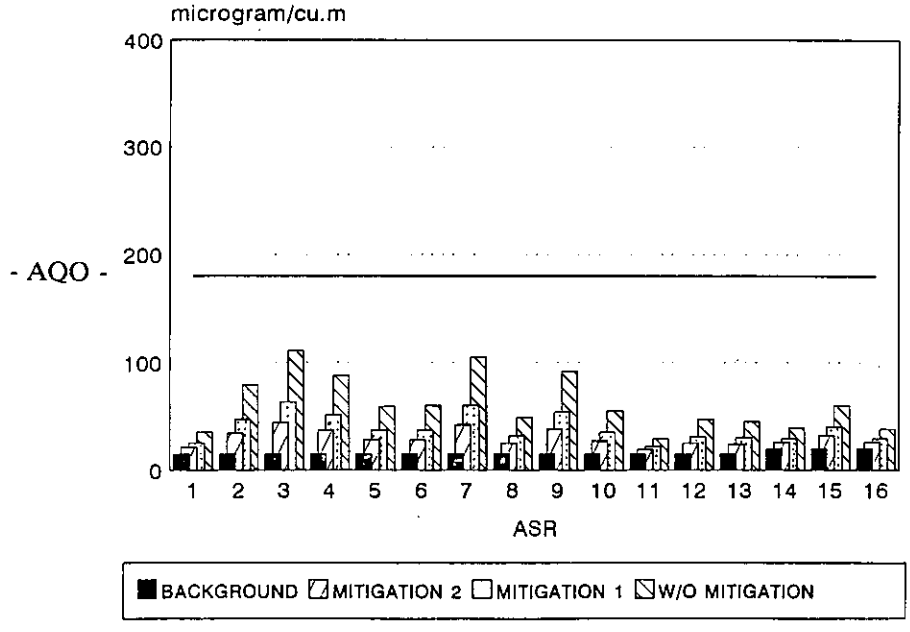


Figure E12
Phase 3
Maximum Predicted 24 Hour RSP

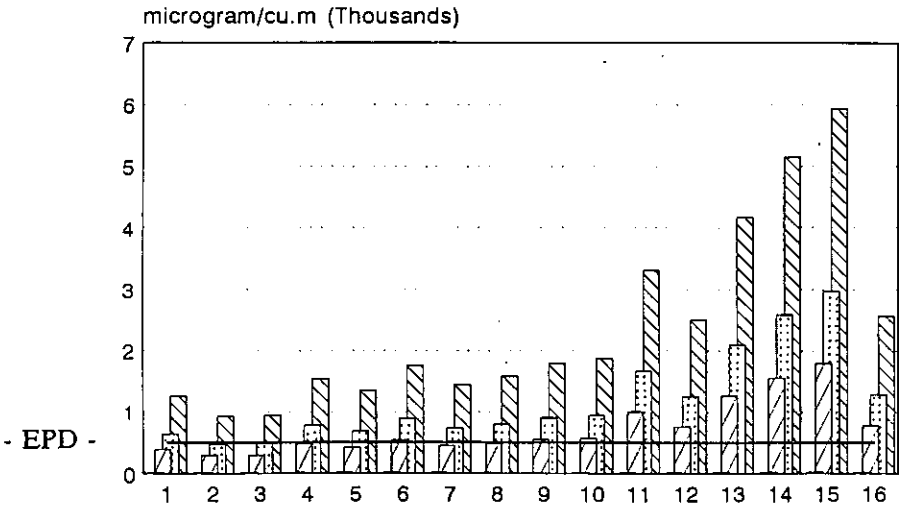


Figure E13
Phase 4
Maximum Predicted 1 Hour TSP

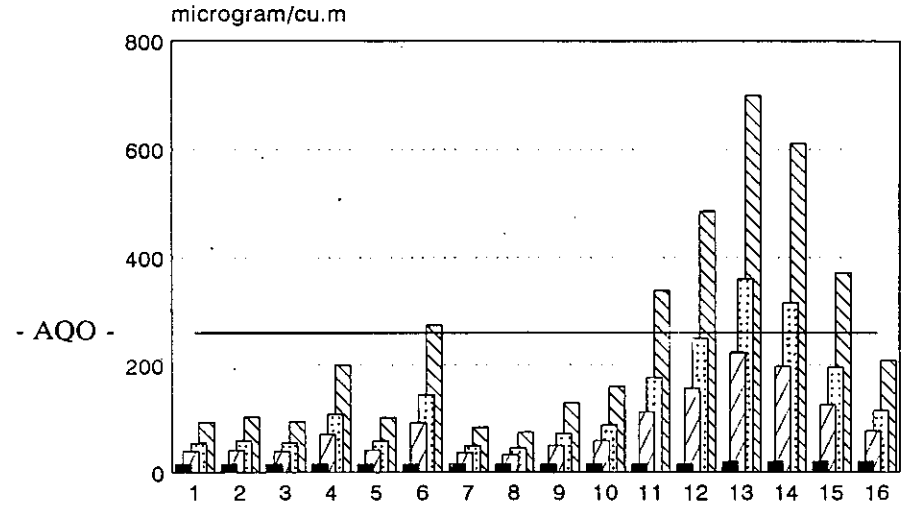


Figure E14
Phase 4
Maximum Predicted 24 Hour TSP

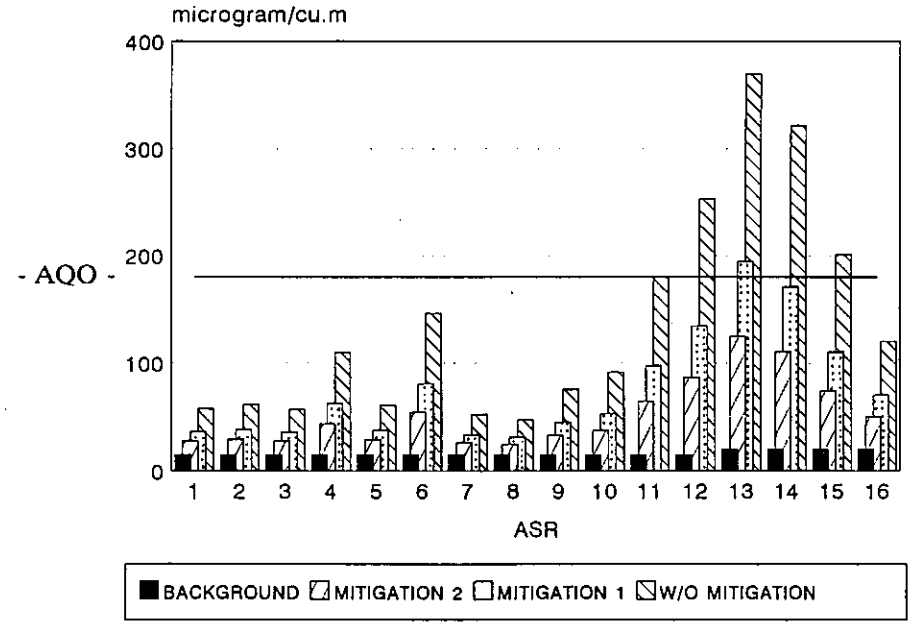


Figure E15
Phase 4
Maximum Predicted 24 Hour RSP

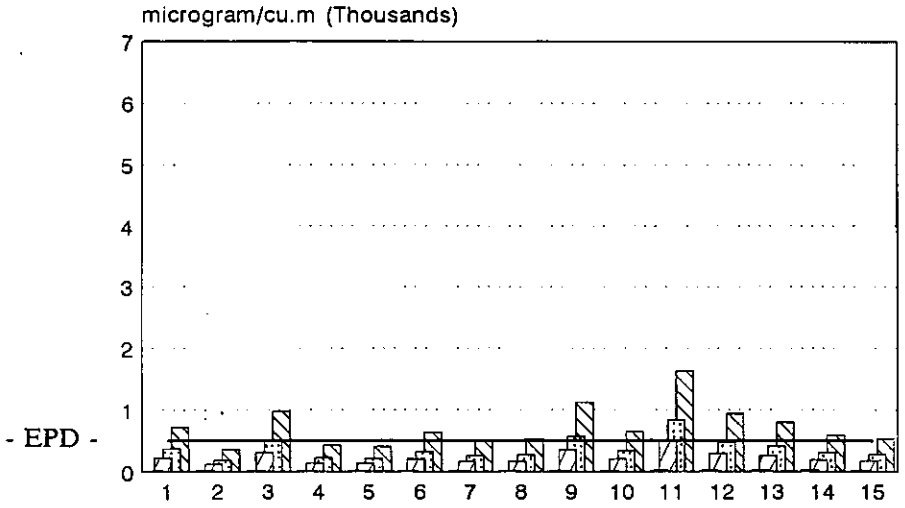


Figure E16
Phase 5
Maximum Predicted 1 Hour TSP

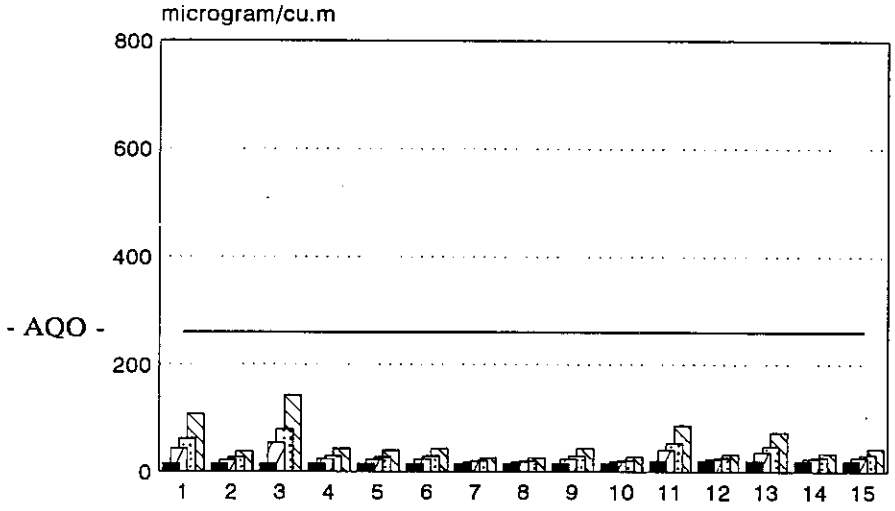


Figure E17
Phase 5
Maximum Predicted 24 Hour TSP

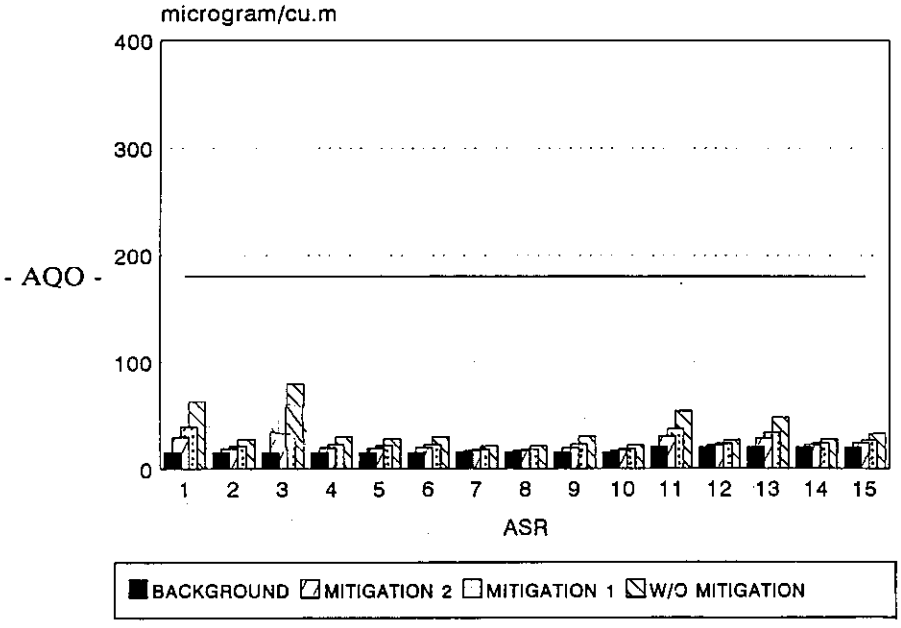


Figure E18
Phase 5
Maximum Predicted 24 Hour RSP

The assessment tested two methods of mitigation for the suppression of dust during construction of Phase 2 and subsequent construction phases and concludes that neither of these will, on their own, be capable of reducing dust to acceptable levels. It is important that this is achieved so that the high quality environment of the New Town is maintained and the New Town is attractive to new residents. The second method of mitigation tested also included dust suppression by limiting the speeds of vehicles on haul roads although this is difficult to enforce.

It is recommended that mitigation of dust, by suppression during construction of Phases 2 onward, should be included in all construction contracts but that this alone should not be relied upon to reduce dust to acceptable levels.

Mitigation of dust therefore needs to be taken into account in the design of land formation and reclamation with the object of reducing the need for movements of vehicles. This can be achieved by one or more of the following:-

- by use of marine fill, rather than land based fill, for all stages of reclamations;
- by programming construction contracts so that there is time for contractors to use smaller numbers of plant items at any one time, thereby reducing dust levels;
- by avoiding the need for stockpiles and surcharges; and/or
- by phasing projects so that any haul road movements are over short distance.

An assessment of the dust impact of each contract should be carried out and modifications to the design made as necessary. In addition dust standards should be included in each contract; the action levels should be the AQOs plus a standard of 500 $\mu g/m^3$ for 1 hour TSP.

The precise methods of achievement of dust standards for Phase 2 construction onwards should be left to the contractor as methods of working will be his responsibility but the contract should include clauses specifying that strict dust control should be employed. The Site Engineer should be empowered to direct the contractor to take appropriate measures if dust levels become excessive.

The present assessment was based on the best available information currently available from the NLD design team. Detail subsequent refinements during the course of the designs for subsequent phases could affect the findings presented here.

E3.2 Construction Water Quality Impacts and Mitigation

Water Quality Impacts Common to all Construction Phases

Water quality impacts may arise from dredging and reclamation and the construction of infrastructure on the reclamation.

Dredging and Reclamation

Impacts on receiving water quality depend, to a large extent, on the actual working methods adopted. The preferred method of reclamation is to place fill directly on the marine mud, possibly surcharging in some areas, and inserting vertical wick drains to enhance consolidation rates. This method will minimise the amount of marine mud to be dredged and disposed.

It is probable that marine sand will be used for most of the reclamation, with the sand being placed hydraulically. The amount of suspended sediment in tailings from the reclamation will depend on the quality of marine fill used. Levels of suspended sediments will be less with better quality fill which has a low proportion of fines or if some of the fines are washed out at the borrow area. Impacts from placing fill could include increased turbidity and possibly an increased oxygen demand in the water column. These effects are expected to be only local to the reclamation site and impacts further field are not likely. The water bodies in the North Lantau area are not sensitive to levels of suspended sediments and data collected by EPD shows that natural levels of suspended solids vary widely. Local impacts from dredging and reclamation will vary phase by phase and these are discussed in more detail with the discussions below on impacts from each phase.

There will, nevertheless, be parts of the reclamation where marine mud will have to be dredged and sediment samples have been collected to identify any contaminated deposits that would need special treatment.

One sample exceeded the action level proposed in the Contaminated Spoil Management Study for cadmium. This was in the area of the First Phase reclamation and additional sampling and testing has been recommended. One other sample in the NLD Study Area showed cadmium concentrations above trigger levels. This was in the Siu Ho Wan area and it is recommended that further sampling and testing of sediments be carried out in this area during detail design for future reclamations and for the submarine outfall.

The Contractor will require a disposal licence, issued by the Environmental Protection Department, before disposing of surplus material. It may be necessary to use spoil disposal grounds some distance away from the works and fly tipping may become a problem. It is recommended that contract conditions include monitoring to ensure disposal is taking place at the allocated site and any necessary measures to minimise the impact on receiving water quality.

No specific mitigation measures are considered necessary for far field impacts from suspended sediments or from dredging and disposal of spoil. Mitigation measures appropriate for different phases of the project are discussed in more detail separately below. The following general mitigation should be included throughout the development:

(a) all reclamations should be designed to minimise dredging;

(b) contract conditions should included suspended sediment standards;

(c) baseline and impact monitoring should be carried out throughout all dredging and reclamation contract; and

(d) licences for the use of dumping grounds (issued by EPD) should included conditions designed to minimise fly dumping.

Prevention of fly dumping is very difficult unless inspectors are employed on every barge or dredger carrying spoil and this is very labour intensive and expensive. Penalty clauses can be included in contract conditions and spot checks carried out but these are unlikely to be wholly effective. There is probably no way that minor spills and leakages can be avoided but major infringments by contractors can be monitored by the installation of load cells on barges and dredgers connected to positioning systems such as the global positioning system (GPS). These will track the vessels and the location that spoil is dumped and the records can be submitted to the Site Engineer for inspection.

Monitoring at the dumping grounds will be necessary but procedures for this will depend on whether the dumping ground is allocated to the contractor for sole use or whether it is a gazetted dumping ground, such as Cheung Chau, which is being used by several contractors. In the former case it is appropriate for the contractor to survey the bathymetry of the dumping ground before dumping starts and on completion. Interim surveys, say at three month intervals, will be appropriate for the larger contracts. Monitoring for joint use dumping grounds will still be necessary but the responsibility for the monitoring is less clear. It may be more appropriate to let a separate monitoring contract but this needs to be reviewed on a case by case basis.

Water Quality Impacts from Work Sites

It has been assumed that work sites will be established at each development area. Possible water quality impacts include release of sediments or oil to water courses, streams or marine waters, accidental spillages to water courses and streams and disposal of domestic and construction wastes.

Sewage treatment and disposal facilities should be mandatory at each site. Contractors' should be required to connect on-site sewage disposal facilities to the foul sewers for treatment and final disposal at Siu Ho Wan unless they are prepared to treat sewage to an acceptable level on site. Effluent should meet the standards in the Technical Memorandum to be acceptable. Pretreatment of the effluent may be required in any case to comply with the effluent standards in the Technical Memorandum.

Solid wastes should be collected at a central refuse collection point on each development site for onward transfer to the Refuse Transfer Station at Siu Ho Wan. An alternative disposal method is burial in the reclamation.

Work sites associated with the industrial park could adversely affect water quality if pollutants are spilled or discharges made to the east of the site. Sensitive receivers include seawater or cooling water intakes which may be installed at the railway depot. If suspended solids levels in the adjacent water column exceed operating limits at the intake points, ameliatory action may be required.

To the west of this site sensitive receivers include the water body in Tai Ho Wan. At present ambient current velocities in this area are slow and any pollutants released into the embayment may take a long time before being dispersed. This area will be overlooked by passengers arriving at the New Airport as well as the high quality residential and commercial properties in the New Town and the visual impact of any pollution could be significant.

Mitigation measures proposed for work sites are:

(a) enforcement of the Technical Memorandum for all works sites;
(b) collection of domestic solid waste at a recognised central point for onward disposal at the RTS;
(c) use of stoplogs in drainage channels or streams to contain and then collect spillages or discharges;
(d) separation of surface water runoff using oil and grit separators; and
(e) inclusion of pollution control clauses in the contract conditions.

Phase 1 : Construction Impacts and Mitigation

Tai Ho East and Sui Ho Wan : Water Movement and Water Quality

The removal of seabed deposits and reclamation of Phase 1 land at Tai Ho East and Siu Ho Wan will have no significant impact on water movements or water quality during the construction phase.

Marine access will be required for the Refuse Transfer Station (RTS) site at the eastern end of the reclamation. It is unlikely that any changes in water movements would affect vessel handling.

Tai Ho Wan and Siu Ho Wan : Suspended Sediments

Phase 1 land required for the sewage treatment and water treatment works will be formed in Siu Ho Wan by the end of the third quarter of 1993; about 77,000 cu m of marine deposits will be removed over a six month period prior to filling. Assuming a six day working week, this is equivalent to just under 500 cu m per day. Given the relatively small volume and the fact that inshore velocities are small, the impact on the receiving waters will be minor.

Dredging will also be required prior to land formation seaward of the NLE for the refuse transfer station (RTS). Dredging works for the RTS are programmed to follow on from the sewage treatment works for a period of nine months. Assuming a six day working week, the average daily dredging rate for this reclamation is approximately 1,500 cu m. The loss of material at the dredging face would be approximately 1 to 2 cu m per hour assuming that grab dredgers are used.

Land reclamation will follow the dredging and a total of about 3 million cu m of marine sand will be placed. Sea walls will probably be constructed first to retain the fill. It is possible that a rehandling basin will be constructed close to the shore. Fill would be dumped into this basin and redredged and placed by a cutter suction dredger. Tailwaters from the marine fill will contain some suspended sediments but most of the sediment load will be deposited close to the reclamation.

There will clearly be some impact on the fish fry and benthic biota local to the site and the white dolphins which are occasionally seen in these waters but this is not likely to be significant unless an extremely large proportion of fines are released at the dredging work face or in marine fill tailwaters. The fish culture zones at Ma Wan are about 7.5 kilometres from Siu Ho Wan and are unlikely to suffer any impact as any sediment in the water column will be dispersed by the strong water currents in the approaches to the Kap Shui Mun channel.

Tung Chung : Water Movement and Water Quality

Dredging and reclamation for the works at Tung Chung is programmed to commence at the beginning of 1992 and to take about ten months. The seawall formation is scheduled to commence six months after the start of the dredging.

A temporary breakwater will be built at Tai Po to give shelter to contractors' boats and a public dumping area. Water movements in the embayment formed by the breakwater will be very small and there will be poor flushing. Floating rubbish and other pollutants will therefore tend to accumulate behind the breakwater. This is not likely to be a long term problem as the area will be filled in Phase 2.

The temporary pier at the mouth of the sea channel will need to be taken into account in the design of the sea channel as it will tend to disturb the water flow as it leaves the channel. This would not be a good location for a permanent pier but it is acceptable for a temporary facility.

Tung Chung : Suspended Sediments

Nearly 12 million cu m of marine mud will be dredged for the seawalls, culverts and other structures and some 5 million cu m of marine sand will be used in the reclamation. The construction method will probably be similar to that for Tai Ho East.

Peak current velocities in most of the reclamation area are low and are probably no more than about 0.1 - 0.2 m/s. Water quality will be poor locally during the construction of the reclamation with increased levels of suspended solids. The impact of this will not, however, be significant as there are no sensitive receivers locally. The contribution of this reclamation to the sediment load in the North Western Waters will be small in comparison with the new airport reclamation

Tung Chung : Ecology

During field trips as part of the ecological studies, sea grass (*Zostera Nana*) was found near to the pier west of Tung Chung Wan as detailed in previous sections. It is understood that the World Wide Fund for Nature are particularly interested in this and have made an application to have this designated a Site of Special Scientific Interest.

EPD water quality data taken offshore from Tung Chung show variations in suspended sediments from 0.5 mg/l to 40 mg/l. The range of suspended sediments inshore is likely to be at least as great. The sea grass is therefore currently thriving in a brackish environment with dramatic natural fluctuations in suspended solids concentrations in the water body and it is unlikely that construction activities associated with Phase 1 (which is over 1.5km away) will affect its survival chances unless there are massive loads of suspended sediments over a long period of time.

Phase 2 : Construction Impacts and Mitigation

Water Movements

Reclamation comprises all site formation for the first stage of the industrial park in area 9 and is scheduled (subject to the findings of the SARA Study) to commence in 1996 and is scheduled to be completed in 1998. This could affect local water movements and it is expected that exchange of water between the large embayment formed to the east and mainstream flows will be slow. Within central Tung Chung the land formation will be on land which will have no impact on water movements with the exception of diversions of stream courses and construction of new drainage channels in Tung Chung. In east Tung Chung land formation of Planning Areas 15 and 19 will commence in 1993 and will be on reclamation. These works will reclaim the embayed area formed by the Phase 1 development although this reclamation is unlikely to affect water movements either during or after construction. Reclamation methods should aim to limit the water quality impact on the adjacent water column.

Mitigation measures proposed to minimise water movement impacts should include:

(a) those common to all phases discussed above; and

(b) attention to detail of the seawall alignment of the first stage of the industrial park at Tai Ho and of the Phase 2 reclamation in east Tung Chung.

Water Quality

Construction of the first stage of the industrial estate by means of reclamation could create water quality impacts. These will lead to an increase in suspended solids, increased turbidity and an increased oxygen demand in the water column adjacent to the reclaimed area. However, such impacts could be reduced by limiting the extent of dredging prior to land formation and adoption of reclamation methods to limit the impact on the adjacent water column detailed above. Of particular importance should be the maintenance of existing quality in the embayment between the east of the Phase 2 reclamation and the Phase 1 reclamation in the vicinity of the Refuse Transfer Station site. This is considered to be a sensitive water body as it is predicted that water exchange between the embayment and the mainstream flows will be low. Discharge into this embayment should wherever possible be avoided. Any necessary inputs into this sensitive embayment would build up as their dilution or dispersal would be slow so any discharges should be strictly controlled by the enforcement of the Technical Memorandum on Effluent Standards.

Additionally, site formation and work sites could also affect water quality in drainge channels and streams.

Mitigation measures to minimise water quality impacts should include:

(a) those common to all phases discussed above;

(b) attention of detail of newly formed temporary or permanent seawalls;

(c) impact monitoring in the embayed area east of the Phase 2 reclamation comprising the second stage of the industrial park and continuation of impact monitoring in East Tung Bay while marine based construction work is undertaken; and

(d) control of drainage channels where construction works are undertaken via silt traps and stoplogs when necessary to prevent polluted, silty discharge waters, especially into Tung Chung Wan.

Drainage

Water quality impacts arising from the limited Phase 2 extension of the drainage system in Tung Chung via existing stream diversions and diversions to existing drainage channels. These activities will generate silty downstream waters.

Mitigation of drainage associated water quality problems could be via the use of silt traps and stoplogs where monitoring indicated significant deleterious impacts or when spillages occur.

Phase 3 : Construction Impacts and Mitigation

Water Movements

Reclamation for the second stage of the industrial park could affect local water movements and it is expected that exchange of water between the bay formed to the east and mainstream flows will be slow.

Part of the existing intertidal mudflat in Tai Ho Wan will be reclaimed for development of Planning Area 11. Water movements within the bay are likely to be affected both during and after construction.

Extensive reclamation in this phase has the potential to adversely affect flows in Tung Chung Wan and in the sea channel.

Planning Areas 30, 31, 32, 41, 42 and 65 will all be developed on existing land. Consequently impacts will be restricted to diversion of stream courses and the building of new drainage channels. Planning Area 29, designated as open space, will require a small area of reclamation alongside the sea channel. It is unlikely this area will affect flow rates either during or after construction. Planning Areas 33, 34, 35 and 36 in Tung Chung Wan will be, at least in part on reclamation. All these areas require diversion of the existing drainage channels but alterations to the flow regime will only be local. The method of reclamation and the alignment of the temporary seawalls will determine the extent to which flows out of Tung Chung Wan are affected. Small embayments will be formed both east and west of Area 36. Alterations to flow in this area combined with diversions created by the small island in the sea channel may have an impact, albeit temporary, on water quality.

In the east of the Sea Channel an artificial island (3.3 hectares) is proposed to form part of the town park (Planning Area 28). Hydraulic design of the channel to the south of the island will require particular attention given to maintaining flow through the secondary channel. One of the hinterland drainage culverts will discharge into this channel and this will improve flushing during the wet season.

Formation of land in Planning Areas 15, 16, 18, 19, 20, 58 behind the breakwater constructed in Phase 1 will have little impact on water movements either during or following construction.

Mitigation measures to minimise water movement impacts should include:

(a) those common to all phases discussed above;

(b) attention to detail of seawall alignment particularly at the industrial park in Tai Ho and at Tai Po; and

(c) alignment of the seawall of the channel island to maintain flow both in the secondary channel and in the sea channel.

Water Quality

Construction of the second stage of the industrial estate could create water quality impacts similar to those identified for Phase 2. The embayment to the east will be partly filled and it is likely that flushing of any pollutants from this area will be extremely slow.

Land within Tai Ho Wan will be formed by drained reclamation techniques. The drainage channel to the east should be maintained and care will be required to ensure this channel does not become polluted.

Site formation and works sites could affect water quality in drainage channels and streams, while reclamation may create high turbidity levels in Tung Chung Wan. Reclamation in Tung Chung Wan could affect the viability of the sea grass at San Tau and cause sedimentation in the sea channel. The sea grass is presently thriving in a marine environment in which suspended solids levels vary seasonably and it is considered this species is probably highly

tolerant of fluctuating water quality including salinity regime. However, impact monitoring is recommended whenever marine based activities are undertaken in Tung Chung Wan. If the suspended solids levels rise more than 30 per cent above ambient levels, mitigation measures may be required to protect this species.

The exchange of water between Tung Chung Wan and the Sea Channel and ultimately the main stream marine environment will be slow. Pollutants could be retained within these waters for a long period of time before being dispersed or diluted. Visual intrusion will be an important factor by this stage. Unless controlled, floating refuse could litter the coastline, particularly in the Sea Channel. Similarly construction of the residential developments adjacent to Tai Po could have an impact on water quality, especially in terms of aesthetics. Ambient current velocities in this area are probably only of the order of 0.1 - 0.2 m/s. Consequently dispersion and dilution of pollutants will be limited and it is more likely that deposition will occur close to the site.

Mitigation measures proposed to minimise water quality impacts should include:

(a) those common to all phases discussed above;

(b) attention to detail of the seawall alignment in Tung Chung;

(c) impact monitoring in the Sea Channel, San Tau, Tung Chung Wan, Tai Ho Wan and adjacent to any seawater intakes; and

(d) control of drainage channels where construction works are undertaken to prevent the discharge of drainage waters containing silt and other pollutants particularly to Tung Chung Wan. Use of temporary silt traps or stoplogs when necessary.

Drainage

Impacts on water quality from extension of the drainage system in both Tai Ho and Tung Chung during Phase 3 will be from diversion of existing streams and drainage channels and discharge of waters polluted with silt.

Mitigation measures similar to those proposed for Phase 2 should apply.

Phase 4 : Construction Impacts and Mitigation

Water Movements

The seawall at Tai Ho has been designed to create visual interest. However two partial embayments will be formed and these should be considered in more detail during detail design with the objective of sustaining, and if possible, enhancing flow of water in this area to maintain water quality.

Developments in Tai Ho Wan are expected to exert impacts similar to those discussed in Phase 3. The artificial lake at Pak Mong will be designed and constructed during Phase 4. Flow and pollution loads monitoring of the streams entering the lake and sea water outside the lake will be needed so that an environmental design may be carried out. Any drainage control structures should be designed to maximise flushing of the lake and no pollution loads from adjacent development should be allowed into the lake. The lake should also be designed to maintain the wetlands at Pak Mong. Otherwise land formed in Tai Ho Wan (Planning Areas 12, 13, 14 and 15), designated for residential and recreational purposes, is unlikely to have other than a minor impact on water movements.

Reclamation of land seaward of the NLE and west of the railway depot will be undertaken during this phase (Planning Areas 17 to 29 inclusive). Formation of the land has the potential to alter water movements out of the lake at Pak Mong. The design of the seawall in this area will require careful attention to detail to maximise flushing of the bay formed due west of the site and the artificial lake.

Reclamation of Planning Areas 37, 45, 46 and 47 in Tung Chung Wan will complete the drainage design for Tung Chung Wan and flow of water into the sea channel should improve.

The residential, commercial and open space in Planning Areas 51 to 57 due east of the ferry terminal would affect local water movements and water exchanges with the sea channel. This will depend upon the final shape of the sea wall and the seaward extent of the reclamation. Both aspects require further detailing at a later stage.

Mitigation measures to minimise water movement impacts should include:

(a) those common to all phases discussed above; and

(b) attention to detailing the final alignments of seawalls throughout but particularly in Tung Chung Wan, inner East Tung Chung Bay and in the Pak Mong area.

Water Quality

Phase 4 will see the completion of most of the reclamation and land formation presently proposed for the New Town and the partial embayments at Tai Ho Wan and Tung Chung Wan will be filled with the exception of the Phase 5 area in Tung Chung. This will remove most of the areas where water exchange could be poor and water quality along the sea frontage of the New Town will generally improve so long as the sea walls are designed to maximise flow as recommended above.

Construction of reclamation in Tung Chung Wan could impact on water quality due to sedimentation in the sea channel and the proposed SSSI. Impact monitoring is recommended during these works in the sea channel and adjacent to the site of the proposed SSSI.

Mitigation measures similar to those proposed for Phase 2 and 3 should apply.

Drainage

Drainage systems will be substantially completed during this fourth phase. If the water feature has not been created as part of the Phase 2 developments it will be built during this phase. It is proposed that this will include a control structure such as a rubber dam which will have the additional function of being a pollution control mechanism once operational.

Mitigation measures similar to those recommended for Phase 2 should apply.

Phase 5 : Construction Impacts and Mitigation

Water Movements and Sedimentation

Phase 5 will be the completion of the development as it is presently envisaged. There are no fundamental residual water movement impacts as it is considered that the design of the development has resolved all the main issues. Residual impacts therefore relate mainly to uncertainties surrounding sedimentation rates due to the modification in the tidal regime following formation of the New Airport platform and NLD reclamations.

Sedimentation rates within East Tung Chung Bay and the Sea Channel should be monitored on an annual basis and an audit of the efficiency for the sea channel, to flush both itself and the adjacent water bodies, should be carried out. Maintenance dredging of the Sea Channel and the navigation channel to the ferry terminal at Tai Po will probably be required but the frequency and quantities involved remain uncertain.

Water Quality

The main pollution loads from the New Town will enter the water body via the sewage outfall. Preliminary assessments of sewage flows and loads were based on the residential and employment forecasts given in LDPC Paper 20/90. The accuracy and reliability of such forecasts requires professional judgement to be applied when determining levels of sewage treatment. Although recourse was made to some of the WAHMO models, these are also based on many assumptions. Monitoring of flows and loads and receiving waters is thus recommended so that the programme for upgrading of sewage treatment works may be reviewed. Monitoring of water quality in East Tung Chung Bay will allow an audit of the efficiency of the Sea Channel.

The water features at Tai Ho Wan and Tung Chung Wan should enhance the environmental quality of the development. However, it is not certain whether the Pak Mong wetlands, which comprise the main ecological feature in this area, will be able to sustain life in the mainly freshwater habitat or indeed whether there will be sufficient ingress of seawater to maintain the brackish conditions in which mangrove communities thrive. This needs to be taken into account in the detail design of the lake.

Drainage

There should be no residual drainage impacts or impacts from Phase 5 construction.

Mitigation of Water Quality Impacts

Some components of the developments have the potential to adversely affect water movement and water quality during construction as detailed in the previous sections. Proposals for mitigation measures are made in the following paragraphs for each major component of the development for mitigation measures with the aim of minimising impacts. These proposals are not intended to form an exhaustive list, rather to highlight areas requiring specific attention. Furthermore they do not preclude the need for environmental assessments and impact monitoring which are discussed further in Section 8.

Work Sites

The main impact on water quality from work sites will be from effluent discharges and spillages. Inclusion of clauses covering the following mitigation measures is recommended in all contracts:

(a) ensure liquid and solid wastes arising on-site are properly disposed of;

(b) ensure liquid domestic wastes are treated to comply with the Technical Memorandum on Effluent Standards;

(c) dispose of any chemical wastes at the Chemical Waste Treatment Facility planned for Tsing Yi;

(d) dispose of solid waste at a central refuse collection point or in parts of the reclamation;

(e) provide adequate and appropriate pollution control equipment to deal with accidental spillages both on and off-site;

(f) monitor water quality, during marine based activities, to ensure his operations are not creating adverse impacts on water quality in the Sea Channel, Tung Chung Wan or East Tung Chung Bay;

(g) undertake impact monitoring in Tung Chung Wan, the Sea Channel and East Tung Chung Bay as appropriate;

(h) arrange that oily or bituminous wastes are cleaned and re-used or sent to either a landfill site or the Chemical Waste Treatment Facility on Tsing Yi Island for disposal;

(i) minimise the risk of marine pollution by floating refuse possibly by installation of refuse booms;

(j) prepare a spill action plan to handle potentially polluting spillages including any made to drainage channels;

(k) provide basic pollution control equipment to clean up spillages; and

(l) provide access to a cleaning team in the event of spillages or clean up of floating refuse.

Phase 1

The following Phase 1 mitigation measures have been identified:-

(a) impacts from dredging and reclamation works at Tai Ho East, Sui Ho Wan and Tung Chung are not likely to be significant unless there are excessive levels of suspended sediments in tailwaters from marine fill or at dredging faces. This is unlikely to happen but clauses should be included in the construction contracts empowering the Engineer to take action if necessary;

(b) pollution from the construction support facility and general work sites could be significant. Effluents should be controlled through contract clauses and contractors should be advised in their contracts that Table 10a of the Technical Memorandum "Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters" will be used as a standard firstly to approve their proposals and secondly for monitoring;

(c) contractors should maintain proper equipment and trained staff to clean up accidental spillages and should submit a spill action plan for approval prior to start of the works or construction of any facilities;

(d) floating refuse booms should be used to contain floating debris form dumping activities inside the breakwater;

(e) a cleaning team should be set up to be used on the Engineer's instructions to clean up floating debris or rubbish on beaches and shorelines that cannot be attributed to any one contractor;

(f) facilities proposed by operators for the construction support facility should be subject to environmental review and provisions for effluent control and monitoring should be included in lease conditions; and

(g) baseline and impact monitoring should be carried out by the Engineer for turbidity, temperature, salinity, dissolved oxygen and suspended solids. Additional data should be collected to monitor pollution levels in effluents from the construction support facilities and possibly works sites.

Phase 2 : Industrial Park

The following should be taken into account:

(a) adoption of reclamation methods to limit the impact on the adjacent water column;

(b) limiting the extent of dredging prior to land formation;

(c) maintaining flows out of Tai Ho Wan and minimising potential ingress of pollutants via control drains;

(d) all clauses relating to work sites;

(e) undertaking impact monitoring adjacent to the work site and in Tai Ho Wan when required;

(f) impact monitoring in front of any seawater intake points, eg at the railway depot, for the duration of marine based construction activities;

(g) if suspended solids levels in the water column adjacent to the aforementioned intake points rise above levels, agreed before commencement of the works, then consideration may need to be given to either altering working methods causing the problem or installation of temporary silt curtains for the duration of the works;

(h) provide personnel trained in the use of basic pollution control equipment kept on-site; and

(i) compliance of any off-site discharges with the Technical Memorandum. Discharges should not be made to either bays east or west of the site.

Phase 2 : Tung Chung

In Tung Chung Wan Phase 2 works are land based activities. Action required to limit water quality impacts relate to:

(a) clauses a, b, c, d, e and h given above for work sites;

(b) general site cleanliness; and

(c) separation of silt and grease from surface water runoff to comply with standards given in the Technical Memorandum.

Phase 2 : Tai Po

For the development in Tai Po behind the breakwater, Planning Areas 9, 14, 17, 21 and part of 18 and 19, the following actions are proposed:

(a) adoption of all clauses relating to work sites;

(b) particular attention given to floating refuse, installation of refuse nets and the routine collection of water borne litter to prevent it spilling into inner East Tung Chung Bay; and

(c) impact monitoring in inner East Tung Chung Bay while marine based construction work is undertaken.

Phase 3 : Extension of the Industrial Park

The conditions proposed in Phase 2 will apply.

Phase 3 : Tai Ho Wan (Planning Area No. 11)

Within Tai Ho Wan consideration will need to be given to the following:

(a) all clauses relating to work sites;

(b) adoption of drained reclamation technique; and

(c) use of stoplogs in the existing drainage channel in the event of spillages;

Phase 3 : Artificial Island for Town Park

During the creation of the artificial island, Planning Area No. 28, particular attention will need to be given to:

(a) all clauses relating to work sites;

(b) adoption of reclamation techniques to minimise the impact on water quality within the Sea Channel;

(c) impact monitoring in the sea channel, inner East Tung Chung Bay and adjacent to the site of the sea grass at San Tau, when marine works are undertaken; and

(d) should the ambient suspended solids concentrations in the water column increase by more than 30% then consideration may have to be given to installation of silt curtains.

Phase 3 : Other Areas in Tung Chung

In Tung Chung Wan construction of Planning Areas 33, 34, 35 and 36 require attention to be given to:

(a) all clauses relating to work sites apply;

(b) reclamation methods adopted should minimise the impact on water quality;

(c) impact monitoring should be undertaken for the duration of all marine based activities in Tung Chung Wan, the sea channel and particularly at San Wau; and

(d) mitigation measures should be adopted if the level of suspended solids rises more than 30% above ambient.

Phase 3 : Upper Tung Chung Valley

Development of Planning Areas 41, 42 and 65 will require attention to be given to:

(a) clauses a, b, c, d, e and h for work sites;

(b) use of temporary silt traps or stoplogs to prevent pollutants being conveyed by drainage channels; and

(c) compliance with the standards set in the Technical Memorandum for any discharges made to the existing stream course.

Phase 3 : Tung Chung East

Construction of Planning Areas 15, 16, 18, 19, 20 and 58 in East Tung Chung Bay will require attention given to the following:

(a) all clauses relating to work sites;

(b) impact monitoring undertaken in East Tung Chung Bay as well as the sea channel when marine based activities are being undertaken; and

(c) supply of personnel trained in the use of basic pollution control equipment and the routine collection of refuse and floating debris.

Phase 4 : Siu Ho Wan

Final formation of land in Siu Ho Wan and for the industrial park will require similar conditions to those given for phase 2.

Phase 4 : Tai Ho Wan

In Tai Ho Wan development of Planning Areas 12, 13, 14 and 15 will require special attention given to:

(a) all clauses relating to work sites;

(b) adoption of drained reclamation techniques;

(c) minimising the potential impact on water quality in the artificial lake during development;

(d) impact monitoring of water quality in the artificial lake for the duration of the water based construction phase; and

(e) use of a pollution control mechanism if any pollutants are accidentally released into drainage channels.

Phase 4 : Planning Areas 17 to 29

Land formation for the development of Planning Areas 17 to 29 inclusive, will require particular attention to be given to:

(a) all clauses relating to work sites;

(b) adoption of reclamation methods which will have mininum impact on receiving water quality;

(c) maintenance of flows within the area, especially from the artificial lake;

(d) rapid response to spillages especially those from the west of the site;

(e) impact monitoring adjacent to the site and especially close to the inlet of the Pak Mong artificial lake; and

(f) impact monitoring in front of any seawater or cooling water intakes which may be located within a 2 kilometre radius of the work site.

Phase 4 : Planning Areas 51 to 57

For the construction of Planning Areas 51 to 57 inclusive, east of the Tai Po ferry pier, account will need to be given to:

(a) all clauses relating to work sites;

(b) adoption of reclamation methods to minimise the impact on water quality and local flows;

(c) impact monitoring in East Tung Chung Bay and the sea channel; and

(d) consideration given to altering work methods if local water quality is affected.

Key Issues and Conclusions of Water Quality Construction Impact Assessment

Key issues identified during the foregoing assessment include:

(a) the final alignment of seawalls will be critical for the maintenance of flow between the Sea Channel island and the mainland;

(b) similarly alignment of seawalls is important at the industrial park, the area seaward of Pak Mong lake and east of the Tai Po ferry pier;

(c) during construction most of the potential water quality impacts relate to land formation and operation of work sites;

(d) impact monitoring is especially recommended when marine based construction activities are undertaken.

Conclusions identified during the assessment include:

(a) Short term impacts on water movements and water quality will mostly be resolved by successive developments.

(b) Residual impacts on the flow regime consequent to development of the four phases, relate principally to alterations in sedimentation rates. Areas most likely to be affected include the Sea Channel, and the secondary channel as well as East Tung Chung Bay.

(c) Residual water quality concerns relate to the future assimilative capacity of the marine water body.

(d) Monitoring of effluent from development on North Lantau especially at the industrial park is recommended.

(e) Water quality monitoring during and following construction and development in each phase will be necessary to maintain standards in the North Western Waters in general, and in the Sea Channel, Tung Chung Wan, East Tung Chung Bay and Tai Ho Wan in particular.

E3.3 Construction Noise Impacts and Mitigation

Construction noise could produce an adverse impact on the existing village settlements and the new noise sensitive development. Tung Chung and Tai Ho will be developed in five phases with construction commencing in 1992 and extending beyond 2011. Figures E19 and E20 show the phasing and location of the work sites.

Topic Report TR18 (Revised) assessed the construction noise impact from the first phase development using eleven noise neighbourhoods in North Lantau. This is detailed below.

Phase 1 Construction Noise Impact Assessment and Mitigation

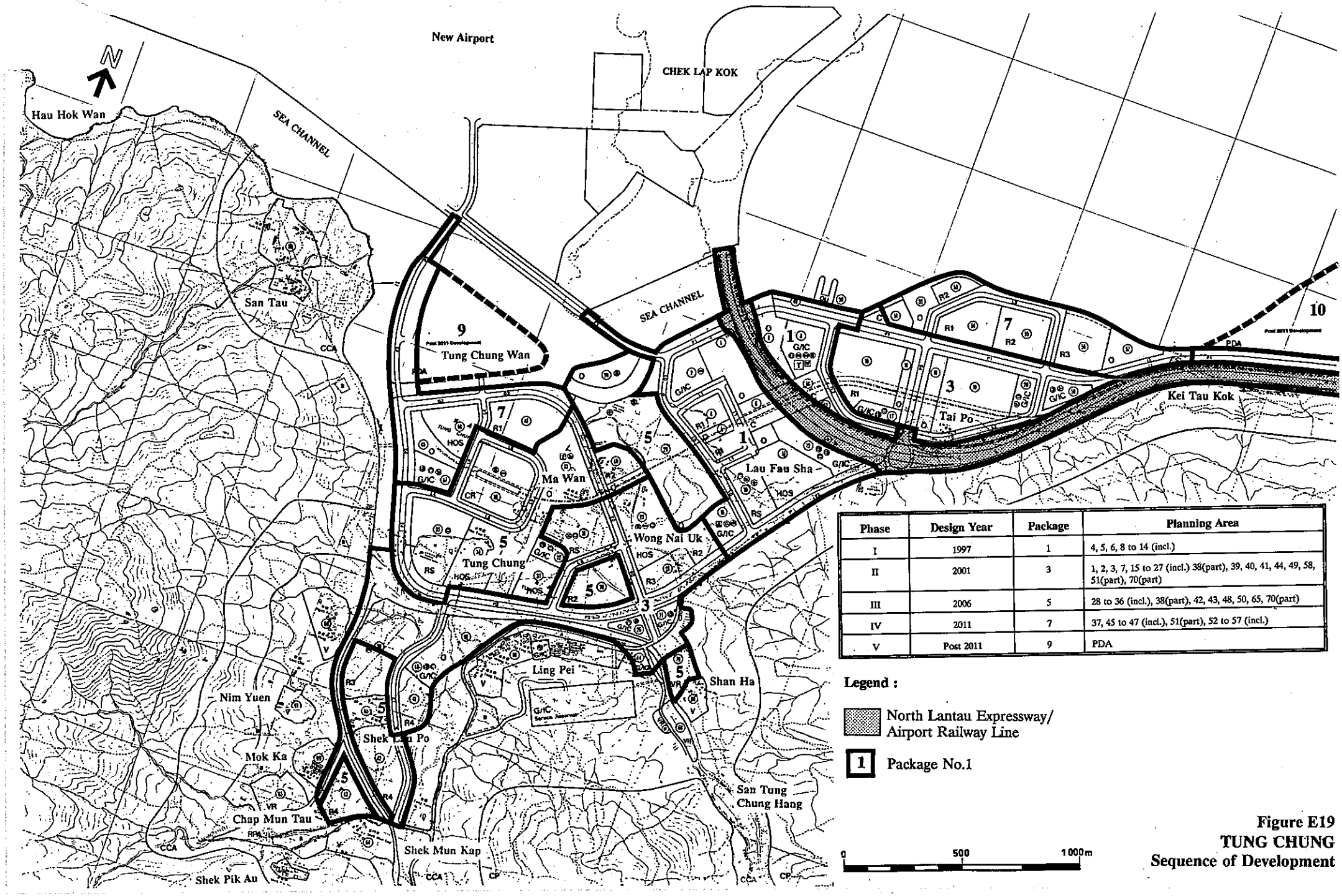
Impacts

As there is considerable uncertainty over the construction programme to be adopted by the contractor, noise levels have been predicted for single activities only. The predicted noise levels at all neighbourhoods (indicated on Figure E21) are summarised at the end of this section. Noise levels from infrastructure and building works have been assessed even though they will not be included in the present contract. Construction activities are shown on Table E7 and predicted noise levels are shown on Table E8.

The highest noise level of 83 dB(A) is predicted to occur at N1 (Figure E21) during rock excavation for Tung Chung Land Formation. However, this activity may not be a critical activity and therefore may not need to work more than 12 hours a day. High noise levels are also predicted to occur at N1 during site formation in Tung Chung. This activity, again, may not be critical and therefore may not normally need to operate in the restricted hours.

Dredging and reclamation using marine plant in Tung Chung will require 24-hour working. The predicted noise levels are 66 dB(A) at N1 but no higher than 50 dB(A) at other locations. A number of other activities will cause noise levels greater than 50 dB(A) at N1.

Other noise sensitive areas are not predicted to be exposed to high noise levels partly because of distance effects and partly due to screening by the local topography.



Phase	Design Year	Package	Planning Area
I	1997	1	4, 5, 6, 8 to 14 (incl.)
II	2001	3	1, 2, 3, 7, 15 to 27 (incl.) 38(part), 39, 40, 41, 44, 49, 58, 51(part), 70(part)
III	2006	5	28 to 36 (incl.), 38(part), 42, 43, 48, 50, 65, 70(part)
IV	2011	7	37, 45 to 47 (incl.), 51(part), 52 to 57 (incl.)
V	Post 2011	9	PDA

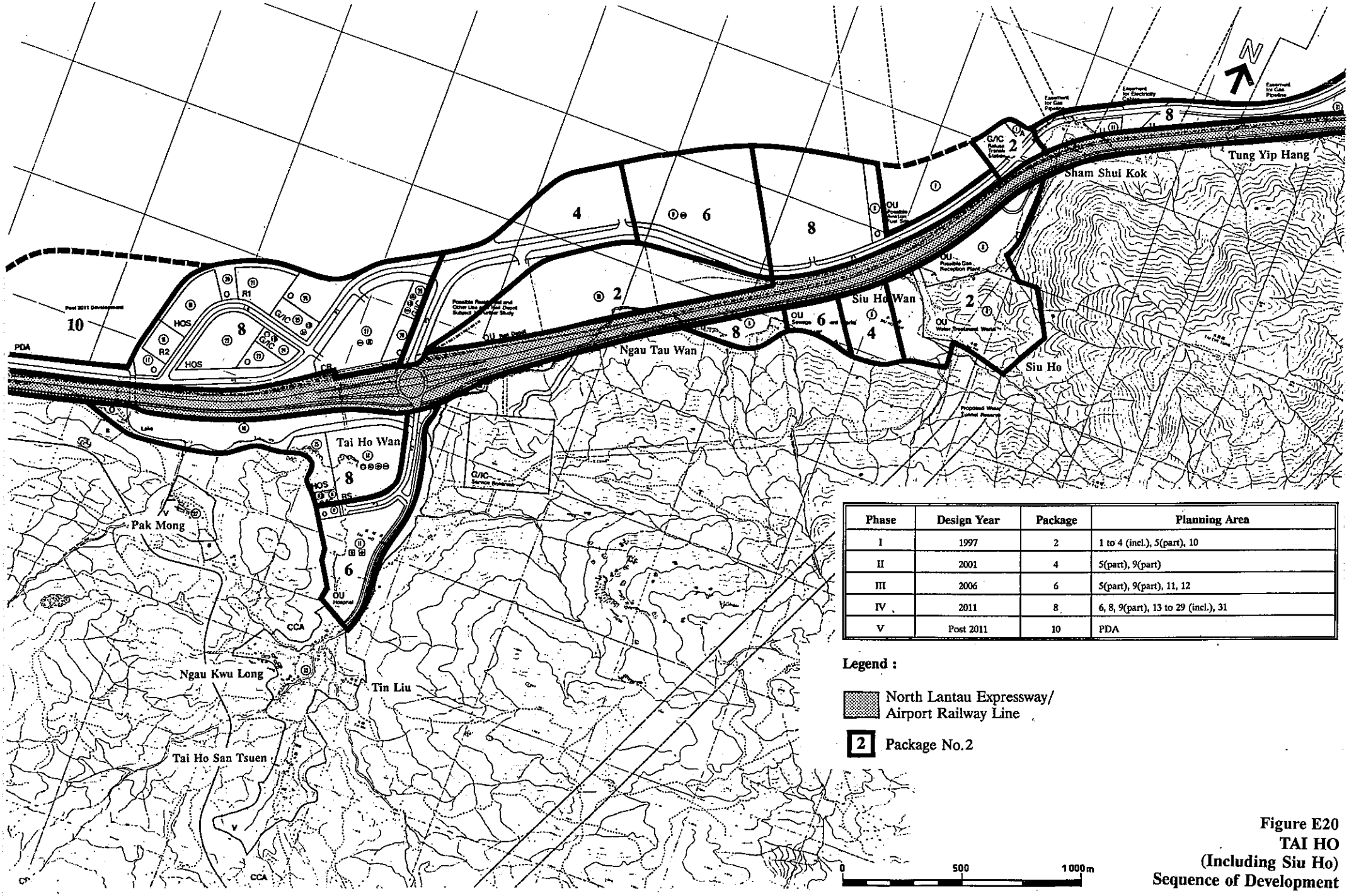
Legend :

North Lantau Expressway/ Airport Railway Line

1 Package No.1

0 500 1000m

Figure E19
TUNG CHUNG
Sequence of Development



Phase	Design Year	Package	Planning Area
I	1997	2	1 to 4 (incl.), 5(part), 10
II	2001	4	5(part), 9(part)
III	2006	6	5(part), 9(part), 11, 12
IV	2011	8	6, 8, 9(part), 13 to 29 (incl.), 31
V	Post 2011	10	PDA

Legend :

North Lantau Expressway/
Airport Railway Line

2 Package No.2

Figure E20
TAI HO
(Including Siu Ho)
Sequence of Development

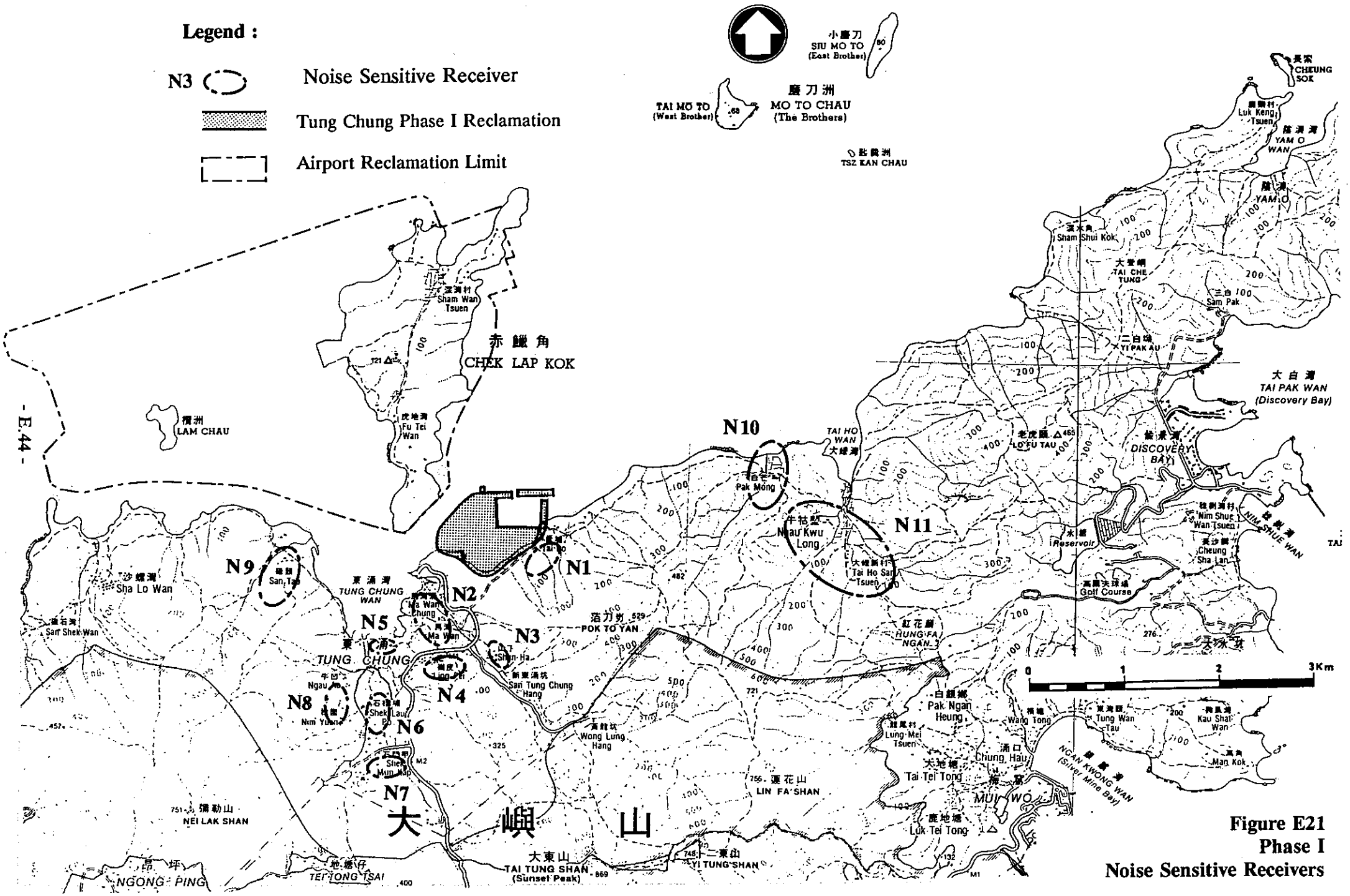


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Figure E21
Phase I
Noise Sensitive Receivers

Table E7 Major Construction Activities for Phase 1

CONSTRUCTION ACTIVITIES	
ACTIVITY I.D.	ACTIVITY DESCRIPTION
A.1	Tung Chung Phase I Reclamation
A.1.1	Seawall
A.1.2.1	Site Formation
A.1.2.2	Reclamation
A.1.3	Concrete
A.1.4	Road Paving/Asphalt
A.1.5	Infrastructure/Building
A.1.6	Piling
A.1.7	Dredging
A.2	Phase I Tung Chung Land Formation
A.2.1	Rock Excavation
A.3	Temporary Ferry Pier
A.3.1	Piling
A.3.2	Concrete
B.1	Sewage Treatment Works at Siu Ho Wan
B.1.1	Seawall
B.1.2	Reclamation
B.1.3	Concrete
B.1.4	Road Paving/Asphalt
B.1.5	Infrastructure/Building
B.1.6	Piling
B.1.7	Dredging
B.2	Refuse Transfer Station at Sham Shui Kok
B.2.1	Seawall
B.2.2	Reclamation
B.2.3	Concrete
B.2.4	Infrastructure/Building
B.2.5	Piling
B.2.6	Dredging
B.3	Rail Depot at Siu Ho Wan
B.3.1	Seawall
B.3.2	Reclamation
B.3.3	Concrete
B.3.4	Road Paving/Asphalt
B.3.5	Infrastructure/Building
B.3.6	Dredging
B.4	Water Treatment Works at Siu Ho Wan
B.4.1	Soil Excavation
B.4.2	Rock Excavation
B.4.3	Concrete

Table E8 Predicted Noise Levels for Single Activities for Phase 1

ACT.I.D.	N1a	N1b	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11
A.1.1	70	67	51	43	43	50	40	37	45	51	37	34
A.1.2.1	80	83	63	58	56	62	52	49	57	63	49	47
A.1.2.2	64	68	47	42	40	46	36	34	41	47	33	31
A.1.3	65	69	48	43	41	47	37	35	42	48	34	32
A.1.4	53	56	36	31	29	35	25	22	30	36	22	20
A.1.5	76	80	59	54	52	58	48	46	53	59	45	43
A.1.6	74	77	57	51	49	55	46	43	50	57	42	40
A.1.7	65	68	48	42	40	46	37	34	41	48	33	31
A.2.1	74	77	78	66	65	67	60	58	60	60	53	51
A.3.1	55	55	41	38	37	38	35	33	35	46	34	31
A.3.2	58	57	43	41	40	40	37	36	37	48	36	34
B.1.1	25	24	18	18	17	17	16	16	16	26	25	25
B.1.2	44	43	37	37	36	36	35	35	35	45	44	44
B.1.3	32	31	25	25	24	24	23	23	23	33	32	32
B.1.4	21	20	14	14	13	13	12	12	12	22	21	21
B.1.5	39	39	32	33	32	32	31	30	31	41	39	40
B.1.6	39	38	31	32	31	31	30	30	30	40	39	39
B.1.7	28	27	21	21	20	20	19	19	19	29	28	28
B.2.1	32	31	25	25	24	24	24	23	24	34	31	31
B.2.2	39	38	32	32	32	32	31	31	31	41	38	38
B.2.3	30	29	23	23	22	22	21	21	21	31	29	29
B.2.4	36	36	30	30	29	29	28	28	28	38	35	36
B.2.5	37	37	31	31	30	30	29	29	29	39	36	36
B.2.6	27	26	20	20	19	19	18	18	18	28	26	26
B.3.1	38	37	30	30	29	29	28	28	28	38	52	50
B.3.2	50	50	43	43	42	42	41	41	41	51	63	62
B.3.3	44	33	26	26	25	25	24	24	24	34	46	45
B.3.4	24	23	16	16	15	15	14	14	14	24	36	35
B.3.5	42	41	34	35	34	34	33	32	33	43	55	54
B.3.6	35	35	28	28	27	27	26	25	26	36	48	47
B.4.1	42	41	35	35	35	34	34	33	34	44	42	42
B.4.2	54	52	47	47	46	46	46	45	46	55	53	54
B.4.3	37	36	30	30	29	29	29	28	29	39	36	37

Note : Shaded noise levels are those which exceed the ANL of 50 dB(A) in Period 2

Under normal circumstances the only activity which will require 24 hour working will be the dredging and reclamation. However the construction programme for the Phase 1 is tight and contractors may need to work for 24 hours on many activities to meet unforseen delays. Any delay to completion of these works would delay construction of other critical components of the Airport Core Projects and would therefore be unacceptable.

Percussive piling has been predicted to produce no higher than 85 dB(A) at the noise neighbourhoods. According to TM2, daytime piling will be permitted.

Activities which could not work in the restricted periods are shown in Table E9.

Table E9 Activities Which Could Not Work in the Restricted Periods

Activity		Period 1	Period 2
Code	**Description**		
	Tung Chung		
A.1.1	Seawalls	*	*
A.1.2.1	Site Formation	*	*
A.1.2.2	Reclamation	*	*
A.1.3	Concrete placing	*	*
A.1.6	Piling	*	*
A.1.7	Dredging	*	*
A.2.1	Rock Excavation	*	*
A.3.1	Piling	*	*
A.3.2	Concrete placing (ferry pier)		*
	Tai Ho East/Siu Ho Wan		
B.3.1	Seawalls		*
B.3.2	Reclamation		*
B.4.2	Rock Excavation		*

Mitigation

The contractor should have the flexibility to work 24 hours on the critical activities and some form of mitigation will therefore be necessary. Mitigation at source is difficult for these activities. The reclamation works will be carried out initially in open water and the site formation will use mobile plant which is difficult to screen or silence. Nevertheless the contractor should be encouraged to silence all equipment items on site by enclosures, baffles, mufflers or silencers, particularly if night works are required. Also quiet equipment should be employed for the construction work as far as practical.

The above assessment has shown that the proposed construction activities are unlikely to cause significant noise impacts on the existing villages in North Lantau except at Tai Po and the neighbouring Youth Camp which could be exposed to higher noise levels because of their close proximity to the works sites. Other villages are further from the works sites or are well screened by the local topography and therefore would not experience high noise levels.

Most activities should not require 24-hour working and normally would only work for 12 hours a day, 6 days a week. The reclamation works in Tung Chung and Tai Ho East/Siu Ho Wan will require 24-hour working and other activities may require 24 hour working.

Mitigation at receivers must therefore be considered. This would comprise insulation of the receivers firstly by installing and operating airconditioners and secondly by adding window insulation. Airconditioners allow windows to be closed at night so that the sound proofing effect of the windows can be used. Insulation of windows provides further sound insulation. Table E10 shows the noise levels that would be acceptable with sound insulation.

Table E10 ANLS with Sound Insulation

Method of Insulation	Maximum Allowable Noise Levels (dB(A))	
	Period 1	Period 2
Airconditioners	65	60
Airconditioners and Window Insulation	75	70

The two activities which are most likely to need 24 hour working are reclamation and site formation in Tung Chung. The maximum noise levels from these activities will exceed those in Table E10 as follows:-

(a) site formation will cause noise of 80 dB(A) at Tai Po and 83 dB(A) at the Youth Camp.

(b) reclamation will cause noise of 64 dB(A) at Tai Po and 68 dB(A) at the Youth Camp.

Reclamation and site formation could last from the start of the works in early 1992 to late 1993.

Sound insulation comprising airconditioners and window insulation will be needed at Tai Po and the Youth Camp to allow these activities to proceed at night and it is recommended that these are installed. Approximately 19 properties in Tai Po would qualify. Of these 10 are permanently occupied and the remainder are occupied at weekends and holidays. The contractor would then be able to work to a noise levels of 70 dB(A) and 75 dB(A). These are less than the predicted levels but it is considered that a reduction to this level could be effected by additional mitigation at source. This could include working away from sensitive receivers or using fewer plant items during the restricted periods.

These properties are due to be relocated in 1993, little more than a year after the start of construction. The NAMP Consultants have also recommended sound insulation but their works will not start until after the First Phase. The sound insulation therefore needs to be carried out for the First Phase construction if restrictions on the contractor are to be avoided. Early relocation of these properties is not possible due to statutory notice periods and the lack of suitable relocation sites.

Noise from Construction of Phase 2 and Subsequent Development Phases

Following the Phase 1 development, there will be a need to address the impact on NSRs in the Phase 1 development. Meanwhile, many of the existing village settlements in North Lantau which fall within the development areas will have been cleared or resited. For example, Tai Po will be relocated during Phase 1, Ma Wan and Wong Nai Uk will be resited during the Phase 2 and Ma Wan Chung and Sha Tsui Tau will be resited during Phase 3. Due consideration has been given to the interaction of the development phasing in order to minimize any unnecessary impact.

Civil engineering works for each phase will comprise reclamation/dredging and cutting/excavation activities. The construction noise assessment has assumed that the subsequent phases of development will comprise similar activities to those in Phase 1 as discussed in NLDS TR18 (Revised) and detailed above.

Reclamation/dredging will include:

(a) dredging of marine mud underneath sea walls using grab dredgers;

(b) seawall construction by dumping from barges, followed by placing fill from derrick barges;

(c) reclamation by sand filling placed hydraulically over the marine mud;

(d) access road construction; and

(e) concrete placing for drainage channels and infrastructure construction.

Cutting/excavation will include soft excavation and rock excavation using excavators loading materials into dump trucks. Access road construction and concrete placing is likely to be required. Drilling for rock blasting is also included in order to present a worst case noise scenario.

On the basis of the construction methods for Phase 1 development, similar activities and sub-activities have been developed for Phase 2 and all the subsequent phases, together with a list of powered mechanical equipment. Facade noise levels from construction activities for Phase 2 and subsequent phases are presented in Topic Report TR20 (Tables C1-C21) and the results are discussed later.

Reclamation and dredging will require 24-hour working under normal circumstances, while other activities will normally be carried out during the daytime (0700-1900 hours). However, contractors may need to extend the working hours in order to make up for any loss of time due to bad weather or unforeseeable delays. Under the latter situation, the contractors will have to apply for a construction noise permit and the Noise Control Ordinance will have to be fully complied with.

According to the Technical Memorandum on 'Noise from Construction Work Other Than Percussive Piling', the ANLs for the works excluding percussive piling are as detailed in Table E11.

Table E11 Acceptable Noise Levels for Construction Works Other Than Percussive Piling

Period \ ASR	A	B	C
All days during the evening (1900 to 2300 hours), and general holidays (including Sundays) during the day-time and evening (0700 to 2300 hours)	60	65	70
All days during the night-time (2300-0700 hours)	45	50	55

Twelve village groups which cover all existing village noise sensitive receivers likely to be affected by the construction of Phase 2 onwards in the Study Area have been identified. They include all the existing village settlements in Tung Chung, Tai Ho Wan and Siu Ho Wan. The locations of these village groups are shown in Figure E22. In addition new noise sensitive receivers have been referred to by Planning Areas which are indicated on the RODP.

As the development progresses, NSRs in the developed areas will need to be included and the relocated villages will need to be excluded from the list of NSRs. Due consideration has been given to identifying all of the NSRs which are likely to be affected by each phase of the development.

Additionally, it should also be noted that from the end of Phase 1, the area will change from a rural/low density residential area, Type "A" development, to a high density residential area consisting of low rise or isolated high-rise (urban) developments, Type "B" development. Thus the Area Sensitivity Rating for the construction noise assessment after the first occupation of Phase 1 should be Type "B" development.

After the first occupation of Phase 1 the only Type "A" developments will be when villages or other low density development are located close to the construction works. Under these circumstances the Type "A" criteria will be applicable.

The calculation methodology is similar to that described in Topic Report TR18 (Revised). The predicted noise levels, Leq(5-min.), at the facade of the worst-affected NSR have been compared with relevant noise criteria.

No details of the need to work in restricted periods are available at the present time so this assessment has assumed that reclamation and dredging could be working throughout the non-restricted period and the restricted periods but that other activities would work only until 2300 hours. This allows for the situation where contractors may wish to work beyond 1900 hours to catch up lost time. This is not likely to happen for all activities and will only happen for part of the construction. However the assessment is for the worst case. Noise levels of 50 dB(A) have therefore been used to test reclamation and dredging activities and 65 dB(A) has been used to test other activities at residential receivers.

Normal daytime activities are not commonly of major concern except at schools, hospitals and the like. The likely impacts on these receivers have been assessed by taking a daytime noise criterion of 75 dB(A) as measured at the facade of the receivers.

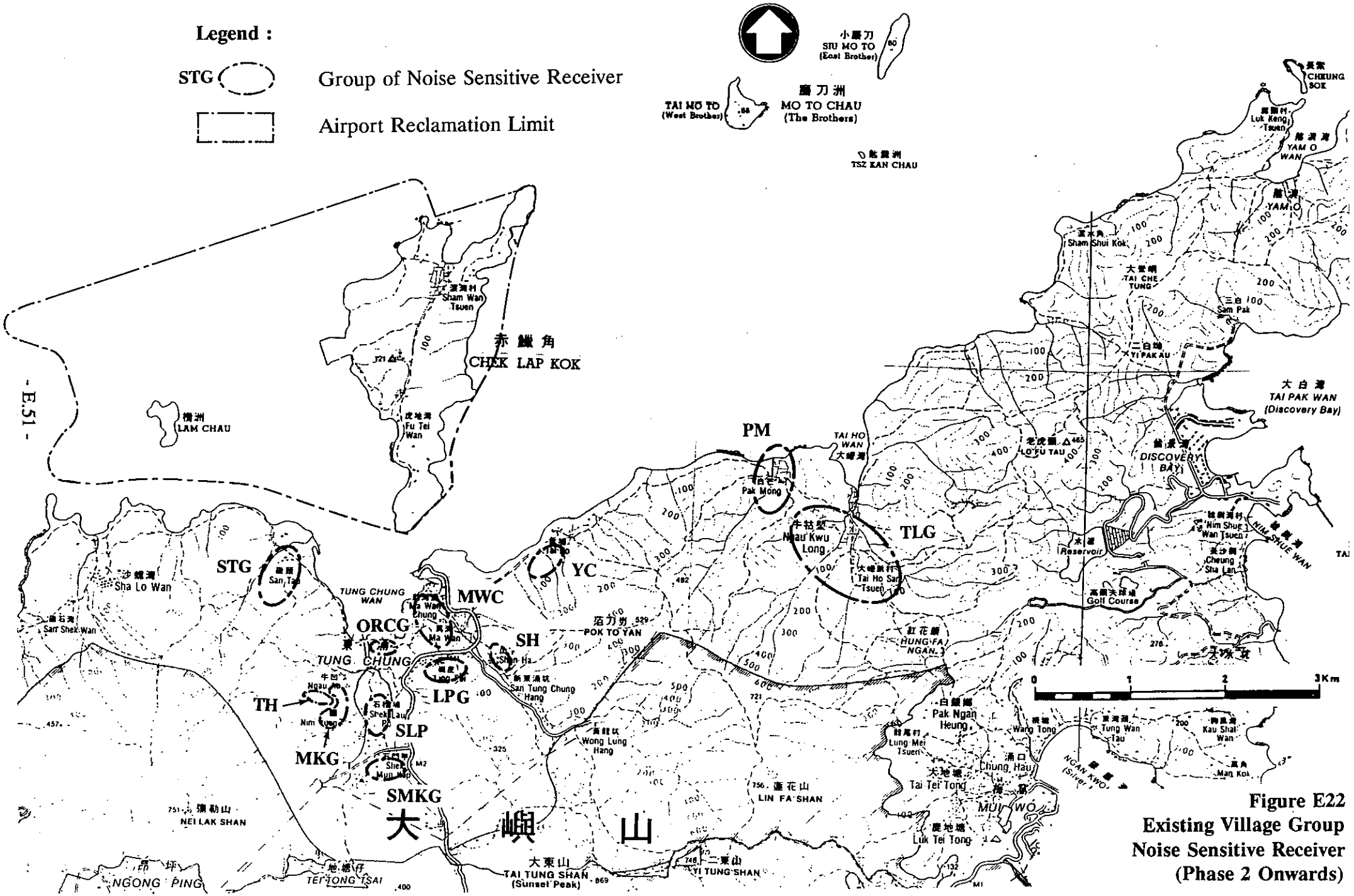


Figure E22
Existing Village Group
Noise Sensitive Receiver
(Phase 2 Onwards)

Phase 2 Impact Assessment and Mitigation

Impacts

Phase 2 will consist of two work sites in Tung Chung and Tai Ho, numbers 3(a) and 3(b) and 4(a) and 4(b) respectively, as indicated on Figures E19 and E20.

The predicted facade noise levels for all the worst-affected NSR by each of the work sites areas are summarised below.

Tai Po village will be relocated during Phase 1 and the Ma Wan and Wong Nai Uk villages resited during Phase 2 and therefore all these have been excluded from the list of affected receivers under Phase 2.

Work on sites 3(a), 4(a) and 4(b) will be mainly reclamation/dredging which will occur on a 24 hour basis. Work on site 3(b) will be mainly cutting/excavation which under normal circumstances will only occur during daytime.

The following NSRs will receive noise from Phase 2 works in excess of the ANL:

- o most NSRs from work site 3(a) and 4(a) and 4(b) reclamation;
- o Youth Camp from all work site 3(a) activities except road paving;
- o Planning Areas 4, 10 and 11 from work site 3(a) dredging and also from both NSRs for 4(a) dredging;
- o Planning Areas 4, 10, 11 and 12 from work site 3(a) infrastructure works and also from both NSRs for 4(a) infrastructure;
- o all NSRs from work site 3(b) rock excavation;
- o all NSRs from work site 3(b) soil excavation and infrastructure works except Planning Areas 4, 11 and 12 and at San Tau, Tin Sam and Kau Liu village group; and
- o road paving from work site 3(b) lead to exceedances only at Ma Wan Chung village group, Sheung Ling Pei, Ha Ling Pei, Wong Ka Wai and Lung Tseng Tau village group and Skek Mun Kap and San Keng village group.

Mitigation

Effective noise mitigation would be required for the reclamation work to be carried out over 24 hours during Phase 2. The Youth Camp will require noise insulation to protect this property during Phase 2 if 24 hour working is to be allowed.

Night-time working for Phase 2 work site 3(b) cutting/excavation and soil excavation and infrastructure works is not recommended unless there is very effective noise mitigation and control on site. Similarly, for work site 4(a) infrastructure works will usually only occur during daytime and will require very effective noise mitigation and control on site to allow night-time working.

Phase 3 : Impact Assessment and Mitigation

Impacts

Phase 3 development will consist of four work sites in Tung Chung 5(a) to 5(d) and three at Tai Ho, 6(a) to 6(c), as indicated on Figures E19 and E20. The predicted facade noise levels for all the worst-affected NSR by each of these work areas are summarised below.

Ma Wan Chung and Sha Tsui Tau will be relocated during this phase and therefore both have been excluded from the list of affected receivers under this package.

Work sites 5(a), 6(a) and 6(b) will be mainly reclamation/dredging. Work sites 5(b) and 6(c) will consist of both reclamation/dredging and cutting/excavation. Work sites 5(c) and 5(d) will be mainly cutting/excavation.

The following NSRs will receive noise from Phase 3 works in excess of the ANL:

- all NSRs from work sites 5(a), 5(b), 6(a) and 6(b) reclamation;
- all NSRs from work sites 5(b), 5(c) and 5(d) rock excavation;
- all NSRs from work site 5(b) dredging, infrastructure works and soil excavation except planning areas 4 and 43;
- Planning Areas 23 and 24 from work site 5(b) seawall construction and concreting works;
- San Tau, Tin Sam and Kau Liu village group and Planning Areas 4, 23 and 24 from work site 5(a) dredging and infrastructure works;
- Planning Area 4 from work site 5(a) seawall construction;
- all NSRs from work site 5(c) infrastructure works and soil excavation except planning areas 23, 24 and 25;
- road paving from work site 5(d) lead to exceedances only at Sheung Ling Pei, Ha Ling Pei, Wong Ka Wai and Lung Tseng Tau village group and Skek Mun Kap and Mok Ka, Nim Yuen, Tung Hing and Ngau Au village group;
- Tin Liu, Ngau Kwu and Tai Ho San Tsuen village group from all work site 6(c) activities except road paving; and
- Pak Mong village group from dredging, reclamation and rock excavation at work site 6(c).

Mitigation

Effective noise mitigation would be required for the reclamation work to be carried out over 24 hours during Phase 3 at all NSRs and for dredging works at some NSRs. Night-time working for Phase 3 infrastructure works, rock and soil excavation, seawall construction and road paving are not recommended unless very effective noise mitigation and control on site are instigated.

Phase 4 : Impact Assessment and Mitigation

Impacts

Phase 4 development will consist work sites 7(a) and 7(b) at Tung Chung and a 8(a) to 8(f) at Tai Ho, as indicated on Figures E19 and E20. The predicted facade noise levels for all the worst-affected NSR by each of these work areas are summarised below.

Work sites 7(a), 7(b), 8(a), 8(b) and 8(d) will be mainly reclamation/dredging. Work on site 8(e) is for the man-made lake and therefore would be mainly dredging and seawall construction. Work on sites 8(c) and 8(f) would consist of both types of work. Mainly two existing noise neighbourhoods and a proposed hospital in Tai Ho would be affected by work on sites 8(a) to 8(f). Predicted noise levels are generally lower for Phase 4 than other Phases.

The following NSRs will receive noise from Phase 4 works in excess of the ANL:

- all NSRs from work sites 7(a), 7(b), 8(a), 8(b), 8(c), 8(d), 8(f) reclamation;
- all NSRs from work site 7(a) infrastructure works;
- all NSRs from work site 7(a) seawall construction except Planning Area 17;
- all NSRs from work site 8(f) rock excavation;
- Planning Area 58, 19 and 15 from work site 7(a) dredging;
- Planning Area 58 from work site 7(a) concreting works;
- all NSRs except Planning Area 4 from work site 7(b) dredging and infrastructure works;
- all NSRs except Planning Area 4 and Tung Hung village group from work site 7(b) seawall construction;
- Planning Areas 23, 24, 35 and 36 from work site 7(b) concreting works;
- Pak Mong village group from work site 8(e) dredging and seawall construction;
- Planning Area 11 from work site 8(e) dredging;
- Pak Mong village group from infrastructure works from work site 8(d);
- Planning Areas 24 from work site 7(b) road paving;
- Tin Liu, Ngau Kwu and Tai Ho San Tsuen village group and planning area 11 from work site 8(f) rock excavation and infrastructure works; and
- Planning Area 11 from work site 8(f) seawall construction and concreting works.

Mitigation

Effective noise mitigation would be required for the reclamation work to be carried out over 24 hours during Phase 4 at all NSRs and for dredging works at some NSRs. Night-time working for Phase 4 infrastructure works, rock and soil excavation, seawall construction and road paving are not recommended unless very effective noise mitigation and control on site are instigated.

Phase 5 : Impact Assessment and Mitigation

Impacts

The fifth phase of development is the post 2011 development and this would be carried out under work site 9 for Tung Chung and work site 10 for Tai Ho, as indicated on Figures E19 and E20. The predicted facade noise levels for all the worst-affected NSR under work site 9 and work site 10 are summarised below.

Work on site 9 and 10 will consist of mainly reclamation/dredging type of work.

The following NSRs will receive noise from Phase 5 works in excess of the ANL:

- all NSRs from work sites 9 and 10 reclamation;
- San Tau, Tin Sam and Kau Liu village group and Planning Areas 46, 47, 48 and 4 from work site 9 dredging;
- all NSRs from work site 10 dredging except Planning Areas 22, 15, T55, T54, T58, T19 and T20;
- Planning Areas 18, 19 and 21 from work site 10 and Planning Areas 46 and 47 from work site 9 seawall construction;
- Planning Areas 18 and 19 from work site 10 and Planning Areas 46 and 47 from work site 9 concreting; and
- Pak Mong village group and Planning Areas 18, 19 and 21 from work site 10 and San Tau, Tin Sam and Kau Liu village group and Planning Areas 46, 47, 48 and 4 from work site 9 infrastructure works.

Mitigation

Effective noise mitigation would be required for the reclamation work to be carried out over 24 hours during Phase 5 at all NSRs and for dredging works at some NSRs. Night-time working for Phase 5 infrastructure works, rock and soil excavation, seawall construction and road paving are not recommended unless very effective noise mitigation and control on site are instigated.

Mitigation of Impacts During Phase 2 and Subsequent Phases

There are a number of methods of noise mitigation available to contractors ranging from the use of silenced plant to noise screens. Details of construction activities are not sufficiently well developed at the present time to define specific methods of mitigation; these details will not become available until detail design for each contract has started.

Noise mitigation proposed therefore falls under two broad categories:-

- the NCO should apply in its entirety to all construction contracts and no exemptions should be permitted. Construction contracts should also specify a maximum noise level of 75 dB(A) at any sensitive receiver during periods not controlled by the NCO; and
- contracts should be designed, phased and planned to minimise noise.

The latter of these requires that noise considerations should be taken into account at an early stage in the design for each contract. The works should be designed to minimise noisy activities. Contract periods should additionally be designed to allow contractors sufficient time to programme their works so that noisy activities are not necessary at night and so that there is sufficient time to carry out these activities during the daytime with plant numbers reduced to avoid excessive noise.

It should be possible to plan the works so that activities such as rock drilling and site formation can be programmed to meet these objectives without any cost penalty. Dredging and reclamation are traditionally carried out over 24 hours to maximise the use of the capital intensive equipment and greater care will be needed in programming these activities to minimise noise. The objectives should be achievable if contractors are allowed sufficient time to carry out the works. This can lead to the use of smaller numbers of plant and if they are allowed sufficient flexibility to programme their works so that, for example, any activities needing 24 hour working can be located further away from sensitive receivers.

From Phase 2 onwards construction will be constrained by the presence of both the existing and new noise sensitive receivers. Effective noise mitigation and control on site will be required for the works to be carried out within the constraints of the Noise Control Ordinance.

Reclamation is likely to produce unacceptable noise levels at the facade of the adjacent NSR during 24-hour working and 24 hour working should not be permitted unless the noise levels in the NCO can be achieved.

The assessment has assumed the worst case where any activity could continue into the evening. Contractors will normally wish to complete all activities using daytime working to avoid the extra costs of working at night and therefore the worst case will only materialise on infrequent occasions.

E4 OPERATION IMPACTS AND MITIGATION

E4.1 Operation Air Quality Impacts

Details of how the exceedances of AQOs were predicted are included in NLDS TN3.

General Findings

The AQO's contain additional limits for 24-hour averaged concentrations but these have not been considered where 1-hour limits exist as the 1-hour AQO has been taken as the limiting condition. The 24-hour averaged concentrations for RSP have been derived by averaging the 1-hour averaged values over 50 wind directions.

Table E12 shows air quality predictions at the ten receptors (see Figure E23) compared with the AQOs. Concentrations are predicted for ground level. As only low level sources are considered, concentrations above ground will be equal or lower than predicted for ground level. The concentrations are also illustrated in Figure E23. No AQO's exist for VOC. VOC concentrations are presented as yearly averaged to indicate the likely levels.

Table E12 Air Quality in the Study Area plus Comparison with AQO's

receptor	Concentrations ($\mu g/m^3$)							
	NO_2		VOC	CO	SO_2		RSP	
	yearly average	1-hour average	yearly average	1-hour average	yearly average	1-hour average	yearly	24-hour average
1	29	187	14	814	21	505	8	50
2	27	205	14	1112	20	950**	8	67
3	27	171	12	701	13	261	7	44
4	31	204	14	1891	18	473	8	52
5	30	200	13	1487	17	392	7	48
6	23	187	11	1125	14	322	6	42
7	24	172	10	980	12	289	5	38
8	22	168	10	904	11	278	5	37
9	19	156	9	722	10	270	4	31
10	23	178	12	2390	13	422	5	42
AQO	80	300	-	30,000	80	800	55	180

Source : Consultants' Assessments
* 24-hourly average
** 800 $\mu g/m^3$ to be exceeded 5 hours per year

Carbon Monoxide

The concentrations for CO will be well below permitted levels. The highest predicted level of 2390 $\mu g/m^3$ will occur at receptor point 10 close to Sha Lo Wan village. This high level results from New Airport emissions. It is considered that levels of CO will not pose a constraint on future development within the NLD Area.

Respirable Suspended Particulates

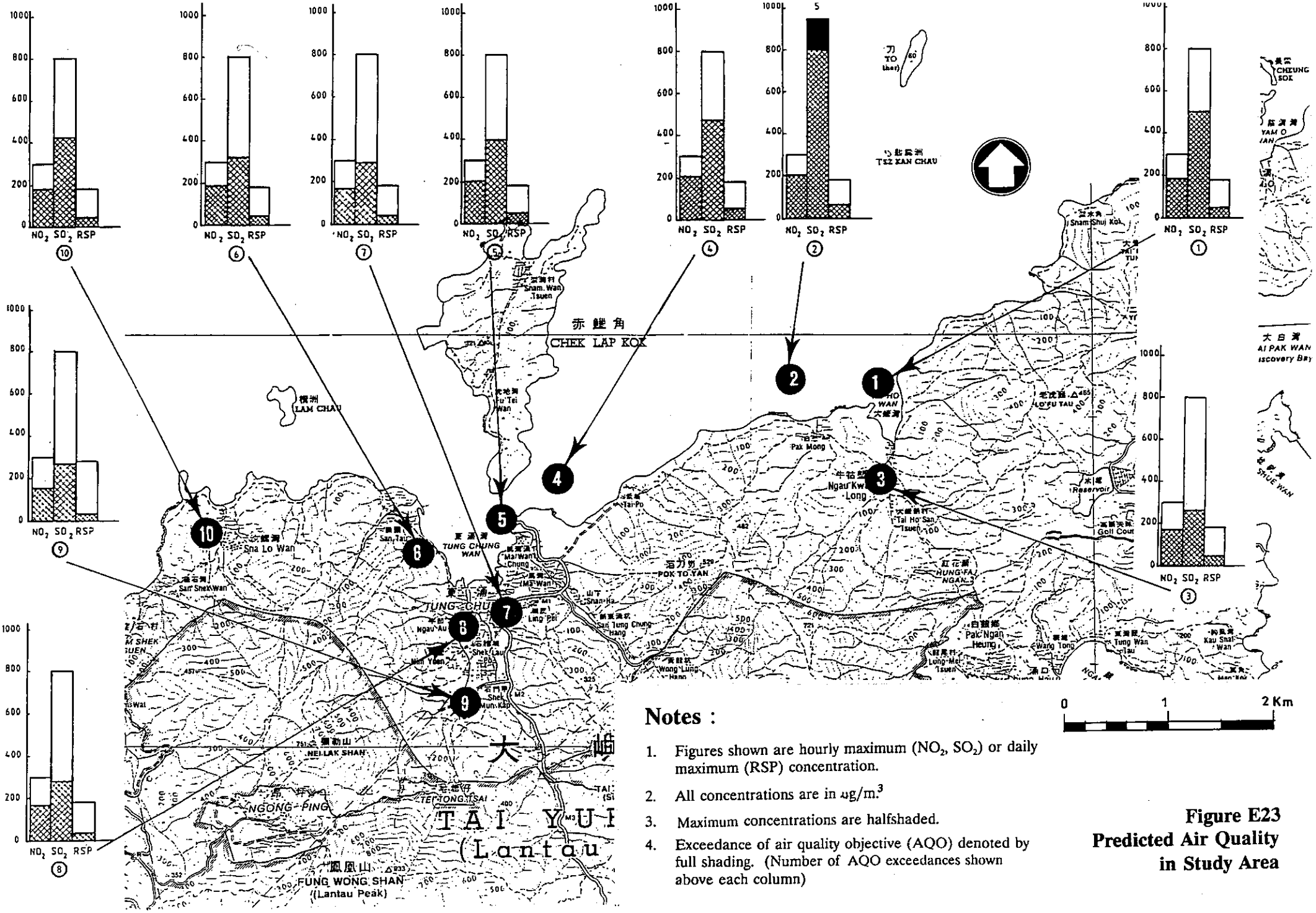
Twenty four hour levels range from 31 $\mu g/m^3$ to a maximum of 67 $\mu g/m^3$ at receptor site 2 near Pak Mong. Levels are low in comparison with the AQO of 180 $\mu g/m^3$. It is considered that concentrations of RSP will not pose a constraint on future development within the NLD Area.

Nitrogen Dioxide

The highest level of NO_2 is 205 $\mu g/m^3$ (1-hr) at receptor site 2 near Pak Mong with relatively high levels at receptor points 4 and 5 near Tai Po and Ma Wan Chung. These are due to the NLE and the background contribution at the 60° wind direction. In general, impacts from the NLE occur during westerly winds on the Tai Ho Wan area and during north easterly winds in the Tung Chung area. However, none of the predicted levels at receptor locations exceed the hourly or yearly AQOs.

The results from the NLE Environmental Impact Study indicate levels in exceedance of the 1-hour and 24-hour AQOs directly alongside the NLE. Figure E24 (from the NLE EIA Study) shows the reduction in NO_2 concentrations with distance from the NLE.

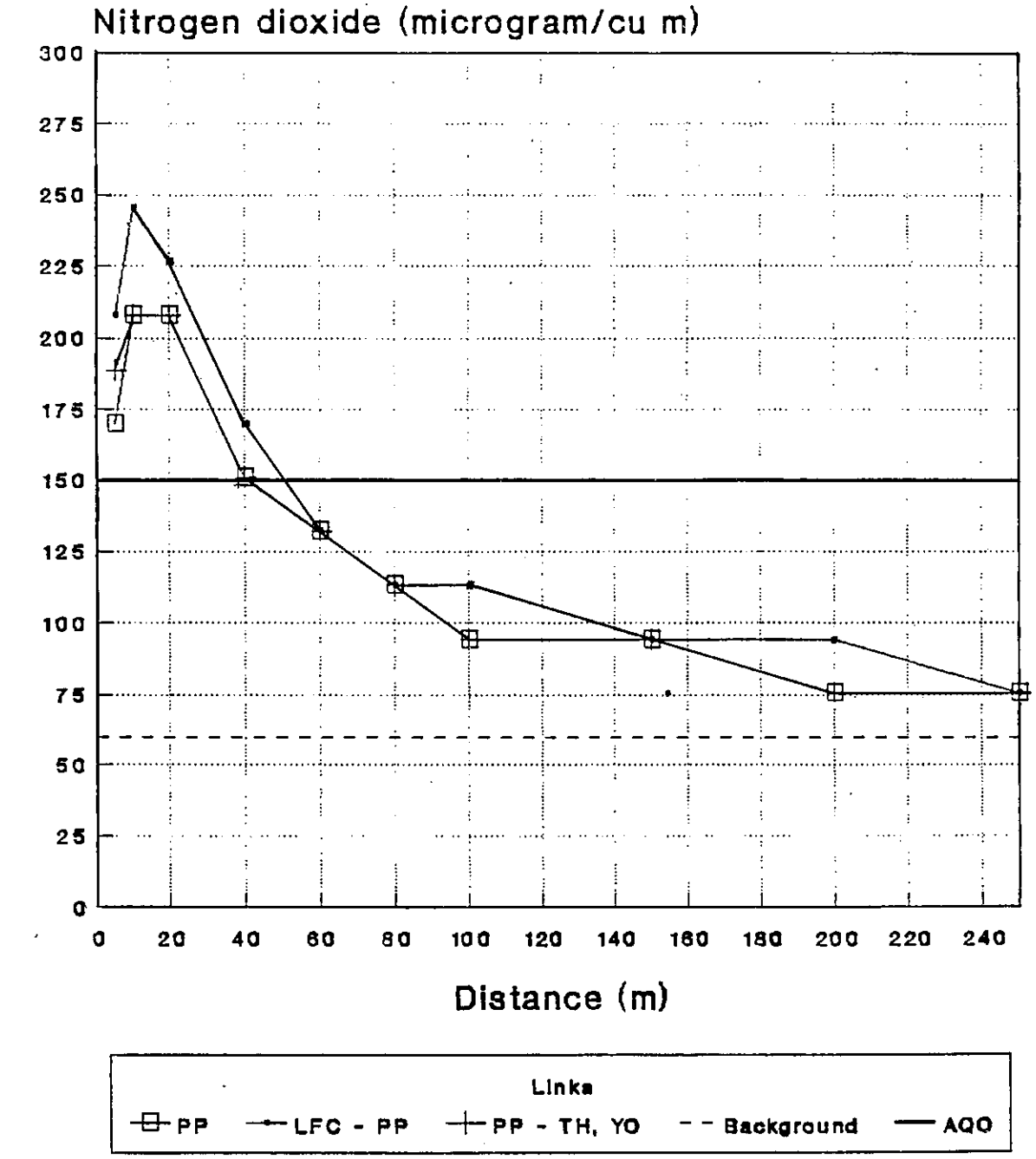
The NLE EIA results show that a set back distance of approximately 40-45 metres from the centre of the NLE will be necessary for the development of any sensitive land use adjacent to the NLE. However, considering that the distance from the centre of the NLE to the highway boundary (including either the railway or service road on one side of the NLE) is approximately 30 metres, the constraint imposed by NO_2 emissions from the NLE is unlikely



Notes :

1. Figures shown are hourly maximum (NO_2, SO_2) or daily maximum (RSP) concentration.
2. All concentrations are in $\mu g/m^3$
3. Maximum concentrations are halfshaded.
4. Exceedance of air quality objective (AQO) denoted by full shading. (Number of AQO exceedances shown above each column)

Figure E23
Predicted Air Quality in Study Area



Note: PP - Port Peninsula Road,
LFC - Lantau Fixed Crossing,
TH - Tai Ho, YO - Yam O.

Figure E24
Setback Distance Due to NO_2 Levels

to be major. The predicted set backs required for noise impact mitigation alongside the NLE are likely to be greater than the air quality constraint distance of 40-45 metres.

Junction layouts for the NLE have yet to be finalised and these could be open areas within the boundary of the NLE where, for example, recreation facilities could be built. It is likely that AQOs will be exceeded at these locations. The HKPSG should be followed in determining suitable uses for these areas and it is considered that neither active nor passive recreation should be used although the areas could be used for amenity.

Sulphur Dioxide

The highest level of SO_2 is 950 $\mu g/m^3$ (1-hr) at receptor site 2 near to Pak Mong. This concentration is in excess of the 1-hour AQO ($800\mu g/m^3$) and will occur for approximately 5 hours per year. This high level results primarily from SO_2 emissions derived from the Siu Ho Wan industrial estate area, which will impact on the Tai Ho Wan - Pak Mong area during north easterly winds and also during north westerlies. Details of alternatives to prevent exceedance of AQOs, adjacent to the proposed Siu Ho Wan industrial developments, are detailed later. The pollutant concentration windroses also show that background levels of SO_2 from outside the Study Area will form a substantial part of SO_2 contributions within the NLD Area during certain wind directions although this is not the case in the instance of AQO exceedance.

High SO_2 concentrations at receptor sites 4, 5 and 10 result from westerly to northerly winds bringing SO_2 from industrial developments of Chek Lap Kok South. However, these levels are well below the 1-hour and 1-year AQOs for SO_2.

Volatile Organic Carbons

There are no AQOs for VOC. It is, therefore, not possible to determine the significance of the predicted VOC emissions, although it would appear that the levels are considerably lower than comparative European objectives.

Impact at Other Locations

The air quality improves rapidly with increasing distance from the New Airport, the NLE and the industrial sites and impacts within the Country Parks will be relatively small. This is illustrated by the improved air quality at receptor sites 3, 9 and 10. However, it should be noted that the impact from the BPPS and CPPS may be much higher on hillsides. This has not been rigourously tested in this Study and it is understood that this impact will be assessed by the BPPS Consultants in their operational stage assessment.

The Preferred Concept Plan avoided the location of high rise residential land uses in recirculation zones. The air quality assessment highlighted potential problems and in view of this the RODP has avoided the location of high density, high rise residential land uses in the areas in Tai Ho Wan and Tai Po where recirculation could, under certain unfavourable circumstances, lead to unacceptable air quality. Additionally, the recirculation zone at Tai Ho is considered to be very limited and no large emissions take place within this zone, so no unacceptable impacts are foreseen. The recirculation zone at Tai Po mainly covers the hill side where no residential areas are foreseen. The residential areas are east of the NLE. The NLE might increase pollutant levels on the hill side, but comparison of figures showing recirculation zones and residential areas, lead to the conclusion that this will not extend to the residential area.

Odour

There could be odours from the sewage treatment works and the refuse transfer station but the impact of these will be minimal due to their distance station but the impact of these will be minimal due to their distance from sensitive receivers. There could also be odours from unburnt fuel from aircraft and it is understood that this will be considered by the AMPS Consultants.

Mitigation Measures

General Measures

Neither CO nor RSP emissions will have significant environmental impacts by 2011 on the NLD Area. No special mitigatory measures will therefore be required and there will be no constraints on future development from these pollutants.

Concentrations of SO_2 near to and associated with the industrial areas at Siu Ho Wan are predicted to exceed AQOs for about 5 hours per year and thus it is recommended that the use of solid fuel (coal) should be prevented and the use of distillate oil and fuel oil should be restricted below specified limits (detailed below) and the use of LPG and town gas should be stipulated. Additionally, relatively high SO_2 concentrations are predicted close to the New Airport.

Nitrogen dioxide concentrations are likely to be significantly below the AQOs. However, according to the detailed results of the NLE-EIA Study, concentrations of NO_2 immediately adjacent to the NLE are likely to exceed the AQOs and could constrain development in these areas. NO_2 concentrations will reduce away from the NLE, however and a setback distance of around 40-45 metres from the centre of the NLE will be necessary for the development of any sensitive land use adjacent to the NLE. At this distance noise will be the main constraint on development.

Main air quality impacts originate from: the background (including power stations) the New Airport, the NLE and local industry.

Potential mitigation measures to be considered are:

- desulphurisation and denitrification of all proposed power stations;
- reduction of road traffic by encouraging use of the railway. The availability of an attractive railway connection between the New Airport and the mainland is important from the point of view of air quality. The assessment has assumed that the rail link will be operational when the New Airport opens. Any deferral of the railway will increase traffic on the NLE with a corresponding increase in air pollution;
- the early development of an efficient road based public transport system is also recommended as it will contribute to reductions in private traffic on the NLE;
- the use of two way catalytic converters (TWCC) is already assumed. For diesel engines, clean technologies are also expected to be developed. Application of those technologies is recommended;
- only very limited information on industry types has been available for this assessment. Certainly air pollution from industrial sources should be controlled but it is difficult to make definite recommendations until the industry mix is known. In

broad terms, process emissions as well as fuel (combustion) emissions from local industry should be limited and the use of low sulphur fuels (Town gas, LPG) should be stipulated. Industries likely to cause significant air pollution, such as chemical processing industries, should be discouraged;

- o an appraisal of the source of the SO_2 AQO exceedance indicated that it was predominantly derived from industrial emissions from the Siu Ho Wan industrial area. Annexe A3 indicated that the exceedance was derived from a SO_2 emission of 594 tonnes per year SO_2 at the Siu Ho Wan industrial area. Calculations have indicated that a reduction of total annual SO_2 emissions from industrial sources at Siu Ho Wan by 20% (i.e.: by 119 tonnes per year SO_2 to 475 tonnes per year SO_2) would lead to no exceedance of HKPSG SO_2 criteria (i.e. would lead to a maximum of 3 exceedances of the AQO per year). An overall 20% reduction in the use of fuel oil, distillate oil and coal at the Siu Ho Wan industrial area would achieve such a reduction. For example the reduction in industrial emissions at Siu Ho Wan would correspond to a ceiling on usage of approximately 2168 TJ per year of distillate oil (60,000m^3 per year) if the only industrial fuel source used at Siu Ho Wan industrial park was distillate oil and no coal or fuel oil was used. No such additional restrictions in fuel use at industrial developments at Chek Lap Kok south would be necessary as even the highest SO_2 concentrations derived from industrial developments at Chek Lap Kok south are well below the 1-hour and 1-year AQOs for SO_2. However, this does assume that total industrial SO_2 emissions do not exceed the estimated modelled SO_2 emission at Chek Lap Kok south industrial developments of 279 tonnes per year.

- o the New Airport emissions depend mainly on the number of aircraft movements and future engine technology. Emissions during taxiing can be reduced by effective airport lay-out (short routes between boarding gates and runways), operational measures (no queuing at runway holdings, short engine start-up and push-back procedures) and ancillary facilities (e.g. external power supply to diminish the use of the auxiliary power units-APU's).

Operational Phase Air Quality Guidelines for Potential Operational Air Pollution Sources

Following the construction of each phase of the NLD some components may have the capability to adversely affect air quality. Proposed operational guidelines for such facilities are given in the following paragraphs.

Industrial Park

The first stage of the industrial park at Siu Ho Wan will be developed during Phase 2 and its completion will be during Phase 4 of the New Town development. The guidelines listed below should be followed in planning and operating the industrial park:-

(a) only clean industry or industries which do not have significant off-site air quality impacts should be allowed to locate in the industrial park;

(b) the use of solid fuel (coal) should be prevented and the use of distillate oil and fuel oil should be restricted below limits specified in Topic Report TR10 (Revised). These limits would comprise a ceiling on usage of approximately 2170 TJ per year of distillate oil (60,000m^3 per year) if the only industrial fuel source used at Siu Ho Wan industrial park was distillate oil and no coal or fuel oil was used. However, this assumes that the total SO_2 emissions do not exceed the 279 tonnes poer year SO_2 emission modelled in TR10 (Revised) at the Chek Lap Kok South industrial developments. Additionally, the use of LPG and/or town gas should be stipulated;

(c) process emissions from the industrial park should be strictly limited and industries likely to cause significant off-site air pollution such as chemical processing industries should be discouraged;

(d) industrial/residential setbacks in accordance with HKPSG guidelines should be retained when the precise/nature of industrial developments are established;

(e) environmental assessment, monitoring and audit of the industrial park will be required during the detailed planning phase and should include an investigation into the maintenance of off-site air impacts to below AQO guidelines.

Refuse Transfer Station (RTS)

The RTS will be constructed during Phase 1 of the NLD and will be operational by 1997. The following controls will be necessary to restrict off-site air quality impacts. Further details of the RTS impacts and environmental mitigation are discussed later in Appendix E.

(a) dust control devices and air extraction will be required and should form part of the integrated ventilation system for the transfer building;

(b) the air extraction system should include both natural and powered roof extraction to remove vehicle exhaust fumes and odour; and

(c) environmental assessment, monitoring and audit of the RTS will be required to minimise off-site air quality impacts (dust and odour) to below AQO criteria.

Sewage Treatment Works (STW) and Sewage Pumping Stations

The first stage of the STW will be completed during Phase 1 and stage 3 will be completed in Phase 3. The STW has the potential to cause odour nuisance but sensitive receivers are located some distance away and impacts are not likely to be significant. This needs to be confirmed and an environmental impact assessment of the Sewage Treatment Works should be carried out. Recommendations for monitoring and audit should be developed following such an EIA. Odour control devices could be included if an off-site problem was predicted. The Sewage Pumping Station in Tung Chung could cause an off-site odour nuisance and this should be environmentally assessed and subsequently monitored at the detailed design stage. Mitigation measures should be adopted in the design if off-site odour was predicted to cause odour nuisance.

NLE, Primary and Local Roads

The air quality impact of all roads should be monitored during the build up of road traffic, population and associated air sensitive receivers to validate the air setback results predicted in the environmental assessment. This would comprise part of the routine environmental auditing and monitoring programme of the NLD.

Hospitals

A hospital is scheduled for completion in Phase 4 development at Tai Ho Wan. This should be subject to environmental assessment, monitoring and audit to ensure that this facility has no off-site air quality impacts associated with its boilers. Fuel restrictions could be used if emissions were predicted to be significant.

Operational Air Sensitive Receiver Guidelines

Following the construction of each phase of the NLD certain components will be sensitive to air quality. Proposed operational guidelines to protect air sensitive receivers are detailed below.

Residential Population

The new residential population on North Lantau will increase from 20,000 persons in 1997 to 200,000 by 2011 will an ultimate post 2011 population of 260,000. Air quality considerations have been taken into account throughout the New Town design and residential population has been located with adequate air quality buffers from all potential operational pollution sources. This assessment includes existing villages and village resite areas. Nevertheless, environmental monitoring and audit will be necessary to ensure that air quality is within the AQOs and this is detailed in Chapter 8.

Other Air Sensitive Receivers

Nurseries, homes for the aged, hospitals and clinics, schools and active recreational activity areas have also been located with adequate air quality buffers from all potential pollution sources. Nevertheless, air quality monitoring and audit will be required during the operational phase to ensure air quality is within the AQOs.

Residual Phase 1 Air Quality Impacts

The RODP has been reviewed to identify any residual impacts in Phase 1 and these are discussed below.

This review of residual impacts has been based on the final detailed layout plans for the Phase 1 presented in TR17 (Revised).

Residential Sensitive Uses

The air quality assessment has concluded that AQOs should be achieved at all residential receivers so long as they are set back by 40-45m from the NLE. This has been achieved throughout the New Town and thus air quality at all sensitive residential sites should be below the AQOs.

Non-Residential Sensitive Sites

(a) *Area 12 (Tung Chung) : Site 1, Secondary School*

The site boundary is setback a minimum of 58m from the NLE which is more than the required setback of 40-45m.

(b) *Area 12 (Tung Chung) : Site 2, Secondary School*

The site boundary is setback a minimum of 57m from NLE which is more than the required setback of 40-45m.

(c) *Area 12 (Tung Chung) : Site 3, Primary School*

The site is setback a minimum of 110m from the NLE which is more than the required 40-45m setback.

(d) *Indoor Recreation Centre : Type A, Tung Chung - Area 6*

The air intakes should preferably be located on the facade located furthest from the NLE (ie the west side of this building), although the building is located in excess of the required 40-45m setback.

(e) *Area 5 (Tung Chung) District Open Space*

The HKPSG specifies that open space should be set back at least 5m from adjacent local distributor roads. The actual site is setback more than this and thus will be suitable for the proposed passive recreational use.

(f) *Sitting Out Area between Tung Chung Areas 1 and 6*

The site is setback a minimum of 60m from NLE and therefore should be suitable for its intended purpose.

(g) *Area 8 (Tung Chung) Landscaped Sitting Out Area*

The site meets the 5m set back requirement from the adjacent local distributor road. The site is setback from NLE by approximately 110m and will thus be suitable for proposed passive recreational use.

(h) *Tai Po Buddish Youth Hostel, Basketball Court*

The HKPSG specifies a setback of more than 20m from a primary distributor road for active recreation and this has been achieved in the detailed layout plan.

(i) *Tai Ho Wan Proposed Artificial Lake (Open Space) Tai Ho Wan Area 16*

The lake is setback a minimum of 34m from the centreline of the NLE. The Expressway EIA indicated that a 40-45m setback would be required for sensitive uses to avoid exceedance of the AQO for NO_2. HKPSG criteria require a minimum 20m air quality setback for active recreational uses from trunk roads. Some AQO exceedance could be experienced on the north western "perimeter" of the lake under certain wind conditions.

(j) *Tai Ho Wan Area 6 : Undetermined Use*

The final use should take account of the requirement for a 40-45m setback from the NLE to any air quality sensitive uses (eg residential, schools, nurseries, homes for the aged, hospitals and clinics and active recreational uses).

Residual Air Quality Impacts from Phases 2 to 5

The assessment of residual impacts from Phases 2 to 5 has been based from the RODP as detailed layout plans are not available. The assessment has concluded that there should be no residual impacts subject to the following:-

- the application of the development controls proposed above for the industrial park;
- the maintenance of a minimum setback of 45m from the NLE for all residential uses;
- the maintenance of setbacks specified in the HKPSG for all open space; and

- the application and maintenance of air quality controls to pollution sources external to the NLD, notably the existing and proposed power station at Castle Peak and the New Airport.

The last of these is outside the scope of this Study but these sources could have a major impact on air quality in the New Town.

It is recommended that a permanent air quality station should be installed on North Lantau so that the background conditions can be monitored over a period of years. This could be installed on the roof of one of the GI/C buildings to be constructed during Phase 1 and should be operational at least one year before the opening of the New Airport.

E4.2 Operation Water Quality Impacts

The Sea Channel

The Sea Channel has been designed to maintain water quality in East Tung Chung Bay and to provide a buffer between the New Airport and Tung Chung. The design has included a hydraulic and water quality assessment which has concluded that the channel should meet its stated objectives. However this needs to be confirmed by monitoring of water quality in the channel and attention to detail in the designs of the channel walls as these are progressed during subsequent stages of the development. The characteristics of the channel will change as reclamation is formed in Tung Chung Wan. It is recommended that water quality in the channel is monitored on a regular basis and that the velocities over a cross section of each end of the channel are monitored on completion of each phase of reclamation. The first monitoring should be immediately following completion of the New Airport and Tung Chung Phase 1 reclamations. The results of this monitoring should be taken into account in subsequent designs with the objective of maintaining the existing flow into East Tung Chung Bay.

Water Quality Impacts from Effluents from Completed Development

All units at the industrial park will be connected to the foul sewer providing an opportunity to monitor and control the waste water processes within. Land leases should include conditions related to the specified processes and define any pretreatment of effluent, which may be necessary, prior to discharge to the foul sewer. Standards required should be in accordance with the Technical Memorandum. Review of the leases will be required should any operational changes occur. As with all such conditions they are only useful if followed up by subsequent monitoring.

One of the basic assumptions made, in keeping with the recommendations of the Sewage Strategy Study, when determining the level of sewage treatment required for the NLD was that metals in industrial effluents would be removed at source. It has been noted that in the New Airport Master Plan Study Working Paper No. 34 'small but significant amounts of heavy metals will be discharged to the foul sewer from maintenance workshops'. This will need to be given further consideration in the context of treatment levels and enforcement of metal removal at industrial units.

The Technical Memorandum will be used to control discharges to the foul sewer for each individual industry. The level of sewage treatment required for the NLD was necessarily developed by making certain assumptions and using best estimates for processes. As flows and loads build up, consideration may need to be given to control of effluent from the industrial park. Alternatively the programme of upgrading works for the Sewage Treatment Works should be kept in review, and if necessary treatment levels upgraded.

Mitigation measures proposed for impacts from effluents are:

(a) enforcement of the Technical Memorandum for users of the industrial parks in the NLD and New Airport;
(b) issue of licences or leases on condition that any necessary pretreatment measures are taken prior to discharge and that effluents are monitored; and
(c) regular visual inspection of the drainage channels to determine when maintenance cleaning is required; and
(d) impact monitoring and auditing of water quality in Tai Ho and Tung Chung Wan.

Drainage

Stormwater drainage channels will be designed to carry runoff from the steep upland basins and from reclamation and development areas. The larger stream courses in Tung Chung, Tai Ho Wan and Siu Ho Wan are left as open channels while most channels in reclaimed areas will be culverted.

Boulder traps sand traps and silt traps will be included to minimise siltation. Dry weather channels will be included to aid flushing during periods of low flow thereby minimising the impact on receiving water quality. Silt, sand and boulder traps will require regular cleaning.

Water Quality Mitigation Recommendations

Following the construction or development of each of the phases for the NLD some new components may adversely affect water quality. Proposed operational guidelines are given in the following paragraphs:

Industrial Park

- lease conditions will include any requirement for pretreatment of effluent prior to discharge to the foul sewer;
- leases will be granted for specific activities and any changes in process design or effluent produced;
- metals will be removed from waste waters at source and not discharged to the foul sewer;
- access will be provided for monitoring effluent flow rates and quality.

Railway Depot

- discharges or accidental spillages will be controlled by enforcement of the Technical Memorandum;
- surface water collectors and oil traps to be provided in maintenance areas; and
- bunding may be required around fuel storage areas.

Water Features

- maintenance of the control structure at the Pak Mong lake; and

- o prevention of accidental spillages entering water features or other drainage channels using stoplogs or temporary traps.

Refuse Transfer Station

- o collection of vehicle washdown waters and leachates from tipping hall and compaction units to be collected and directed to sewage treatment works;
- o monitoring of leachate quality and quantity prior to discharge to foul sewer; and
- o surface water collectors in vehicle maintenance areas with separation of the effluent before the aqueous fraction is discharged to the foul sewer for treatment and the oil fraction is re-used or drummed and disposed of at the Chemical Waste Treatment Facility on Tsing Yi.

Sewage Treatment Works

- o monitoring of influent and effluent;
- o audit of the diffuser performance; and
- o monitoring of receiving water quality to determine whether any alterations in the programme for upgrading the treatment levels is required.

E4.3 Assessment of Operational Noise Impacts

Road Traffic Noise

Road traffic noise has been one of the key issues in preparing the RODP because of the constraints it could impose on development of land uses sensitive to noise in the area. The initial assessment of the RODP showed that the HKPSG standards, (Table E13) could only be met alongside the NLE if mitigation of noise was applied. The recommended mitigation measures were a combination of one or more of:-

(a) noise barriers consisting of a 6m high landscaped bund with a 3m high solid (non absorptive) barrier were recommended wherever noise sensitive development was proposed alongside the NLE;

(b) setbacks to noise sensitive development dependent on receiver sensitivity. Setbacks of approximately 160m - 170m from the nearside edge of the road were recommended for residential use;

(c) a friction course should be applied to the road surface where traffic flows were high; and/or

(d) residential blocks should be aligned such that their windows had an angle of view of the road of 120° or less.

Some flexibility in these measures could be permitted in certain circumstances. For example developers might wish to plan their estate layouts with a larger setback and have a larger angle of view of the road. A smaller setback would be permissible if windows had a smaller angle of view if non-sensitive uses were built facing the road or if some sheltering from other buildings could be achieved.

Noise barriers with 3m landscaped bunds were also considered for primary distributors. However, the improvement in setback with this treatment alone was not considered to be cost effective as the noise conflicts were little reduced and thus this form of mitigation was not recommended. An investigation into the use of a friction course adjacent to dwellings has indicated that the required setback could be significantly reduced for less busy primary roads. For busier primary roads, including P2, a friction course plus a noise barrier comprising a 3m earthbund together with a 3m solid (non absorptive) barrier would be required adjacent to sensitive receivers. No noise treatment was considered necessary for local roads because of the anticipated low traffic volumes.

These results were derived based on a set of preliminary traffic figures which have been subsequently updated following transport testing. The broad guidelines for noise mitigation presented previously have therefore been reviewed taking account of the most recent traffic figures and the detailed layout plans for Phase 1, and recommendations for noise mitigation prepared.

Table E13 Summary of HKPSG Road and Rail Noise Standards

Noise Source Noise Standards Uses	Road traffic Noise L10 (1hour) dB(A)	Rail Traffic Noise
All domestic premises including temporary housing accommodation	70	(a) Leq (24 hr) = 65 dB(A)
Hotels and hostels	70	and
Offices	70	(b) Lmax (2300 - 0700) = 85 dB(A)
Educational institutions including kindergartens, nurseries and all others where unaided voice communication is required	65	
Places of public worship and courts of law	65	
Hospitals, clinics, convalescences and homes for the aged - diagnostic rooms - wards	55	
Amphitheatres, and auditoria, libraries, performing arts centres and Country Parks	depend on locations and construction	

Source : HKPSG

Notes:

(a) The above standards apply to uses which rely on opened windows for ventilation.

(b) The above standards should be viewed as the maximum permissible noise levels at the external facade.

Train Noise

Noise from trains will depend, inter alia, on the type of rolling stock used, the design of the track and the train frequency. Details of these will depend on decisions to be made by the railway operator which are not available at the present time. The NLE Consultants calculated the train noise based on the frequencies stated in the Airport Rail Feasibility Study Final Report and assuming a BREL type of train is used. BREL supplied details of a noise test carried out on their rolling stock in accordance with ISO 3095. The test conditions were:-

- o continuously welded rail on concrete sleepers on a straight, level, ballasted trackbed;
- o disc brakes on rolling stock;
- o new wheels; the wheels had covered only a few hundred kilometres;
- o ground cover between the track and measuring position was lightly ballasted on hard ground;
- o the measurements were made on a warm day with a wind force of approximately "0" on the Beaufort Scale;
- o 4-car train; and
- o train speed 100mph (160 kph).

Their results (reported in the NLE Environmental Impact Assessment Final Report) have formed the basis of the assessment of impacts in this report.

EPD have stated that there is a possibility that trains much noisier than the BREL train could be used and have thus suggested that a noise level of 89 dB(A) (free field) be tested. It has therefore been agreed that the train noise impacts should be assessed on the basis of an "83 dB(A) train" but that the sensitivity of the plan to a "89 dB(A) train", considered by EPD to be representative of the noise performance of existing high speed railways overseas, should also be considered.

Two types of rolling stock have therefore been considered in this report. These are:

- o Rolling stock with an emission strength of 83 dB(A) (free field) at 25m from the centre line of the track at grade when measured in accordance with ISO 3095 (83 dB(A) train); and
- o Rolling stock with an emission strength of 89 dB(A) (free field) at 25m from the centre line of the track at grade when measured in accordance with ISO 3095 (89 dB(A) train).

Noise generated by 83 dB(A) 4-car train was adjusted in the calculation to allow for 8 car trains on the LAL and 10 car trains on the ARL, these adjustments produced emission strengths of 84.0 dB(A) and 84.1 dB(A) respectively. However, for clarity this report has referred to the quieter train as the 83 dB(A) train. It is understood that the 89dB(A) train already allows for 8-10 car trains. Noise generation was also adjusted to the assumed 135kph train speed.

Operational noise predictions have been based on the year 2011. The frequency of railcar passby are as stated in the Airport Rail Feasibility Study (ARFS) are summarised in Table E14.

Table E14 Assumed Train Frequencies

Train Service	Passby, Each Direction
ARL	
0500-0930	8 mins
0930-1730	4 mins
1730-0100	8 mins
LAL (Tung Chung Section)	
0500-0700	8 mins
0700-1000	4 mins
1000-1600	8 mins
1600-1900	4 mins
1900-0100	8 mins

As can be seen from Table E14 the frequencies in the ARFS additionally allow for a system shut down from 0100 to 0500 hours and this has been allowed for in the rail noise assessment.

The HKPSG railway noise standards are indicated in Figure 4.3 and Appendix D. The NCO criteria for rail noise are:-

- 70dB(A) in the daytime (0700 to 1900 hours) and evening (1900 to 2300 hours); and
- 60dB(A) in the night-time (2300 to 0700 hours).

Assessment Methodology For Road Traffic Noise

Road Traffic Noise

Traffic figures used for the assessment are based on those presented in Topic Report TR19 (Revised). These are summarised in Table E15. The calculation methodology and the assessment criteria are based on the UK Department of Transport procedure "Calculation of Road Traffic Noise", 1988 and are identical to those given in Topic Report TR10 (Revised).

Table E15 Traffic Figures, Links, Speeds, Percentage Heavy Vehicles and Noise Generation

Road Section	Worst-case traffic volume (Veh/hr)	Year	Speed (km/hr)	% of Heavy Vehicle	Facade noise level at distance of 25m dB(A)	
					30m above road level	80m above road level
NLE N(2)	2590	2011(OP)	67	29	75	73
NLE S(2)	3200		67	25		
NLE E(3)	3830	2011(PM)	56	31	76	74
NLE W(3)	3667		58	32		
P1(37)	1079	2011(PM)	48	39	69	66
P2 E(12)	1390	2011(AM)	39	35	72	69
P2 W(12)	1040		45	51		
P2(13)	1342	2011(AM)	42	42	70	67

The NLE and sections of primary distributors close to sensitive uses are assumed to have a surface friction course which will reduce the generated noise by at least 3.5 dB(A). Other roads are assumed to have normal road surfaces. In addition, a 120° angle of view is assumed for all NSRs except schools. Local roads are excluded in the noise prediction as traffic data for local roads have not been calculated except at junctions. These will depend on number of factors not presently available (estate layouts and accesses, location of car parks etc). However the detailed layout plans for Phase 1 have been checked to ensure that sensitive uses alongside local roads will not be affected by unacceptable noise levels. This check has used the traffic figures calculated for the junctions. These assumptions have been used to determine the setback distances necessary from the edge of the nearside carriageway to satisfy the HKPSG requirements at a lower floor receiver in all noise sensitive land uses in years 2001 and 2011.

Road Mitigation Assumptions

Noise treatment, in the form of earth bunds/barriers, has been considered where the noise levels without mitigation alongside the NLE, primary roads or district roads exceed the HKPSG at the facades of residential buildings. This will be at 160m for the NLE and 50m for primary and district roads. Noise mitigation has therefore only been considered when noise at these distances from the road is greater than the HKPSG standards.

The noise mitigation considered takes one of the following forms :

- Type I - 3m earth bund with 3m high non-absorptive noise barrier on top;
- Type II - 6m high earth bund with 3m high non-absorptive noise barrier on top; and
- Type III - 3m high non-absorptive noise barrier.

Detailed specifications of the mitigation measures are provided herein for Phase 1 for which detailed layout plans are available. Detailed layout plans for Phase 2 and subsequent phases are not available and schematic layouts of noise treatments have been provided.

Residual noise impacts could exist with the proposed earth bund/barrier mitigation treatment. The residual setback distances required to satisfy the HKPSG noise criteria for residential premises with the proposed noise treatment have been determined.

Train Noise

Table E16 gives the setback distances required to satisfy the HKPSG and the NCO for the ARL, LAL and ARL+LAL without noise mitigation. The controlling criteria for the HKPSG is L_{eq}(24hr) of 65dB(A) and for the NCO it is the night-time L_{eq}(30min) of 60dB(A). Setback distances are given for receivers at 1.5m, 40m and 80m above ground and are measured from the centreline of the track. The following assessment of the extent and severity of rail noise impact and mitigation requirements has been based on these criteria.

Table E16 Setback Distances in Metres Required to Satisfy the Prescribed Noise Standards for ARL, LAL and ARL + LAL Without Mitigation

Train Service	Ht. above Ground (m)	83dB(A) Train		89dB(A) Train	
		HKPSG L_{eq}(24hr)	NCO Night-time (60)	HKPSG L_{eq}(24hr)	NCO Night-time (60)
ARL	1.5	105	285	325	880
	40	100	285	320	880
	80	70	275	315	880
LAL	1.5	80	225	245	710
	40	70	220	240	710
	80	nil	210	230	710
ARL + LAL	1.5	185	510	570	>1000
	40	175	505	560	>1000
	80	160	495	555	>1000

Trackside barriers have been considered to reduce the setback distances. The double barrier considered consists of a 1.5m high inward curved trackside barrier as indicated on Figure E25. This would need to be installed alongside each track on the side of the noise sensitive receiver. Where there are noise sensitive receivers located on either side of the tracks, barriers will be required on either side of the tracks (ie double barriers on both tracks). Noise reductions have been calculated using the methodology in "Transportation Noise Reference Book" assuming that the double trackside barrier is of an absorptive type. For receiver locations at 80m above ground and closer than about 40m from the tracks, the predictive equation for barrier attenuation becomes invalid and a "no line of sight" approach was adopted.

The residual setback distances which are required to satisfy the noise standards assuming these double 1.5m trackside barriers are used are shown in Table E17. Setback distances to satisfy the NCO night-time criteria are given for receivers at 1.5m, 40m and 80m above ground. Setback distances are measured from the centre line of the track.

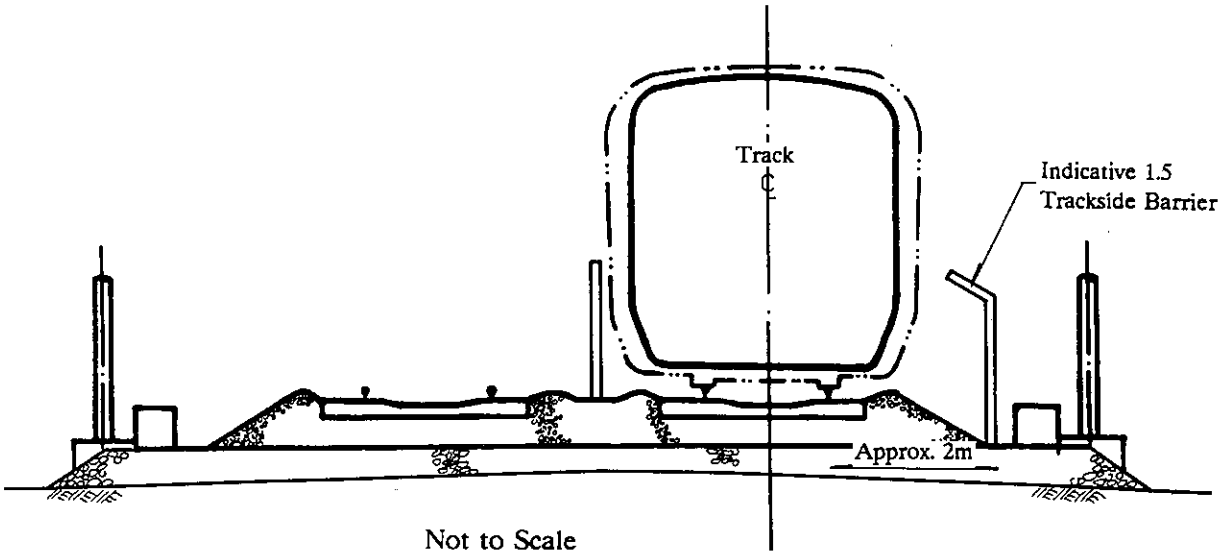


Figure E25
Indicative Configuration of 1.5m
Trackside Railway Double Noise Barriers

Table E17 **Setback Distances in Metres Required to Satisfy the Prescribed Noise Standards for ARL, LAL and ARL + LAL With Mitigation**

Train Service	Ht. above Ground (m)	83dB(A) Train		89dB(A) Train	
		HKPSG L_{eq}(24hr)	NCO Night-time (60)	HKPSG L_{eq}(24hr)	NCO Night-time (60)
ARL	1.5	< 10	< 10	< 10	13
	40	26	31	32	45
	80	37	54	55	70
LAL	1.5	< 10	< 10	< 10	10
	40	20	30	30	40
	80	nil	51	52	65
ARL + LAL	1.5	< 10	< 10	< 10	21
	40	28	36	38	60
	80	50	60	62	85

As can be seen, an 89 dB(A) train rolling stock requires about 50 percent more setback than that required for an 83 dB(A) train rolling stock to achieve the 60 dB(A) NCO night-time standard with the double 1.5m trackside barriers.

Assessment of Noise Impacts from Road and Rail Traffic in Each Phase

General

All road setbacks in this section are given as the distance from the edge of the nearside carriageway of roads. The road and rail noise assessment of Phase 1 has been based on the detailed Phase 1 layout plans which are available. The assessment of Phase 2 and subsequent phases has been based on the RODP layouts as detailed layout plans have not been prepared for these phases under the NLD Study.

Phase 1 : Road Traffic Noise

Topic Report TR17 (Revised), "First Phase Development Layout Plans", describes the detailed planning layouts for the First Phase. Phase 1 includes the following noise sensitive land uses :

- o Planning Area 4 - Proposed residential development (R1);
- o Planning Area 10/11 - Proposed public housing estate (RS/HOS) including a primary school, a neighbourhood community centre and a health clinic; and
- o Planning Area 12 - Proposed educational use (E) including a primary school and 2 secondary schools.

Table E18 gives the setback distances from the edge of the nearside road carriageway required to satisfy the HKPSG criteria for all the above NSRs without earth bunds/barriers but with a friction course for 2001 and 2011. The two secondary schools and the primary school would be exposed to road traffic noise in excess of the HKPSG guidelines. Also, NSRs in Planning Area 10/11 fronting the NLE are likely to be exposed to noise levels slightly higher than 70 dB(A).

Table E18 Setback Distances Required to Satisfy the HKPSG Criteria for Tung Chung Phase 1 Development Without Mitigation

Planning Area	Major Line Source (Link)	Land Use	Setback Distance (m)	
			2001	2011
4	D1(8)	R1	25	27
10	D1(9)	RS	43	39
	NLE (2)		172	169
	P2 (12)		30	37
11	NLE (2)	HOS	172	169
	P2 (12)		30	37
12	NLE (2)	E	408	400
	P2 (12)		72	87

Both Planning Area 12 and Planning Area 10/11 will need noise treatment of the NLE to ensure compliance with HKPSG. The primary school in Planning Area 12 will further require noise treatment of Road P2. Table E19 summarizes the mitigation proposals for the above planning areas. The setback distances are considered to be acceptable following the noise treatment. For the primary school in Planning Area 12 facing Road P2, a Type III mitigation is considered sufficient to protect the school because the middle carriageway of P2 is depressed and the nearside and farside carriageways are at a similar level to the school.

Table E19 Noise Mitigation Proposals for Tung Chung Phase 1

Planning Area	Major Line Source (Link)	Land Use	Type of Mitigation	Approximate Barrier Length (m)	Residual Setback distance (m)
10	NLE(2)	RS	II *	280	46
11	NLE(2)	HOS	II *	280	46
12	NLE (2)	E	II *	280	51
	P2 (12)		III *	160	41

Note: * plus friction course

In addition, a Type I noise barrier will be necessary to protect the existing Youth Camp at Tai Po Interchange. The resulting noise contours at 85m PD with the proposed barriers are shown in Figure E26. The 70 dB(A) contour line falls beyond the plot boundary of the residential sites and therefore will not constrain residential development. Figure E27 shows the predicted facade noise levels at the three schools and the Youth Camps with the proposed earth bund/barrier noise treatment of the roads. No exceedance of the HKPSG noise criteria is predicted with the proposed school layouts and the proposed noise treatment of the roads.

Phase 1 : Train Noise

The LAL is proposed to run through Planning Areas 5 and 6. An underground station is planned for Area 6 and the tracks continue underground through Area 5. Since the tracks are underground in these sections, no mitigation will be needed. Tracks running through Planning Area 14 are assumed to be integrated with the proposed podium development to the extent that train noise is contained by the building envelope. Thus no mitigation is considered necessary to protect Planning Areas 10/11 and 12 from LAL.

Noise from ARL trains will have a significant impact on Planning Areas 10/11 and 12 and the setbacks for either the 83dB(A) or 89dB(A) train will constrain development unless mitigation is provided. Figure E28 shows the proposed location of trackside barriers. Installation of double 1.5m absorbent barriers in these locations will remove noise constraints in Planning Areas 10/11 and 12.

Phase 2 : Road Traffic Noise

Sensitive land use development in Phase 2 is also confined to Tung Chung. Table E20 gives the road traffic setback distances required to satisfy HKPSG criteria without noise mitigation.

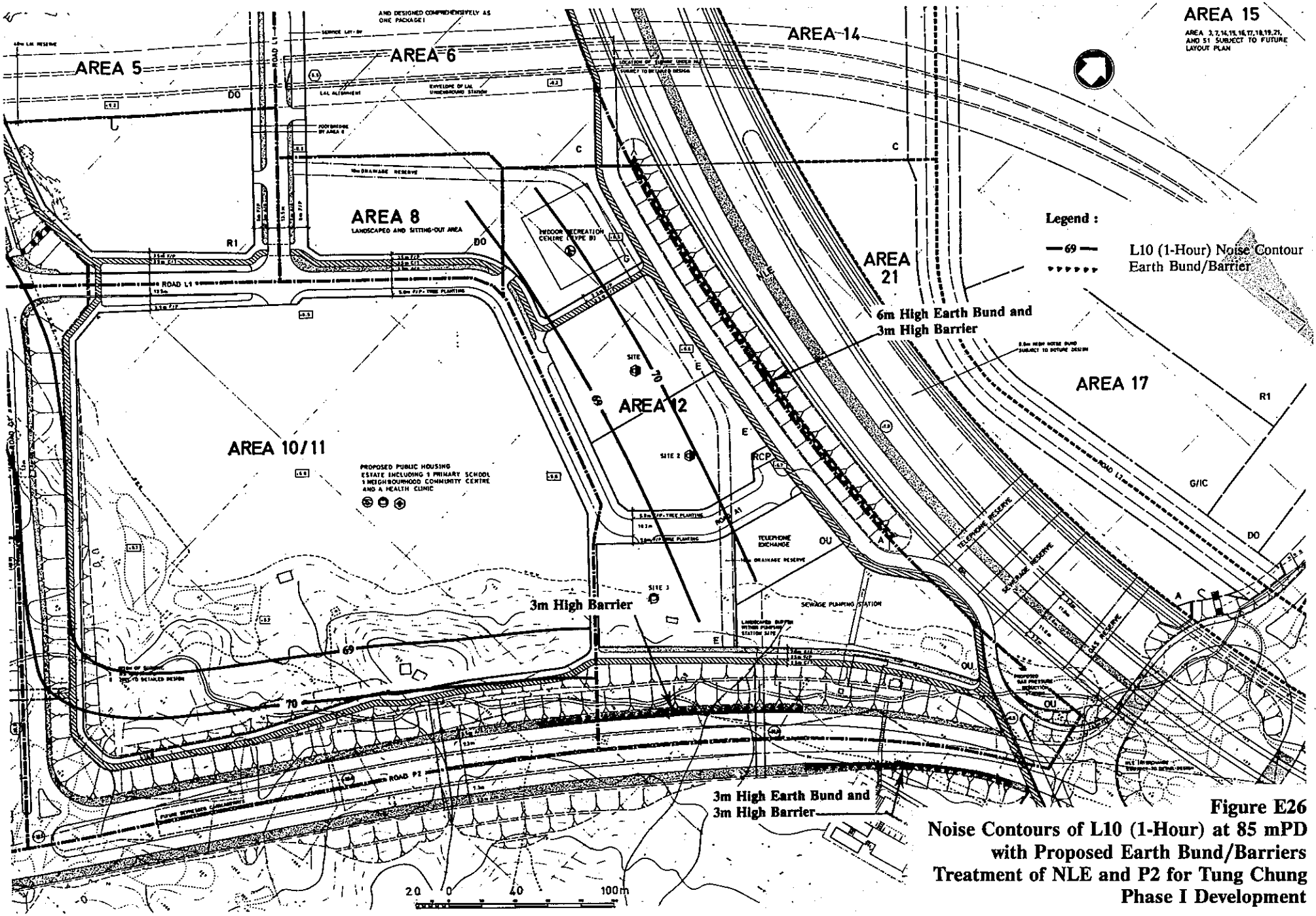


Figure E26
Noise Contours of L10 (1-Hour) at 85 mPD with Proposed Earth Bund/Barriers Treatment of NLE and P2 for Tung Chung Phase I Development

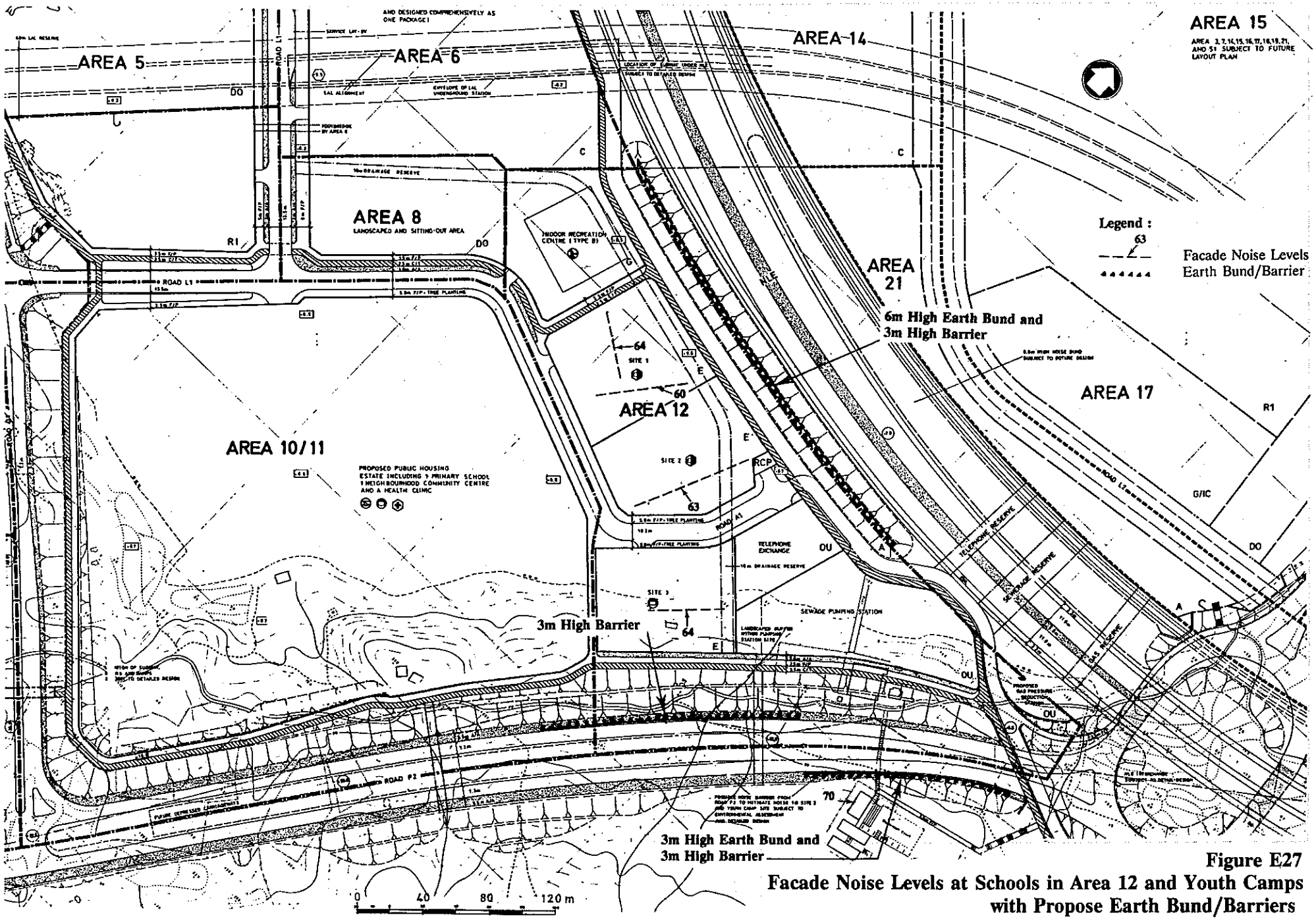


Figure E27
Facade Noise Levels at Schools in Area 12 and Youth Camps with Propose Earth Bund/Barriers Noise Treatment of NLE and Road P2

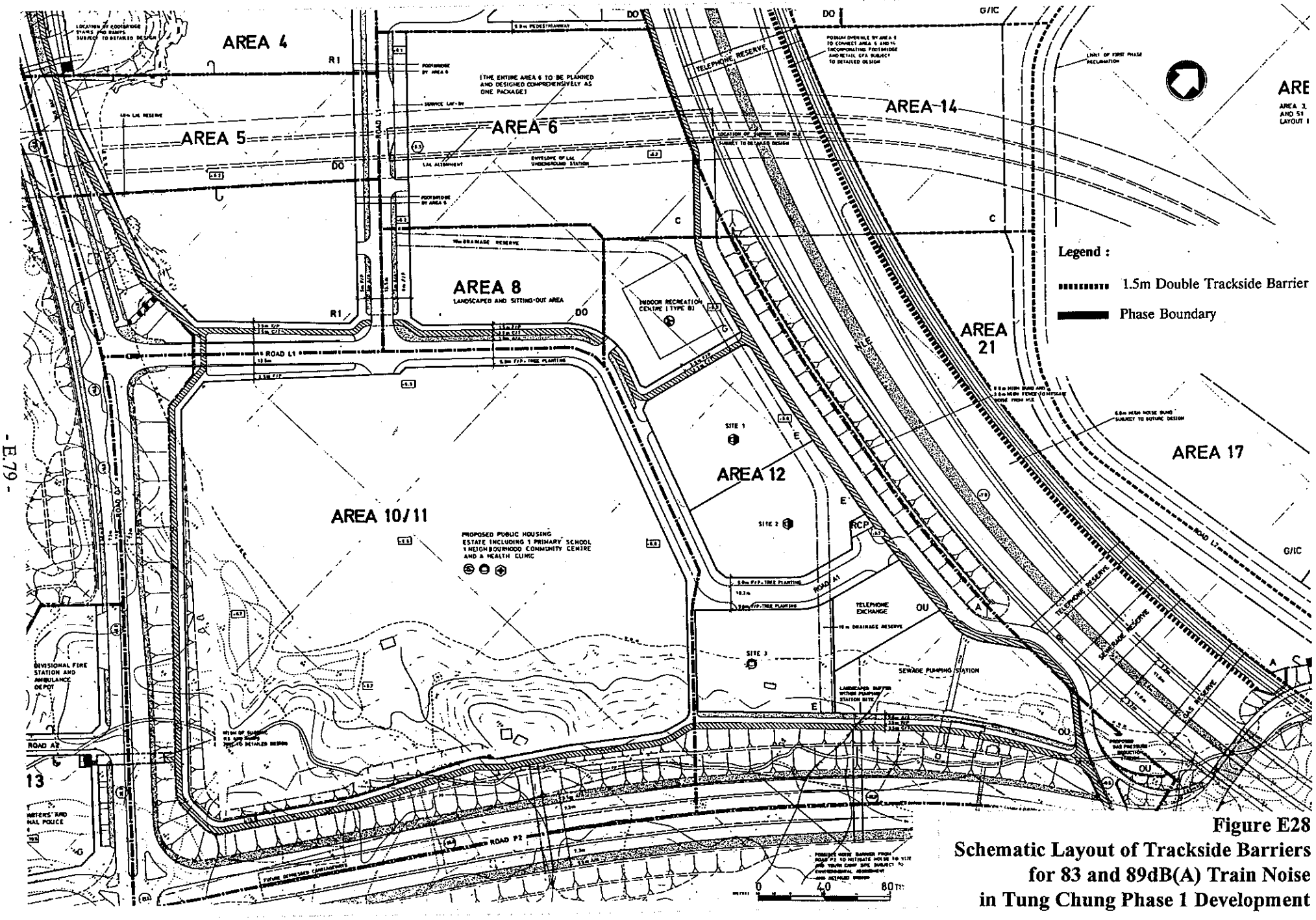


Figure E28
Schematic Layout of Trackside Barriers for 83 and 89dB(A) Train Noise in Tung Chung Phase 1 Development

Table E20 **Setback Distances Required to Satisfy the HKPSG Criteria for Tung Chung Phase 2 Development Without Mitigation**

Planning Area	Major Line Source (Link)	Land Use	Setback Distance (m)	
			2001	2011
15	NLE (2)	R1	172	169
	P1 (28)		nil	15
17	NLE (2)	E	408	400
	P2 (20)		nil	40
19	NLE (3)	R1	192	209
	P1 (27)		nil	15
	P2 (20)		nil	17
20	NLE (3)	E	455	496
	P1 (27)		nil	36
58	P1 (37)	G/IC	nil	77
	NLE (3)		455	496
22	P2 (13)	R2	25	40
23	D2 (17)	HOS	34	53
	D2 (30)		nil	46
24	D2 (30)	RS	nil	46
25	D2 (17)	R3	34	53
	P2 (13)		25	40
27	P2 (13)	E	58	96
38	P2 (22)	R3	nil	28
43	nil	R4	nil	nil
70	nil	VR	nil	nil

The most affected Planning Areas are Areas 15, 17, 19, 20 and 58 flanking the NLE and Planning Area 27 alongside Road P2 where noise treatment of the roads is required. Residual setbacks required in Planning Areas 23, 24 and 25 are shown on Figure E30. These development constraints would be eliminated by the provision of a friction course on Road D2. Table E21 gives the noise mitigation proposals required to ensure HKPSG compliance for Tung Chung Phase 2. Schematic layouts of the noise bunds/barriers are shown in Figures E29 and E30 together with the residual setback lines. Mitigation proposals for Phase 1 are also shown.

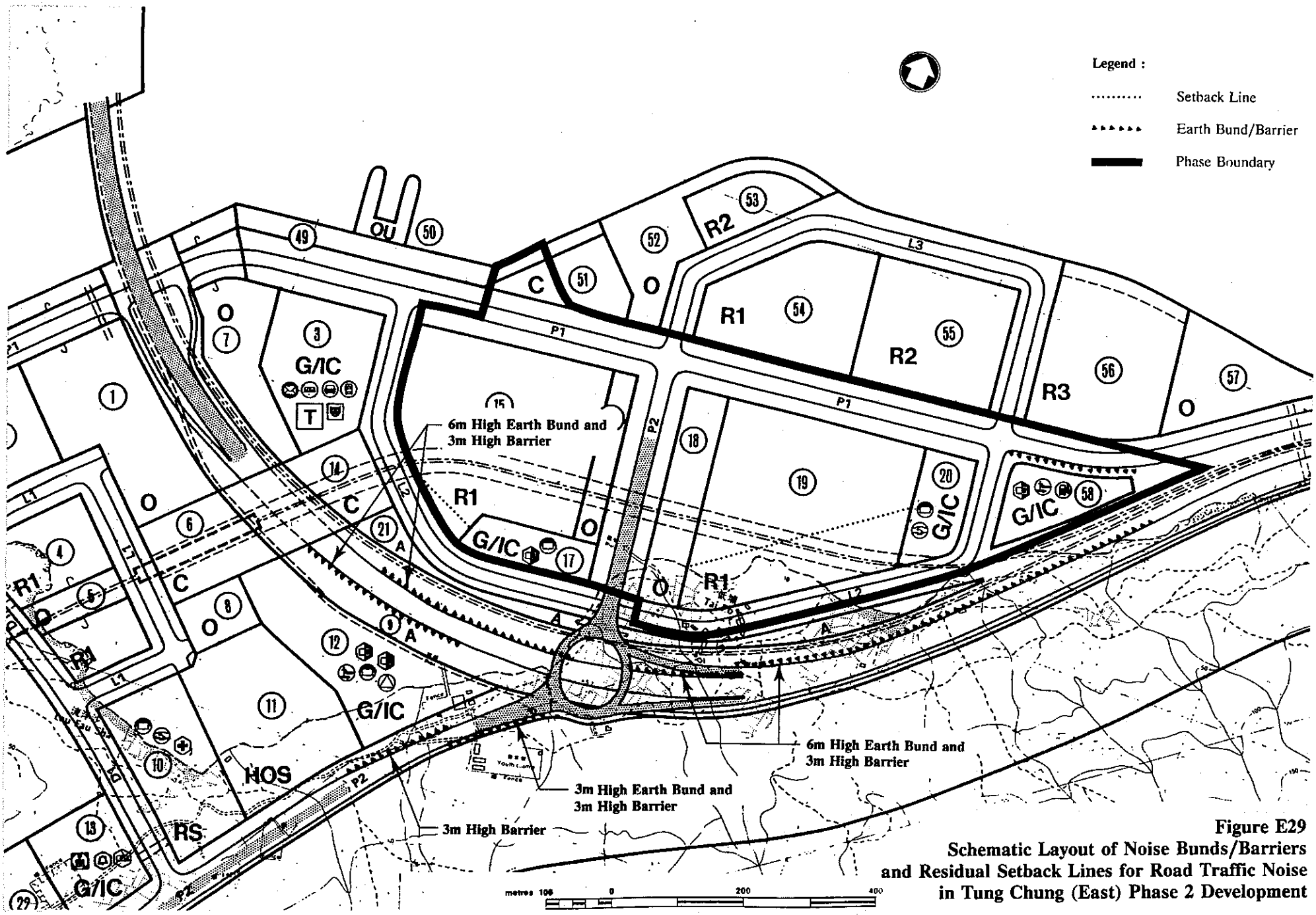


Figure E29
Schematic Layout of Noise Bunds/Barriers and Residual Setback Lines for Road Traffic Noise in Tung Chung (East) Phase 2 Development

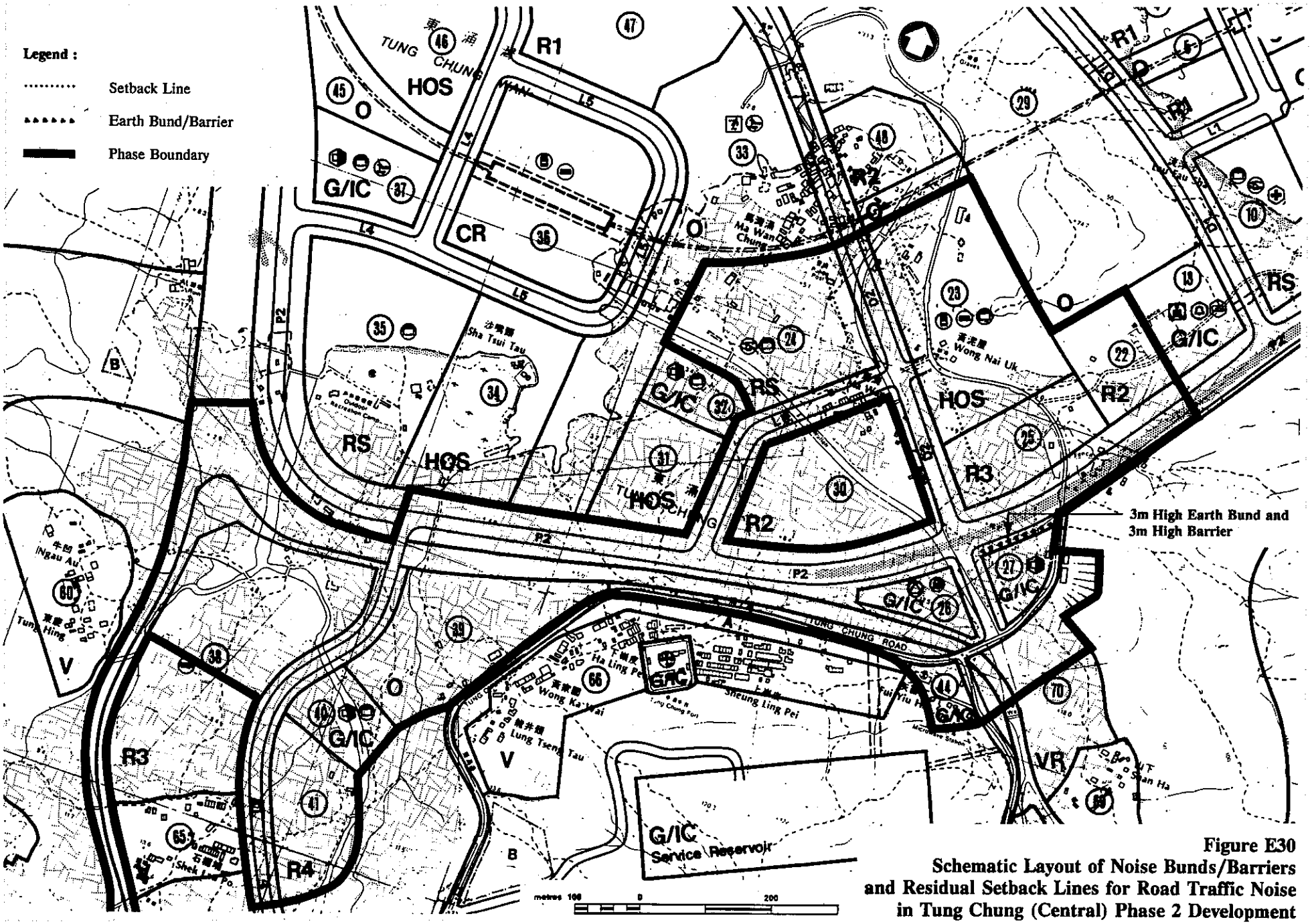


Figure E30
Schematic Layout of Noise Bunds/Barriers and Residual Setback Lines for Road Traffic Noise in Tung Chung (Central) Phase 2 Development

Planning Area 58 is planned for a secondary school and noise tolerant uses. It is possible that the noise tolerant facilities could be planned during the detailed layout stage to screen the school from the NLE and Road P1 so that noise treatment of the two roads may not be required.

Table E21 Road Noise Mitigation Proposals for Tung Chung Phase 2

Planning Area	Major Line Source (Link)	Land Use	Type of Mitigation	Approximate Barrier Length (m)	Residual Setback distance (m)
15	NLE (2)	R1	II *	350	136
17	NLE (2)	G/IC	II *	350	51
19	NLE (3)	R1	II *	600	176
20	NLE (3)	E	II *	600	51
27	P2 (13)	E	I *	150	31
58	P1 (37)	G/IC	I *	170	31
	NLE (3)		II *	250	51

Note : * plus friction course

Phase 2 : Train Noise

Portions of Planning Areas 15 and 19 are sandwiched between the ARL and LAL alignments as can be seen in Figure E31. However, it should be noted that the LAL is underground in Planning Area 15 and is fully covered in Planning Area 19. Figure E32 shows indicative cross sections illustrating the different LAL vertical alignments and Figures E33, E34 and E35 shown the plan locations of different vertical sections on the RODP.

Trackside barriers in Planning Area 15 and 19 will not be necessary with either an 83 dB(A) or an 89dB(A) train when the LAL is underground and fully covered respectively. The mitigation necessary for Phase 2 for both train types in Tung Chung (East) is shown on Figure E31.

1.5m double trackside barriers will be required to protect Planning Areas 10/11, 12, 15 or 19 from ARL noise with either an 83 dB(A) or 89 dB(A) train. 1.5m double trackside barriers have already been recommended on the west of the ARL to protect Phase 1 (Planning Areas 10/11 and 12) and similar barriers will be required on the east of the ARL to protect Planning Areas 15, 19 and 20 during Phase 2. These will eliminate ARL noise constraints on Planning Areas 15 and 19 with either train type.

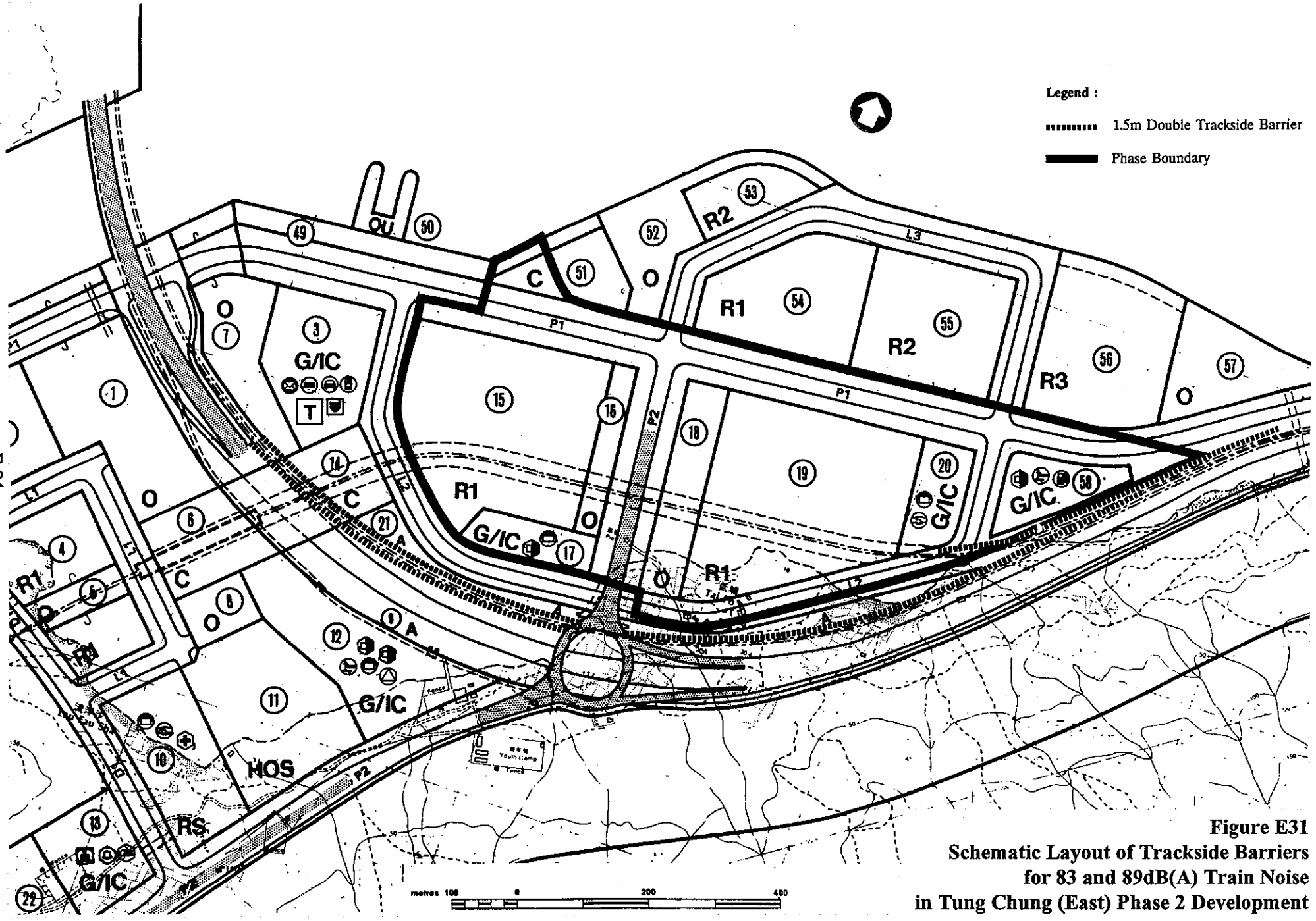
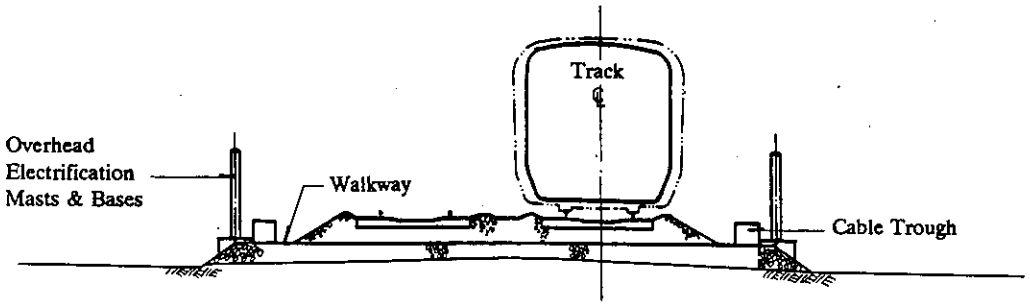
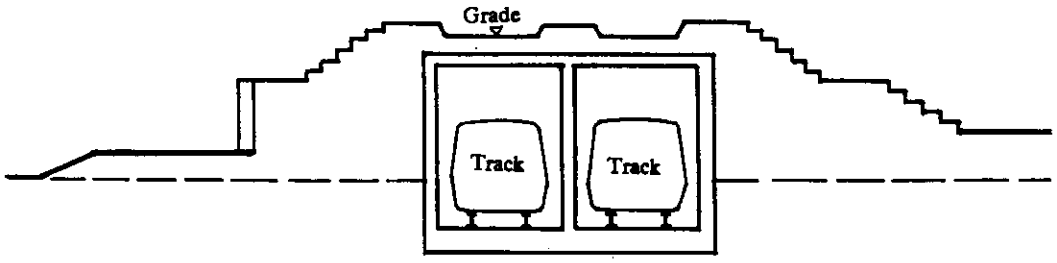


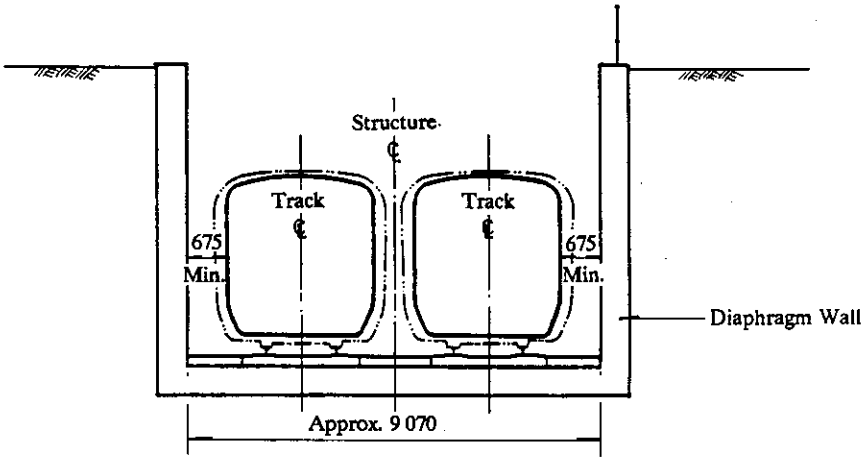
Figure E31
Schematic Layout of Trackside Barriers for 83 and 89dB(A) Train Noise in Tung Chung (East) Phase 2 Development



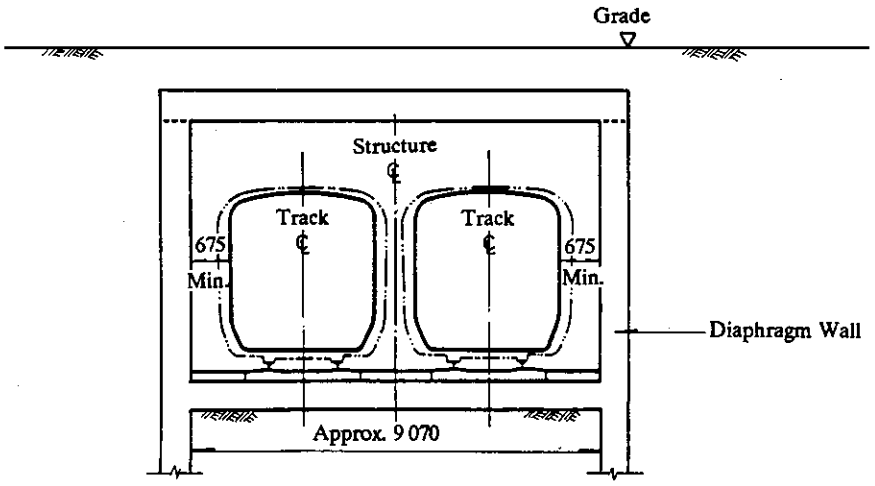
At-Grade



Fully Covered



Depressed



Underground

Figure E32
Indicative Vertical Railway Alignment Cross Section

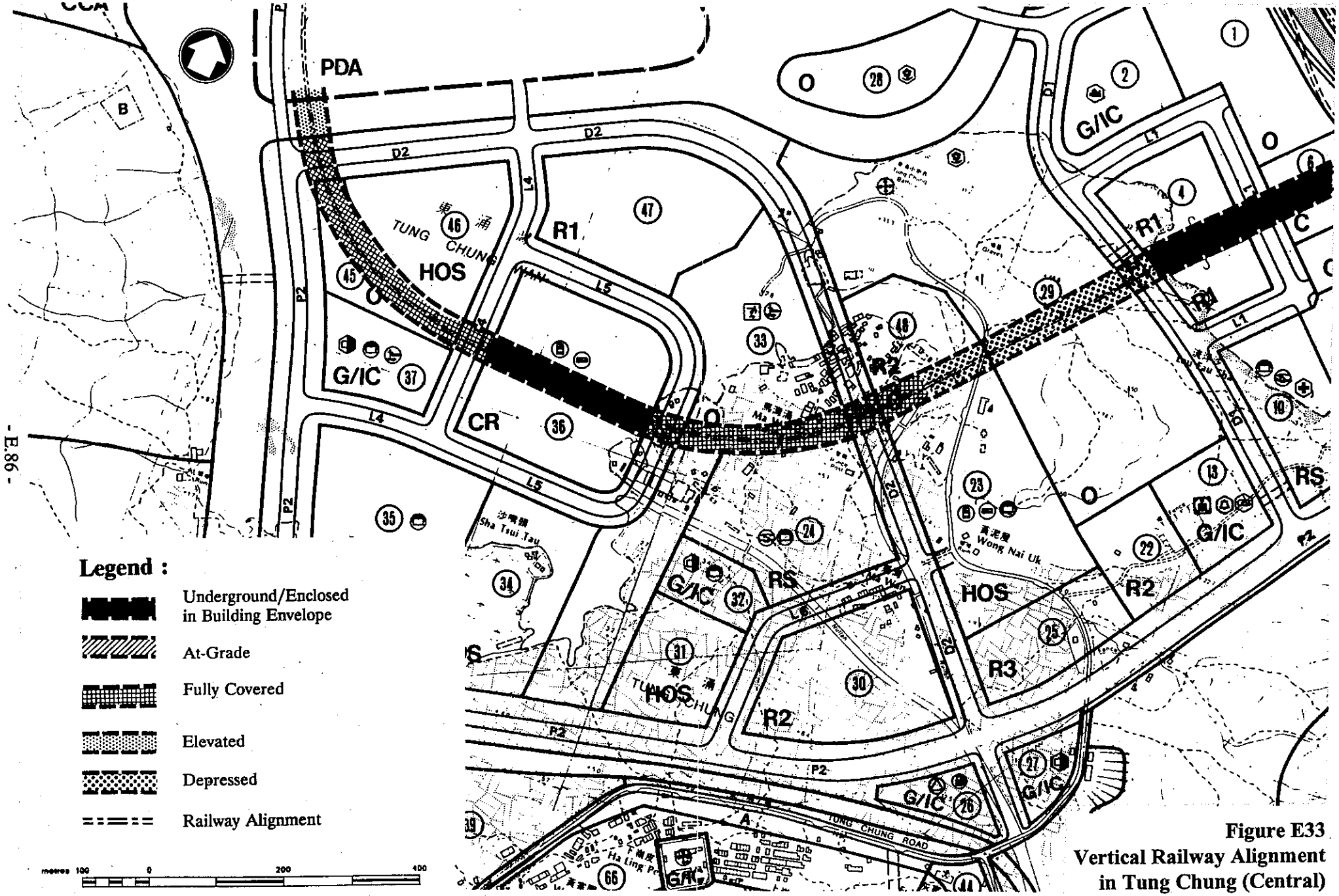


Figure E33
Vertical Railway Alignment in Tung Chung (Central)

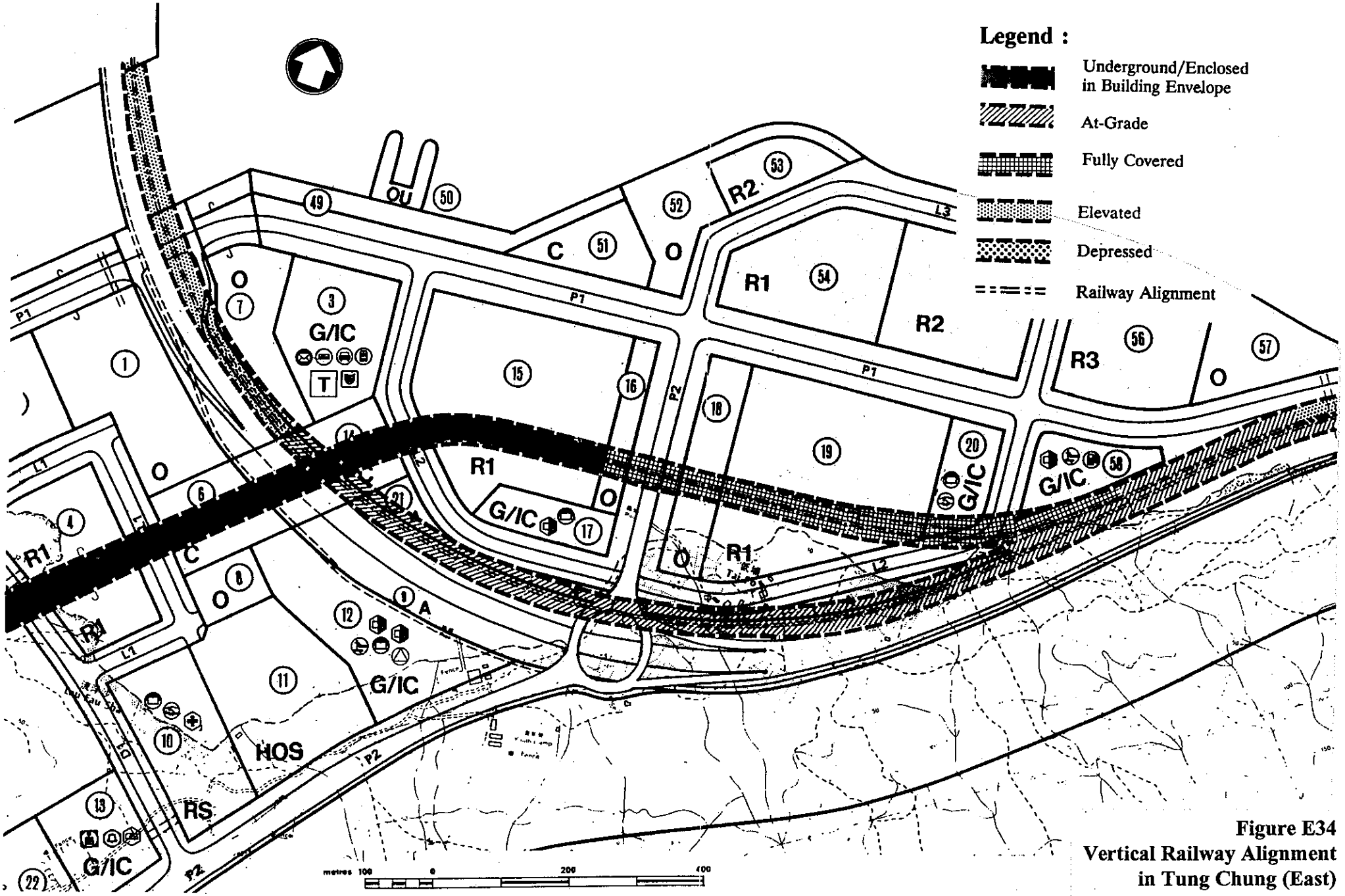


Figure E34
Vertical Railway Alignment in Tung Chung (East)

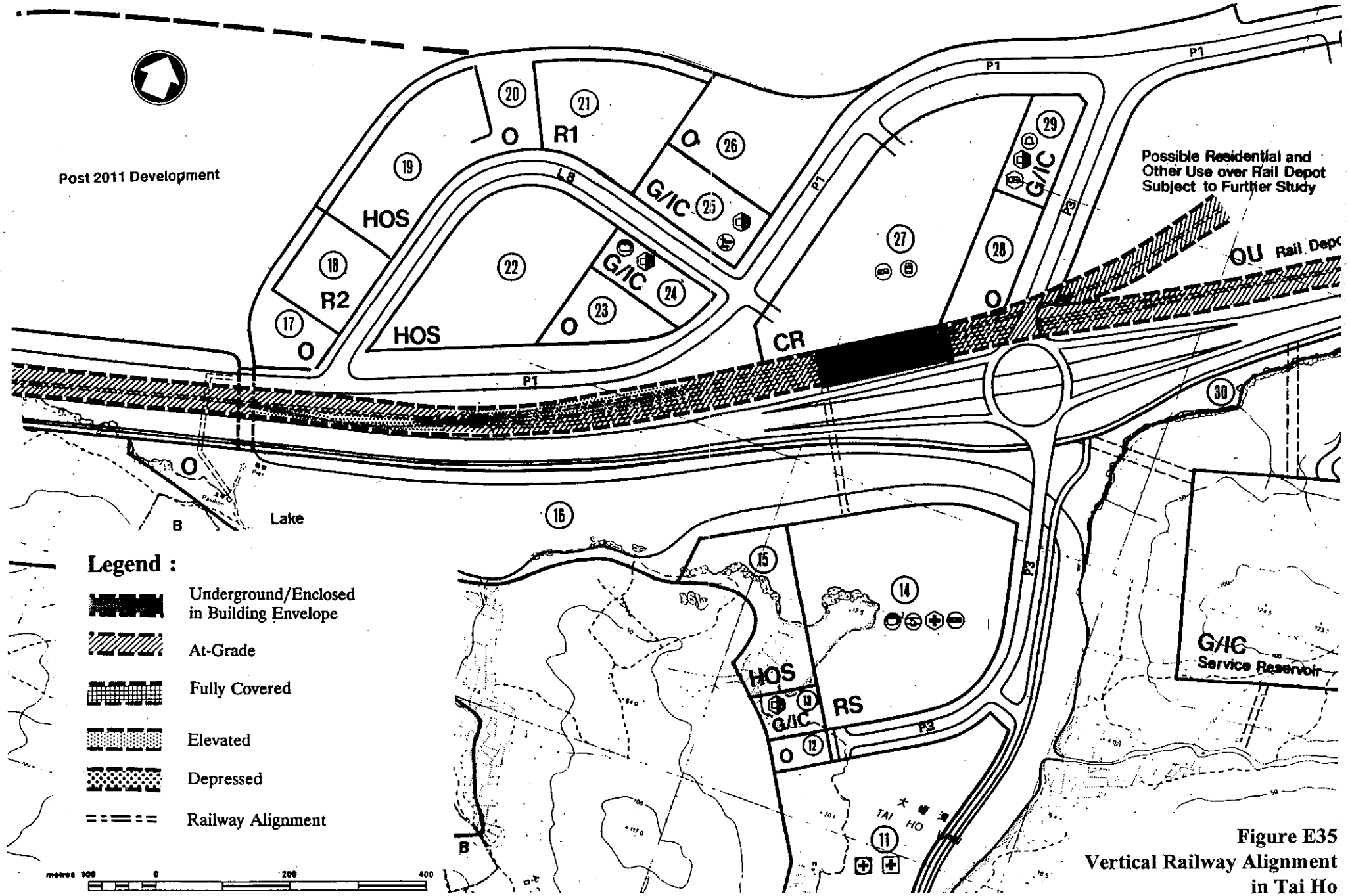


Figure E35
Vertical Railway Alignment in Tai Ho

Where the LAL and ARL run together south of Planning Area 58 the 1.5m double trackside barriers will be required north of the tracks on the at grade ARL and LAL with both the train types to protect the school proposed for part of this site. However, where the LAL is fully covered no LAL barriers will be necessary. The residual setback required for a low receiver such as a school, which will be 5-6 storeys (approximately 20m) high, should be such that it should be possible to locate the school site within the noise barrier "noise shadow area" i.e. relatively close to the railway tracks. Barriers will not be required on the south side of either the ARL or LAL tracks as no sensitive receivers are located here.

The LAL between road D1 and Road D2 will be depressed through Planning Area 29 and depressed and fully covered north of Planning Area 23. As a result, no trackside barriers are considered necessary in Planning Area 29 with either train type. Where the LAL is fully covered north of Planning Area 23 and through Planning Area 24 trackside barriers will not be necessary on the LAL tracks. Figure E36 shows that no railway noise barriers are required to protect Phase 2 in Tung Chung (Central).

Phase 3 : Tung Chung - Road Traffic Noise

The setback distances required to satisfy the road traffic noise requirement are shown in Table E22.

Table E22 Setback Distances Required to Satisfy the HKPSG Criteria for Tung Chung Phase 3 Development Without Mitigation

Planning Area	Major Line Source (Link)	Land Use	Setback Distance (m)	
			2001	2011
30	D2 (17)	R2	34	53
	P2 (14)		4	11
31	P2 (15)	HOS	4	36
32	--	E	nil	nil
34	P2 (15)	HOS	4	36
35	P2 (22)	RS	nil	28
36	--	CR	nil	nil
38	P2 (22)	R3	nil	28
40	--	E	nil	nil
41	--	R4	nil	nil
42	--	R4	nil	nil
48	D2(33)	R2	nil	nil
65	--	V	nil	nil
70	--	VR	nil	nil

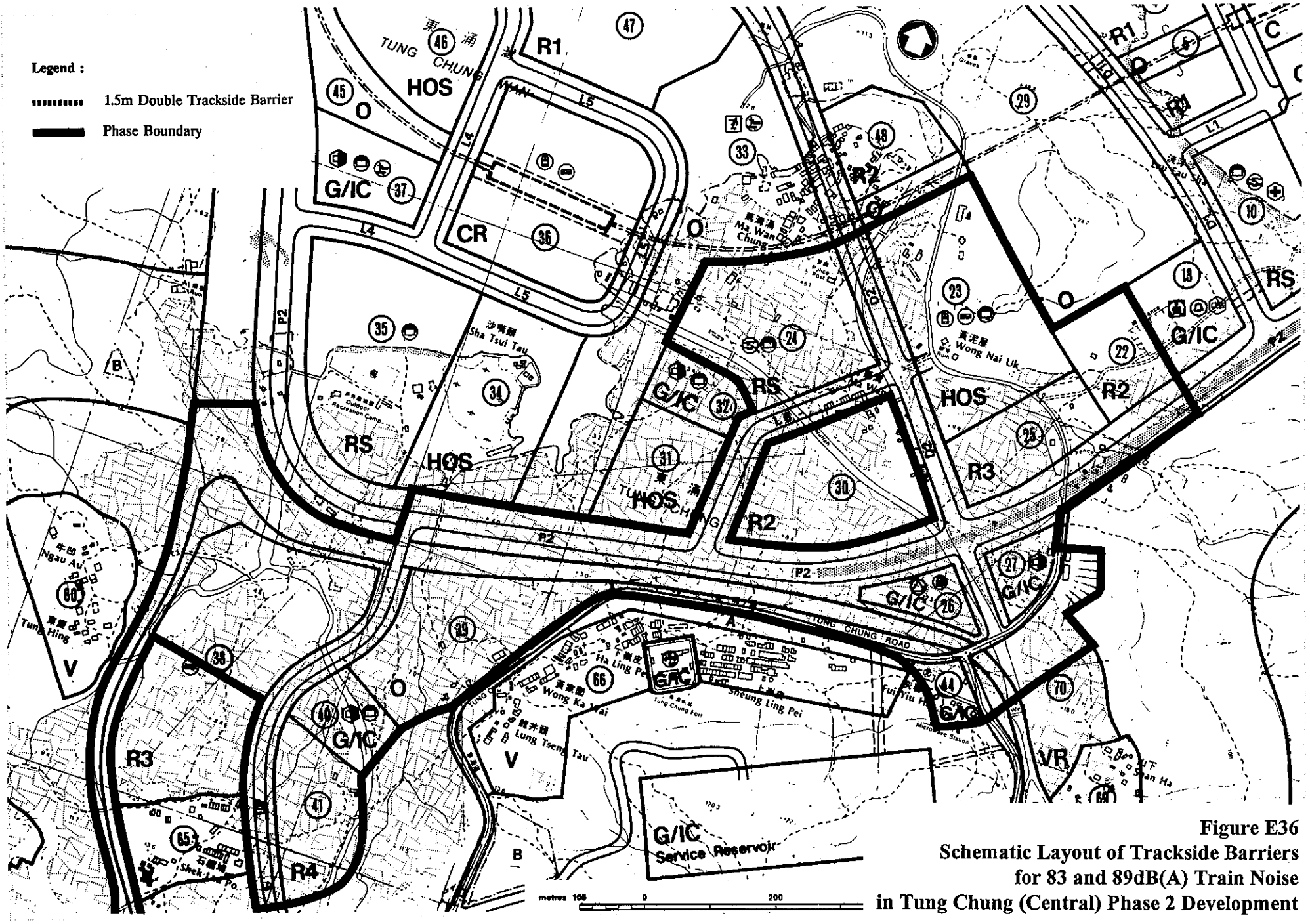


Figure E36
Schematic Layout of Trackside Barriers for 83 and 89dB(A) Train Noise in Tung Chung (Central) Phase 2 Development

No noise mitigation is considered necessary for Phase 3 other than that recommended previously for Phases 1 and 2. Sensitive receivers located in Planning Area 30 will require a setback of 53m from Road D2. However, this development constraint could be eliminated by the provision of a friction course on Road D2. Figure E37 shows the setback distances for residential development in Phase 3 in Tung Chung.

Phase 3 : Tung Chung - Train Noise

Train noise impacts on Tung Chung Phase 3 are expected to be similar to those in the previous two phases. The LAL will run through Area 36 but will not impact on the CR development as it is envisaged that the second Tung Chung LAL station site will be integrated into the building. No trackside barriers will be required for the fully covered sections east and west of the station. South of Planning Area 48 the LAL is fully covered and depressed and thus no mitigation will be necessary with either train type. Figure E38 shows no trackside barriers are required for Phase 3.

Phase 3 : Tai Ho Wan - Road Traffic Noise

Table E23 gives the setback distances required to ensure compliance with HKPSG criteria without mitigation for Tai Ho Wan Phase 3. The only affected land use is Planning Area 11 which is planned for a District Hospital. No noise treatment of Road P3 is considered necessary. Figure E39 shows the calculated setback line for noise sensitive uses on this hospital site.

Table E23 Setback Distances Required to Satisfy the HKPSG Criteria for Tai Ho Wan Phase 3 Development Without Mitigation

Planning Area	Major Line Source (Link)	Land Use	Setback Distance (m)	
			2001	2011
11	P3 (7)	Hospital	nil	46

Phase 3 : Tai Ho Wan - Train Noise

Train noise will not constrain Phase 3 development in Tai Ho Wan Planning Area 11 for 83 dB(A) train rolling stock as the site boundary is over 500m from the tracks. However, double 1.5m trackside barriers would be required for 89 dB(A) train rolling stock. These requirements are shown in Figures E40 and E41.

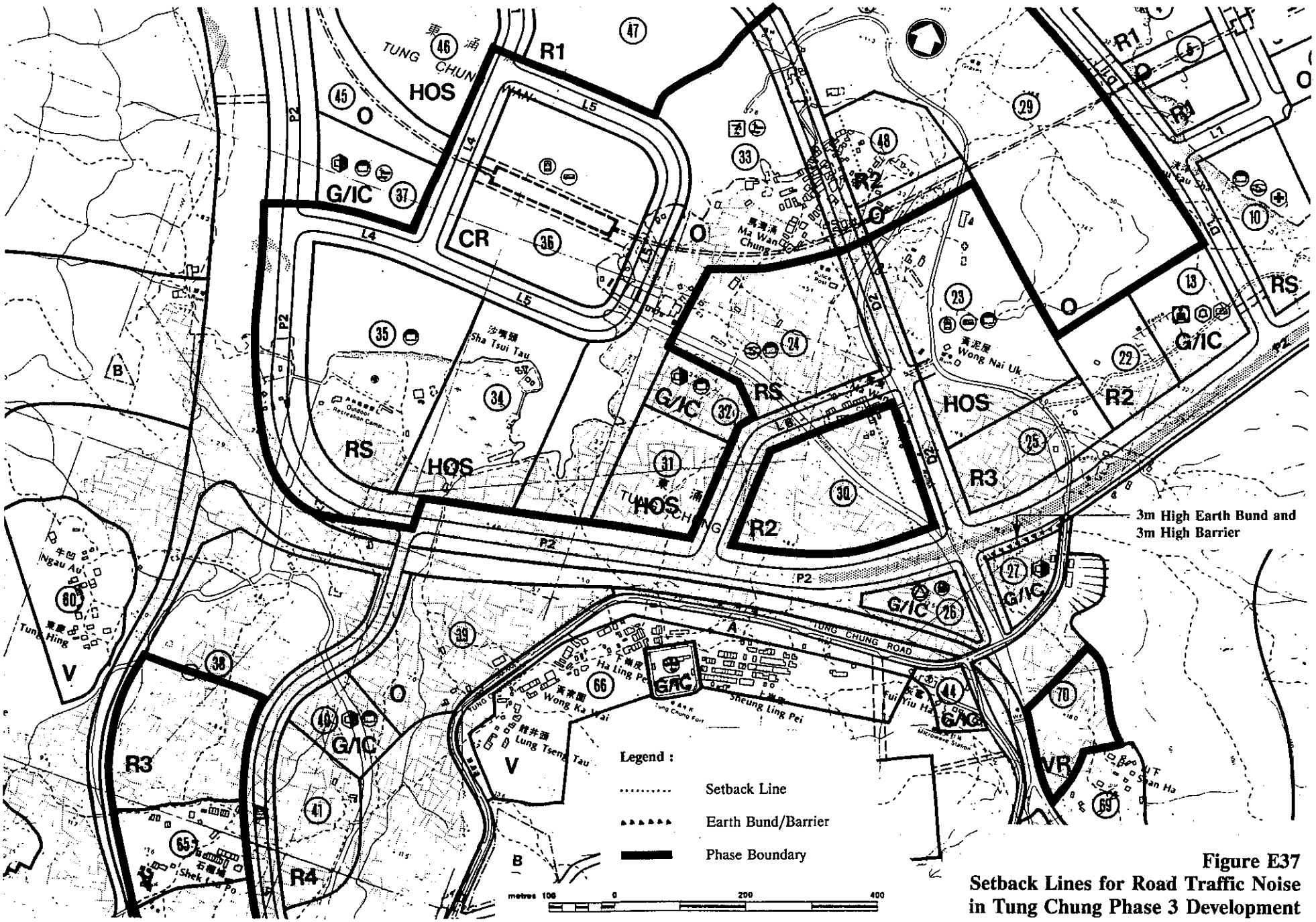


Figure E37
Setback Lines for Road Traffic Noise in Tung Chung Phase 3 Development

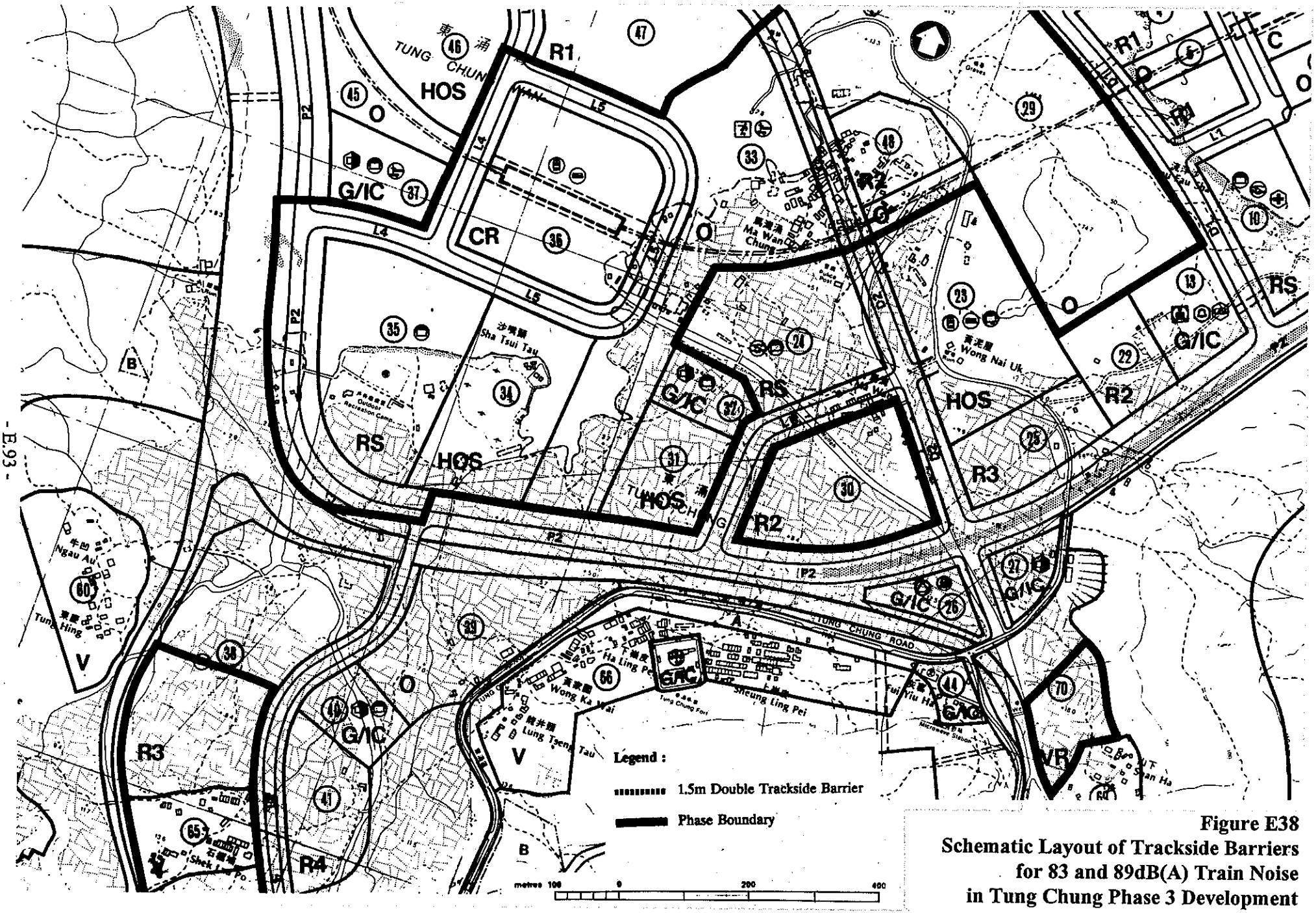


Figure E38
Schematic Layout of Trackside Barriers for 83 and 89dB(A) Train Noise in Tung Chung Phase 3 Development

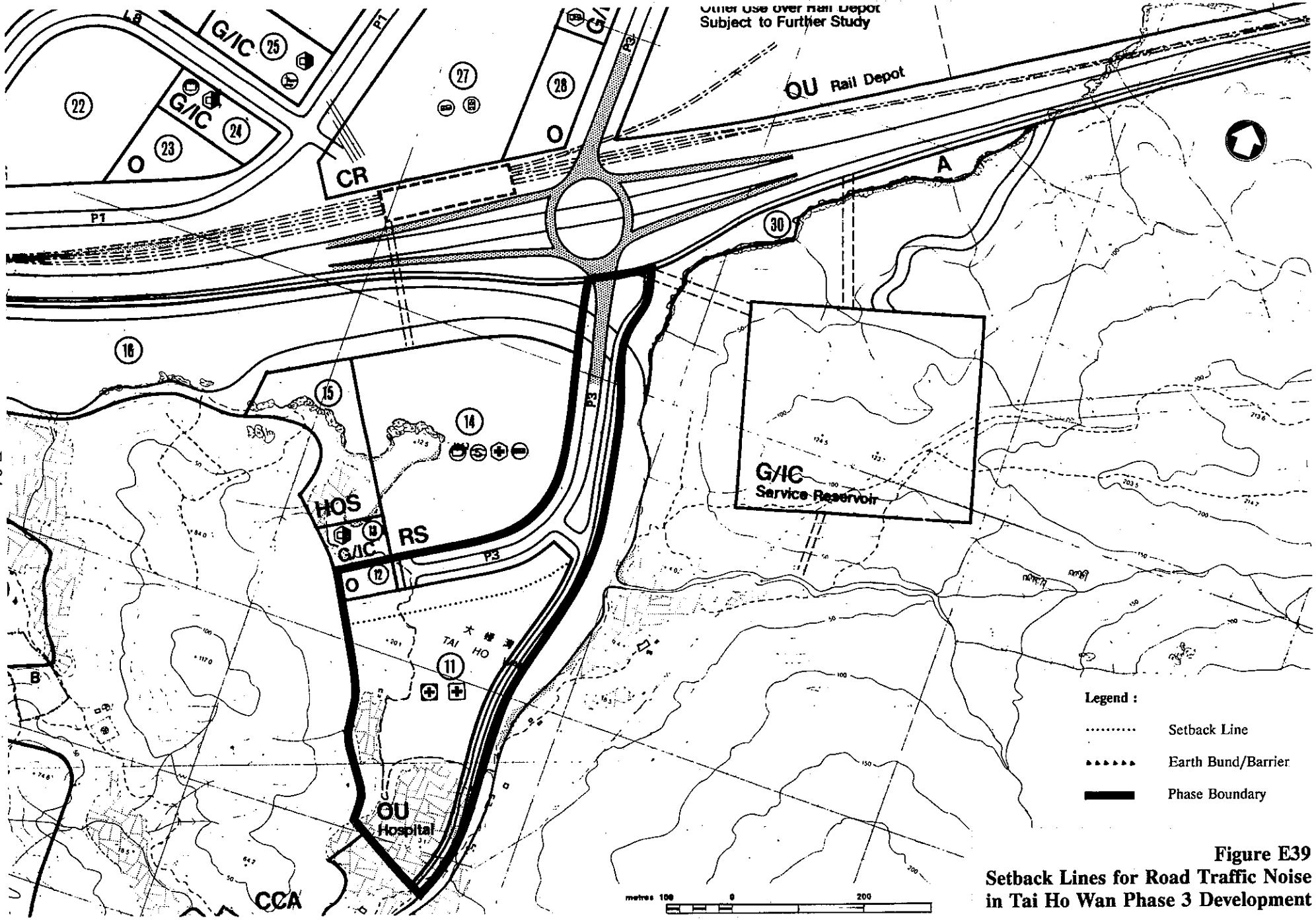


Figure E39
Setback Lines for Road Traffic Noise in Tai Ho Wan Phase 3 Development

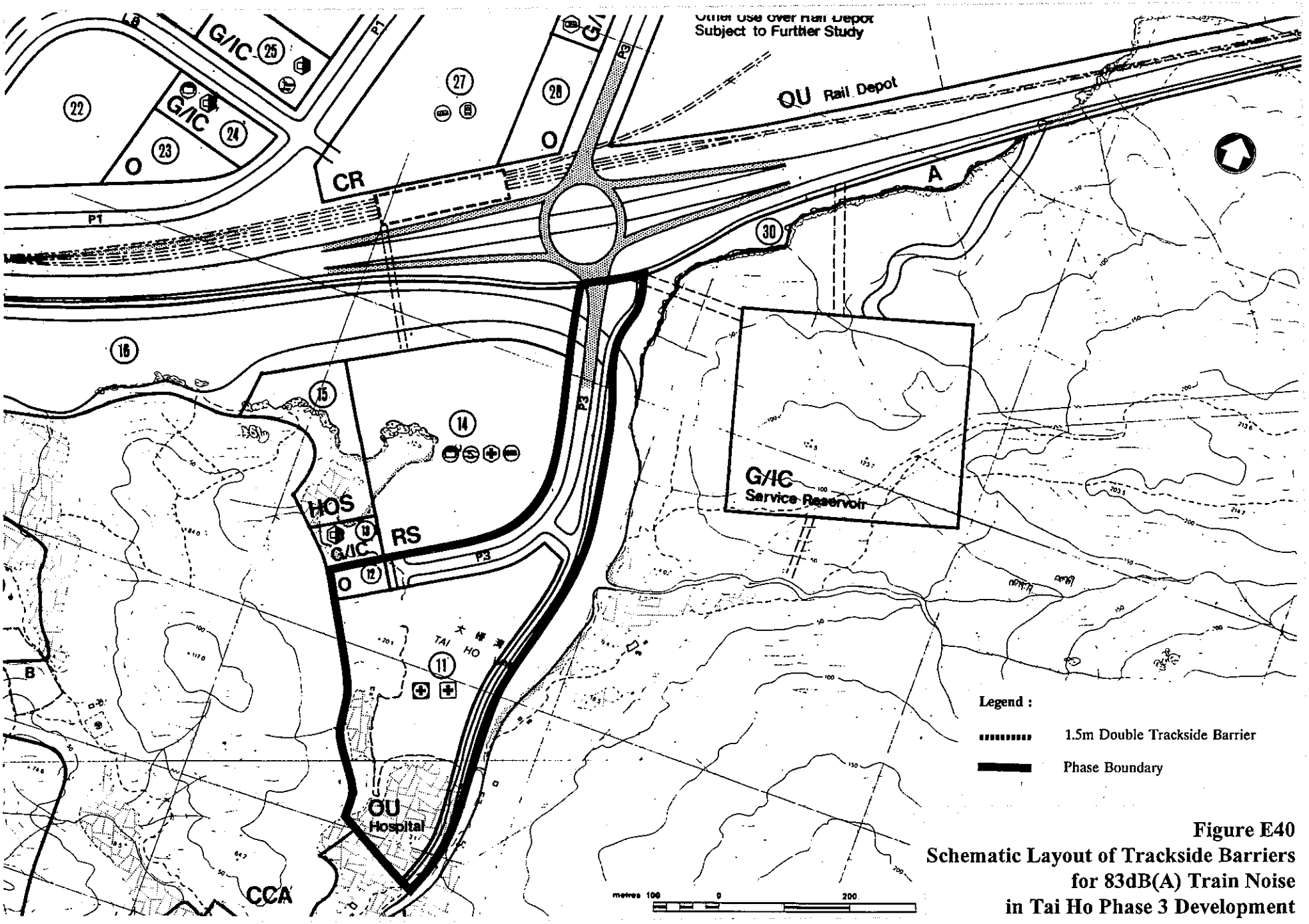


Figure E40
Schematic Layout of Trackside Barriers for 83dB(A) Train Noise in Tai Ho Phase 3 Development

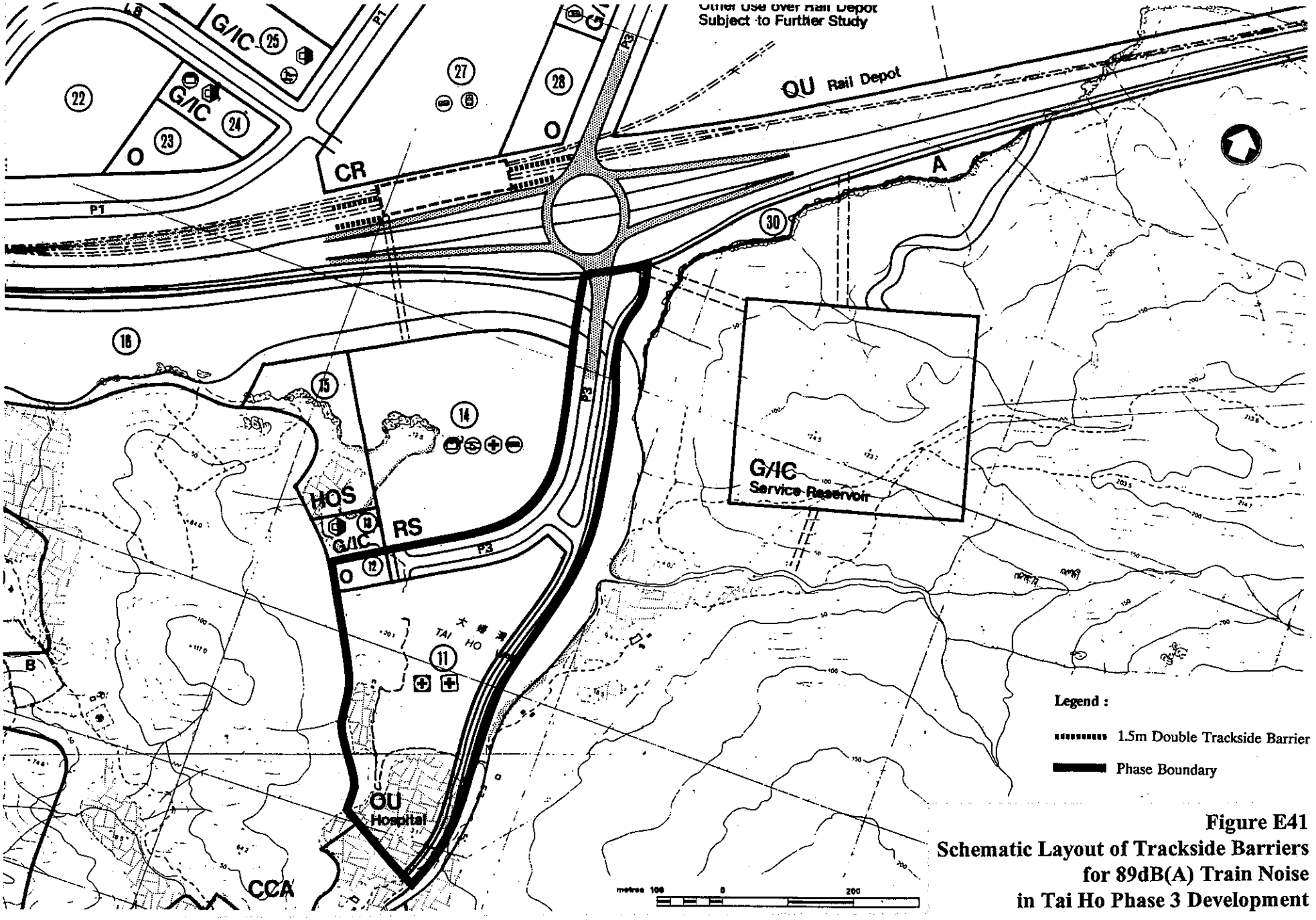


Figure E41
Schematic Layout of Trackside Barriers for 89dB(A) Train Noise in Tai Ho Phase 3 Development

Phase 4 : Tung Chung - Road Traffic Noise

Table E24 gives the road traffic setback distances required for Phase 4 Tung Chung to ensure HKPSG compliance without mitigation. Planning Area 47 would require 42m setback from Road D2, as shown in Figure E42, although this development constraint would be eliminated by covering of Road D2 adjacent to this Site with a friction course. No noise barrier mitigation of the roads is considered necessary for this phase other than that recommended for Phases 1, 2 and 3. Figure E42 shows the setback lines for all noise sensitive land uses in this phase.

Table E24 Setback Distances Required to Satisfy the HKPSG Criteria for Tung Chung Phase 4 Development Without Mitigation

Planning Area	Major Line Source	Land Use	Setback Distance (m)	
			2001	2011
37	P2 (31)	G/IC	nil	25
46	D2 (32)	HOS	nil	23
	P2 (31)		nil	11
47	D2 (33)	R1	nil	42
53	nil	R2	nil	nil
54	P1 (27)	R1	nil	15
55	P1 (27)	R2	nil	15
56	P1 (37)	R3	nil	32

Phase 4 : Tung Chung - Train Noise

Train noise will not constrain development in Tung Chung Planning Areas 46, 35, 47 and 37 without mitigation, with either train type as this section is fully covered. There are, therefore, no mitigation requirements for Phase 4 as indicated on Figure E43.

Phase 4 : Tai Ho Wan - Road Traffic Noise

Phase 4 development in Tai Ho Wan could be constrained by road traffic noise from the NLE, (Table E25) without the erection of earth bunds and barriers. In particular, Tai Ho Wan Planning Areas 14, 15, 18, 22, 24, 25, 27 and 29 are likely to be adversely affected and large noise setbacks would be required. Table E26 gives the noise mitigation proposals for these areas to ensure HKPSG compliance.

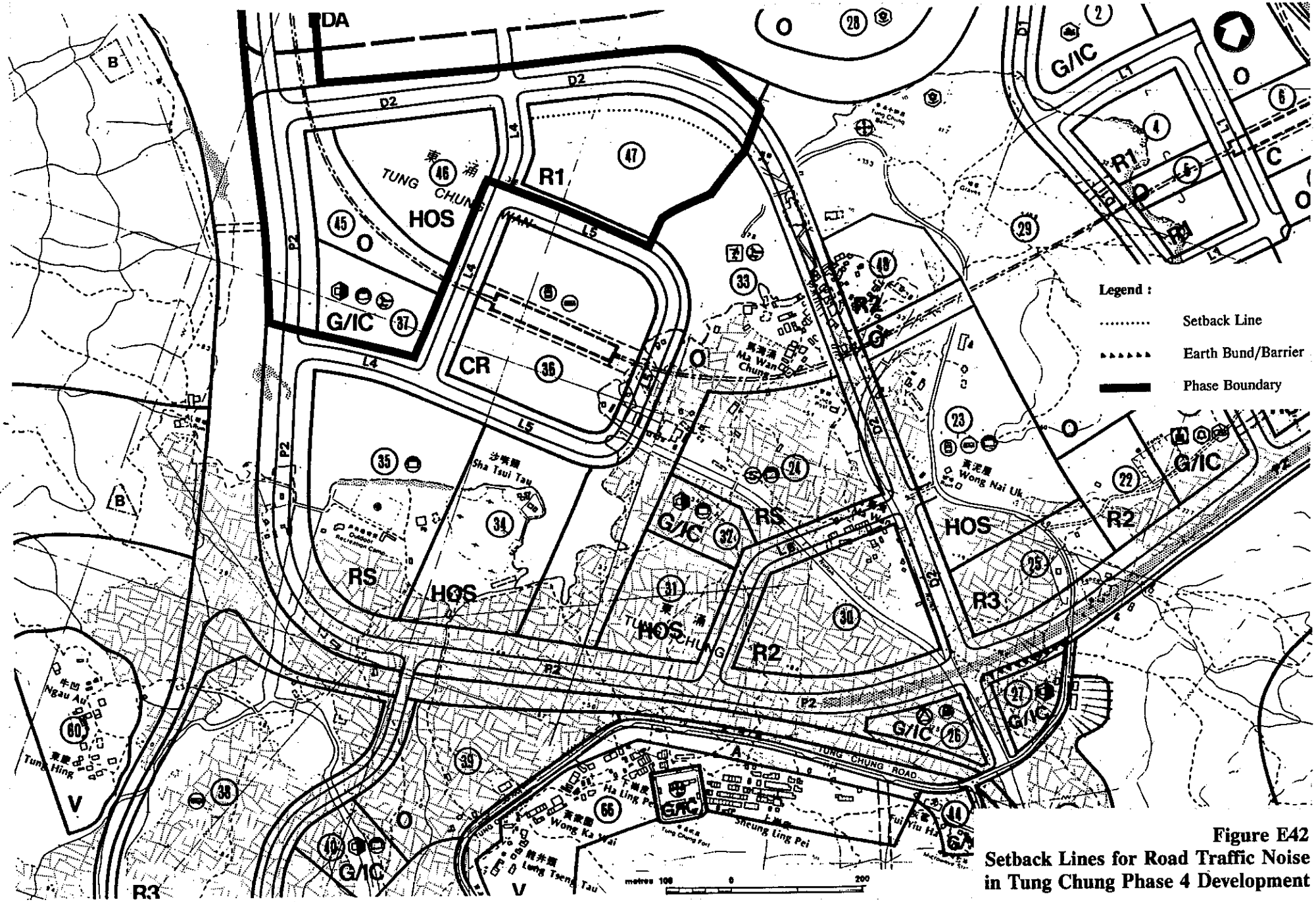


Figure E42
Setback Lines for Road Traffic Noise in Tung Chung Phase 4 Development

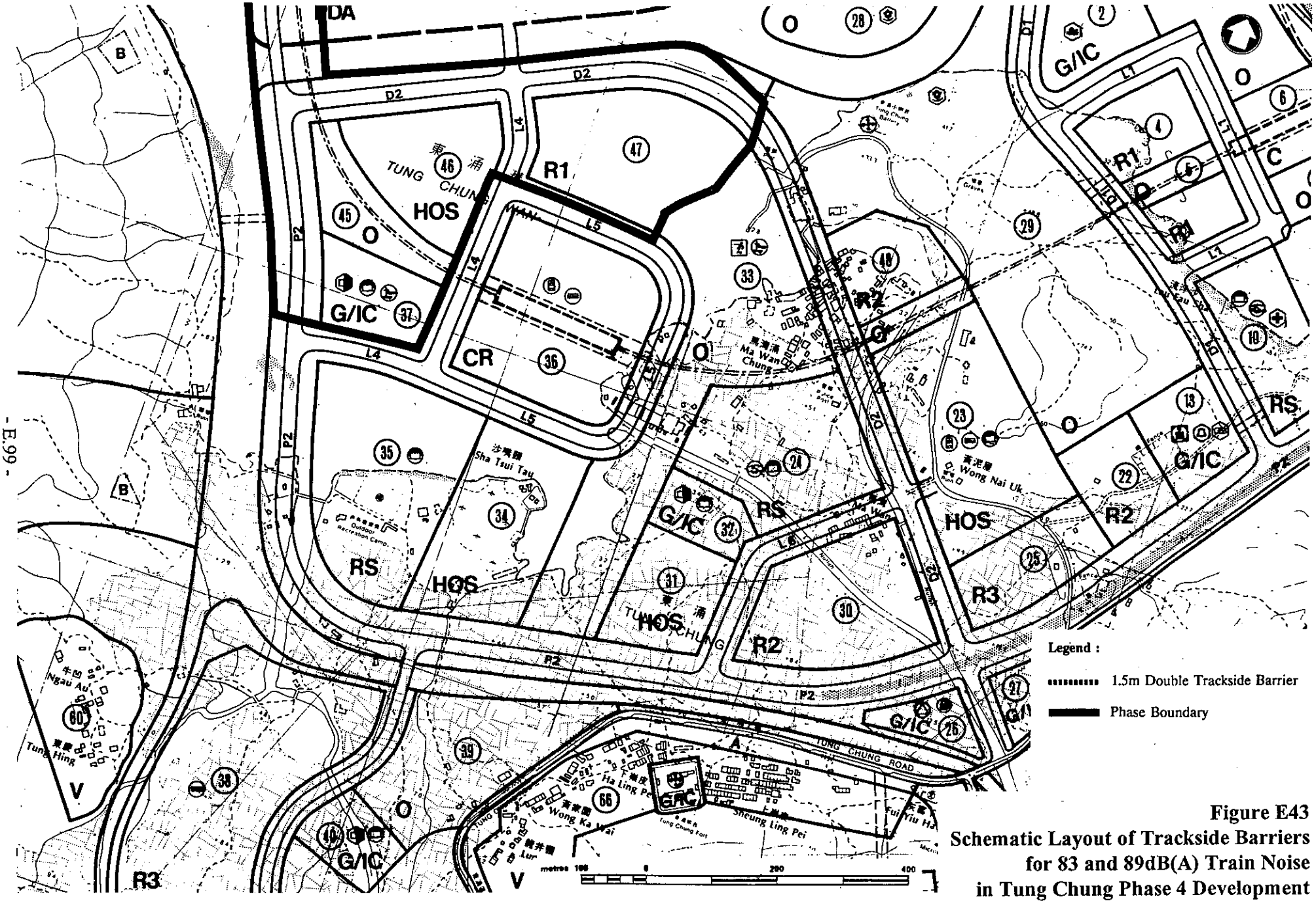


Figure E43
Schematic Layout of Trackside Barriers for 83 and 89dB(A) Train Noise in Tung Chung Phase 4 Development

Table E25 Setback Distances Required to Satisfy the HKPSG Criteria for Tai Ho Wan Phase 4 Development Without Mitigation

Planning Area	Major Line Source (Link)	Land Use	Setback Distance (m)	
			2001	2011
13	--	E	nil	nil
14	P3 (6)	RS	nil	21
	NLE (1)		192	208
15	NLE (1)	HOS	192	208
18	P1 (10)	R2	nil	31
	NLE (1)		192	208
19	--	HOS	nil	nil
21	--	R1	nil	nil
22	P1 (10)	HOS	nil	31
	NLE (1)		192	208
24	P1 (10)	E	nil	74
	NLE (1)		455	493
25	P1 (11)	E	nil	134
27	NLE (1)	CR	192	208
	P1 (11)		nil	56
29	P1(12)	E	nil	135
	P3 (5)		109	177

Table E26 Noise Mitigation Proposals for Tai Ho Wan Phase 4

Planning Area	Major Line Source	Land Use	Type of Mitigation	Approximate Barrier Length (m)	Residual Setback distance (m)
14	NLE (1)	RS	II *	600	176
15	NLE (1)	HOS	II *	600	176
18	NLE (1)	R2	II *	200	176
22	NLE (1)	HOS	II *	400	176
24	P1 (10)	E	I *	120	31
	NLE (1)		II *	220	51
25	P1 (11)	G/IC	I *	120	41
27	NLE (1)	CR	II *	250	176
29	P1 (12)	E	I *	200	41
	P3 (5)		I *	150	41

Note : * plus friction course

Planning Area 29 at Tai Ho Wan is planned for a secondary school, an ambulance depot and a fire service station. The school is the only sensitive use on the site and noise barriers for Road P3 and Road P1 may not be required if the non-sensitive facilities can be planned to screen the school. Figure E44 shows the schematic layout of earth bunds/barriers and the associated setback lines for all noise sensitive uses in Phase 4 development at Tai Ho Wan.

Phase 4 : Tai Ho Wan - Train Noise

Train noise will constrain all the sensitive land uses in Planning Areas 18, 19, 22, 27 and 29 in Tai Ho Wan as the ARL + LAL setback distance, without mitigation, with the 83dB(A) train is 510m and with the 89dB(A) train is even greater. With either an 83dB(A) or 89dB(A) train the installation of a double 1.5m trackside barrier on the north of both of the railway lines will virtually elimate all constraints as shown on Figure E45. However, noise constraints will remain even with double 1.5m barriers for both train types in the south eastern corner of Planning Area 27. The extent of constraint will depend on the detailed layout plans for this Planning Area including that of Tai Ho Wan station. Trackside barriers greater than 1.5m or full rail enclosure would be necessary if sensitive uses are necessary in this area if the constraint can not be removed via land use planning. Figure E45 shows the schematic layout of the proposed double 1.5m trackside barriers and additional mitigation required to protect the adjacent land uses for both train types and indicates the location of additional mitigation required in Planning Area 27.

Double 1.5m trackside barriers on the south of the ARL/LAL will be required for both types of train rolling stock as the nearest dwellings (Planning Areas 14 and 15) would be affected by noise unless mitigation is applied. However, the proposed double 1.5m trackside barriers will protect these sensitive uses and eliminate railway noise constraints for either train type.

Phase 5

As the land uses in this post 2011 development are undetermined at this stage, no assessment of noise impacts can be made.

Operation Noise Mitigation Recommendations

It is recommended that the following noise mitigation should be applied.

(a) An integrated noise "package" to the whole of the NLD should consist of a combination of one or more of:

- surfacing of the NLE and all primary roads with a layer of friction course;
- provision of appropriate noise setbacks for sensitive land uses alongside busy roads;
- restricting the angle of view from residential buildings of the adjacent roads to less than 120°; and
- noise barriers.

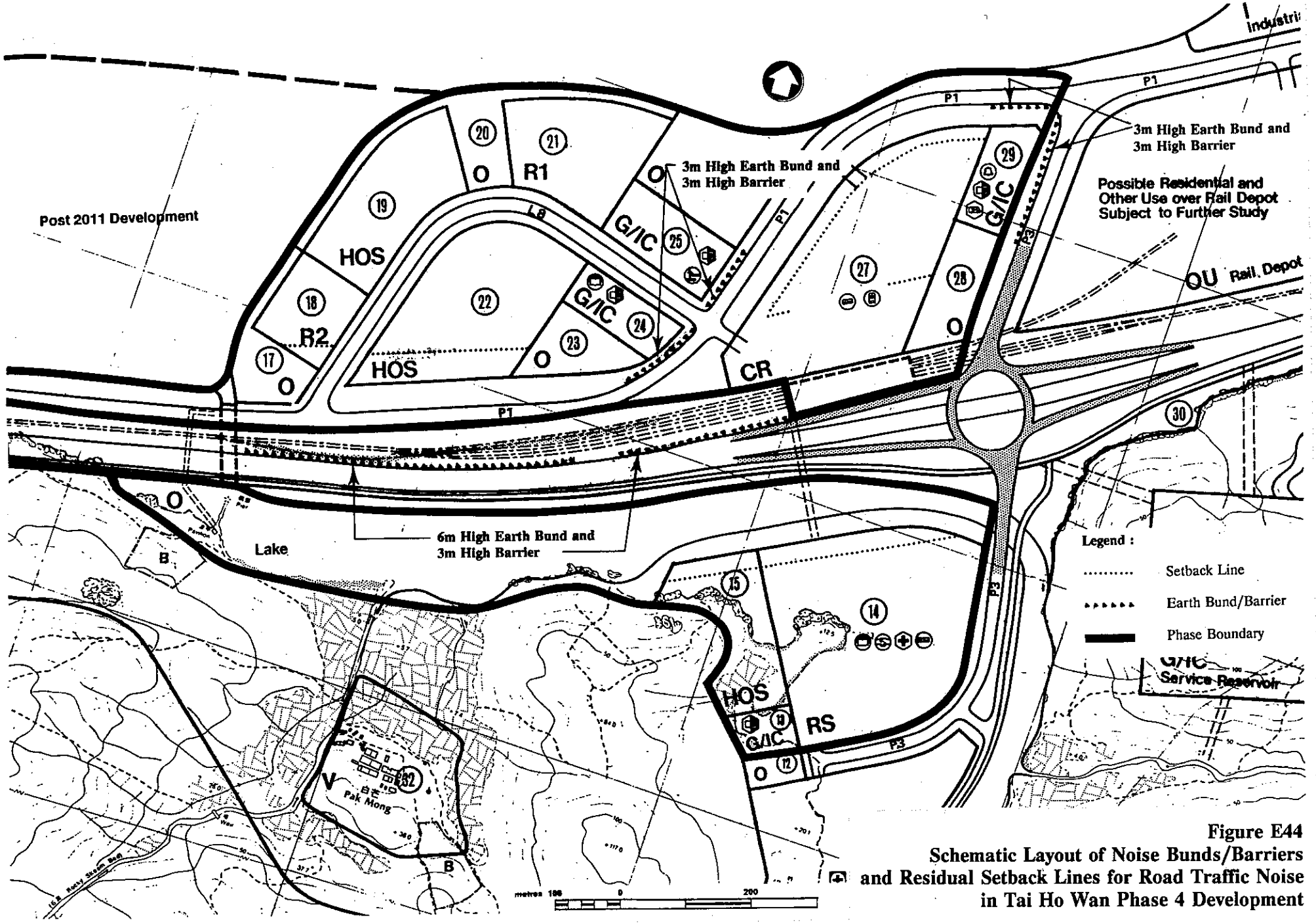


Figure E44
Schematic Layout of Noise Bunds/Barriers and Residual Setback Lines for Road Traffic Noise in Tai Ho Wan Phase 4 Development

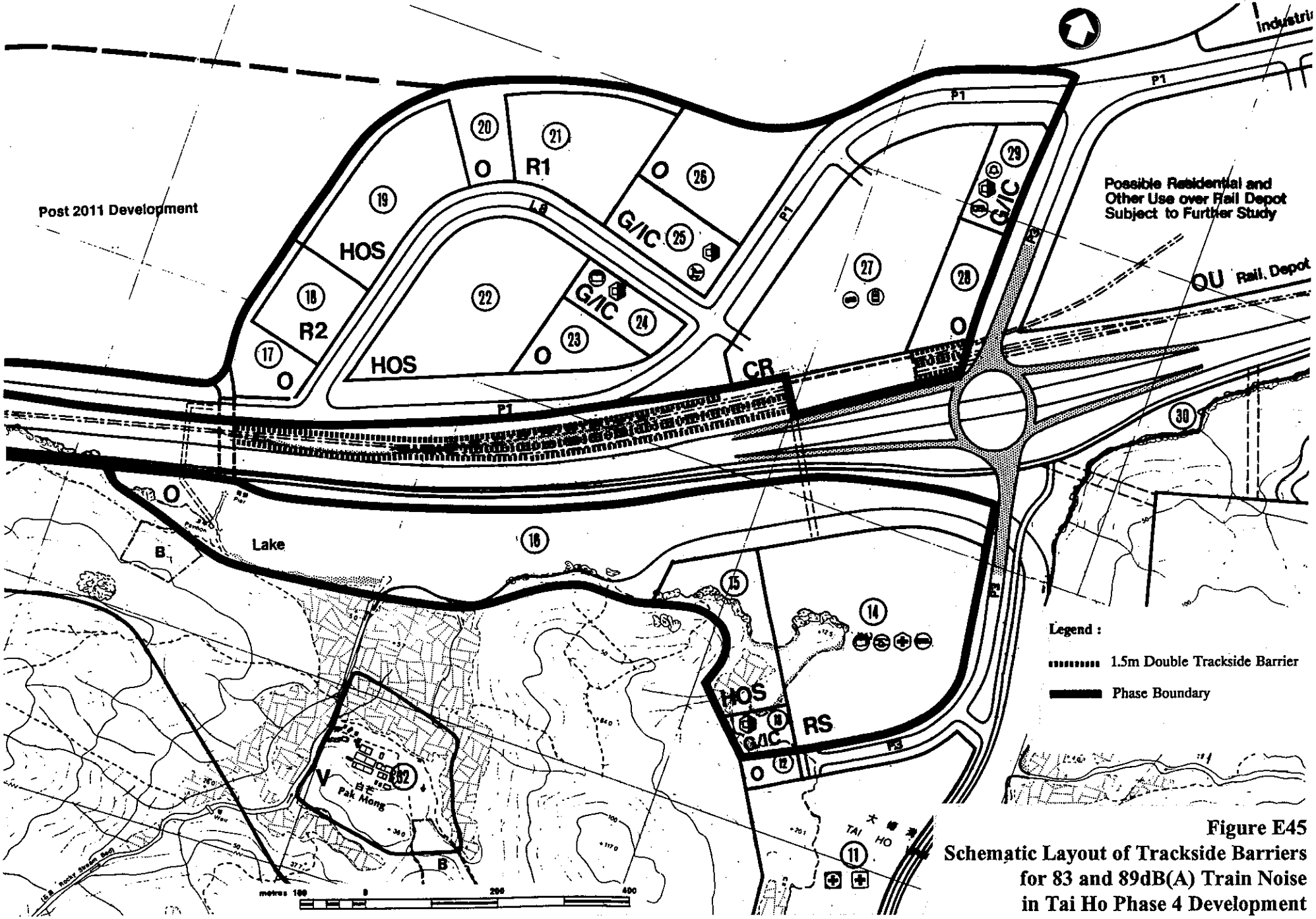


Figure E45
Schematic Layout of Trackside Barriers for 83 and 89dB(A) Train Noise in Tai Ho Phase 4 Development

(b) The following noise barriers are recommended:

- o noise barriers comprising a landscaped earth bund 6m high with a 3m high noise barrier on top are recommended alongside the NLE wherever, the setback distances at the noise sensitive land uses flanking the road exceed approximately 160m - 170m without the use of this barrier. Provision must be made so that these measures are in place prior to the occupation of any noise sensitive sites protected by them;

- o noise barriers comprising either a landscaped earth bund 3m high with a 3m high noise barrier on top or a 3m noise barrier alone are recommended where the setback distances at the noise sensitive land uses alongside primary roads exceed 50m without the use of this barrier; and

The timing for the erection of railway trackside barriers cannot be established in this study and needs further consideration when details of the vertical alignment of the LAL and more details of rolling stock and train frequency are available. Absorptive trackside barriers of 1.5m high, when placed on the side of the noise sensitive receiver, have been shown to be sufficient to reduce noise to acceptable levels in virtually all instances. These results and schematic layouts are based on the RODP layout and assumed vertical railway alignments and illustrate the likely extent of measures necessary to mitigate rail noise. However, it should be noted that a review of the rail noise mitigation type, timing and installation requirements will be required when further details of rolling stock and railway operational characteristics are available.

The schematic location of at source road and rail mitigation requirements for all phases are summarised on Figures E46, E47 and E48. These figures also include the friction course requirements necessary to eliminate noise constraints.

Operation Noise Source Guidelines

Potential Operation Noise Pollution Sources

Some components of the NLD may lead to noise pollution. Proposed operational guidelines are given in the following paragraphs.

Industrial Park

The first stage of the industrial park will be completed during Phase 2 and its completion will be during Phase 4. The following development controls should be applied to minimise noise pollution impacts:

(a) only industries which do not have off-site noise pollution impacts (in accordance with the HKPSG) should be allowed to locate at the industrial park;

(b) structured management of the industrial park will be required to ensure noise (and water and air) pollution control measures are being adopted;

(c) industrial/residential setbacks should be retained when the precise nature of industrial developments are established; and

(d) environmental assessment, monitoring and audit of the industrial park will be required.

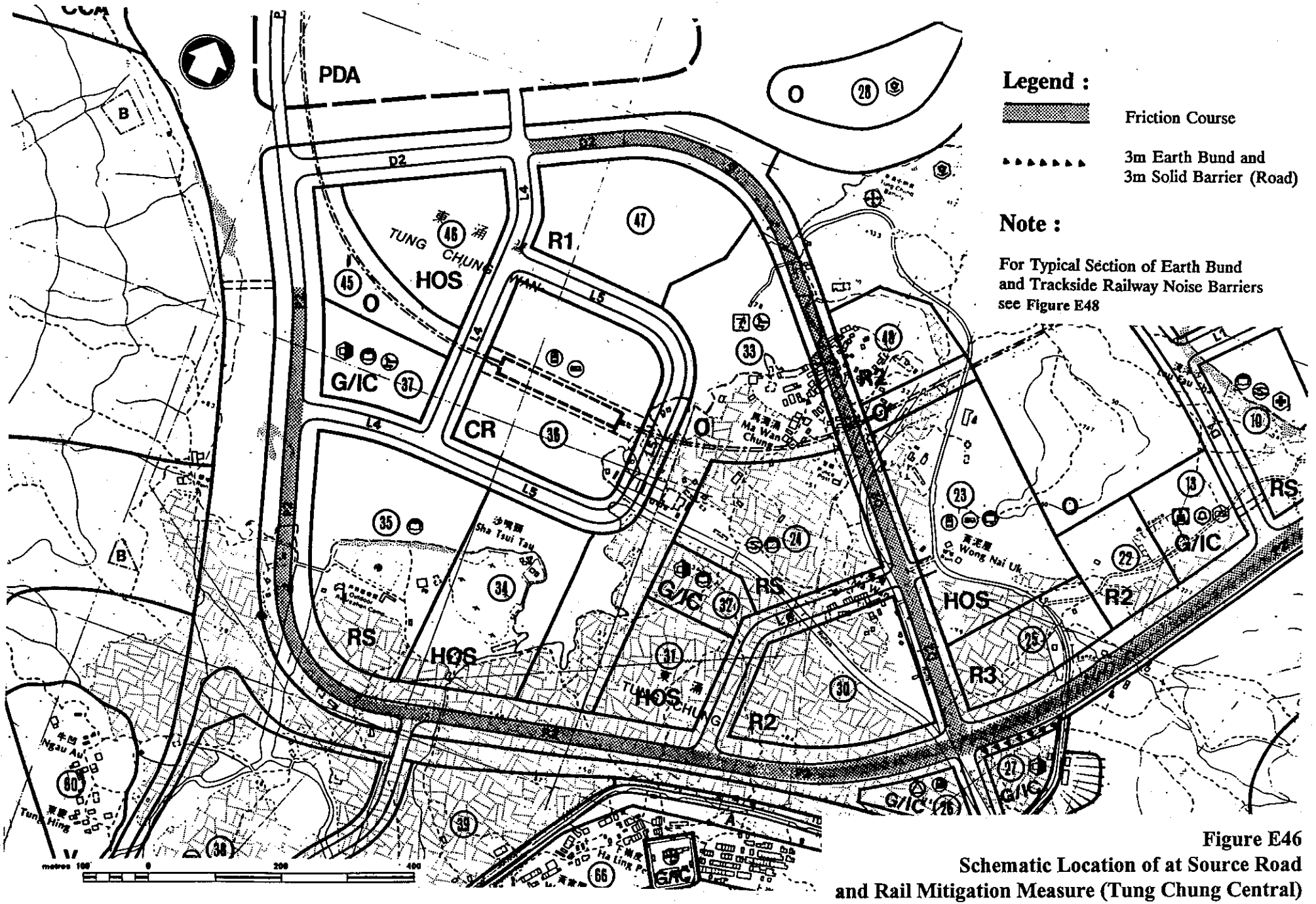


Figure E46
Schematic Location of at Source Road and Rail Mitigation Measure (Tung Chung Central)

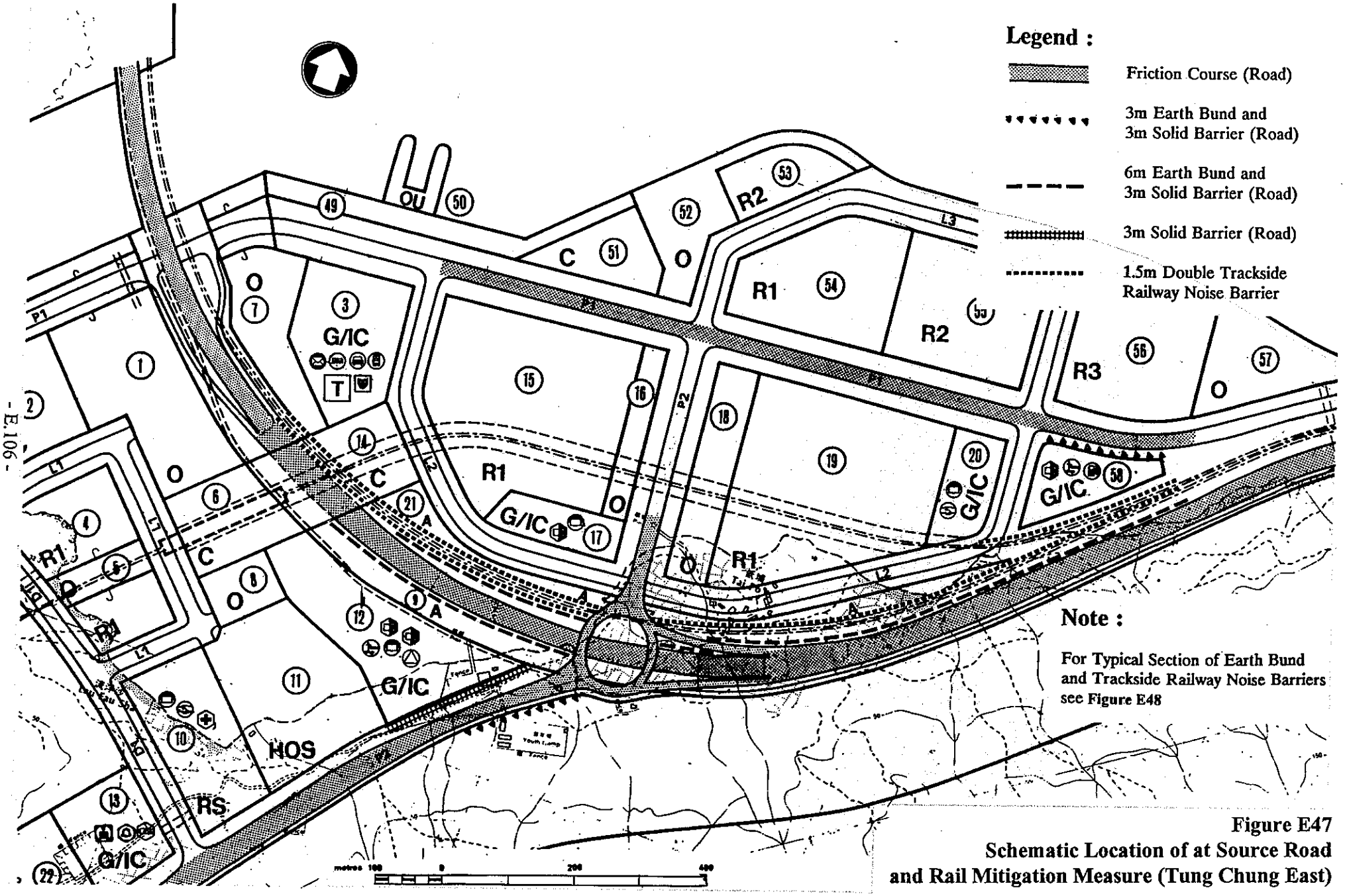


Figure E47
Schematic Location of at Source Road and Rail Mitigation Measure (Tung Chung East)

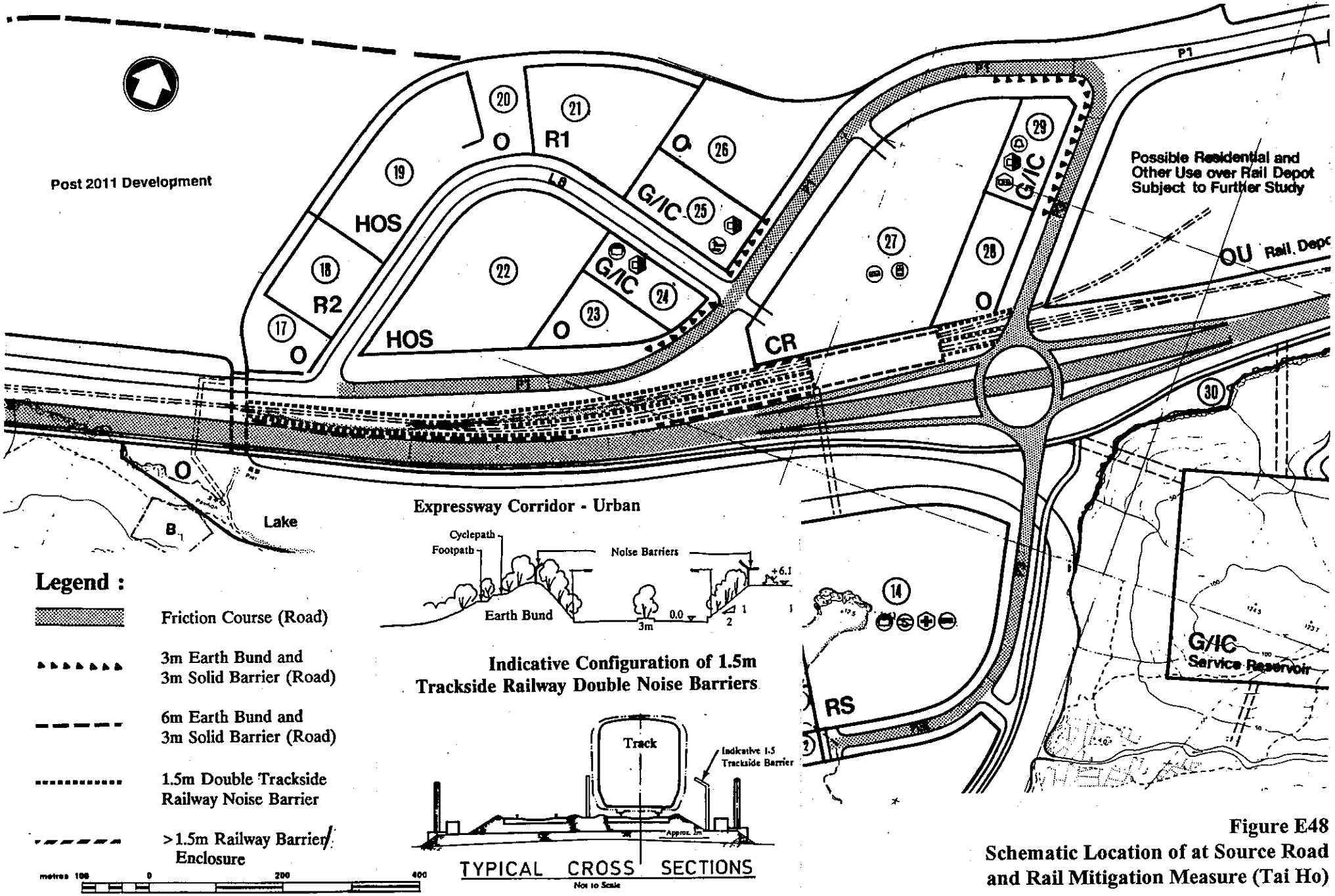


Figure E48
Schematic Location of at Source Road and Rail Mitigation Measure (Tai Ho)

Railway Depot

The railway depot will be completed during Phase 1 and Phase 2. The following development control will minimise off-site noise pollution impacts:

(a) enclosure of parts of the railway depot may be necessary to prevent noise pollution; and

(b) environmental assessment, monitoring and auditing of the railway depot will be required.

In addition the possibility of a noise tolerant building acting as a screen above the railway depot should be investigated during the detailed design of the railway depot area.

Railway Track Maintenance Operations

It has been assumed that there will be a high standard of maintenance and the noise calculations are based on smooth wheels and tracks. Frequent grinding of both will be needed to achieve this. Careful timing and management of track grinding operations and other maintenance measures will be required to minimise noise pollution impacts. The train operator will be responsible for the achievement of acceptable noise levels for railway operation and maintenance and the assessment of these and other railway operational factors such as frequency of operation will be critical and should be considered in the required EIA of the train operation.

NLE, Primary and Local Roads

The noise impact of roads should be monitored during the build up of road traffic, population and associated noise sensitive receivers to validate the setback results predicted in the environmental assessment. This would comprise part of the routine environmental auditing and monitoring programme of the NLD to ensure HKPSG levels are not exceeded.

Operation Noise Sensitive Reciever Guidelines

Following the construction of each phase of the NLD certain components will be sensitive to noise. Proposed operation guidelines to protect such noise sensitive receivers are given below.

Residential Population

The new residential population will increase from 20,000 persons in 1997 to 200,000 by 2011 with an ultimate post 2011 population of 260,000. Noise pollution considerations have been taken into account throughout the New Town design and residential population has been located with adequate noise buffers from all potential pollution sources. This assessment includes existing villages and village re-site areas. Nevertheless, environmental monitoring and audit will be necessary to ensure that HKPSG noise levels are achieved.

E5 ECOLOGY

E5.1 Terrestrial Ecology

Direct Impacts

The NLD and other developments such as the NLE will have significant impact on terrestrial ecology although the direct impacts will be confined to the coastal zone and lower slopes. These areas have already been anthropogenically modified as can be seen by channelization of streams in both Tung Chung and Tai Ho Wan.

In terrestrial ecological terms the major direct impacts will be those on the coastal mangrove habitats at Tai Ho Wan and Tung Chung which will be lost and the ecology of these areas will be fundamentally altered. Other direct terrestrial impacts will be the alteration and channelization of previously natural stream courses with their associated impact on surrounding wetland and marshland habitats. In view of the proposed NLD land uses, drainage and sewerage proposals the water quality of streams should not be detrimentally affected by the NLD.
In addition to these impacts detailed infrastructure developments such as the provision of power cables and power lines, water storage reservoirs etc. could have considered potential adverse impact on terrestrial ecology and visual intrusion. It is recommended that their environmental and ecological impact should be assessed and should be part of their locational criteria.

Indirect Impacts

In addition to the areas directly affected by development, experience elsewhere in Hong Kong warns that a much larger surrounding area can be irreversibly damaged by large scale developments. Immediately around the development areas, damage may, for example, be done by uncontrolled dumping and movement of vehicles. Further afield, the major threats are from fire and hunting.

The adverse impact of fire is obvious, and represents a special danger in Hong Kong because of the seasonal pattern of summer rainfall and winter dryness. The effects can be seen in several parts of the NLD Area, particularly north of Ngong Ping and east of Tai Ho Wan. Other areas have not been burned in recent years but are still in the highly inflammable successional stage of recovery. Closed shrubland and woodland will only burn in exceptionally dry weather, but such conditions are sufficiently common in Hong Kong for there to be a real risk of damage to the unique upland woodlands. It is essential that steps are taken to prevent fires starting associated with the NLD. The most sensitive areas and the most likely sources of fire should be separated by fire breaks of adequate width between the urban areas and the surrounding hill slopes.

Hunting presents a special problem given the low density of the local mammal fauna, and the tendency of individual animals to use regular routes to feeding areas. Controlling the movement of people outside the development areas may be impractical, but it is important that every effort should be made to control such hunting particularly that associated with recreational land uses.

As a result of the unavoidable adverse ecological impacts on certain areas within the NLD Area the ecological conservation and ecological mitigation measures, proposed focus on the on the preservation of valuable ecological habitats in areas less affected by the NLD and other developments.

Mitigation for Terrestrial Ecology Impacts

Landscape, visual and ecological issues have been covered in Topic Report Tr10(Revised) 'Environmental Assessment', in Topic Report TR14 (Revised) 'Master Landscape Plan' and Topic Report TR15 (Revised) 'Rural Hinterland Strategy Plan'. The Master Landscape Plan includes landscape and urban design proposals and guidelines for the New Town and proposed landscape design techniques for amelioration of environmental impacts on the surrounding area. The Rural Hinterland Strategy Plan includes a hinterland framework for North Lantau Development and provides guidelines for the planning, development control and management of the urban fringe of the New Town in North Lantau.

E5.2 Marine Ecology

As many of the organisms in the nearshore areas of the principal marine habitats, the sheltered bays, are highly specialised and demonstrate high degrees of interdependence, the consequence of removal of one key species, can have corresponding a knock on effect on the food supply and distribution of a number of diverse organisms.

In the case of the North Lantau littoral zone this is best illustrated by the mangrove communities. The mangrove plants generate large amounts of carbon and nitrogen. As leaf litter decomposes, it undergoes a process of nutrient enrichment that is seldom found in terrestrial ecosystems. The rapid recycling of nutrients permits the maintenance of a very high biomass in relation to other systems. Depletion or removal of mangroves does not permit replication of the required nutrient levels for sustaining the community. Under the proposals for the NLD programme, it is anticipated that all of the sheltered inlets on this part of the coast, ie. those areas that constitute the most productive zones, will be either lost to reclamation, or will become embayed.

The marine impacts will include:

(i) Significant impacts on some fish stocks. The fluctuating physical conditions associated with run-off from the Pearl River, might be expected to result in a highly variable natural mortality rate among young fish on an annual basis. In the absence of further information on the population dynamics it is not clear whether habitat depletion would result in observable differences in the population in the short term.

(ii) Most of the mangrove areas will be debilitated when combined with New Airport and NLE developments, with corresponding effects on the associated plant and animal communities. This will represent a major proportion of the existing mangroves on Lantau, assuming a worst case situation. Where direct reclamation occurs and the littoral zone is replaced with armoured wall, species composition will change radically, these areas becoming populated by the less diverse communities associated with boulder and rocky shores. The extent to which recolonisation by these forms takes place will depend on the levels of effluent discharge expected to occur.

(iii) Embayed areas such as Tai Ho Wan will experience major fluctuations in salinity, turbidity, and temperature. These changes in physical conditions will be manifested in a more marked seasonality in the distribution of motile animals, and with a general reduction in the diversity and abundance of benthic and sessile organisms.

(iv) Increased population pressure in association with planned light industrial development, and storm water discharges from the New Airport, may lead to an increase in effluent loading to the marine environment, although all discharges will have to conform to Government objectives. Impacts associated with this are unquantifiable until further details of planned industrial activities are known. Contaminated by aviation fuel. PAH's are carcinogenic, and acutely toxic to marine organisms at concentrations between 0.2 and 10.0 ppm; at reduced concentrations of 5 to 100 ppb, fish develop cell abnormalities and tumours. It is understood that this issue will be addressed by the New Airport Master Plan Consultants in their operational environmental assessment.

Marine Impact and Mitigation

The NLD programme and associated PADS developments will have a major impact on the coastal ecology of North Lantau on a localised scale there are a number of measures which should be adopted.

The only alternative to general depletion of the entire littoral zone would be the establishment of protected zones at specified locations along the coast. The areas of most interest in this respect would be Tai Ho Wan and San Tau. At San Tau such a scheme would perhaps permit maintenance of the existing mangrove and sea grass areas, and at anticipated water exchange rates under the Recommended Outline Development Plan may provide a suitable conservation associated with the proposed SSSI for the sea grass area.

E6 ENVIRONMENTAL IMPACTS ARISING FROM THE REFUSE TRANSFER STATION OPERATION

E6.1 Introduction

The main source of installed plant noise will be from hydraulic power packs which power the waste compactor and the air exhaust fans used to control environmental conditions in the waste reception area. These are housed in the process building and the units could be readily incorporated in acoustic enclosures to produce satisfactory noise levels. Other mechanical and electrical equipment is unlikely to generate high noise levels. Waste discharging from RCVs and other vehicles will contain hard objects. On discharge, these materials can fall some 5m into feed shutes of the waste compactors. Noise control from this source can be controlled by the use of insulating material applied to the external surfaces of affected areas of plant.

Refuse collection vehicles (RCV) and bulk transfer vehicles will generate noise in the transfer building and in particular during the "banging out" operation often used during unloading to dislodge waste adhering to the inside of collection vehicle. The incorporation of reflection and absorption measures in the design of the station cladding can be used to reduce this noise impact.

Noise generated outside the building but within the site boundary can be contained to some extent within the site, if required, through the provision of perimeter screening. This is rarely used since the main source of noise is from the collection vehicles which must travel on the adjoining roads where their noise emissions cannot be contained.

Vehicle repair and maintenance noise would be associated with power tool use, body repair and engine testing. These would mainly occur within the building enclosure and it is considered that that would be unlikely to cause external nuisance. Vehicle traffic into and out of the site may be concentrated at shift starting and finishing times but it is not considered that they would be a serious environmental nuisance.

The special wastes assembly point will be a small scale operation. Noise impacts would arise from the handling of continuous used for initial storage onto collection vehicles. However, these may be of plastic or GRP construction and noise emission levels will therefore be minimal.

The sources of internal noise are waste delivery vehicles, site container vehicles, mobile container handling plant and the power unit of the barge derrick crane. Careful equipment selection and design specification will be effective in controlling noise levels which are mainly associated with diesel power units and exhausts. In addition, the movement of containers between the various process points of the station generate impact noise through container contact with hard surfaces. Careful control of container movement will minimise the frequency and level of noise.

E6.2 Litter

Litter on the site will be virtually eliminated by the proposed approach. The totally enclosed building will retain any spillage during the process and the enclosed container transport arrangements limits the opportunity of refuse spread in the station yard or on the route to the landfill disposal site. A mechanical sweeper unit would be employed to provide a clean station and surrounding road surfaces.

The internal and external design of the RTS should aim to facilitate cleaning and avoid crevices, ledges and corners which can not be easily accessed and cleaned and will avoid waste accumulations. This will assist in maintaining good housekeeping and will have environmental benefit and will additionally reduce the number of sites suitable for flies, rats and other vermin to nest and breed. The overall good housekeeping practices, including regular thorough cleaning will minimise problems.

Vehicles utilising the workshop and parking area would not normally be loaded with waste and therefore littering is unlikely to be a problem. On occasions, if a loaded vehicle has technical problems associated with its compaction loading or ejection equipment, some waste spillage may occur if the vehicle is repaired and tested in the workshop area. The proximity of the transfer station would allow ease of access for the fitter to travel into the transfer building in order to check vehicle functioning and discharge loaded wastes into a compaction chute.

Care must be taken to ensure that the quality standards of waste containerisation for privately collected waste meet those adopted for publicly collected waste. Container door systems and total enclosure of wastes during storage and transit is a pre-requisite to litter control.

E6.3 Transport Considerations

Queuing lanes for RCVs and transfer vehicles will be provided within the station complex to avoid congestion on the public approach roads. The transfer station and transport system will be virtually dust and litter free from the time waste is delivered to the transfer station to the time it is received at the landfill site. The transfer of the waste from a large number of small collection vehicles to one container barge per day makes optimum use of bulk transportation system in terms of traffic densities, vehicle economics and manpower resources.

A further transport consideration would be transport contingency plans for extreme bad weather, for example, during typhoon conditions. In addition to bad weather condition, consideration should also be given to emergency conditions such as power failure, plant breakdown etc. In these cases waste would either be stored at the RTS in sealed containers or in protracted periods of bad weather road transport to WENT may be required to prevent

excessive build-up of containerized waste. The impact of this would be principally that of the additional numbers of heavy goods container vehicles between the RTS and WENT. However, it is considered that the overall impact would not be great due the likely short-term nature of this contingency disposal route.

The following additional points are suggested:

- o an automatic vehicle washing system should be installed at the exit to facilitate washing of RCVs after unloading; and
- o the floor surface of the off-loading platform for RCVs should be made of non-slippery material to prevent skidding.

E6.4 Dust

The movement and transfer of wastes in the transfer station will cause airborne dust and odour and the potential spread of light paper and plastic sheet material through air disturbances caused by falling waste.

In general, Hong Kong waste has a high moisture content and does not release any substantial amount of free dust. Nevertheless, an air extraction plant is proposed to control dust and odour emissions.

Dust control air extraction would form part of the integrated ventilation system for the transfer building. The system would include both natural and powered roof extraction to remove vehicle exhaust fumes and odour.

The generally recommended Occupational Exposure Level (OEL) for general (nuisance) dust (i.e. dust which contains no obviously harmful agents) is 10 mg per m^3 (time weighted for an eight hour exposure period). If a working shift is longer than eight hours then this exposure limit should be proportionally reduced. A dust level of 10 mg m^3 is "visibly" dusty and it is not recommended that such a level be allowed during the transfer station operation. With the proposed design parameters, it is anticipated that general dust levels will below 1 mg per m^3, which has been recommended as a maximum design target in refuse transfer stations in Hong Kong.

Exposure to high transient levels of dust must be avoided but should they occur temporary control may reasonably be achieved by issuing the "man-on-foot" with disposable ori-nasal dust masks. This type of mask is not onerous to wear and will be effective in protecting against these transient exposures although this is not considered to be necessary if the envisaged conceptual design is adopted.

E6.5 Vehicle Exhaust Emissions

The vehicle exhaust emissions will principally contain carbon monoxide, oxides of nitrogen, sulphur and hydrocarbons. It is not anticipated that the level of these pollutants will be significant in the station provided that an adequate air flow is maintained through the station to dilute them.

RCVs and bulk load vehicles will be required to be weighed at a central weighbridge complex to determine the net weight of their respective loads. At peak times there will be a requirement for them to queue at this complex and at other locations on the site but as this will occur in the open air away from sensitive receivers the impact of exhaust emissions can be expected to be low.

E6.6 Odour

Due to the relatively high proportion of putrescible material and the high average ambient temperatures, and moisture content bacteriological activity in the waste will lead to high odour levels which may be a more significant problem than that of dust control. This is particularly so as the waste from the New Airport catering facility will comprise a large proportion of wet putrescible wastes.

Operational controls must be imposed to limit the time period between waste entering the station and the eventual disposal at the landfill site but unfortunately no control is possible during the time taken for the waste to reach the station. It is therefore likely that on occasions particularly active waste will be delivered to the plant and on these occasions charcoal masks should be made available to operatives having to deal directly with the supervision and/or the unloading and processing of the waste.

Chemical treatment of the waste to reduce biological activity or masking sprays are not receommended as they are unlikely to be effective and may itself introduce additional safety or environmental hazards into the transfer station. Chemical treatment should not be considered as an odour control option.

It is recommended that if any proposal to use odour masking sprays in or around the transfer station is proposed its consideration includes a toxicological assessment of the chemical agents in the sprays since long term exposure to these agents may itself represent a health hazard.

Treatment of air exhausted from waste handling areas can be treated to reduce odour emissions from the station. Wet type air cleansing systems can include chemical treatment and are effective but are expensive. It is considered that dilution of the aerosol component into high volumes of air will be adequate to mitigate external impacts of odour discharges. In addition to dilution, it is preferable to have odour removal equipment to reduce the odour positively.

The control of odour from the station will be a more significant problem than that of dust and vehicle exhaust emission control. The best solution to the control of odour is a planned policy of prevention. Refuse by its very nature has a distinitive odour which can be controlled through the transfer operation if action is taken at the design and operation stages to minimise the contamination of the station plant, infrastructure and environment. These are outlined below: -

a) the complete transfer facility must be easy to clean and of a design that offers the minimum opportunity for waste to accumulate;

b) the plant must include the facility for washing down all surfaces against which refuse depositions may accumulate;

c) the refuse handling plant equipment must feature an effluent collection system of sufficient capacity to handle contaminated water from waste handling and cleaning operations.

d) the bulk storage of waste must only be in closed containers.

e) no full containers should be stored on site for more than 12 hours. An overnight storage restriction should be imposed unless barging fleet operational hours have to be reduced for broader environmental reasons.

f) the venting of extracted air from the building should take place through a number of outlets to reduce local concentrations. This would prevent the development of a persistent and concentrated extract plume.

g) access roads, the ramp, tipping apron and bulk vehicle manoeuvring area must be washed down and mechanically scrubbed at frequent intervals to prevent odour accumulations of waste deposits and potential odour and associated pest problems.

h) the refuse containers and barges must be washed frequently to maintain high standards of hygiene.

If the above design and operating procedures are adhered to then the conceptual design of the station should ensure an environmental acceptable facility.

E6.7 Microbiological Aerosols

There is little published on this subject relating directly to refuse transfer stations. A number of studies have been carried out in the States and the UK to estimate likely exposure to microbiological aerosols (principally coliforms) for persons involved in the operation of refuse transfer stations and landfill sites. Although there have been no reports of any overt health hazards associated with the handling of refuse materials, results have indicated that high concentrations of colony forming units (CFU) can occur in transfer stations due to the relatively enclosed nature of the operations and emphasizes the need for good general ventilation if a build up of such agents in the air is to be avoided. The presence of coliforms clearly indicates the presence of intestinal pathogens which are likely to enter the body by ingestion or inhalation if good hygiene practices or control measures are not applied and enforced. There is also some evidence that respiratory tract pathogens exists which could produce chest infections in susceptible individuals.

At the present time no standards (ie acceptable exposure levels) exist for microbiological numbers or types of species that might be considered safe or unsafe in the working environment. In the absence of any specific guidelines it is recommended that exposure to such agents is kept as low as possible. This is likely to be achieved by keeping dust levels low and emphasizing the importance of good personal hygiene practices (eg washing prior to food consumption).

E6.8 Further Mitigation Opportunities

Conceptual Ventilation Design

To achieve environmentally acceptable standards a method of treating some of the extracted air will be necessary to eliminate dust and odour prior to its eventual emission from the station. It is therefore suggested that the design of the station takes this requirement into account.

This report can, however, only address ventilation design in very general terms as actual design will be dependent on plant detail design and joint development uses.

There are two basic approaches to transfer station ventilation one being dilution ventilation and the other local exhaust ventilation. The conceptual design of the station is based on the direct tipping of waste into hoppers located in the reception hall prior to packing the waste into containers. It has been recognised that the direct discharge of refuse will not generate high transient dust levels due to the moisture content but there will be odour and vehicle exhaust fumes.

In these circumstances ventilation control designed to ensure that dust and odour levels are diluted to acceptable levels would seem to be the most practical solution except for dusty load bays. The envisaged general design will therefore be based on the concept of dilution ventilation with the provision for enhanced local extraction applied at the back of the tipping bays. The general ventilation principle for the tipping apron will be to generate a relatively low velocity air movement away from the front or vehicle entrance side of the building to the back or where the RCVs discharge their loads. This air movement, which is too low to raise dust or to keep it in suspension, has the effect of keeping that part of the tipping apron used by visiting personnel dust and fume free.

Sufficient louvre area must be allowed to ensure that the air velocity through the ramp doors and louvres is kept low. Make-up air would have to enter the building to match the volume of air extracted. It is intended that this air should enter the building by means of louvred (bird proof) ventilation grills at high and low level sited opposite the tipping bays or by means of roof ventilation fans. This arrangement will ensure that an adequate supply of fresh air enters the building such that air flow will be towards the tipping bays. Air will also enter the building from the entrance ramp doorway. By creating postive directional air flow in the building, exhaust products and sub micron dust deposits, which have a low settling velocity, will be induced to move towards the air extraction points and thus remove the risk of permanent accumulation in particular building volume zones where air conditions are quiescent.

The achievement of this objective is frequently complicated by the existence of tipping hall access doorways and the changes in the prevailing wind directions during the different seasons of the year. All these factors must be carefully considered during the detail design stage.

Leachate Treatment/Disposal Systems

A drainage reserve will be required at the tipping hall of the RTS as wash down water is likely to be heavily charged with solids. Space will be required in the packer complex for cleaning containers and for hosing down components of the packer which are contaminated by leachate. As the refuse is packed into the containers fresh leachate is generated by the action of compressing the wastes. This free effluent should not leak out of the sealed containers unless they are damaged. However, this wash down water will be contaminated with leachate and refuse. The water has to be collected and treated to reduce the solid content and the pollutants loading to the acceptable level before it is discharged into the foul sewer.

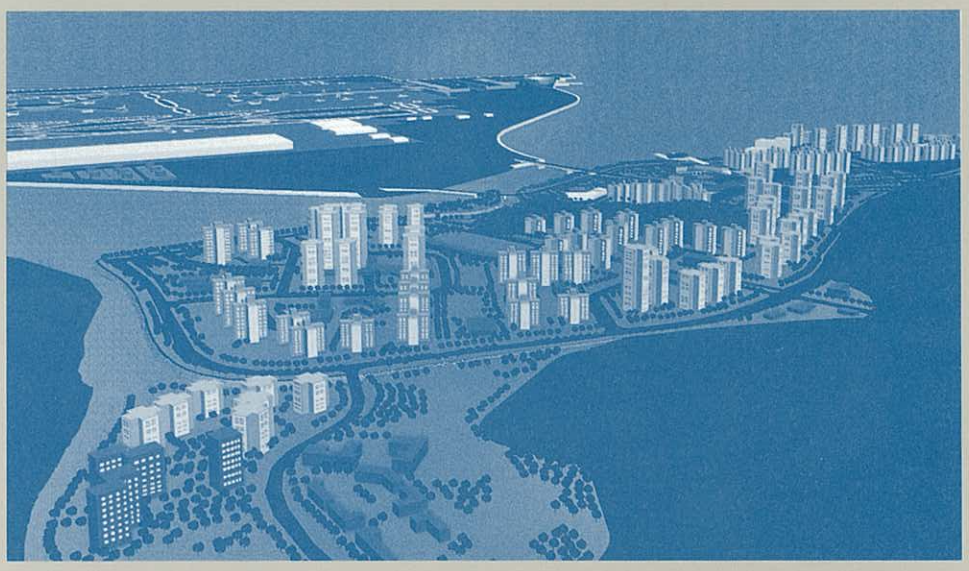
If a wet dust extraction system is adopted at the RTS, then the charge water will also need to be directed to the sewage treatment works.

A vehicle maintenance area may be located at Siu Ho Wan within the refuse transfer station site. This will be provided for the fleet of refuse collection vehicles as well as other Government vehicles requiring servicing. The facilities provided will include oils, grits, greases and foams. Oil based substances will need to be seperated and the charge water sent to the sewage treatment works. Used oil and lubricant from vehicle maintenance centre should be separated from water and collected for reuse. Collection facilities for the oil and lubricant should be provided. The oils and lubricants will then be reused.

E6.9 Conclusions

Taking into account the relative location, the forms transport proposed and environmental controls likely to be adopted at the refuse transfer station it is considered that the RTS will have little environmental impact on its surroundings and on sensitive uses.

North Lantau Development



Appendix F

The Sea Channel

APPENDIX F

THE SEA CHANNEL

F1 INTRODUCTION

The Sea Channel option was introduced in Concept Plans 3 and 4 and subsequently adopted for the Interim Recommended Outline Development Plan (IRODP) to preserve the tidal flow through the strait between Chek Lap Kok and North Lantau and avoid deterioration of water quality in the eastern embayment. Such a reduction in tidal flows, as a result of the reclamation, would also affect tidal velocities and consequently sedimentation rates in the embayment.

The basic criteria adopted for the sizing of the sea channel were briefly outlined in Annex C of Topic Report TR8 with a preliminary sizing and analysis of its hydraulic behaviour with respect to the channel's ability to convey tidal flows. The report investigates hydraulic and water quality aspects of the Sea Channel and concludes that a minimum channel of 200 metres top width with bed level of about -7.0 mPD will provide minimum flushing volumes to the eastern embayment and adequate velocities within the channel to limit siltation rates and thus maintenance costs. A summary of the evaluation of the options considered for draining Tung Chung catchments in Topic Report TR8 and in particular the advantages and disadvantages of the Sea Channel is presented in Technical Note TN5. The Technical Note focuses on the environmental evaluation, costs and revenues.

The Sea Channel is also intended to serve other purposes for the future development, namely:

(a) provide a buffer between the Airport and Tung Chung Development;

(b) preserve the natural coastline between the San Tau (Elephant Trunk) and Sha Lo Wan; and

(c) avoid deterioration of water quality in the tidal section of Tung Chung main drainage channel.

Additionally, if required, the Sea Channel could provide short term access to Tung Chung to fishing boats and ferries, subject to aviation safety regulations.

Detailed design of the channel was carried out for TDD-SWNT Office. A layout drawing of the channel is included in Appendix I. A Design Report describing design approach and results of the modelling exercise undertaken as part of the detailed design has been prepared.

The design criteria for the sea channel design have been described in Section 9 of Topic Report TR9. A summary of the design criteria is presented below.

F2 DESIGN CRITERIA

The main function of the channel is to provide flushing to the eastern embayment and therefore attention focused on water quality aspects. From a hydraulic point of view the channel is considered a form of sea embayment rather than a drainage channel as its conveyance is far in excess of that required to pass the flood flows from Tung Chung valley and newly reclaimed land. However, the channel resistance to slow tidal movements is relatively high and it is likely to be higher than in the present conditions through the existing strait given the channel's length. Present tidal flows in the embayment created by Chek Lap Kok are already rather slow as the embayment are relatively shallow. As the length of the strait is small compared to that of the sea channel, velocities in the channel will be reduced

when compared with the present situation. However the narrowing of the strait will be partially compensated by the increase in depth through most of the western section of the channel and the dredging of the access channel to Tung Chung Ferry pier to the east.

The existing coastline between the "Elephant Trunk" in San Tau and Sha Lo Wan is to be maintained and its eco-system preserved, as much as possible, in its present form. Sedimentation originating from Lantau's upland catchments and newly reclaimed land will be taken into consideration as well as its effect on the channel hydraulic performance and on the environment of the coastline.

The design of the sea channel has considered:

(a) tidal flows in the channel; and
(b) water quality in the channel and eastern Tung Chung bay;
(c) sediment inflows, sedimentation and/or erosion rates and maintenance requirements;
(d) wave climate for the design of the seawalls; and
(e) possible mid-stream obstructions such as bridge piers.

F3 TIDAL VELOCITIES AND CURRENT CONDITIONS

Tidal gauging of flows through the strait has been carried out as part of the NLD Study. Field measurements were carried out for two different spring and neap tides. Results are presented in a report prepared by Electronic and Geophysical Services Limited who carried out the measurements. Results show that maximum velocities in the deepest part of the strait are 0.7 m/sec and 0.6 m/sec for spring and neap tide conditions respectively. As shown by the sea bed contours through the strait the tidal regime appears to be sufficiently strong to maintain a stable section (bed level at -9.0 mPD) at that location. However, there are no available historical data to compare sea bed profiles at different times in the channel area.

F4 HYDRAULIC MODELLING OF THE SEA CHANNEL

The main task of the hydraulic modelling exercise has been to carry out a verification of the channel behaviour under normal and extreme tidal conditions. However, the major concern will be the channel behaviour under the prevailing normal tidal conditions and the effect on water quality. In particular the analysis has investigated:

(a) tidal velocities within the channel and comparison with existing conditions;

(b) tidal volumes into and from the eastern embayment and comparison with existing conditions;

(c) tidal velocities in the lower reaches of the drainage channel and the relief channel separating the "Post 2011 Development Island" and Tung Chung earlier development.

The modelling has been carried out using an unsteady state one-dimensional hydrodynamic model of the sea channel with boundary conditions (differential under tidal conditions) provided by the WAHMO model. Verification of the differential head provided by WAHMO is not possible as this would involve field measurements beyond the accuracy of any available equipment. However this exercise has allowed the current levels of flushing in terms of volume and velocities to be assessed.

Simulations were carried out to establish an optimum channel size. The following factors were considered:

(a) total flushing volumes;

(b) tidal velocities;
(c) shear stress (siltation potential);
(d) flushing volumes through Relief and Tung Chung channels;
(e) dredging volumes and costs;
(f) disruption to existing seabed and coastline in particular in the surroundings of the Elephant's Trunk;
(g) visual and environmental impact; and
(h) navigation constraints

The above list is not a priority list, however, the main objective was to size the channel to preserve tidal volumes while observing visual, environmental and other constraints. Velocities in the Relief channel have also been considered with a view to increasing tidal volumes through Tung Chung channel. Increasing volumes through the Tung Chung channel permits a narrowing of the sea channel along the Post 2011 island by up to 50 metres with considerable gain in reclaimable land.

Trial simulations with different channel bottom widths were examined to arrive at the final layout. The main features of the proposed channel are:

(a) unchanged tidal flushing;
(b) unchanged velocity under tidal conditions;
(c) minimum dredging depth and volumes;
(d) preservation of coastline ecosystem;
(e) preservation of Fung Shui feature (Elephant's Trunk);
(f) allow navigation;
(g) eased maintenance;
(h) flexible design; and
(i) preservation of existing structures and fishing activities between San Tau and Sha Lo Wan.

The design provides smooth transition at both channel's ends to reduce entrance and exit losses as well as at along the channel.

Typical velocities at key locations in the channel for neap and spring tidal conditions are shown in Figures F.1 and F.2. A layout plan of the sea channel model is shown on Figure F.3.

F5 SEDIMENTATION

Sedimentation in the sea channel will originate from three sources:

(a) suspended sediment from the Pearl River;
(b) sediment (mainly bed load during stream floods) from upland catchments; and
(c) sediment originating from soil erosion in the new development areas such as:
    - reclaimed land;
    - developed land, and
    - borrow areas.

The movement of suspended sediment in Hong Kong waters has been investigated by the WAHMO model which incorporates a sediment module for predicting suspended sediment movement. Siltation depends mainly on sediment carried from the Pearl River into Hong Kong waters although a new theory (not proven) suggests that Cheung Chau dumping ground may be the main source of silt for this area. This theory is based on the possibility of residual water movements westwards along the shore of south Lantau and northwards through the eastern pass of the Pearl River Estuary. Reclamation activities for the airport, will

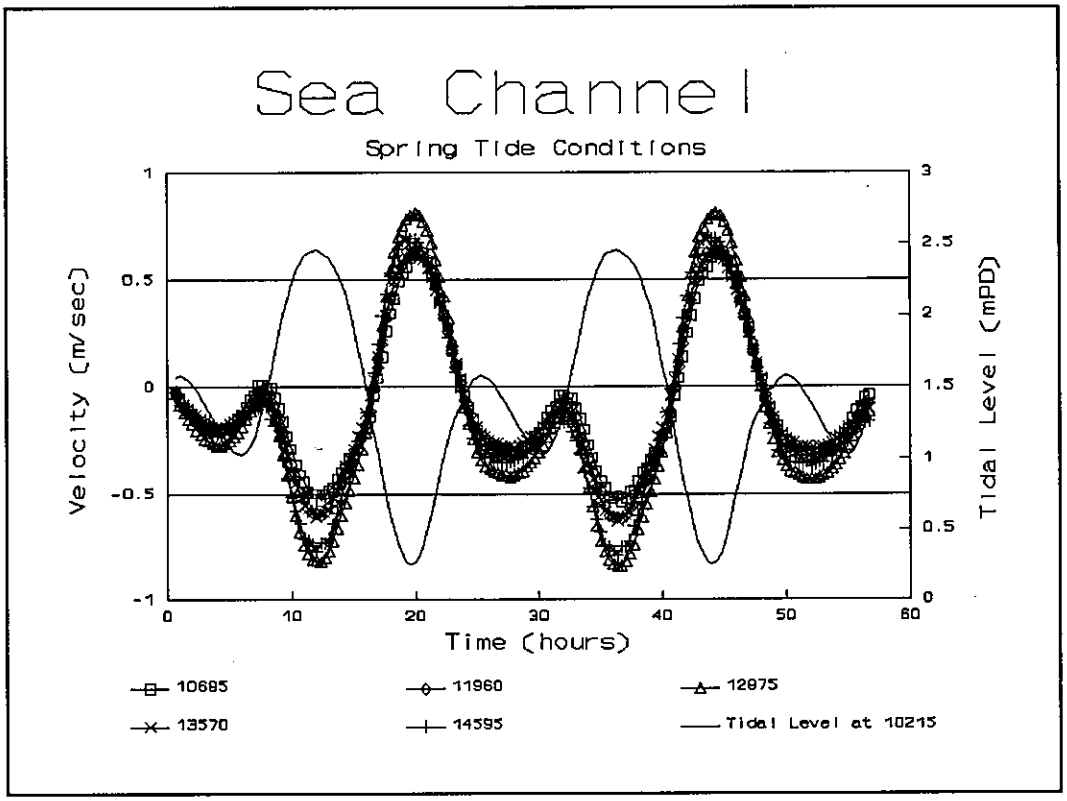


Figure F.1 - Sea Channel: Spring Tide Velocities

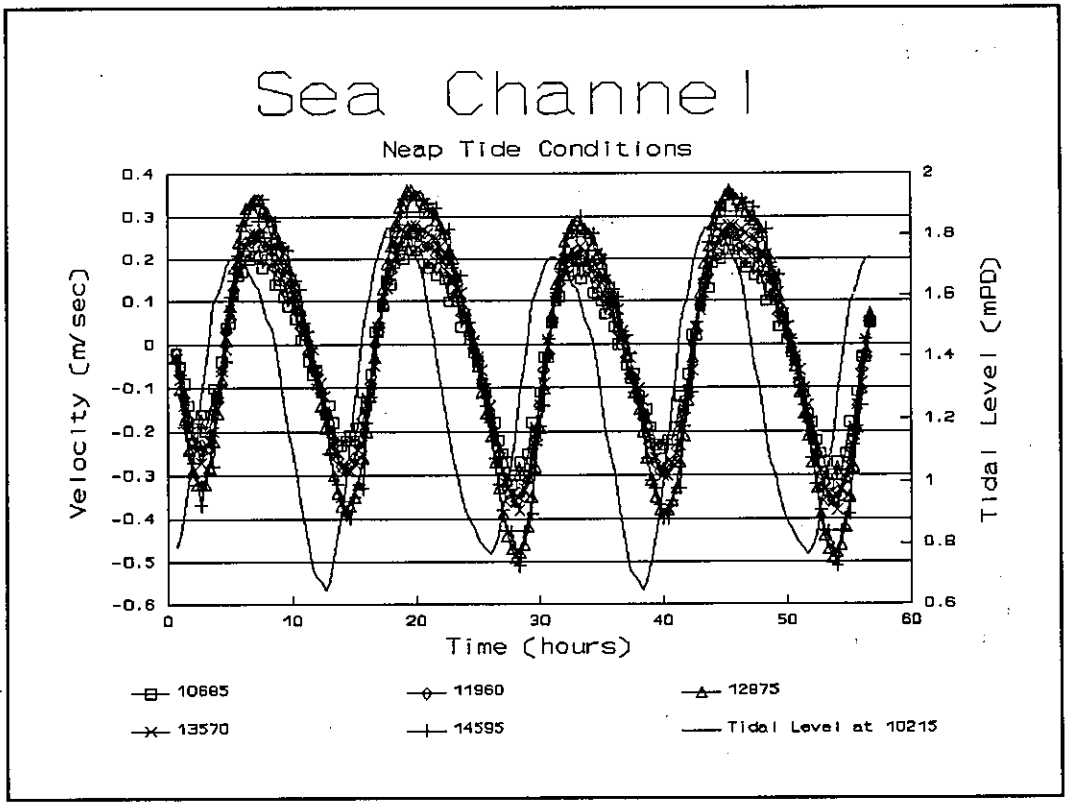


Figure F.2 - Sea Channel: Neap Tide Velocities

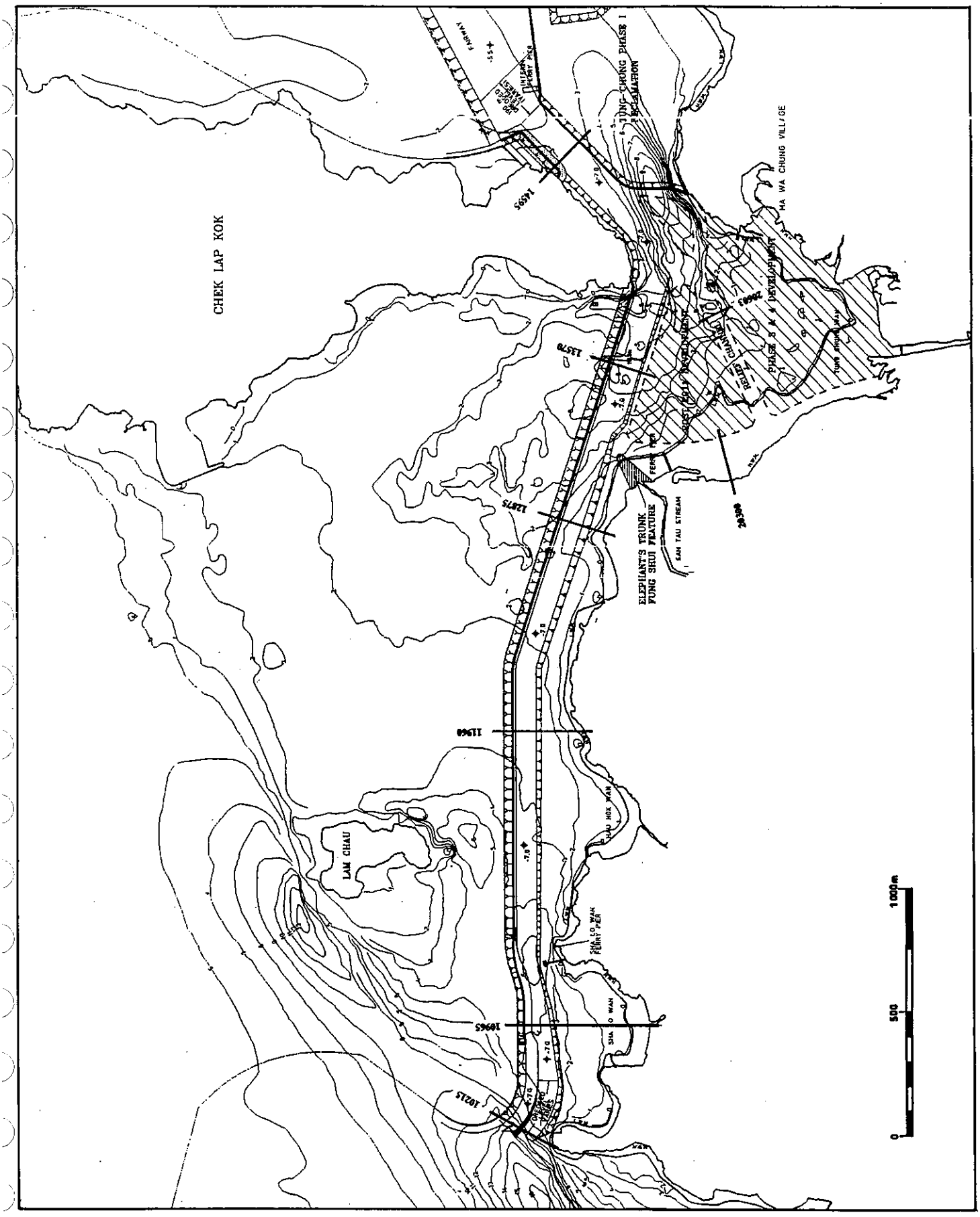


Figure F.3
Sea Channel Layout

additionally increase suspended sediment concentration and as a result sedimentation in the Tung Chung area. This condition will be limited to the construction period but effects from the first two main sources will remain. The bay is already suffering from severe siltation causing problems to the operation of large ferries to Tung Chung.

The second source of sediment is from the steep Lantau catchments. An analysis of the aerial photography of the area shows that sedimentation affects the outfall of all major streams draining into Tung Chung bay and the coastline to Sha Lo Wan. The San Tau stream is maintaining and supplying sediment to the "Elephant Trunk". A similar situation is visible at the outfall of Tung Chung streams.

The third source of sediment load will be more conspicuous during the construction and post-construction period and will add to the natural sediment contribution of the existing drainage system.

F6 THE RELIEF CHANNEL

The presence of the relief channel responds to both planning and hydraulic-environmental requirements. In this modelling exercise the main efforts were devoted to assessing the main sea channel requirements for phase I development, however, a preliminary estimate of the sizing required to enhance recirculation of the Tung Chung lower channel was required as it in turn affects the sea channel sizing.

The bed level in the relief and Tung Chung channels has been set at -4.0 mPD. The channel has a 40 metres bottom width with 1 in 2 seawall on both sides of the relief channel. In the Tung Chung channel the seawall is only on the reclamation side while the western side is formed by the existing shoreline with a transition slope to the dredged bottom. This allows for a considerable flow to be bypassed, reasonable velocities as well as maintenance by marine plant.

Velocities in the relief channel for neap and spring tide conditions are shown in Figures F.4 to F.5.

F7 SILTATION RATES

An assessment of siltation rates has been carried out for different siltation loads. The purpose of this sensitivity analysis is to identify siltation rates for different silt concentrations. Concentration were assumed as average annual values.

Concentration rates at the channel entrance are difficult to evaluate because of lack of data. Prediction of future concentration rates are even more difficult as concentrations will be affected by a variety of causes both of natural and artificial origin. At this stage is therefore important to assess the hydraulic conditions in the channel and its ability to remove silt which is carried in by tidal waters. The siltation analysis results are shown in Table F.1.

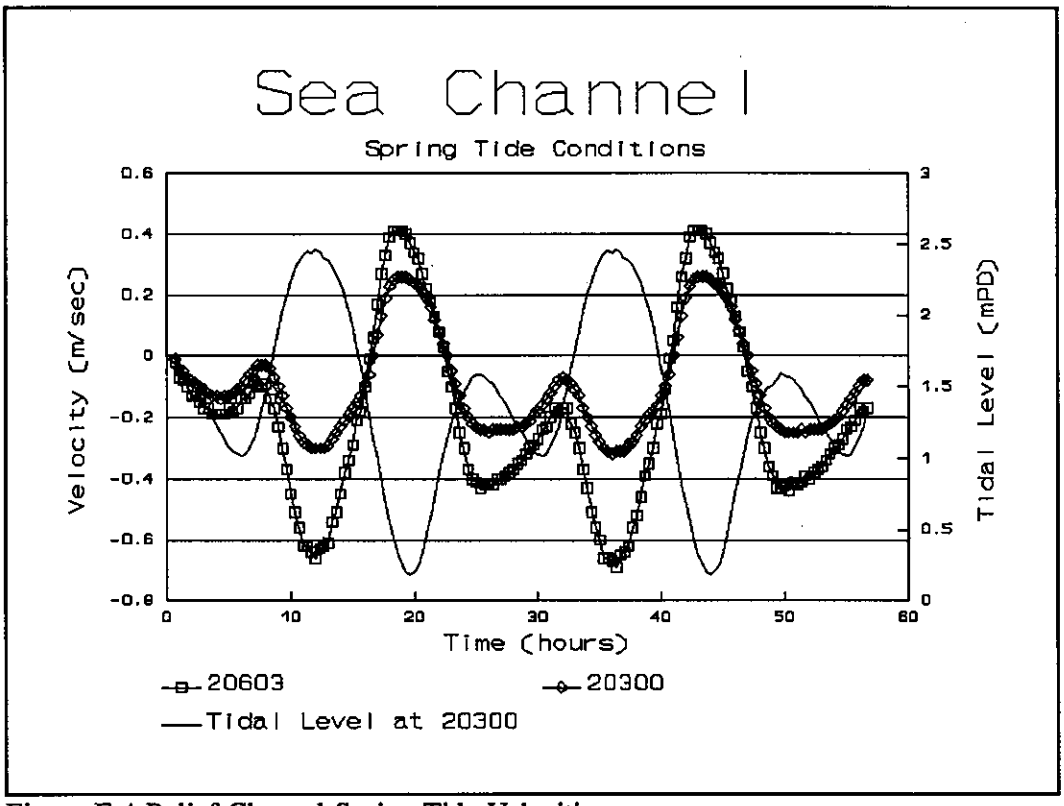


Figure F.4 Relief Channel Spring Tide Velocities

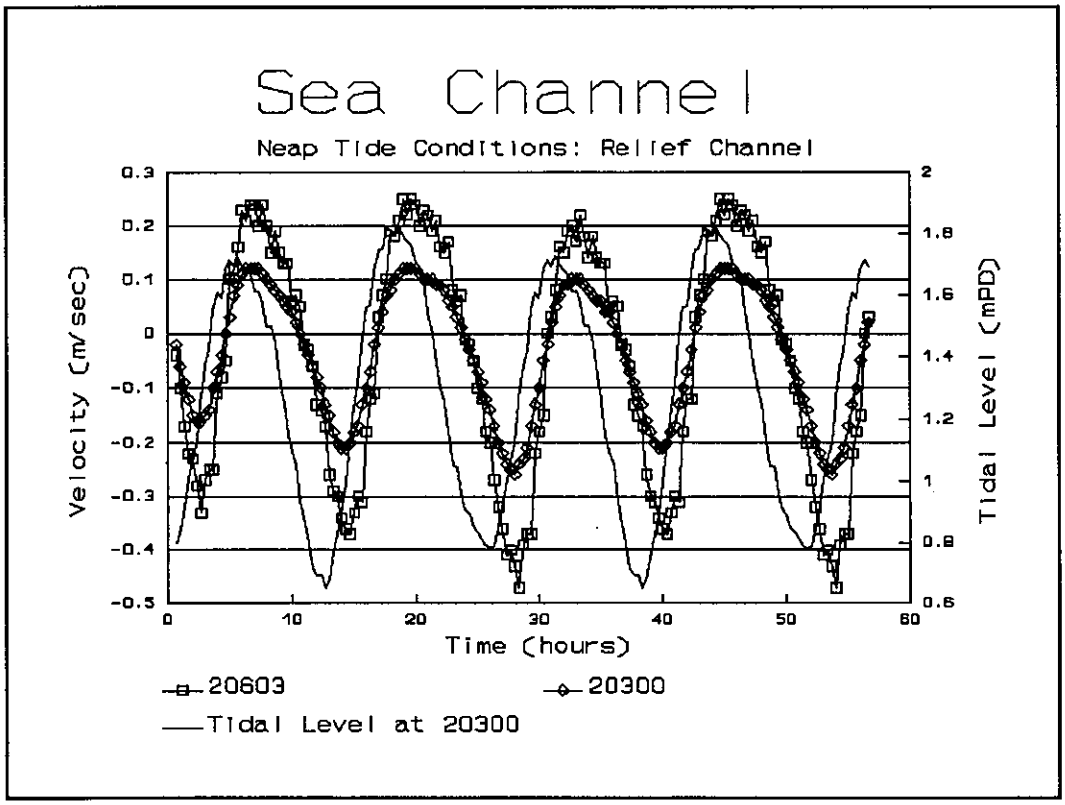


Figure F.5 Relief Channel Neap Tide Flows

Table F.1 Siltation Rates and Silt Concentration in the Sea Channel (mm/year)

Annual Average Suspended Solids Concentration (mg/l)	Marine Deposits (mm/year)	Alluvium (mm/year)
10	0	7
15	30	35
20	45	50
30	125	125
40	235	225

The results show that - if concentration remains as at the present levels of 10 to 15 mg/l - the sea channel has sufficient self cleansing capacity during spring tide to remove silt accumulatedduring period of slack water. Neap tides generate smaller flows but adequate velocities during peak flood periods to prevent deposition in the channel. Deposition during periods of flow reversal will be almost entirely removed during periods of high flow if concentration rates do not increase above present levels.

In the relief channel tidal movements are slow during part of neap tides but during flood periods stress is above the 0.2 N/m^2 limit which causes the very thin fluffy deposits accumulated to be moved towards the faster flowing main sea channel. Spring tide conditions generate faster flows resulting in higher bottom shear stress at flood periods.

F8 DREDGING REQUIREMENTS

Dredging of the channel will amount to approximately 2.2 million m^3. Most of the dredging will involve removal of marine deposits except for a section near the Elephant's Trunk where dredging will incise the alluvium strata. Part of the dredging for the channel is covered by the requirements for the southern airport seawall.

The sea bed level along the channel alignment (west to east direction) is shown in Figure F.6.

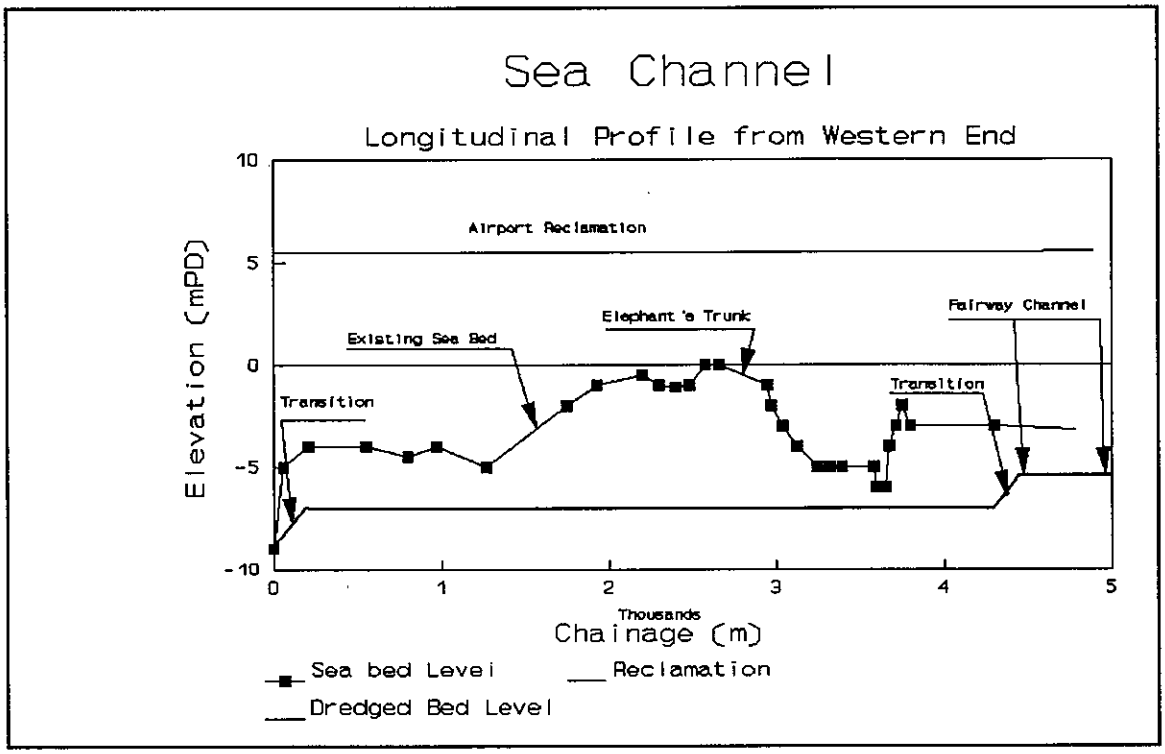


Figure F.6 Sea Channel: Longitudinal Profile

F9 WATER QUALITY

One of the main purposes of the sea channel is to maintain the water quality of East Tung Chung Bay as it was predicted that this might deteriorate following construction of the airport and Tung Chung reclamations and the introduction of new pollution loads. The location of the Siu Ho Wan sewage outfall was determined on the assumption that flows in and out of East Tung Chung Bay would be maintained.

A secondary objective of the sea channel is to maintain water quality in the Tung Chung drainage channels.

Water quality in East Tung Chung Bay is presently maintained by the flushing action of the flows in the straight between Chek Lap Kok and Lantau. These flows were measured in the recent survey as maxima of 0.7 m/s during spring tides and 0.5 m/s during neap tides. The maximum flow during spring tides is about 1200 cumecs and during neap tides is 750-800 cumecs.

The modelling carried out for the detailed design has shown that maximum flows in the channel will be of the order of 0.6 m/s during spring tides and 0.4 m/s during neap tides. The total flow in and out of East Tung Chung Bay will be about 1150 cumecs during spring tides and about 700 cumecs during neap tides. The tidal pattern will not change to any degree as a result of the construction of the reclamations and the sea channel and the total flow in and out of East Tung Chung Bay will be in proportion to the difference in the peak flows.

Total flows will therefore not reduce and it is concluded that the water quality in East Tung Chung Bay should not deteriorate.

Water quality in the sea channel itself and the Tung Chung drainage channels will depend on the pollutants entering the channels and the flushing. Pollutants should be minimised due to the pollution control that will be built in to the drainage system of the new airport even though part of the airport reclamation will still drain into the sea channel. Pollution from the new town should not be significant as there will not be any industrial areas in Tung Chung and all domestic pollution loads will be directed to the sewage treatment works. There could be some pollution in storm run-off during heavy rainfall, particularly during the first flush but storm flushing of the channels will be significant at these times.

The modelling has considered tidal excursions in the sea channel and has shown that the whole sea channel will flush with virtually a complete change of water during every spring tide. There will be significant flushing on other tides.

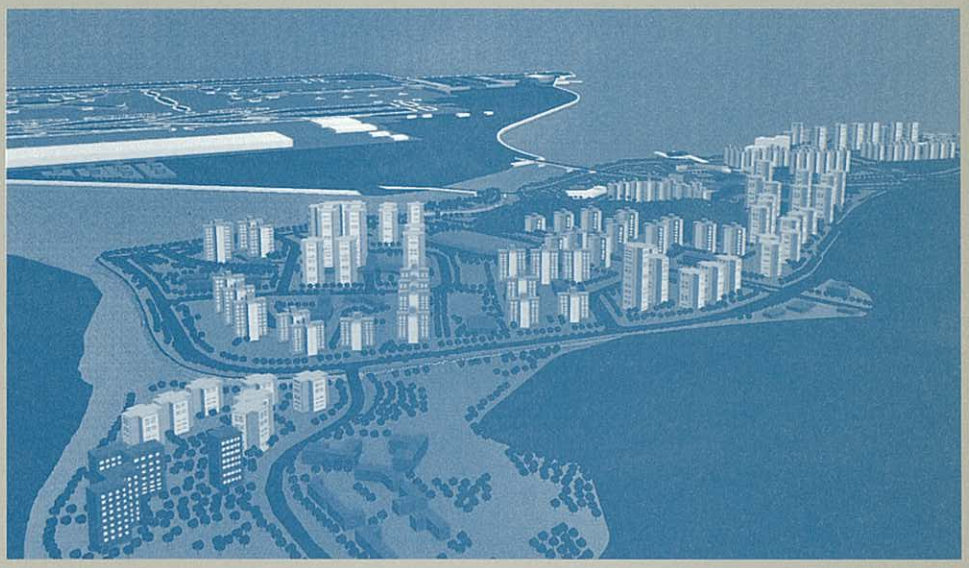
It is therefore concluded that the water quality in the sea channel will be acceptable.

F10 CONCLUSIONS AND RECOMMENDATIONS

The modelling exercise carried out for the detailed design confirmed the findings of Topic Report TR8. The report indicated that a sea channel with a -7.0 mPD bed level with a minimum bottom width of 70 metres would be needed to provide minimum flushing of the eastern embayment. To maintain the existing flushing volumes under tidal conditions the bottom was increased to 100 metres. This refinement results from the new geometry of the airport seawall, accounts for uncertainty in the differential head through the channel, includes a siltation allowance between successive maintenance dredging to avoid excessive loss of capacity and provides better access to ferry piers at Sha Lo Wan and San Tau. The geometry proposed preserves the existing coastline between San Tau and Sha Lo Wan and keeps clear of the Elephant's Trunk fung shui feature.

Verification of the channel behaviour after completion of the airport and NLD seawalls will be required to support future design of seawalls, Tung Chung and Relief channels and future phases of development. Verification should include monitoring of flows and silt concentrations in the channel and re-assessment of the channel behaviour carried out for the design. The effect of the fairway channel on tidal flows will also be possible. This will form the basis for the future design of the Relief and Tung Chung channels. Monitoring of sediment concentration inside and outside the channel will be important to evaluate future maintenance requirements and identify singularities in the flow that may lead to localised siltation.

North Lantau Development



Appendix G

Transport Planning Analysis

APPENDIX G

TRANSPORT PLANNING ANALYSIS

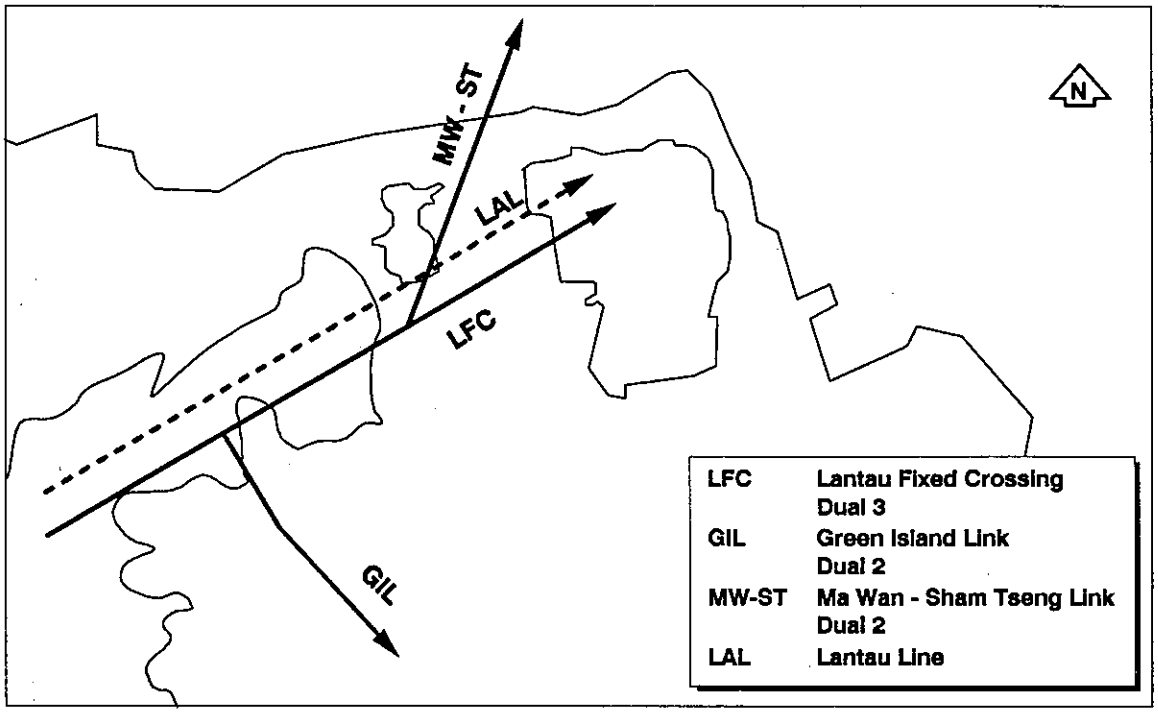
G1 INTRODUCTION

This Appendix contains detailed analysis material which formed a major input to the Transport Planning tasks undertaken in the study. There are four sub-sets of information presented.

- Boundary Conditions for the North Lantau Model (Tables G1 to G5)
- Land Use Assumptions (Tables G6 and G7)
- Traffic Forecast Data for Roads, Junctions and Roundabouts (Tables G8 to G21), and
- Public Transport Traffic Forecasts (Tables G22 to G24).

These tables are also included in Topic Report TR19.

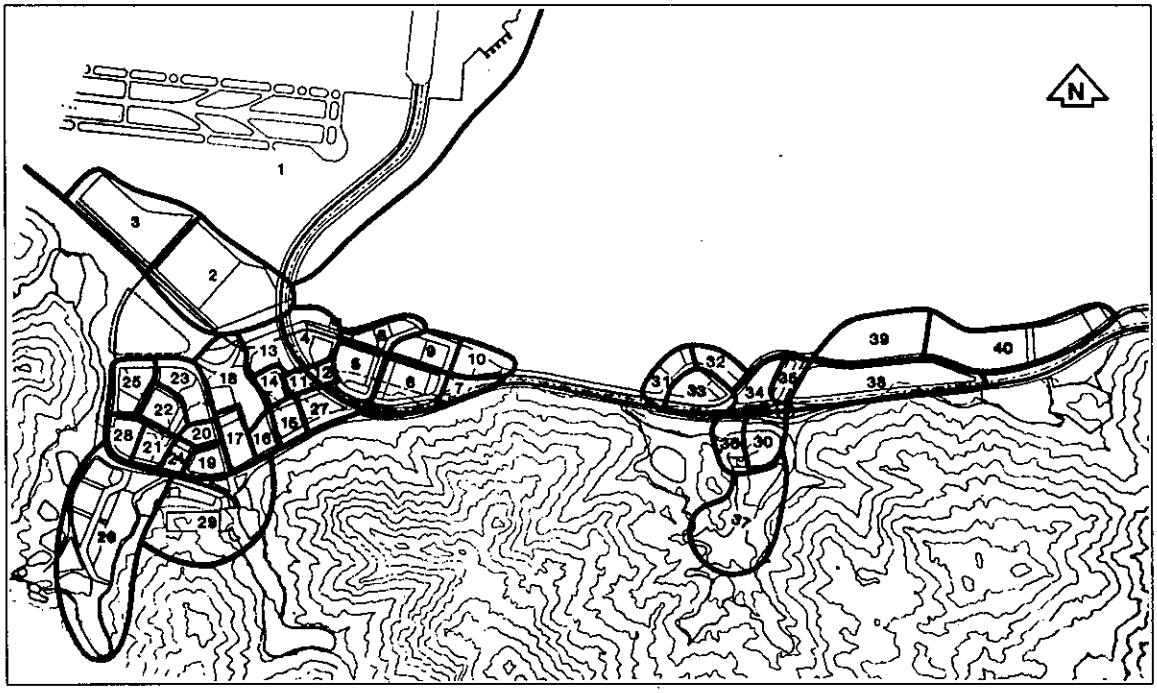
Table G1 External Boundary Conditions



Road Traffic	PCUs ('000s) / Volume/Capacity Ratio					
	To Lantau			From Lantau		
	2001	2006	2011	2001	2006	2011
Lantau Fixed Crossing						
AM Peak Hour	4.7/0.9	4.5/0.8	4.4/0.8	4.1/0.8	4.3/0.8	4.1/0.8
PM Peak Hour	4.1/0.8	4.2/0.8	3.6/0.7	4.8/0.9	4.7/0.9	4.1/0.8
Midday Peak Hour	4.7/0.9	4.7/0.9	4.0/0.7	5.1/0.9	5.1/0.9	4.4/0.8
Daily	75.8	76.7	65.8	75.7	77.3	68.4
Green Island Link						
AM Peak Hour	NA	2.1/0.6	2.7/0.8	NA	2.1/0.6	3.3/0.9
PM Peak Hour	NA	2.1/0.6	3.0/0.8	NA	2.2/0.6	3.0/0.8
Midday Peak Hour	NA	2.3/0.7	3.3/0.9	NA	2.5/0.7	3.5/1.0
Daily	NA	37.5	54.5	NA	37.1	54.2
Ma Wan - Sham Tseng Link						
AM Peak Hour	NA	NA	3.6/1.0	NA	NA	3.4/0.9
PM Peak Hour	NA	NA	3.1/0.9	NA	NA	3.3/0.9
Midday Peak Hour	NA	NA	3.6/1.0	NA	NA	3.5/1.0
Daily	NA	NA	59.6	NA	NA	57.8

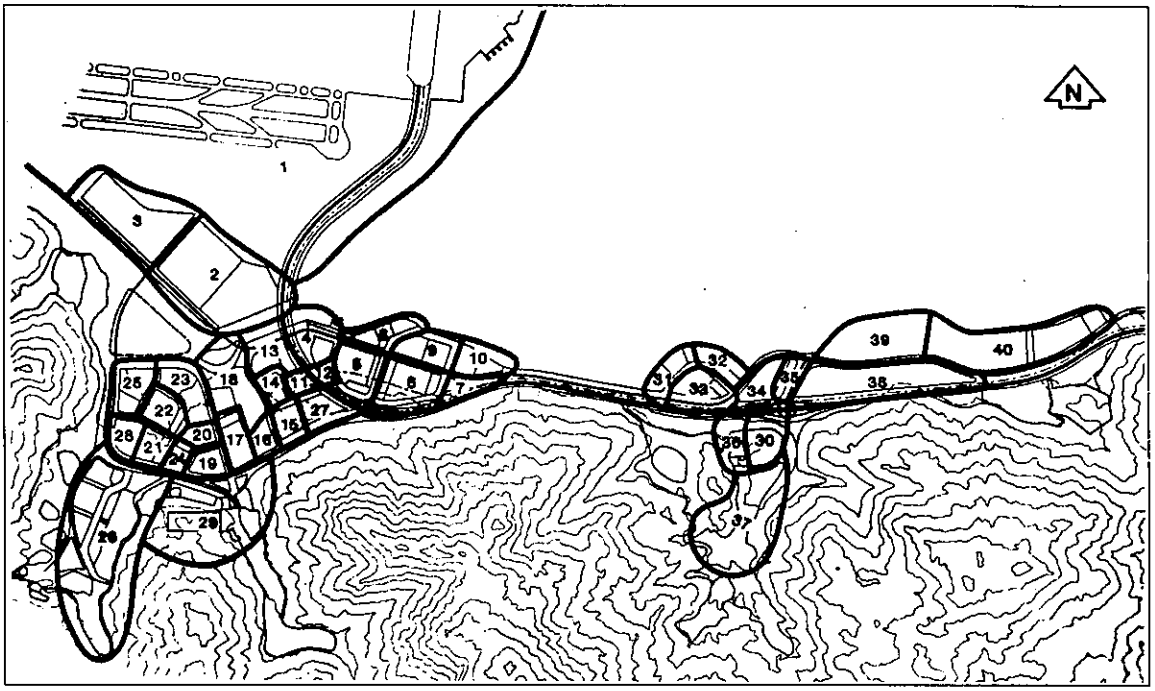
Public Transport Flows	Passengers ('000s)					
	To Lantau			From Lantau		
	2001	2006	2011	2001	2006	2011
Buses						
AM Peak Hour	7.0	8.6	11.0	1.6	1.9	2.7
PM Peak Hour	2.5	2.9	4.0	6.5	8.1	10.7
Midday Peak Hour	2.1	2.5	3.5	1.8	2.0	2.9
Daily	45.7	54.1	73.3	45.9	52.9	74.3
LAL						
AM Peak Hour	7.1	9.1	11.3	2.3	5.9	9.1
PM Peak Hour	2.9	6.1	7.3	6.2	8.2	10.4
Midday Peak Hour	2.4	3.6	4.8	2.2	3.5	4.5
Daily	50.8	79.4	101.4	50.7	79.0	103.9

Table G2 Population by Zone



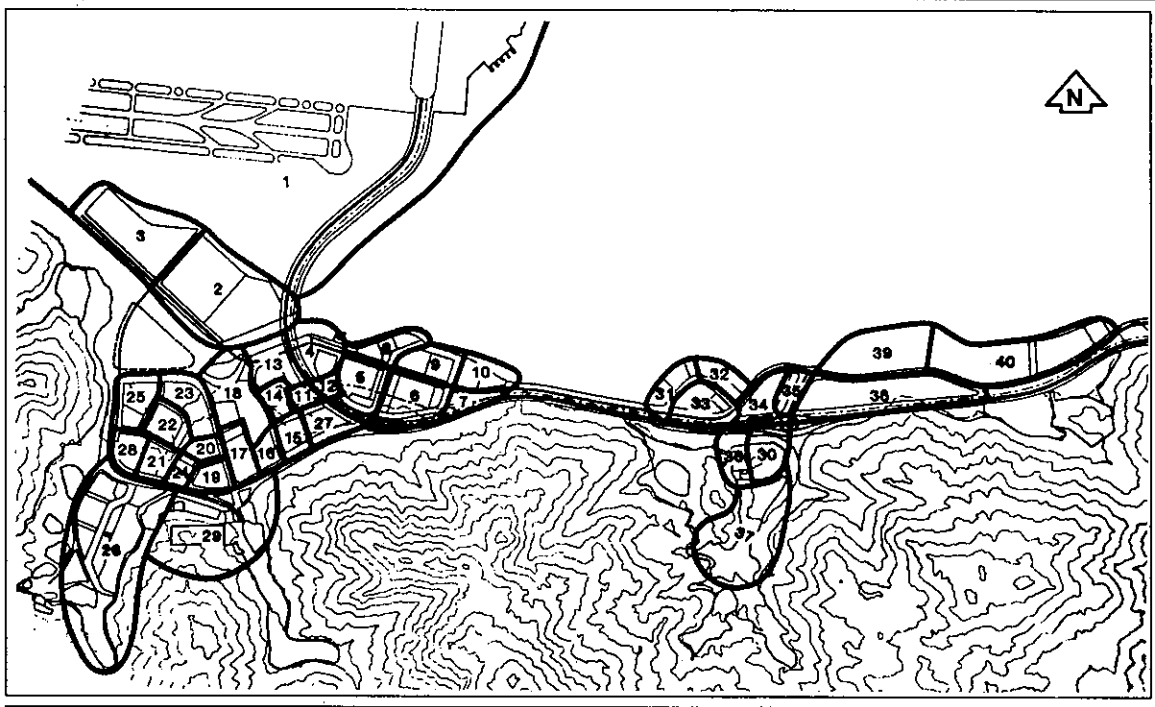
ZONE	POPULATION ('000s)			ZONE	POPULATION ('000s)		
	2001	2006	2011		2001	2006	2011
	CHEK LAP KOK ISLAND			22	0	11	11
1	0	0	0	23	0	0	7
2	0	0	0	24	0	5	5
3	0	0	0	25	0	0	7
Subtotal:	0	0	0	26	3	6	6
				27	9	9	8
	TUNG CHUNG			28	0	13	13
4	0	0	0	29	1	1	1
5	6	12	12	Subtotal:	64	123	150
6	5	11	11				
7	0	0	0		TAI HO WAN		
8	0	0	1	30	0	0	17
9	0	0	9	31	0	0	6
10	0	0	2	32	0	0	4
11	0	0	0	33	0	0	11
12	0	0	0	34	0	0	10
13	0	0	0	35	0	0	0
14	5	5	5	36	0	0	4
15	6	6	6	37	0	0	0
16	4	4	4	38	0	0	0
17	15	15	15	39	0	0	0
18	0	0	2	40	0	0	0
19	0	5	5	Subtotal:	0	0	52
20	10	10	10				
21	0	10	10	TOTAL	64	123	202

Table G3 Employment by Zone



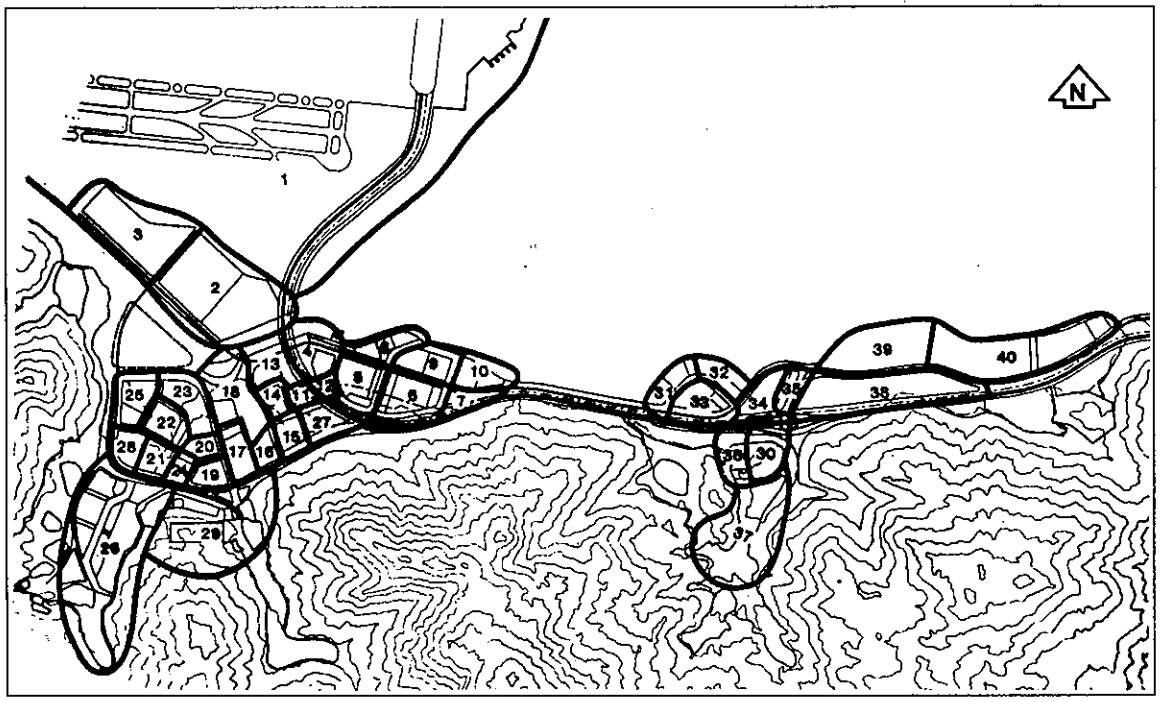
ZONE	EMPLOYMENT ('000s)			ZONE	EMPLOYMENT ('000s)		
	2001	2006	2011		2001	2006	2011
	CHEK LAP KOK ISLAND			22	0	3	3
1	28	31	35	23	0	0	1
2	4	5	5	24	0	0	0
3	14	13	11	25	0	0	1
Subtotal:	46	49	51	26	0	0	1
				27	0	0	0
	TUNG CHUNG			28	0	1	1
4	0	0	0	29	0	0	0
5	1	1	1	Subtotal:	11	22	30
6	1	1	1				
7	0	0	0		TAI HO WAN		
8	0	0	1	30	0	0	2
9	0	0	1	31	0	0	0
10	0	0	0	32	0	0	0
11	3	3	4	33	0	0	1
12	3	4	5	34	0	0	3
13	0	0	0	35	0	0	0
14	0	0	0	36	0	0	2
15	2	2	2	37	0	2	3
16	0	0	1	38	1	1	1
17	1	1	1	39	7	9	9
18	0	1	1	40	0	4	9
19	0	1	1	Subtotal:	8	16	30
20	0	2	2				
21	0	2	2	TOTAL	65	88	111

Table G4 School Places by Zone



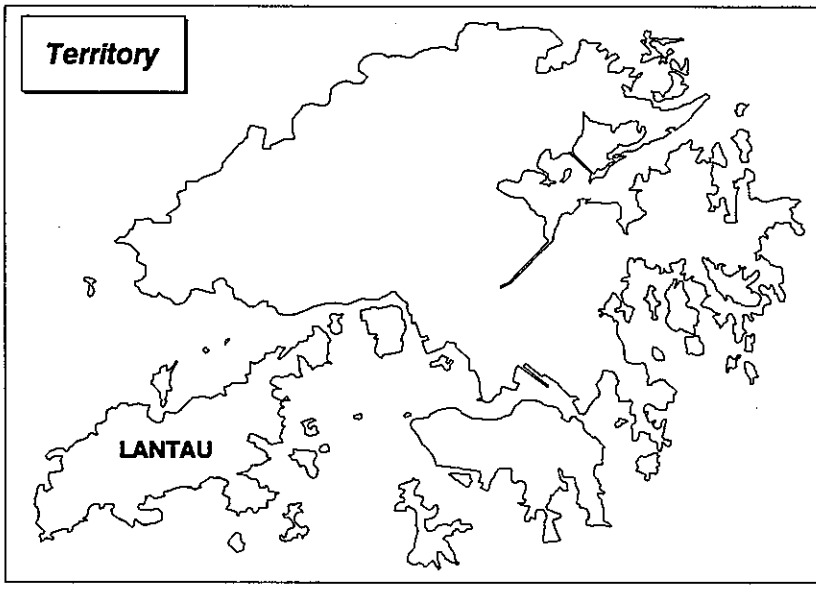
ZONE	SCHOOL PLACES ('000s)			ZONE	SCHOOL PLACES ('000s)		
	2001	2006	2011		2001	2006	2011
	CHEK LAP KOK ISLAND			22	0	1	1
1	0	0	0	23	0	0	0
2	0	0	0	24	0	3	3
3	0	0	0	25	0	0	3
Subtotal:	0	0	0	26	3	3	3
				27	3	3	3
	TUNG CHUNG			28	0	2	2
4	0	0	0	29	2	2	2
5	4	4	4	Subtotal:	20	30	30
6	0	2	2				
7	0	2	2		TAI HO WAN		
8	0	0	0	30	0	0	2
9	0	0	0	31	0	0	0
10	0	0	0	32	0	0	2
11	0	0	0	33	0	0	3
12	0	0	0	34	0	0	0
13	0	0	0	35	0	0	2
14	0	0	0	36	0	0	2
15	4	4	4	37	0	0	0
16	2	2	2	38	0	0	0
17	2	1	1	39	0	0	0
18	0	0	0	40	0	0	0
19	0	0	0	Subtotal:	0	0	11
20	0	2	2				
21	0	0	0	TOTAL	20	30	45

Table G5 Hotel Rooms by Zone

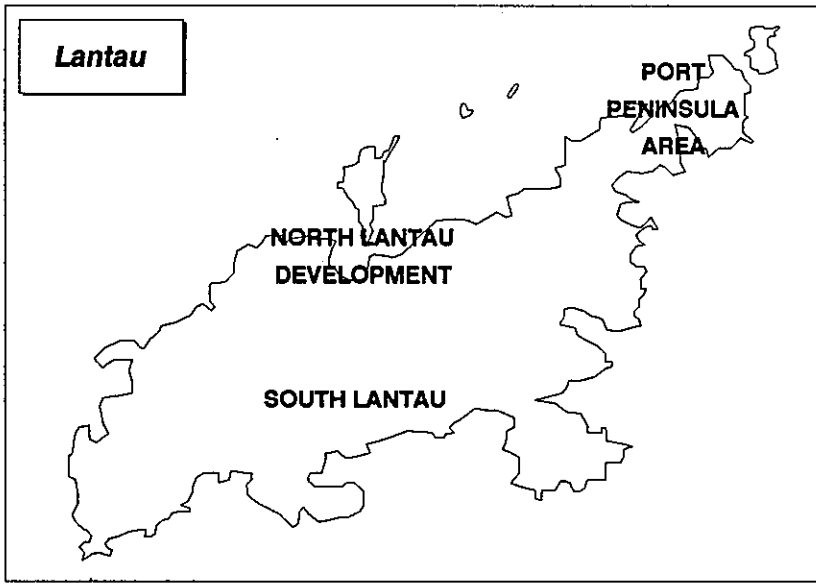


ZONE	HOTEL ROOMS ('000s)			ZONE	HOTEL ROOMS ('000s)		
	2001	2006	2011		2001	2006	2011
	CHEK LAP KOK ISLAND			22	0.0	0.0	0.0
1	0.0	0.0	0.0	23	0.0	0.0	0.0
2	0.0	0.0	0.0	24	0.0	0.0	0.0
3	0.2	0.3	0.4	25	0.0	0.0	0.0
Subtotal:	0.2	0.3	0.4	26	0.0	0.0	0.0
				27	0.0	0.0	0.0
	TUNG CHUNG			28	0.0	0.0	0.0
4	0.0	0.0	0.0	29	0.0	0.0	0.0
5	0.0	0.0	0.0	Subtotal:	0.7	1.0	1.3
6	0.0	0.0	0.0				
7	0.0	0.0	0.0		TAI HO WAN		
8	0.0	0.0	0.4	30	0.0	0.0	0.0
9	0.0	0.0	0.0	31	0.0	0.0	0.0
10	0.0	0.0	0.0	32	0.0	0.0	0.0
11	0.5	0.7	0.5	33	0.0	0.0	0.0
12	0.2	0.3	0.4	34	0.0	0.0	0.0
13	0.0	0.0	0.0	35	0.0	0.0	0.0
14	0.0	0.0	0.0	36	0.0	0.0	0.0
15	0.0	0.0	0.0	37	0.0	0.0	0.0
16	0.0	0.0	0.0	38	0.0	0.0	0.0
17	0.0	0.0	0.0	39	0.0	0.0	0.0
18	0.0	0.0	0.0	40	0.0	0.0	0.0
19	0.0	0.0	0.0	Subtotal:	0.0	0.0	0.0
20	0.0	0.0	0.0				
21	0.0	0.0	0.0	TOTAL	0.9	1.3	1.8

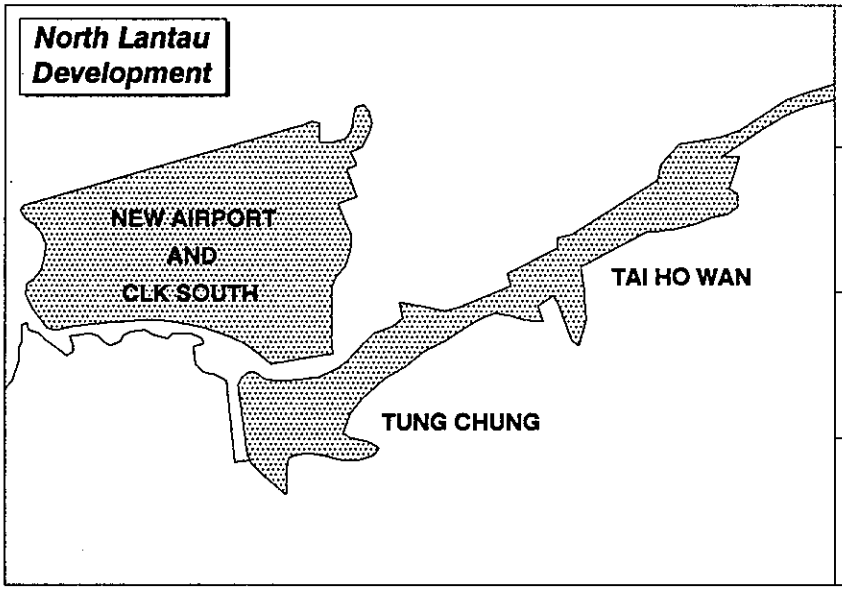
Table G6 Land Use Assumptions (1)



Territory	
Population	
2001	6,339,200
2006	6,506,300
2011	6,629,700
Employment	
2001	3,131,500
2006	3,209,500
2011	3,238,600
School Places	
2001	1,258,900
2006	1,181,800
2011	1,132,600
Hotel Rooms	
2001	78,000
2006	107,400
2011	116,900



Lantau	
Population	
2001	86,800
2006	144,800
2011	223,400
Employment	
2001	75,600
2006	103,700
2011	141,100
School Places	
2001	23,500
2006	33,100
2011	60,100
Hotel Rooms	
2001	1,600
2006	1,300
2011	1,800



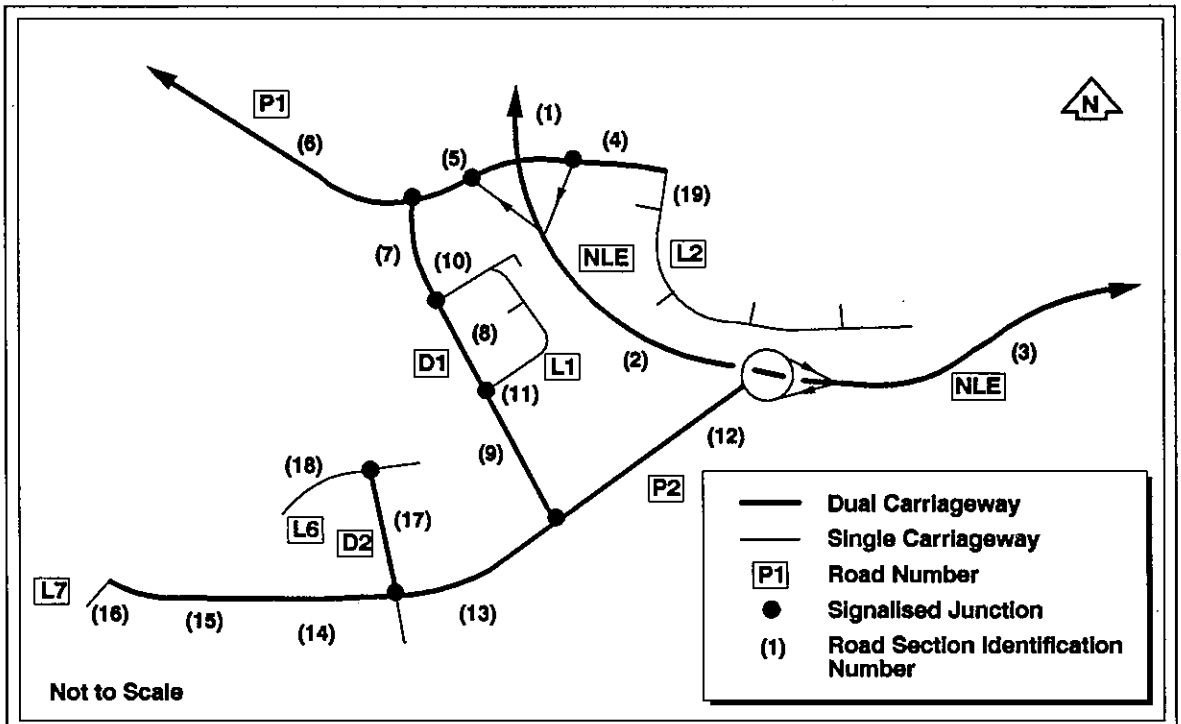
North Lantau Development	
Population	
2001	63,700
2006	122,700
2011	202,200
Employment	
2001	64,800
2006	87,500
2011	110,900
School Places	
2001	19,700
2006	29,900
2011	45,300
Hotel Rooms	
2001	900
2006	1,300
2011	1,800

Table G7 Land Use Assumptions (2)

Area	Population ('000s)			Employment ('000s)		
	2001	2006	2011	2001	2006	2011
▪ New Airport and CLK South	0	0	0	46	49	51
▪ Tung Chung	64	123	150	11	23	30
▪ Tai Ho Wan	0	0	52	8	16	30
* NLD	64	123	202	65	88	111
▪ Port Peninsula	1	0	0	6	12	26
▪ South Lantau	22	22	21	5	4	4
* Rest of Lantau	23	22	21	11	16	30
* Total Lantau	87	145	223	76	104	141
▪ Rest of Territory	6,252	6,361	6,406	3,056	3,106	3,097
* Total Territory	6,339	6,506	6,630	3,132	3,210	3,239

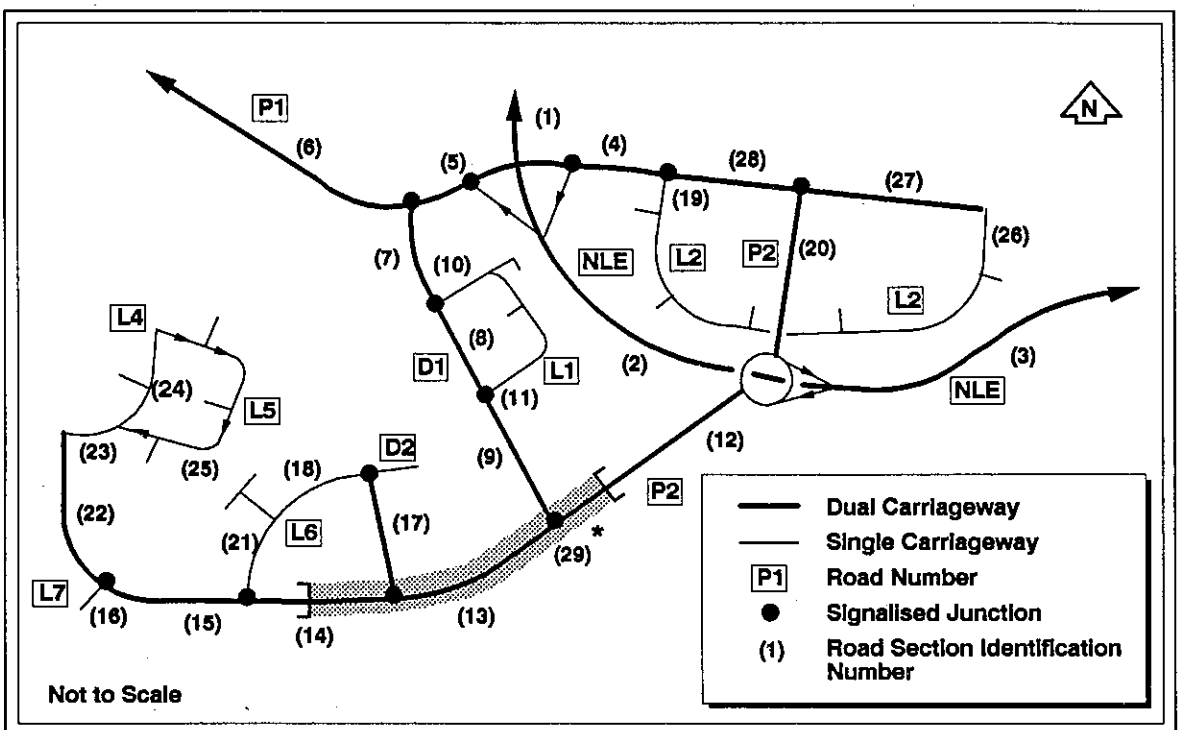
Area	School Places ('000s)			Hotel Rooms ('000s)		
	2001	2006	2011	2001	2006	2011
▪ New Airport and CLK South	0	0	0	0.2	0.3	0.5
▪ Tung Chung	20	30	34	0.7	1.0	1.3
▪ Tai Ho Wan	0	0	11	0.0	0.0	0.0
* NLD	20	30	45	0.9	1.3	1.8
▪ Port Peninsula	0	0	0	0.0	0.0	0.0
▪ South Lantau	4	3	15	0.7	0.0	0.0
* Rest of Lantau	4	3	15	0.7	0.0	0.0
* Total Lantau	24	33	60	1.6	1.3	1.8
▪ Rest of Territory	1,235	1,149	1,073	76.4	106.1	115.1
* Total Territory	1,259	1,182	1,133	78.0	107.4	116.9

Table G8 Tung Chung Traffic Volumes - 2001



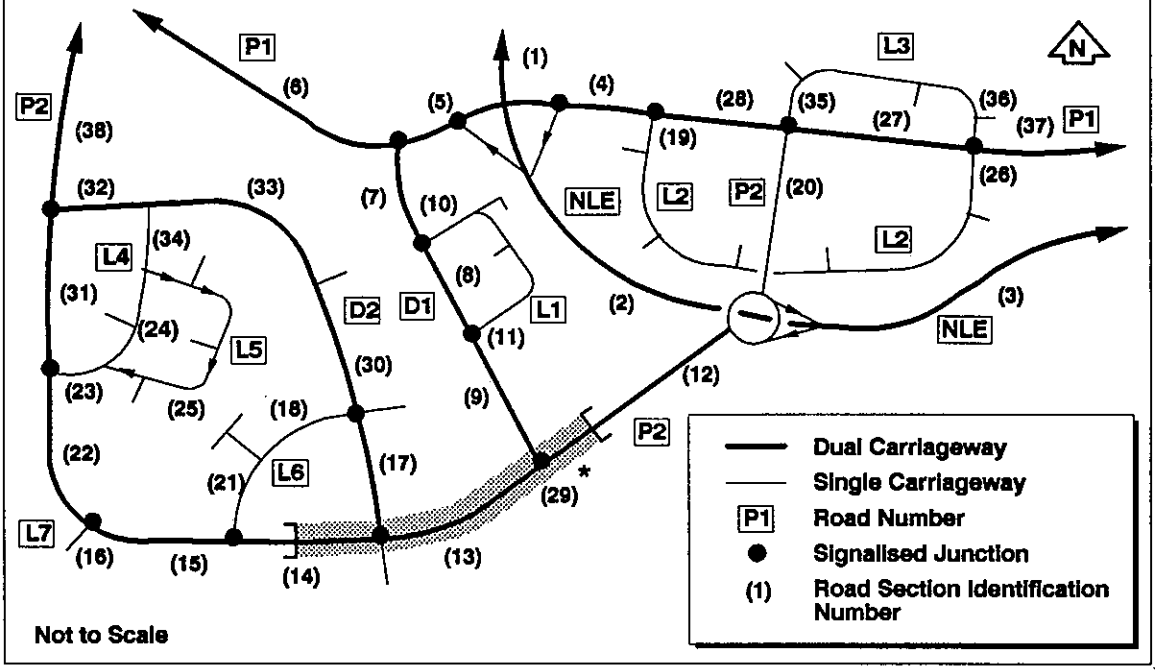
Road Section	Direction	Peak-hour PCUs ('000s)			Road Section	Direction	Peak-hour PCUs ('000s)		
		AM	PM	Midday			AM	PM	Midday
1	NB/SB	2.0/1.5	2.1/2.6	2.2/2.6					
2	NB/SB	2.8/2.3	2.7/3.3	2.8/3.3					
3	EB/WB	2.9/3.3	3.7/3.2	3.8/3.4					
4	EB/WB	0.8/0.9	0.7/0.7	0.6/0.6					
5	NB/SB	0.6/0.7	0.5/0.6	0.4/0.5					
6	NB/SB	0.9/0.4	0.4/0.6	0.3/0.3					
7	NB/SB	1.2/0.6	0.7/0.8	0.6/0.6					
8	NB/SB	0.8/0.3	0.4/0.5	0.3/0.4					
9	NB/SB	0.9/0.5	0.5/0.6	0.6/0.5					
10	EB/WB	0.5/0.6	0.4/0.4	0.4/0.4					
11	EB/WB	0.3/0.3	0.3/0.2	0.4/0.3					
12	EB/WB	0.6/0.5	0.4/0.5	0.5/0.6					
13	EB/WB	0.9/0.5	0.5/0.7	0.5/0.5					
14	EB/WB	0.2/0.1	0.1/0.1	0.1/0.1					
15	EB/WB	0.2/0.1	0.1/0.1	0.1/0.1					
16	NB/SB	0.2/0.1	0.1/0.1	0.1/0.1					
17	NB/SB	0.4/0.8	0.5/0.4	0.4/0.4					
18	EB/WB	0.2/0.1	0.1/0.2	0.1/0.1					
19	NB/SB	0.9/0.8	0.7/0.7	0.6/0.6					

Table G9 Tung Chung Traffic Volumes - 2006



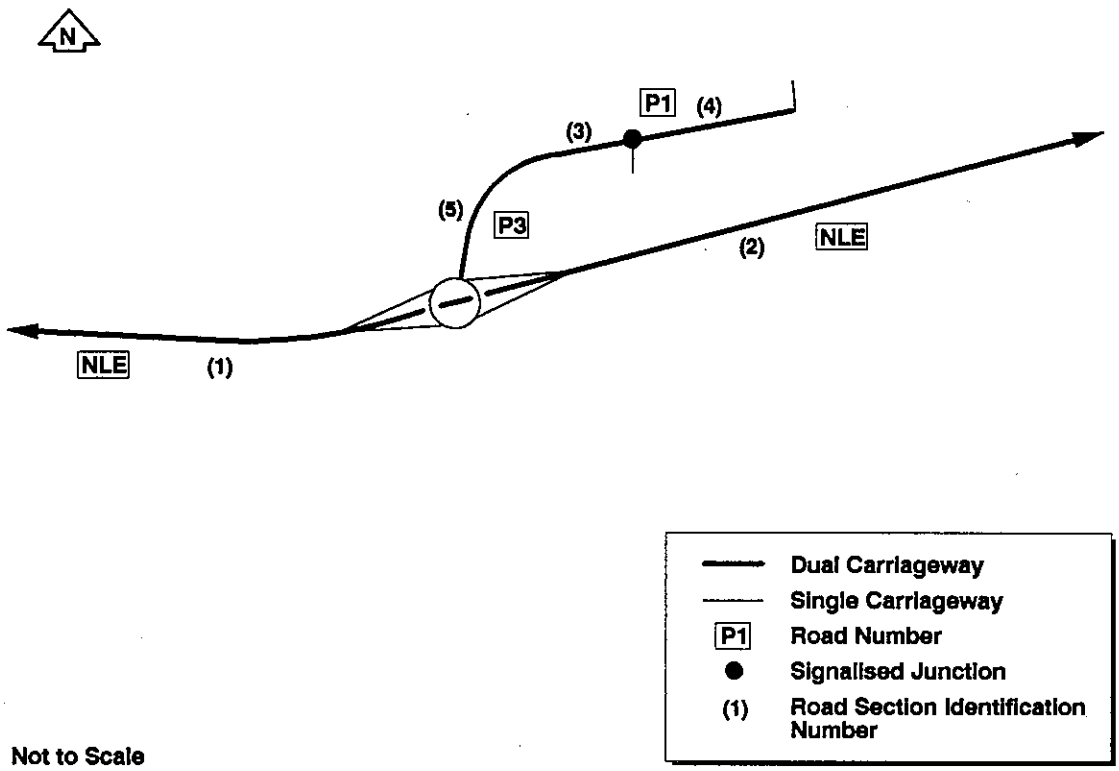
Road Section	Direction	Peak-hour PCUs ('000s)			Road Section	Direction	Peak-hour PCUs ('000s)		
		AM	PM	Midday			AM	PM	Midday
1	NB/SB	2.0/1.7	2.6/3.0	2.6/3.2	21	NB/SB	0.2/0.7	0.2/0.3	0.3/0.6
2	NB/SB	2.6/2.1	3.1/3.2	3.1/3.5	22	NB/SB	0.6/0.9	0.6/0.5	0.6/0.6
3	EB/WB	3.8/3.7	4.5/4.2	4.8/4.3	23	EB/WB	0.6/0.9	0.6/0.5	0.6/0.6
4	EB/WB	0.7/0.8	0.6/0.2	0.5/0.2	24	NB/SB	0.4/0.1	0.5/0.1	0.5/0.1
5	NB/SB	1.0/0.7	0.6/0.4	0.4/0.5	25	SB	0.7	0.4	0.5
6	NB/SB	1.7/0.5	0.6/1.3	0.6/0.6	26	NB/SB	0.9/0.4	0.8/0.3	0.6/0.3
7	NB/SB	1.6/0.8	0.9/1.3	0.8/0.8	27	EB/WB	0.4/0.9	0.3/0.8	0.3/0.6
8	NB/SB	1.3/0.6	0.6/1.1	0.5/0.6	28	EB/WB	0.1/0.6	0.1/0.2	0.1/0.1
9	NB/SB	1.3/0.7	0.8/1.0	0.7/0.7	29 *	EB/WB	0.6/1.3	0.6/0.6	0.6/0.6
10	EB/WB	0.4/0.6	0.4/0.4	0.4/0.4					
11	EB/WB	0.3/0.3	0.3/0.2	0.4/0.3					
12	EB/WB	0.6/0.7	0.3/0.5	0.4/0.5					
13	EB/WB	1.3/0.8	0.8/1.3	0.7/0.8					
14	EB/WB	0.8/0.3	0.5/0.6	0.4/0.3					
15	EB/WB	1.5/0.8	0.9/1.1	0.7/0.7					
16	NB/SB	0.6/0.3	0.4/0.5	0.1/0.1					
17	NB/SB	0.5/0.6	0.7/0.3	0.5/0.3					
18	EB/WB	0.1/0.3	0.1/0.4	0.1/0.3					
19	NB/SB	0.7/0.7	0.5/0.7	0.5/0.5					
20	NB/SB	0.7/0.5	0.4/0.7	0.3/0.6	* Depressed Section				

Table G10 Tung Chung Traffic Volumes - 2011



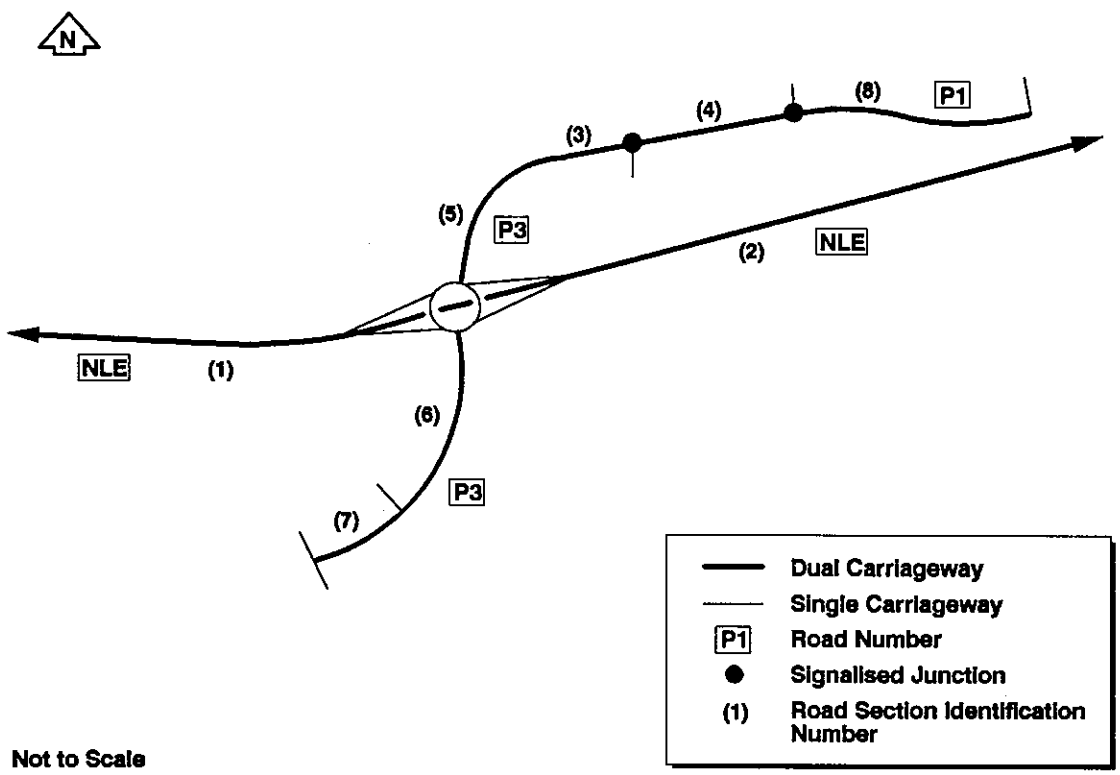
Road Section	Direction	Peak-hour PCUs ('000s)			Road Section	Direction	Peak-hour PCUs ('000s)		
		AM	PM	Midday			AM	PM	Midday
1	NB/SB	2.4/2.1	3.0/3.4	2.9/3.5	21	NB/SB	0.3/0.5	0.4/0.3	0.3/0.4
2	NB/SB	2.9/2.7	3.3/3.7	3.2/3.9	22	NB/SB	0.6/0.7	0.6/0.6	0.4/0.6
3	EB/WB	4.3/4.0	4.8/4.7	5.0/4.4	23	EB/WB	0.5/0.9	0.6/0.5	0.4/0.6
4	EB/WB	0.8/0.8	0.7/0.6	0.6/0.6	24	NB/SB	0.3/0.1	0.3/0.1	0.2/0.1
5	NB/SB	0.8/0.9	0.6/0.7	0.6/0.6	25	SB	0.5	0.4	0.3
6	NB/SB	0.5/0.2	0.7/0.5	0.3/0.3	26	NB/SB	0.6/0.5	0.5/0.6	0.4/0.4
7	NB/SB	1.0/0.6	0.5/0.7	0.5/0.5	27	EB/WB	0.2/0.5	0.2/0.5	0.3/0.3
8	NB/SB	0.7/0.3	0.3/0.4	0.2/0.3	28	EB/WB	0.3/0.3	0.4/0.3	0.3/0.3
9	NB/SB	0.7/0.5	0.6/0.6	0.5/0.6	29 *	EB/WB	0.9/0.7	0.7/0.8	0.7/0.5
10	EB/WB	0.4/0.4	0.4/0.4	0.4/0.4	30	NB/SB	0.7/0.5	0.5/0.5	0.6/0.4
11	EB/WB	0.3/0.4	0.3/0.4	0.4/0.3	31	NB/SB	0.3/0.1	0.2/0.3	0.2/0.2
12	EB/WB	0.9/0.8	0.8/0.9	0.7/0.9	32	EB/WB	0.2/0.4	0.4/0.2	0.2/0.2
13	EB/WB	1.1/0.8	0.8/0.9	0.8/0.7	33	EB/WB	0.5/0.6	0.5/0.5	0.4/0.5
14	EB/WB	0.4/0.1	0.2/0.2	0.1/0.2	34	NB/SB	0.3/0.4	0.2/0.4	0.3/0.5
15	EB/WB	1.0/0.7	0.8/0.8	0.7/0.5	35	NB/SB	0.3/0.3	0.4/0.2	0.2/0.1
16	NB/SB	0.4/0.3	0.4/0.4	0.2/0.2	36	NB/SB	0.2/0.4	0.3/0.3	0.1/0.2
17	NB/SB	0.7/0.7	0.8/0.5	0.8/0.5	37	EB/WB	0.8/0.7	0.7/0.8	0.7/0.6
18	EB/WB	0.1/0.2	0.1/0.2	0.1/0.2	38	NB/SB	0.7/0.3	0.4/0.7	0.3/0.4
19	NB/SB	0.7/0.7	0.6/0.7	0.6/0.6					
20	NB/SB	0.3/0.5	0.4/0.4	0.3/0.3	* Depressed Section				

Table G11 Tai Ho Wan Traffic Volumes - 2001



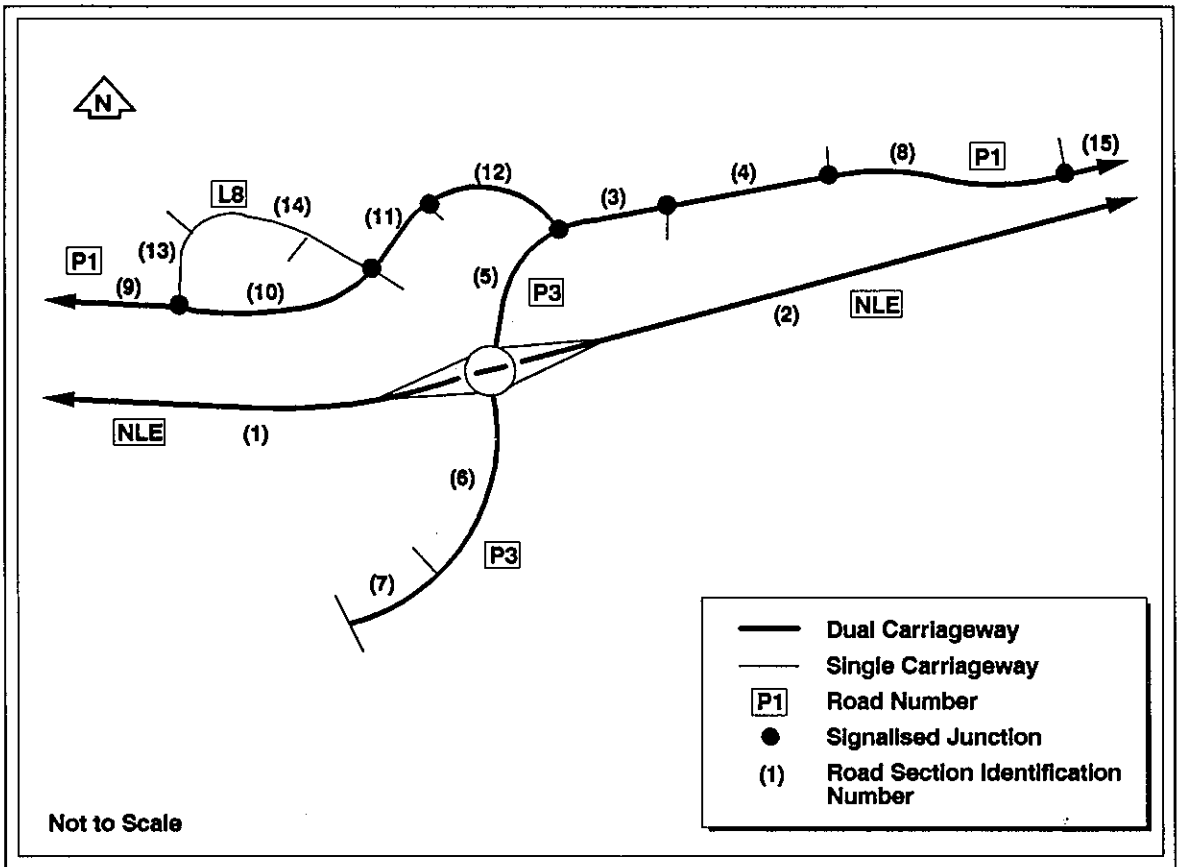
Road Section	Direction	Peak-hour PCUs ('000)		
		AM	PM	Midday
1	EB/WB	2.9/3.3	3.7/3.2	3.8/3.4
2	EB/WB	3.2/3.8	4.0/3.5	4.3/3.9
3	EB/WB	0.8/0.6	0.6/0.6	0.7/0.7
4	EB/WB	0.7/0.5	0.5/0.5	0.6/0.6
5	NB/SB	0.8/0.6	0.6/0.6	0.7/0.7

Table G12 Tai Ho Wan Traffic Volumes - 2006



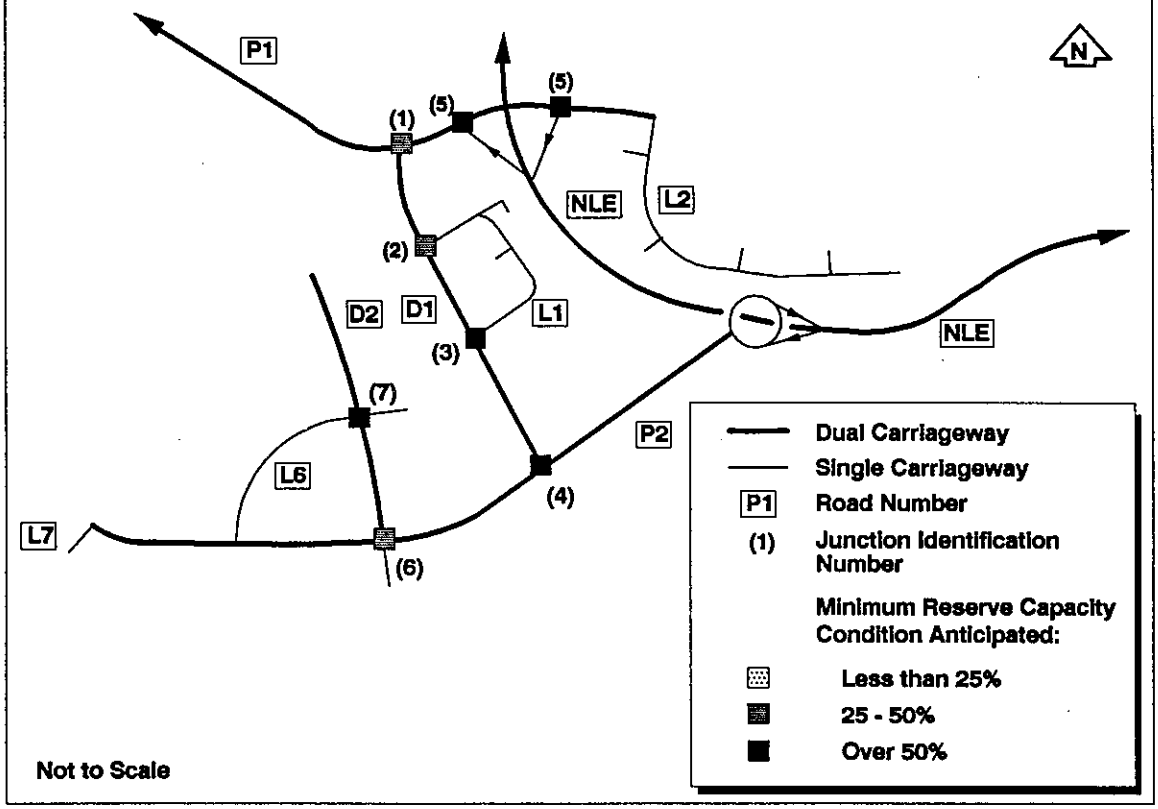
Road Section	Direction	Peak-hour PCUs ('000)		
		AM	PM	Midday
1	EB/WB	3.8/3.7	4.5/4.2	4.9/4.3
2	EB/WB	3.9/4.1	4.7/4.4	5.2/4.7
3	EB/WB	1.2/0.9	0.9/1.0	0.9/0.9
4	EB/WB	1.1/0.8	0.8/0.9	0.8/0.9
5	NB/SB	1.2/0.9	0.9/1.0	0.9/0.9
6	NB/SB	0.1/0.1	0.1/0.1	0.1/0.1
7	NB/SB	0.1/0.1	0.1/0.1	0.1/0.1
8	EB/WB	0.4/0.3	0.3/0.3	0.3/0.3

Table E13 Tai Ho Wan Traffic Volumes - 2011



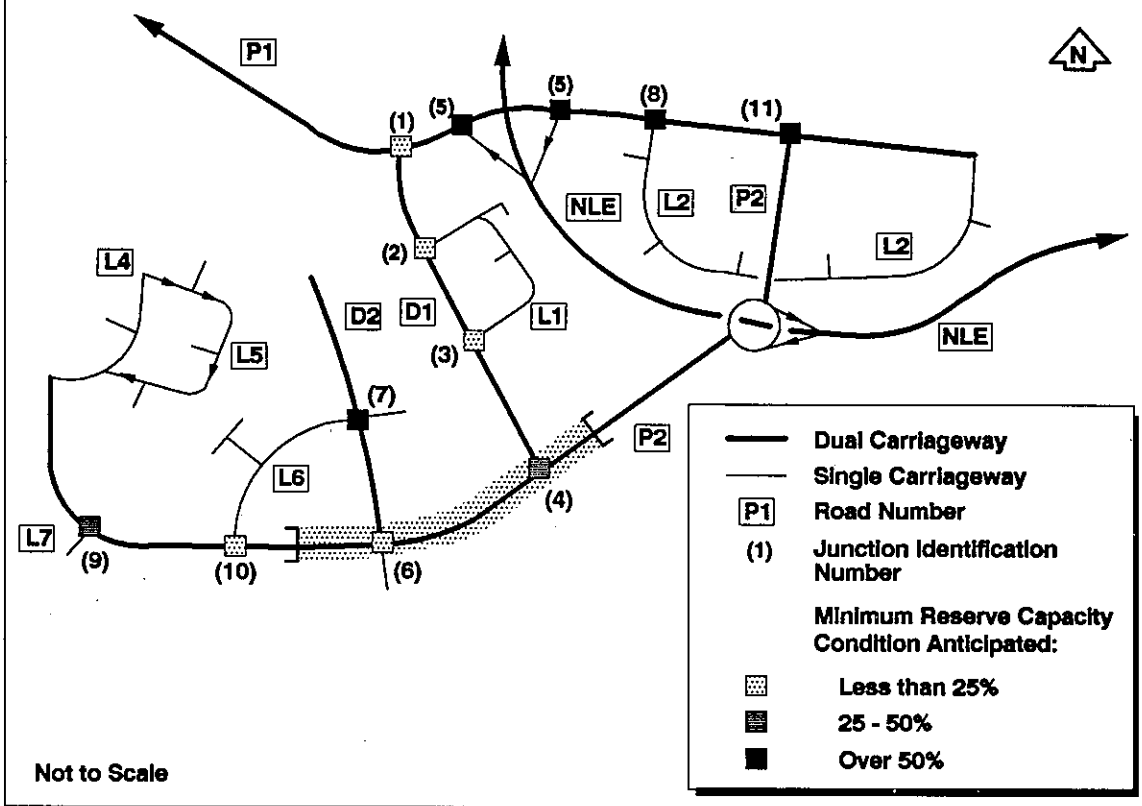
Road Section	Direction	Peak-hour PCUs ('000)		
		AM	PM	Midday
1	EB/WB	4.3/4.0	4.8/4.7	5.0/4.4
2	EB/WB	4.8/4.6	5.1/5.1	5.5/5.0
3	EB/WB	2.0/1.4	1.4/1.6	1.5/1.4
4	EB/WB	2.0/1.4	1.4/1.6	1.4/1.3
5	NB/SB	1.5/1.3	1.4/1.4	1.4/1.4
6	NB/SB	0.5/0.5	0.4/0.5	0.5/0.5
7	NB/SB	0.1/0.1	0.1/0.1	0.1/0.1
8	EB/WB	1.5/1.1	1.0/1.2	1.1/1.0
9	EB/WB	0.8/0.7	0.7/0.8	0.7/0.6
10	EB/WB	0.7/0.5	0.6/0.7	0.6/0.5
11	EB/WB	1.3/0.9	0.9/1.2	0.9/0.9
12	EB/WB	1.6/1.2	1.1/1.4	1.0/1.0
13	EB/WB	0.1/0.2	0.1/0.2	0.1/0.1
14	EB/WB	0.5/0.4	0.3/0.5	0.3/0.3
15	EB/WB	0.7/0.5	0.4/0.7	0.7/0.5

Table G14 Tung Chung Junction Conditions - 2001



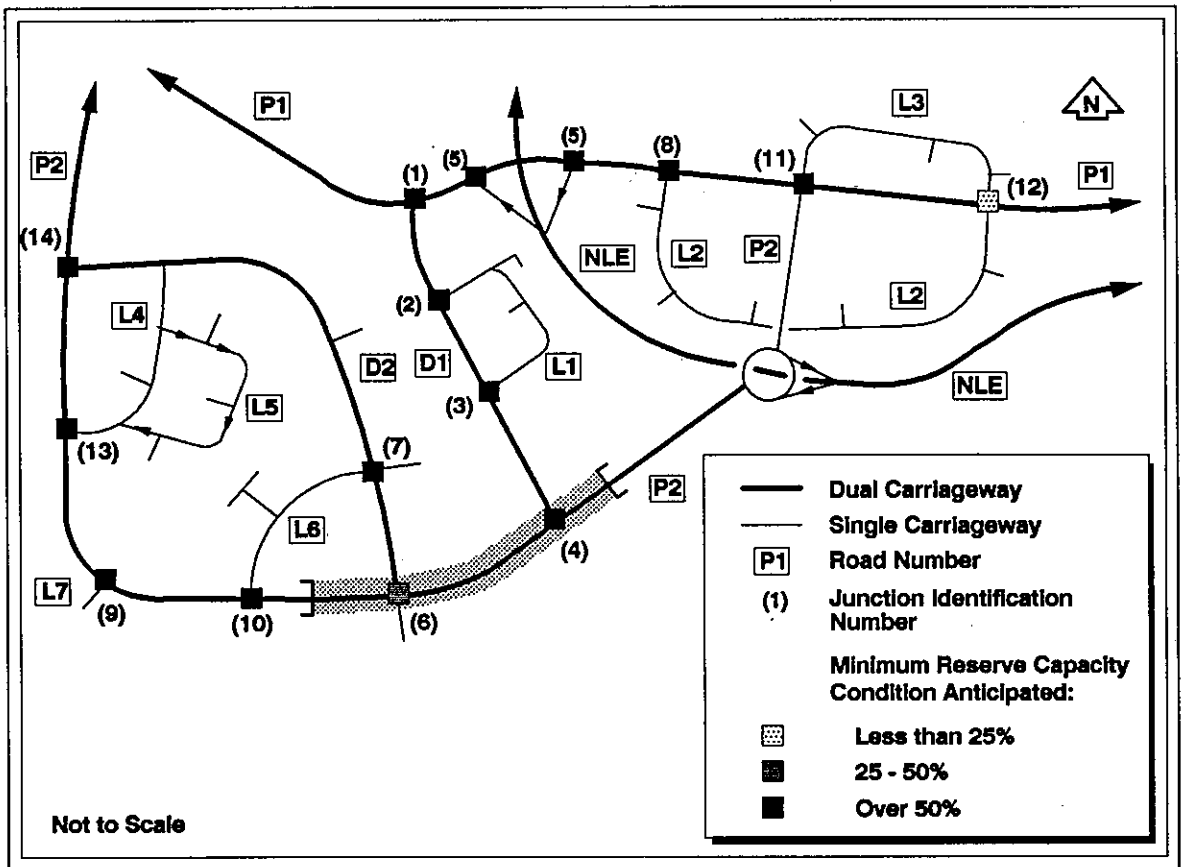
Junction Number	Roads	Peak-Hour Reserve Capacities		
		AM	PM	Midday
1	P1/D1	45	45	100 +
2	D1/L1	40	45	80
3	D1/L1	95	75	75
4	P2/D1	60	100 +	100 +
5	NLE/P1	60	85	95
6	P2/D2	45	100 +	100 +
7	D2/L6	90	100 +	100 +

Table G15 Tung Chung Junction Conditions - 2006



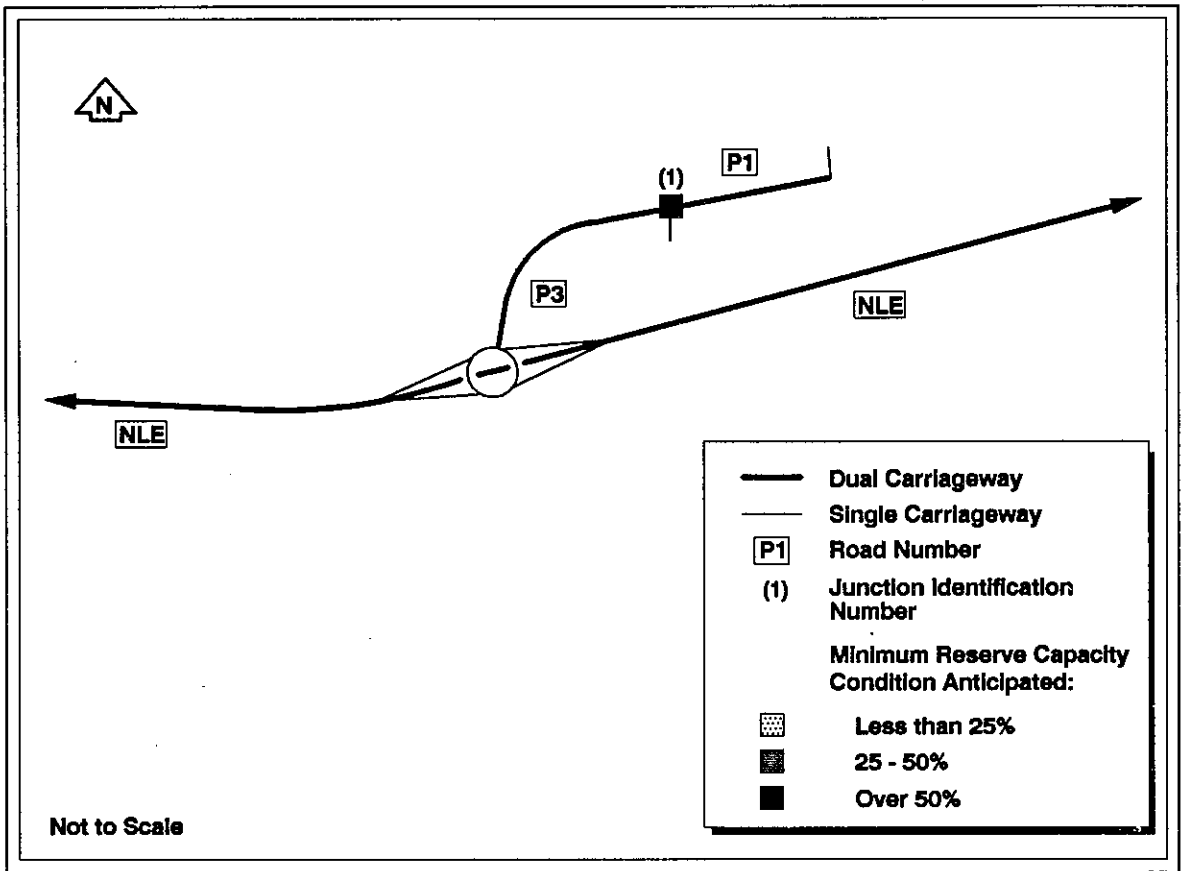
Junction Number	Roads	Peak-Hour Reserve Capacities		
		AM	PM	Midday
1	P1/D1	30	20	75
2	D1/L1	40	15	50
3	D1/L1	55	15	80
4	P2/D1	30	55	85
5	NLE/P1	100	100 +	100 +
6	P2/D2	45	15	85
7	D2/L6	80	95	100 +
8	P1/L2	55	100 +	100 +
9	P2/L7	25	30	100 +
10	P2/L6	40	100 +	100 +
11	P1/P2	100 +	100 +	100 +

Table G16 Tung Chung Junction Conditions - 2011



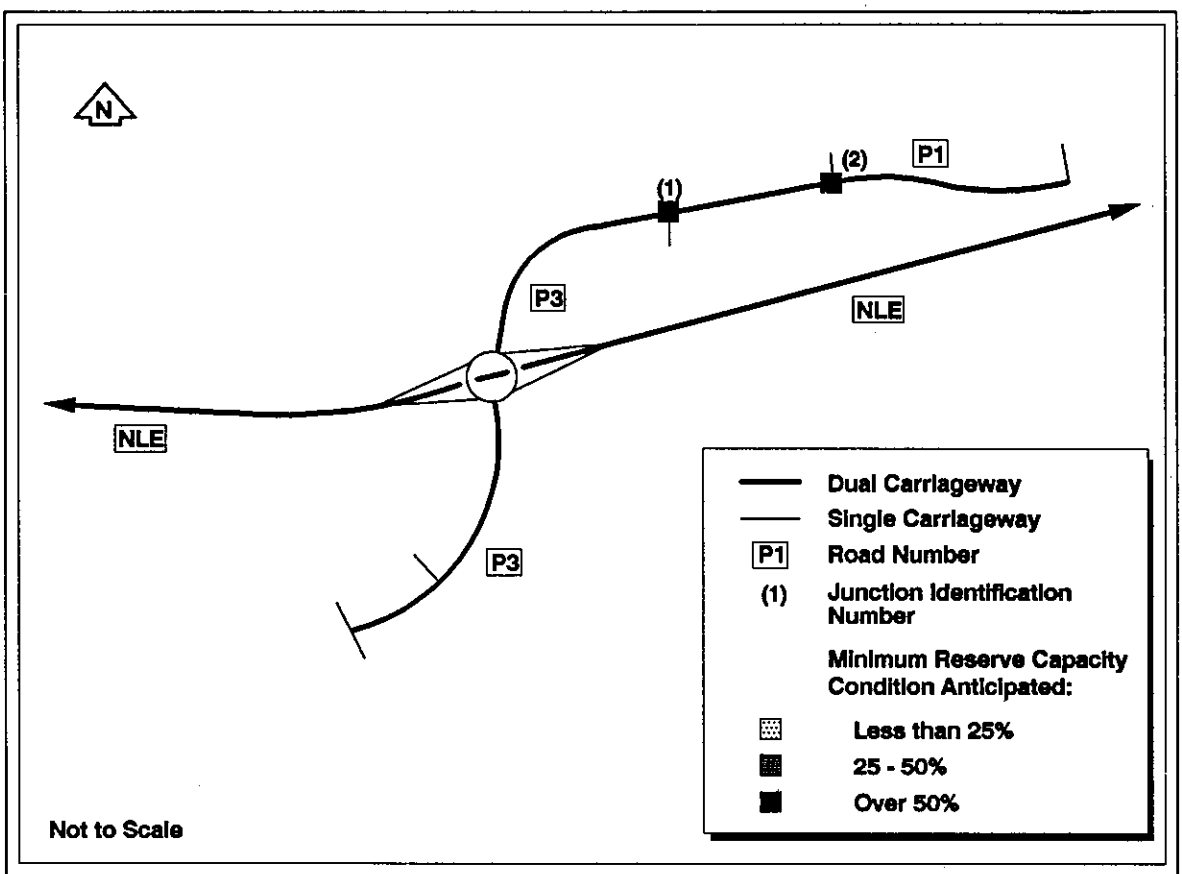
Junction Number	Roads	Peak-Hour Reserve Capacities		
		AM	PM	Midday
1	P1/D1	80	100 +	100 +
2	D1/L1	70	75	90
3	D1/L1	60	100 +	100 +
4	P2/D1	55	75	90
5	NLE/P1	100 +	100 +	100 +
6	P2/D2	40	70	95
7	D2/L6	60	65	75
8	P1/L2	70	100	100 +
9	P2/L7	50	55	100 +
10	P2/L6	100 +	100 +	100 +
11	P1/P2	100 +	100 +	100 +
12	P1/L2/L3	20	20	60
13	P2/L4	100 +	100 +	100 +
14	P2/D2	100 +	100 +	100 +

Table G17 Tai Ho Wan Junction Conditions - 2001



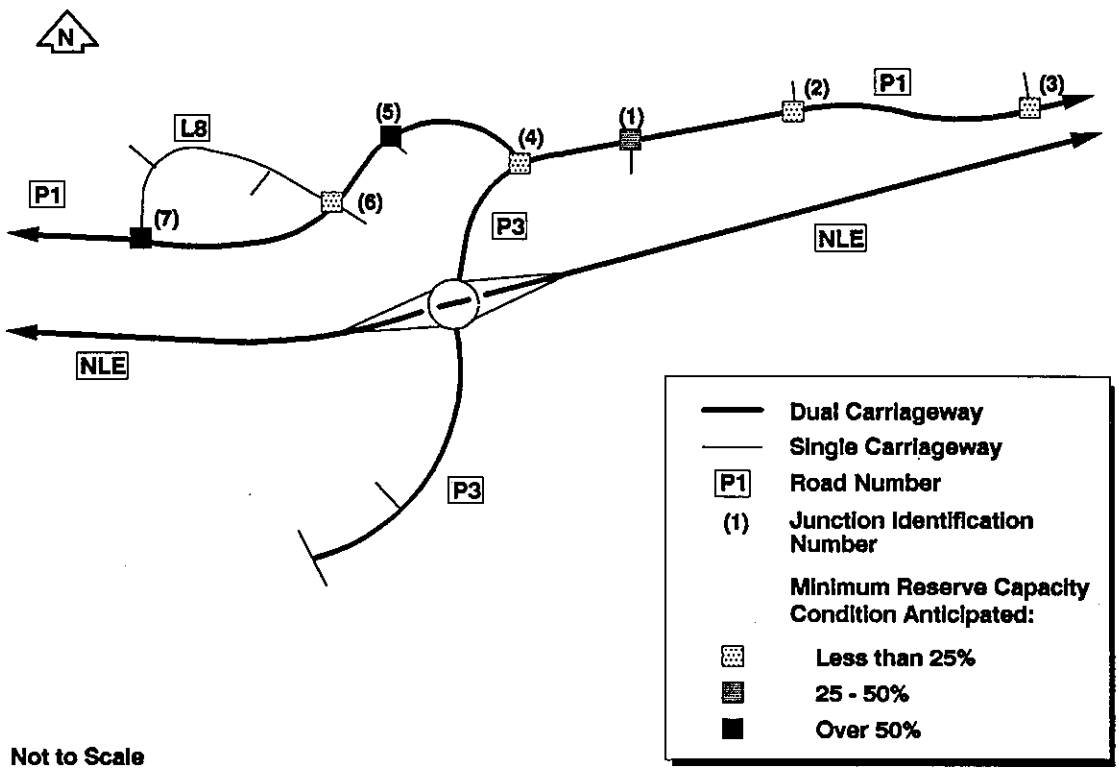
Junction Number	Roads	Peak-Hour Reserve Capacities		
		AM	PM	Midday
1	P1/Depot	100+	100+	100+

Table G18 Tai Ho Wan Junction Conditions - 2006



Junction Number	Roads	Peak-Hour Reserve Capacities		
		AM	PM	Midday
1	P1/Depot	100 +	100 +	100 +
2	P1/Ind PKW	65	60	60

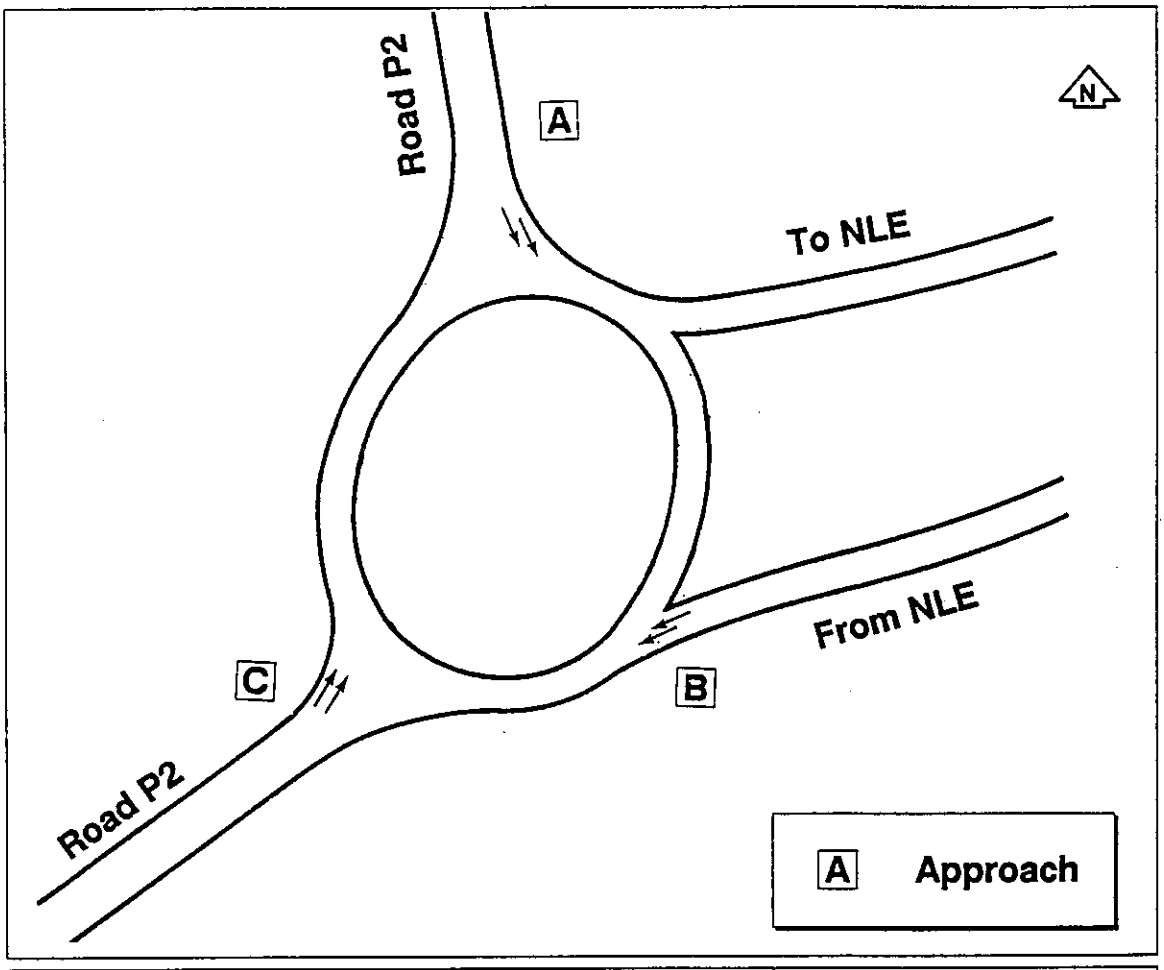
Table G19 Tai Ho Wan Junction Conditions - 2011



Not to Scale

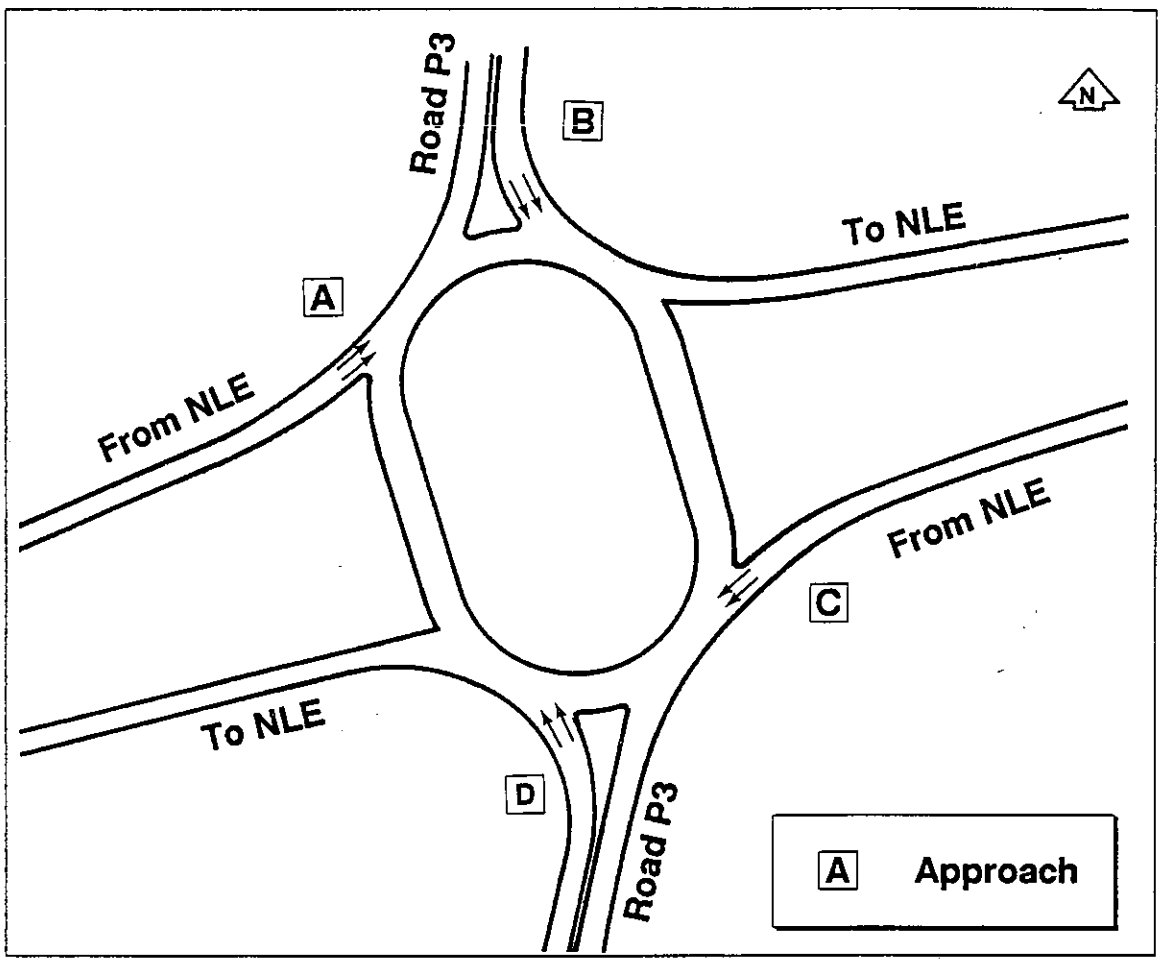
Junction Number	Roads	Peak-Hour Reserve Capacities		
		AM	PM	Midday
1	P1/Depot	40	30	55
2	P1/Ind PKW	10	25	20
3	P1/Ind PKE	10	35	40
4	P1/P3	20	30	45
5	P1/Local	80	85	100 +
6	P1/L8 East	5	5	35
7	P1/L8 West	100 +	100 +	100 +

Table G20 Tung Chung Roundabout Conditions



2001				2006				2011			
Peak Hour	App.	PCUs	V/C Ratio	Peak Hour	App.	PCUs	V/C Ratio	Peak Hour	App.	PCUs	V/C Ratio
AM	A	-	-	AM	A	800	0.4	AM	A	500	0.3
	B	500	0.2		B	1,100	0.4		B	1,100	0.4
	C	600	0.2		C	1,600	0.7		C	1,800	0.7
PM	A	-	-	PM	A	700	0.3	PM	A	400	0.2
	B	500	0.1		B	1,200	0.4		B	1,300	0.5
	C	400	0.2		C	900	0.4		C	1,400	0.6
Mid-day	A	-	-	Mid-day	A	600	0.3	Mid-day	A	300	0.2
	B	600	0.2		B	1,200	0.4		B	1,200	0.4
	C	500	0.2		C	1,000	0.4		C	1,400	0.6

Table G21 Tai Ho Wan Roundabout Conditions



2001				2006				2011			
Peak Hour	App.	PCUs	V/C Ratio	Peak Hour	App.	PCUs	V/C Ratio	Peak Hour	App.	PCUs	V/C Ratio
AM	A	200	0.1	AM	A	500	0.2	AM	A	600	0.3
	B	600	0.2		B	900	0.3		B	1,300	0.6
	C	600	0.2		C	700	0.3		C	1,100	0.5
	D	-	-		D	100	0.1		D	500	0.3
PM	A	100	0.1	PM	A	400	0.1	PM	A	700	0.3
	B	600	0.2		B	1,000	0.4		B	1,400	0.6
	C	400	0.2		C	500	0.2		C	1,000	0.5
	D	-	-		D	100	0.1		D	400	0.2
Mid-day	A	100	0.1	Mid-day	A	300	0.1	Mid-day	A	600	0.3
	B	700	0.3		B	1,000	0.4		B	1,300	0.6
	C	600	0.2		C	700	0.3		C	1,100	0.5
	D	-	-		D	100	0.1		D	500	0.3

Table G22 Daily Rail Station Boardings and Alightings

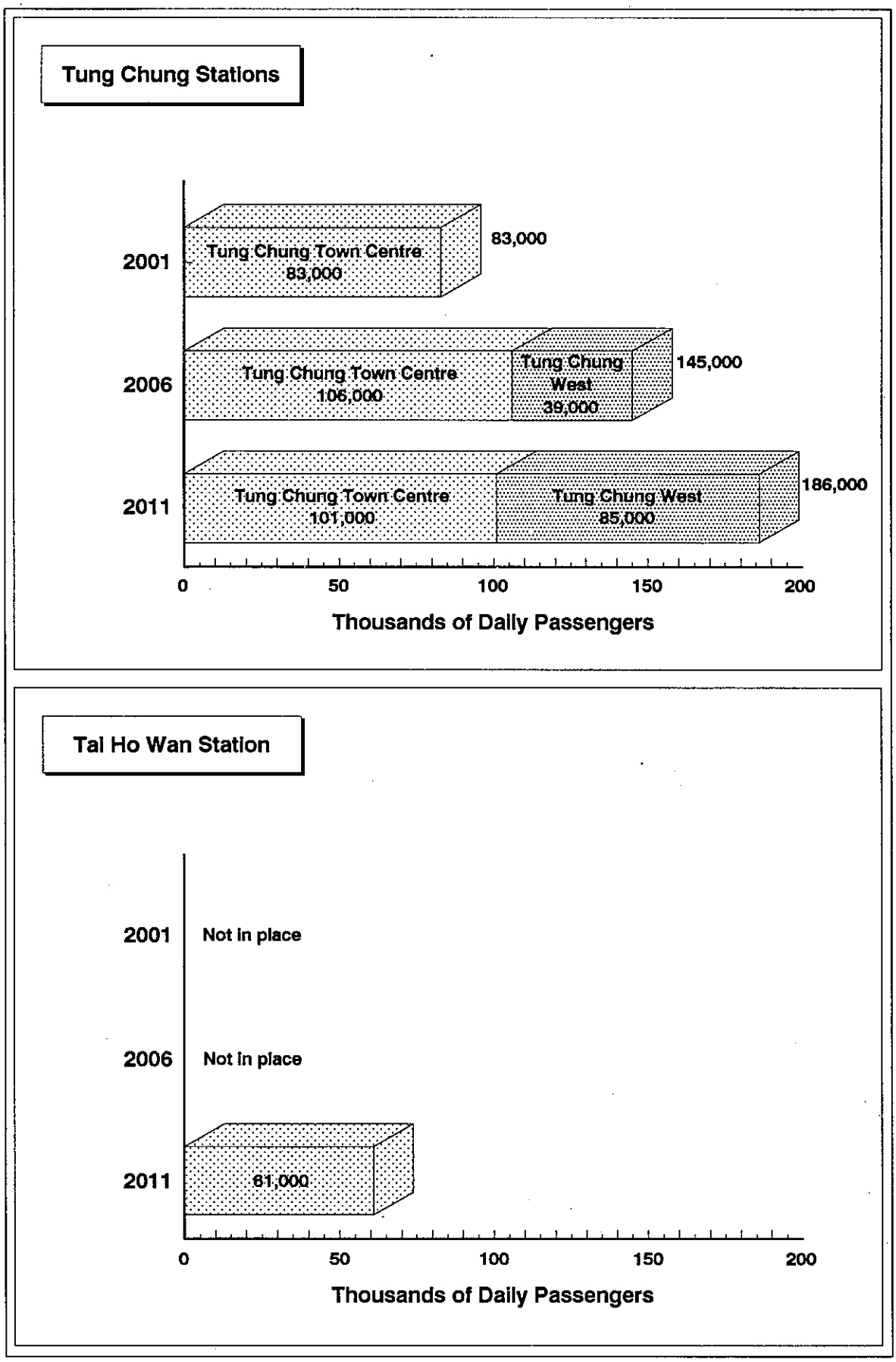


Table G23 Public Transport Routes and Daily Patronage

Type Service	Daily Passengers		
	2001	2006	2011
EXTERNAL ROUTES (NO. OF ROUTES)			
Transport Interchange (4)	32,000	38,000	51,000
Tung Chung West (1)	-	12,000	17,000
Tai Ho Wan North (2)	-	-	19,000
Total	32,000	50,000	87,000
INTERNAL ROUTES			
Tung Chung West - Transport Interchange	-	8,000	12,000
Tung Chung Area 23 - Transport Interchange	4,000	4,000	2,000
Tung Chung Area 43 - Transport Interchange	9,000	13,000	12,000
Industrial Park - Transport Interchange	10,000	23,000	-
Industrial Park - Tai Ho Wan North	-	-	23,000
Tai Ho Wan South - Transport Interchange	-	3,000	-
Tai Ho Wan South - Tai Ho Wan North	-	-	3,000
Total	23,000	51,000	52,000
AIRPORT SHUTTLE			
Transport Interchange	29,000	30,000	27,000
Tung Chung Area 23	13,000	7,000	3,000
Tung Chung West	-	10,000	33,000
Tai Ho Wan North	-	-	5,000
Total	42,000	47,000	68,000

Table G24 Public Transport Termini Traffic

Terminus	Time Period	Public Transport Boardings and Alightings		
		2001	2006	2011
Transport Interchange	AM Peak Hour	9,000	8,000	5,000
	PM Peak Hour	7,000	6,000	4,000
	Daily	80,000	70,000	53,000
Tung Chung Area 23	AM Peak Hour	1,000	500	500
	PM Peak Hour	1,000	500	500
	Daily	9,000	5,000	5,000
Tung Chung West	AM Peak Hour	-	2,500	5,000
	PM Peak Hour	-	2,000	3,000
	Daily	-	24,000	43,000
Tung Chung Area 38	AM Peak Hour	500	1,000	1,000
	PM Peak Hour	1,000	1,000	1,000
	Daily	8,000	12,000	12,000
Industrial Park	AM Peak Hour	1,500	3,000	3,000
	PM Peak Hour	1,000	2,000	2,000
	Daily	10,000	23,000	23,000
Tai Ho Wan North	AM Peak Hour	-	-	5,000
	PM Peak Hour	-	-	4,000
	Daily	-	-	45,000
Tai Ho Wan South	AM Peak Hour	-	500	500
	PM Peak Hour	-	500	500
	Daily	-	3,000	3,000

North Lantau Development

Appendix H

Village Expansion and Village Resite Plans

APPENDIX H

VILLAGE EXPANSION AND VILLAGE RESITE PLANS

H1 Introduction

This Appendix describes the concept plans for the expansion of the existing villages which will be retained in North Lantau Development as the New Town develops. It also describes concept plans for village resite areas for those villages to be relocated during development.

There are 35 settlements within the Study Area, concentrated mainly on the fertile lowlands of Tung Chung and Tai Ho Wan (Figure H.1). Of these, 21 are pre-1898 Recognised Villages and the majority fall into 15 groups of villages with recognised boundaries. These villages are:

- Sha Lo Wan
- Tin Sam/Kau Liu/San Tau
- Ngau Au/Tung Hing
- Nim Yuen
- Mok Ka
- Shek Mun Kap/San Keng
- Shek Lau Po
- Wong Ka Wai/Lung Tseng Tau/Sheung Ling Pei/Ha Ling Pei/Fui Yiu Ha (Ling Pei)
- Shan Ha
- Wong Nai Uk
- Ma Wan
- Ma Wan Chung
- Pak Mong
- Ngau Kwu Long
- Tai Ho Sun Tsuen.

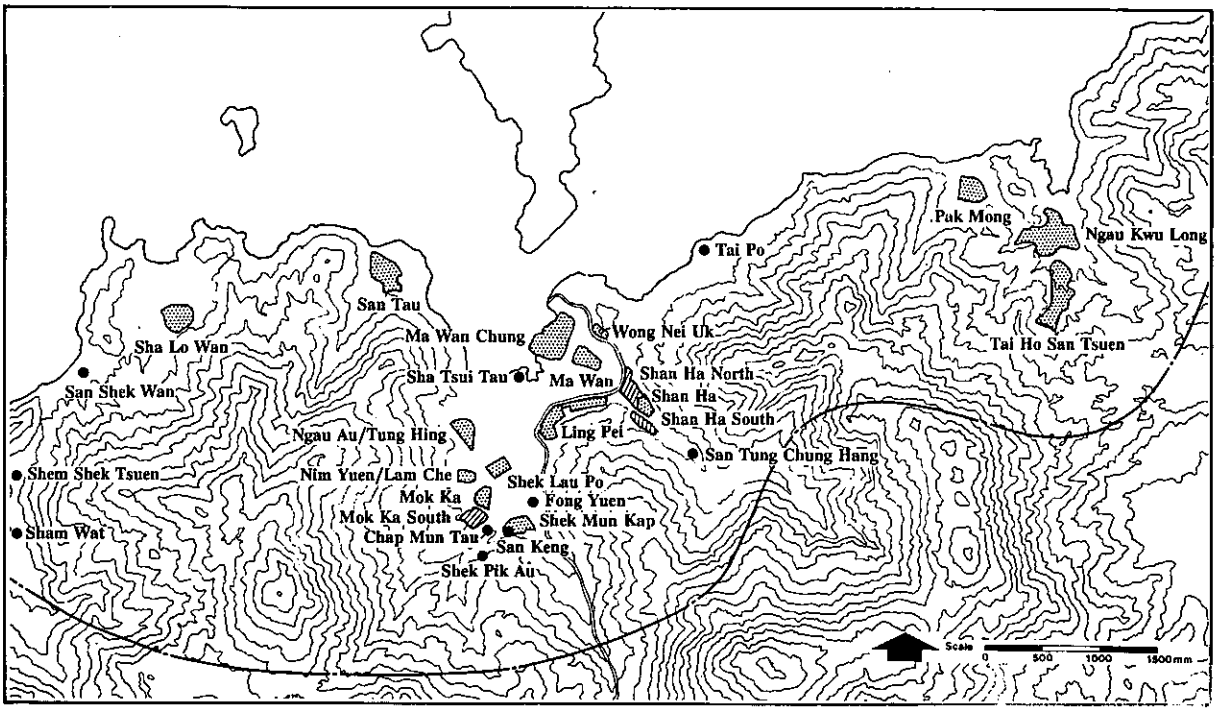
Lam Che, Sham Wat, San Shek Wan and Tei Tong Tsai are Recognised Villages without a recognised boundary. Tai Po has recently been reclassified as not a pre-1898 Recognised Village.

Other settlements in the study area which are not Recognised Villages with or without recognised boundaries include:

- Sha Tsui Tau
- Fong Yuen
- Chap Mun Tau
- Shek Pik Au
- San Tung Chung Hang/Wong Lung Hang

Population of these settlements and their future Small House entitlements have been combined with their host village as follows:

- Sha Tsui Tau requirements have been included in Ling Pei.
- Fong Yuen, Chap Mun Tau and Shek Pik Au requirements are included in Shek Mun Kap.
- San Tung Chung Hang/Wong Lung Hang requirements in Shan Ha.
- Lam Che requirements have been included in Nim Yuen.



Village with Recognised Boundary

Village Resite Area

Village without Recognised Boundary

Figure H.1
Villages/
Village Resite Areas

In developing the Recommended Outline Development Plan (RODP), the principle of retaining as many as possible of the existing villages in-situ has been adopted. Villages and other settlements directly affected by development are to be re-sited to the periphery of the planned urban area into designated village re-site areas. These settlements include:

- Tai Po, to be relocated during Phase 1 development. This village has recently been found to be not a pre - 1898 Recognised Village. Affected Building Lots within Tai Po are to be dealt with individually on government land rather than on a full village removal basis.

- Ma Wan and Wong Nai Uk, to be resited in Phase 2 of development.

- Ma Wan Chung, Sha Tsui Tau and Fong Yuen, affected by Phase 3 development.

The proposal to resite Shek Lau Po, as outlined in the draft RODP, has been reviewed and it is now recommended that this village remain in-situ. Shek Lau Po is retained in-situ with a modified boundary on the RODP.

H2 Village Expansion

H2.1 General Approach

Villages to be retained within the study area are discussed in three groups:

- Sha Lo Wan/San Tau area. These villages and other settlements include Sham Wat, Sham Shek Tsuen, San Shek Wan, Sha Lo Wan and San Tau (Tin Sam, Kau Liu and San Tau).
- Tung Chung area, which includes Ngau Au/Tung Hing, Nim Yuen/Lam Che, Mok Ka, Shek Mun Kap, Shek Lau Po, Ling Pei (comprising five villages) and Shan Ha.
- Tai Ho Wan area, which includes Pak Mong, Ngau Kwu Long and Tai Ho Sun Tsuen.

In the concept plans presented in Figures H.2 - H.12, all villages are recognised villages with recognised boundaries. Small House entitlements of indigenous villagers have been estimated to 2011. These estimates were presented in Topic Report TR16 "Village Concept Plans" and have been summarised in Volume I of the Draft Final Report. These future entitlements are accommodated in expansion areas within the recognised village boundary. In some cases, expansion requirements of settlements adjacent to particular recognised villages have been incorporated with those of the recognised village. In those villages where estimates of demand appear low (for example Ling Pei and Shan Ha) sufficient land is available to accommodate additional housing demand should the need arise.

Any future allocation of Small Houses in retained villages should be guided by a Village Layout Plan, detailing the location of existing and infill Small House Building Lots, the provision of future facilities including G/IC uses, local open space, village carparking and connections to pedestrian networks with the developing New Town. Extension of the future utility infrastructure of the New Town, including electricity, telephone, sewerage, stormwater drainage and water reticulation, to all villages should also be undertaken as part of the New Town development programme.

Concept plans showing how each village could accommodate future Small House entitlements within village environs are described in the following sections.

H2.2 Sha Lo Wan/San Tau Villages

Sham Wat, Sham Shek Tsuen, San Shek Wan

Concept Plans for Sham Wat, a Recognised Village without a recognised boundary, Sham Shek Tsuen and San Shek Wan, both classified as village settlements, have not been prepared.

Detailed information for these villages giving the present total population, indigenous population, land tenure, geotechnical constraints, terrain and vegetation characteristics is currently unavailable.

Sha Lo Wan

Sha Lo Wan has the largest indigenous population of all villages in the Study Area. Indigenous population is estimated at 500.

The built-up area of the village includes 117 Block Crown Lease Building Lots and 10 Post-War New Grant Building Lots. The majority of these Building Lots are located in the village core, where the arrangement of Building Lots follows the traditional form. In the north-western part of the village a number of dwellings have been sited in random manner, on Post-War New Grant Building Lots. These are adjacent to the main footpath linking Sha Lo Wan with Sham Wat in the west. Highways Department has proposed to upgrade access to the village from the west by providing a village access road linking Sha Lo Wan with other villages to the west and connecting to Sham Wat Road to access South Lantau.

Two areas of private agricultural land are located in the north and west of the village. Future grants of Small House Building Lots in these areas could be by land exchange or on a cost recovery basis subject to a detailed Village Planning Layout. The remaining land in the village environs is Crown land.

An estimated 192 Small House Building Lots are required to satisfy Small House entitlements upto 2011. These can be accommodated in four areas as shown on Figure H.2. Area 1 located west of the existing village core provides for about 50 Small House Building Lots. About 20 of these are located within the village environs on Crown land, the remainder in an area of Crown and private land between the village boundary and the footpath connecting Sha Lo Wan to Sham Wat. Area 2, located in the north-western part of the village environs within which a number of Small House are located, could provide sites for about 40 Small Houses. Area 3 is an area of mainly private agricultural land to the north of the main village housing core, and straddles the pedestrian pathway which links Sha Lo Wan to villages to the west and east. This area could accommodate about 60 Small House Building Lots. An area of Crown land north of the existing village housing core, Area 4, and infill development within the existing village housing core would also assist in satisfying estimated Small House demands upto 2011. Careful site planning and the allocation of future Small House Building Lots guided by a detailed Village Layout Plan would increase the lot yield of these areas.

Connection of Sha Lo Wan to the public utility infrastructure of the North Lantau Development is not recommended because of its distance from the New Town.

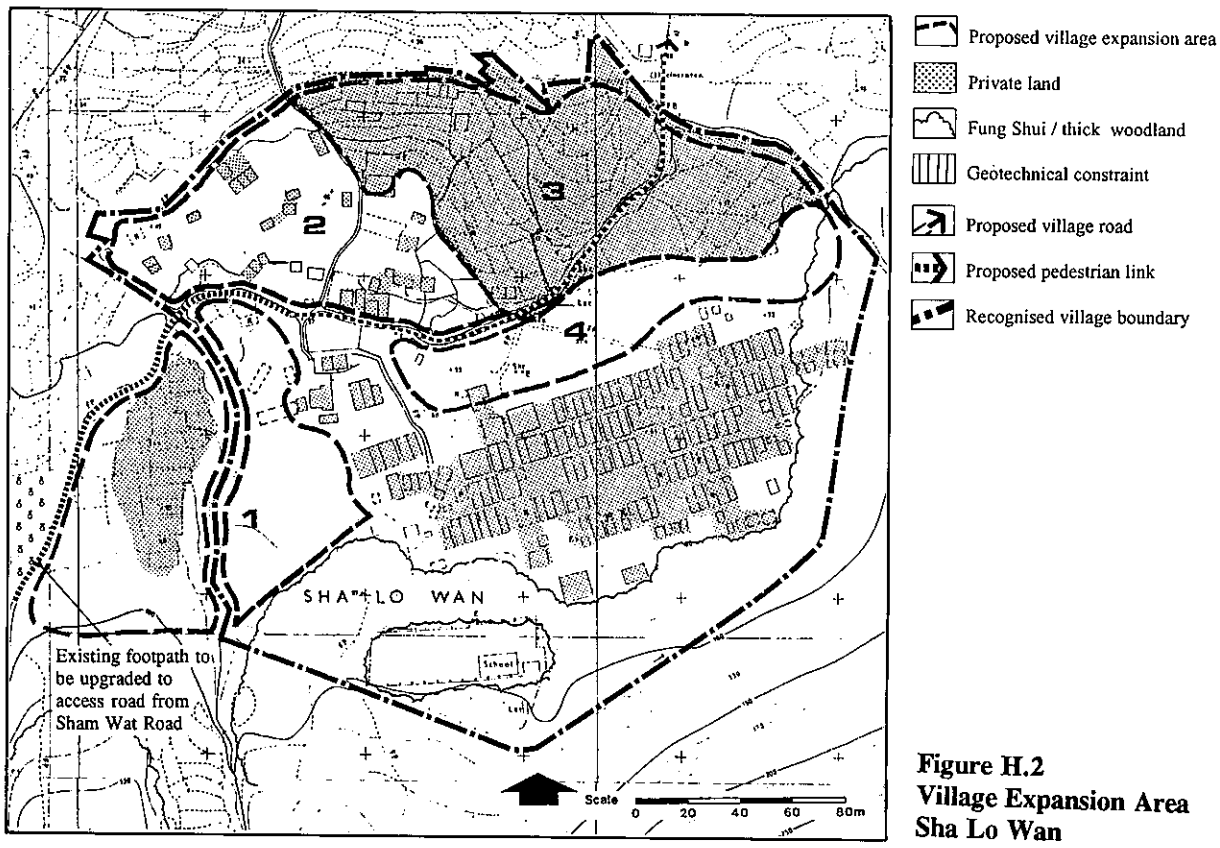


Figure H.2
Village Expansion Area
Sha Lo Wan

San Tau

The village environs contains three settlements. These are San Tau, Kau Liu and Tin Sam. Although tied geographically and economically to the Tung Chung area, San Tau belongs to Tai O Rural Committee. The village has an indigenous population of 320 and an area of 9.43 ha. It contains 89 Block Crown Lease House Lots and 9 Post-War New Grant Building Lots. Access to the village is by footpath, linking to Tung Chung and from a ferry pier which provides sea access to Tung Chung.

The main constraints to village expansion are land tenure and Fung Shui. There are two main Fung Shui features in the village. These are the ridge line separating Tung Chung valley from the San Tau Valley, classified as an "Elephant Trunk" feature and the ridge line forming the western side of the San Tau Valley, considered to be an important "Dragons' Back". No development should be located on these ridges facing the existing village.

Much of the land within the village environs is private land. The allocation of future Small House Building Lots to satisfy estimated demand upto 2011 would require extensive land exchange or resumption of private land. This demand is estimated at 108 Building Lots. Expansion areas to meet this demand are shown in Figure H.3.

Four areas, with a total capacity of about 110 Building Lots, subject to detailed layout planning, are proposed. These are:

o Area 1, located between Tin Sam and San Tau settlements over mainly private agricultural land. This area could accommodate about 40 Small Houses.

- Area 2 comprising Crown land and some private agricultural land located north of the stream running through the village environs. Upto 30 Small House Building Lots could be sited in this area subject to the extent of clearance of woodland adjacent to the existing village houses.

- Area 3 is located north of the major cluster of village houses at San Tau in the southern part of the village environs. This area is on private land and could provide about 20 Small House Building Lots.

- Area 4, located north of San Tau settlement, straddles the stream flowing through the village environs. Land tenure is a mainly Crown land. The area has a potential of about 20 Building Lots. The re-alignment of the existing stream may be necessary to maximise the potential of this expansion area for Small Houses. These proposals may conflict with the "Elephants Trunk" Fung Shui feature. Further investigation is needed to resolve the suitability of the site for Small House development. If found unsuitable, housing requirements from this area could be accommodated in alternative areas north of Kau Liu or by expanding Area 1.

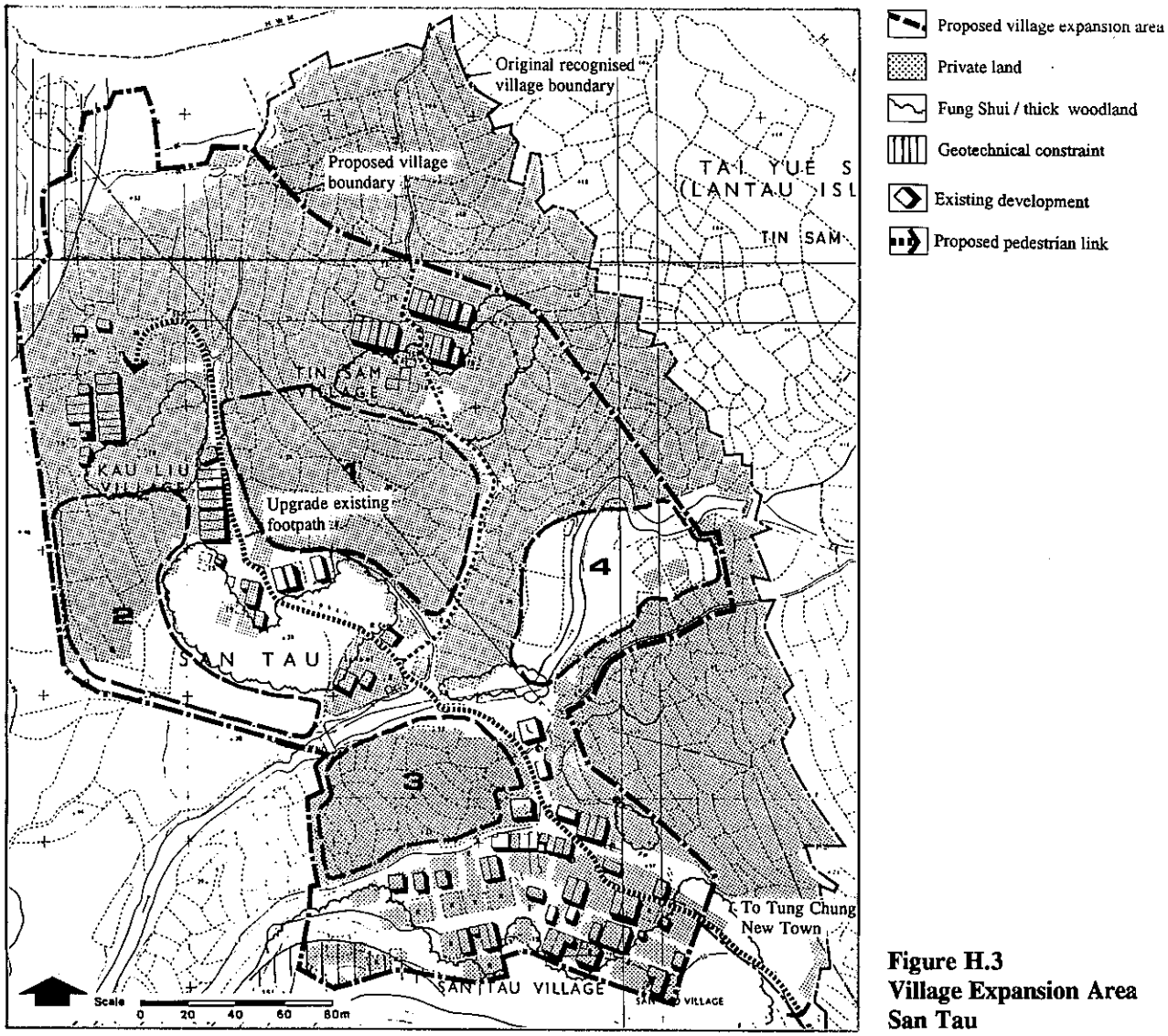


Figure H.3
Village Expansion Area
San Tau

Within the village environs, a substantial area of abandoned private agricultural land is unaffected by these proposals. Unless bought under some control mechanism, this land could provide opportunity for undesirable development, including the ad-hoc siting of Small Houses through land exchange. A review of the northern and eastern village boundary is recommended to reduce the area within the village environs that is unlikely to be needed to meet future Small House entitlements. A recommended revised village boundary is shown on Figure H.3. Land excised from the village in this manner would then be integrated with land to the north-east of the village, overwhich management recommendations are made within the scope of the RODP.

The linking of San Tau and Tung Chung in the short term by upgrading the existing footpath to a village access road would create demands for land within and adjacent to the village environs beyond the indigenous villagers Small House needs, open the way for development of other inappropriate uses and place substantial pressure on the environmental capacity of this section of the north Lantau coastline. For these reasons, a road link to Tung Chung is not recommended. The need for a future village access road could be reviewed as the New Town develops. Concerns raised about environmental capacity and development potential should be addressed in any subsequent review. Upgrading of the existing footpath, provision of sewerage and connection to other utility services from the New Town would be appropriate.

H2.3 Tung Chung Villages

Ngau Au and Tung Hing

This village is about 4.2ha in area and has an estimated indigenous population of 136. Within the village envelope, there are 40 Block Crown Lease House Lots and two Post-War New Grant Building Lots distributed along the footpath which links the village to Shek Lau Po in the south and Tung Chung valley to the east.

The northern and eastern areas of the village are primarily private land and relatively flat, while the southern and western parts are mainly Crown land with gentle to steeper slopes, thick indigenous woodland and scattered Fung Shui trees.

Almost the whole village is built on colluvium soil. This provides a geotechnical constraint to any significant site formation works. Extensive Small House development is only feasible in the northern and eastern parts of the village, mainly on agriculture land to the north of the existing Block Crown Lease House Lots.

Four areas within the village environs are suitable for village expansion and provide adequate area to accommodate the estimated demand of 47 Small House Building Lots upto 2011. Figure H.4 indicates possible village expansion areas. Two areas, Areas 1 and 2, predominantly on private agriculture land are located to the north and east of existing village houses, and can accommodate about 42 Small Houses. Small House Grant Lots in these areas would be either by land exchange or Government resumption, servicing and allocation on a cost recovery basis. An infill site, Areas 3 providing for 5 Small Houses, is located within the village core. Clearance of existing woodland would be required. An area of Crown land affected by an existing Crown Licence at the rear of the village would provide further opportunity should any of the proposed expansion areas prove unsuitable.

Existing footpath access to the village could be upgraded by providing a village access road through the area of R3 housing (Area 38 on the RODP) to the east and crossing the proposed drainage channel, as indicated on Figure H.4.

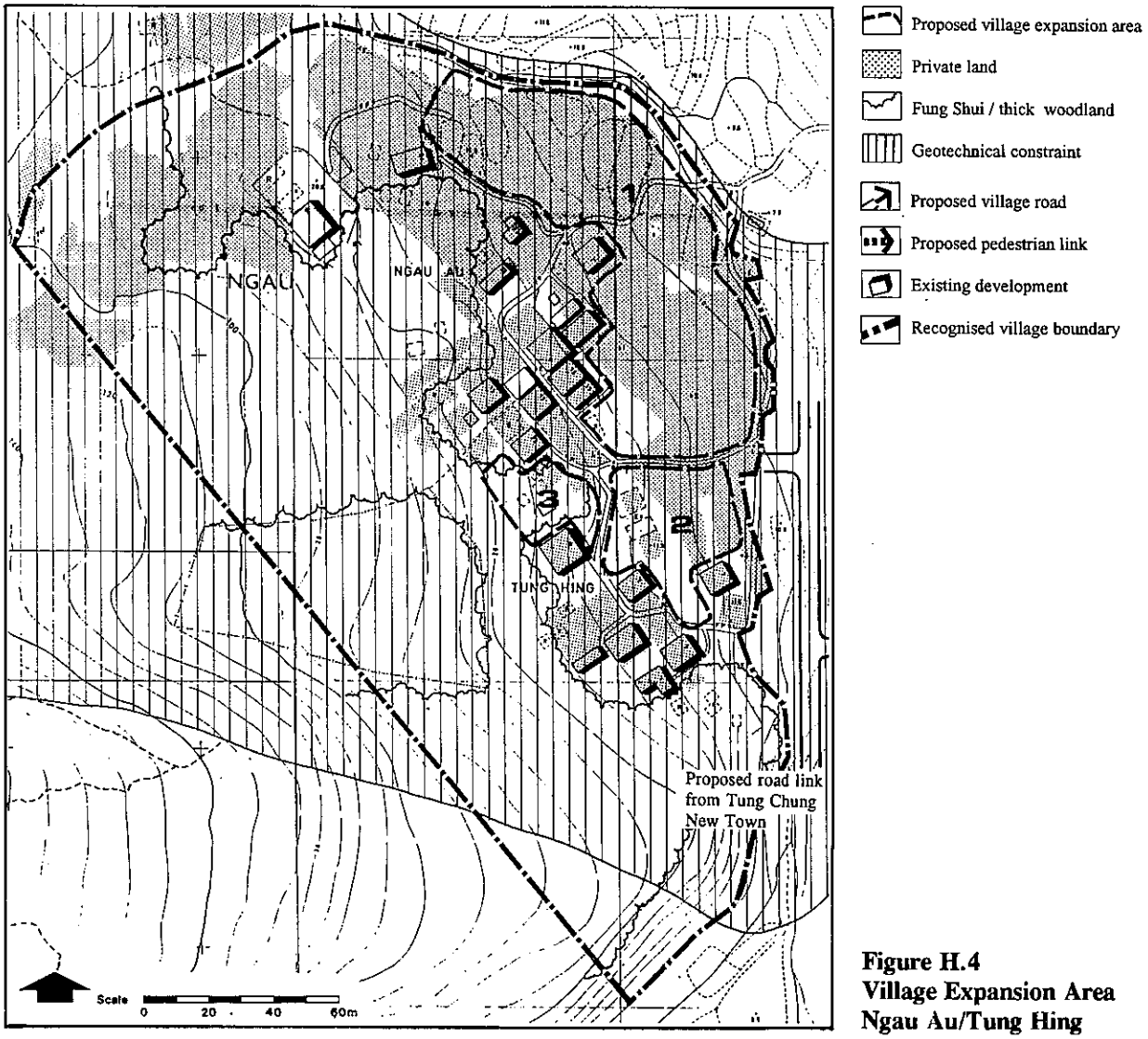


Figure H.4
Village Expansion Area
Ngau Au/Tung Hing

Nim Yuen and Lam Che

Nim Yuen and Lam Che together have an indigenous population of 35 and comprise seven Block Crown Lease House Lots and three Pre-War New Grant Building Lots. Nim Yuen is about 1.7ha in area and is abandoned. Lam Che is a Recognised Village without a recognised boundary and is about 150 metres to the north of Nim Yuen. The two villages are linked by footpath which extends to Shek Lau Po to the east.

Both Nim Yuen and Lam Che are heavily wooded. This woodland lies at the rear of both villages, and may be considered of Fung Shui significance. Geotechnical constraints to development are restricted to the western and southern boundaries of Nim Yuen. Expansion of Lam Che by future grants of Small House Building Lots adjacent to the built area of the village is constrained by a combination of geotechnical constraints and gradients steeper than 1 in 10.

Land tenure is a mix of Crown land and private agricultural land. The Crown land lies on steeper slopes with gradients generally greater than 1 in 10. Private land is located to the north of the abandoned Nim Yuen village houses and in the south-eastern corner of the village and is gently sloping.

Small House demand upto 2011 is estimated at 14 Building Lots. This demand can be satisfied within the environs of Nim Yuen as shown on Figure H.5. Two sites, Areas 1 and 2, are located some 100 metres to the north and east of the existing village houses. These areas could accommodate about 25 houses. The areas are mainly on private land and free from geotechnical and ecological constraints. Future Small House allocation would be by land exchange or grant based on a premium to recover resumption and servicing costs.

The capacity of expansion areas in Nim Yuen (25 Building Lots) exceeds the estimated demand upto 2011. The area not required to satisfy future Small House requirements of Nim Yuen and Lam Che villagers could be considered as a future location to accommodate some of the Small House entitlements from adjacent villages or village re-site requirements arising from the development of the New Town.

Alternatively, should these entitlements be satisfied elsewhere in Tung Chung, or Nim Yuen considered as unsuitable for future village development, the village environs may be appropriate for other community uses such as a community farm and permaculture site as proposed in Topic Report TR15 "Rural Hinterland Study".

Provision of a village access road, linking the village with Mok Ka, to the south, and connecting to Shek Mun Kap Road is recommended.

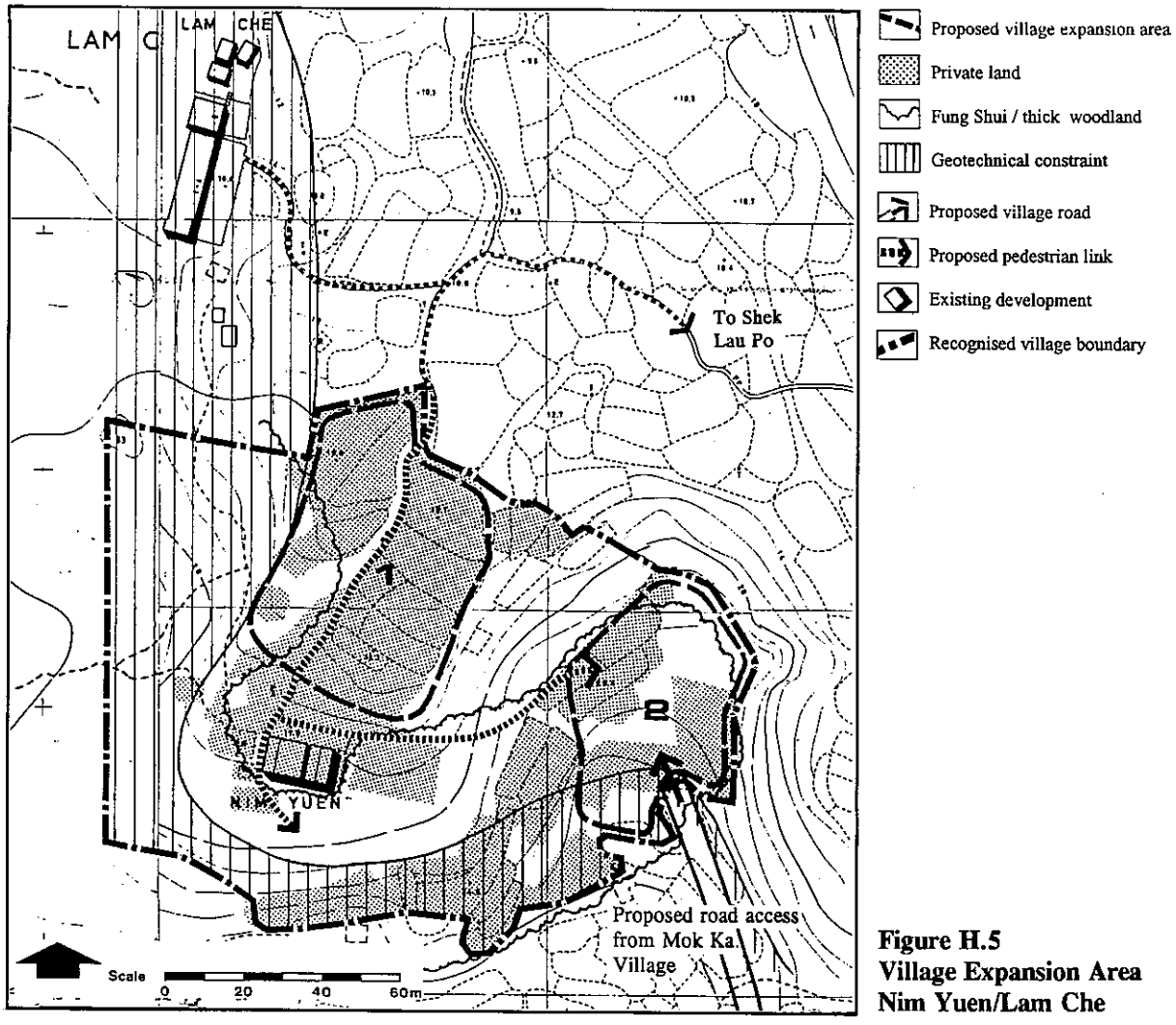


Figure H.5
Village Expansion Area
Nim Yuen/Lam Che

Mok Ka

Mok Ka is the largest village in the western part of Tung Chung. It has an indigenous population of approximately 130 and an area of about 2.5ha. Two natural streams running from north to south form its natural boundaries to the east and west. Access to the village is by footpath linking with Chap Mun Tau and Shek Mun Kap Road to the south-east and Shek Lau Po to the north-east. An existing village wall and Fung Shui gateway define the northern entry to the village and should be retained.

The built-up area of the village includes 40 Block Crown Lease House Lots, 9 Pre-War New Grant Building Lots and 3 Post-War New Grant Building Lots, and is located in the south-east corner of the village. The residue of the south-east corner of the village is Crown land with woodland of Fung Shui significance flanking the village housing area on the west, south and east.

North of the village houses is an area of private agricultural land with no constraints to future Small House development.

Estimated demand for Small Houses upto 2011 is 32 Building Lots. North of the village houses, two areas of private land, Areas 1 and 2, straddle the village access pathway from the north and provide a combined capacity of about 30 houses to meet this demand. The granting of Future Small House entitlements would require either land exchange or House Lot grants based on a premium to recover costs to Government of resumption, formation and servicing. The remaining demand could be satisfied by infill sites on Crown Land within and adjacent to the existing built-up area of the village.

A future village access road linking Nim Yuen and Mok Ka to Shek Mun Kap Road is recommended. Other recommended facilities are the provision of carparking and G/IC facilities adjacent to the southern boundary of the village and the connection to future public utility infrastructure of the New Town development. A buffer zone between the southern boundary of the village and the proposed village resite area to the south (Figure H.6) is proposed. This is intended to provide a route for the village access road serving villages in the western part of Tung Chung and allow a right-of-way for future recreational uses proposed in the rural hinterland strategy.

The future provision of the village access road would modify the south western boundary of the village. The RODP reflects this modified boundary. Discussion with the Head Villager of Mok Ka has indicated that land to the north-west of the creek running to the west of the existing village is the "property" of Shek Lau Po. Further discussion between District Office, District Lands Office and village representatives of Mok Ka and Shek Lau Po should be undertaken to clarify this issue and its impact on the village boundary.

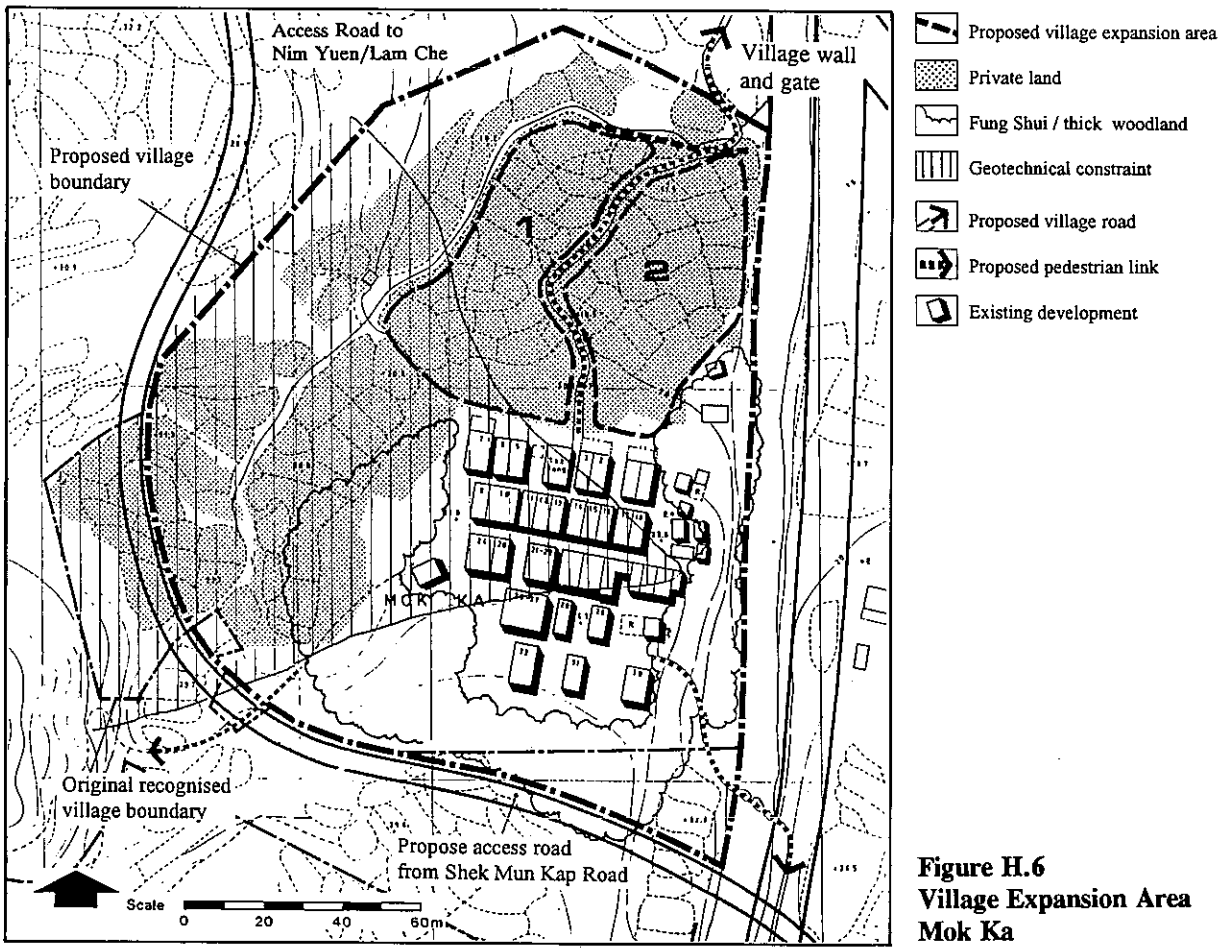


Figure H.6
Village Expansion Area
Mok Ka

Shek Mun Kap

This village, including the settlement of San Keng, is bounded by Shek Mun Kap Road on the north, a stream of high ecological value on the east and steep land to the south. The village has an indigenous population of 120, is 3.9ha in area and has 61 Block Crown Lease House Lots and 3 Post-War New Grant Building Lots.

Constraints to Small House development in the village environs include colluvium soils in the southern part of the village, the existing village houses, a large parcel of private agricultural land in the west of the village environs and a significant stand of woodland flanking the existing village houses to the east and south. A woodland of Fung Shui significance lies north of Shek Mun Kap Road. A stone gateway marks the access to a footpath which runs along the eastern boundary of this woodland. A small temple is located on the footpath.

Small House demand upto 2011 is estimated at 14 Building Lots. Two sites within the village environs are recommended to accommodate this demand. The capacity of these sites is significantly greater than the estimated demand. It is recommended that these areas could be used, subject to negotiation and agreement of Shek Mun Kap indigenous villages, to satisfy Small House demands from other village or re-site requirements in Tung Chung.

Areas to satisfy Small House demand within the village are shown on Figure H.7. Area 1 lies between the existing village houses and San Keng. This area is mainly Crown land and could accommodate about 30 Building Lots. The second expansion area, Area 2, is located in the eastern part of the village environs on private land. This area has a potential capacity of about 36 Small House lots. Small House grants in this area would be by either land exchange or on a cost-recovery basis.

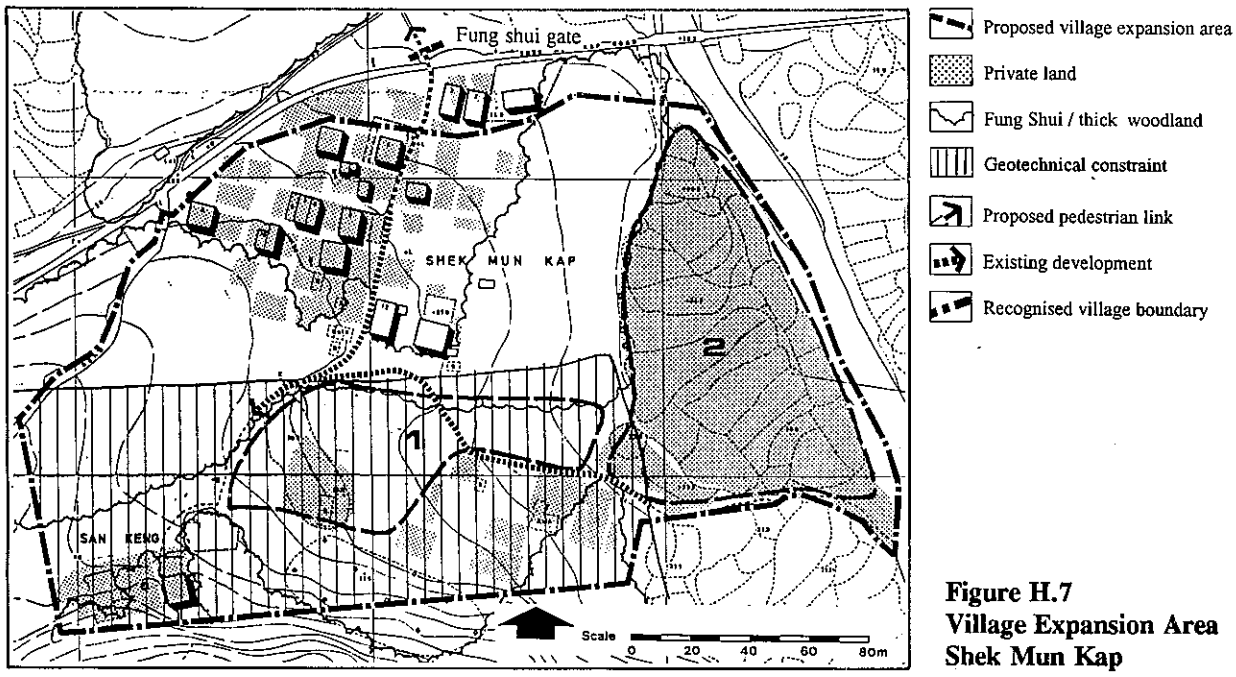


Figure H.7
Village Expansion Area
Shek Mun Kap

Shek Lau Po

Shek Lau Po is located in the centre of Tung Chung valley and surrounded by extensive areas of abandoned agricultural land. Access to the village is by footpath from Tung Chung Road, about 300 metres to the east.

The village has an indigenous population of 140 and an area of 6ha. Within the village environs are 34 Block Crown Lease House Lots, 2 Pre-War New Grant Building Lots and 4 Post-War New Grant Building Lots. The remaining land within the recognised boundaries of the village is mainly private agricultural land. Future allocation of Small House Building Lots to satisfy indigenous entitlement upto 2011 within the village environs would be mainly by land exchange or cost-recovery basis.

Essential to its integration with the adjacent New Town developments is a revised village boundary. It is recommended that the revised boundary shown on Figure H.8 be adopted as the basis for guiding and controlling future development within the village.

Small House demand upto 2011 is estimated at 51 Building Lots. This demand can be partly satisfied within the village environs in two Small House extension areas which together provide about 40 Building Lots. Area 1, located in the west of the village, would provide for about 30 Building Lots. Some clearance of existing woodland would be required in this area. Area 2, located in the east of the village on private land, could accommodate about 10 Building Lots. The remaining demand could be met either by small scale infill adjacent to existing village houses or using some of the surplus potential Building Lots in Nim Yuen.

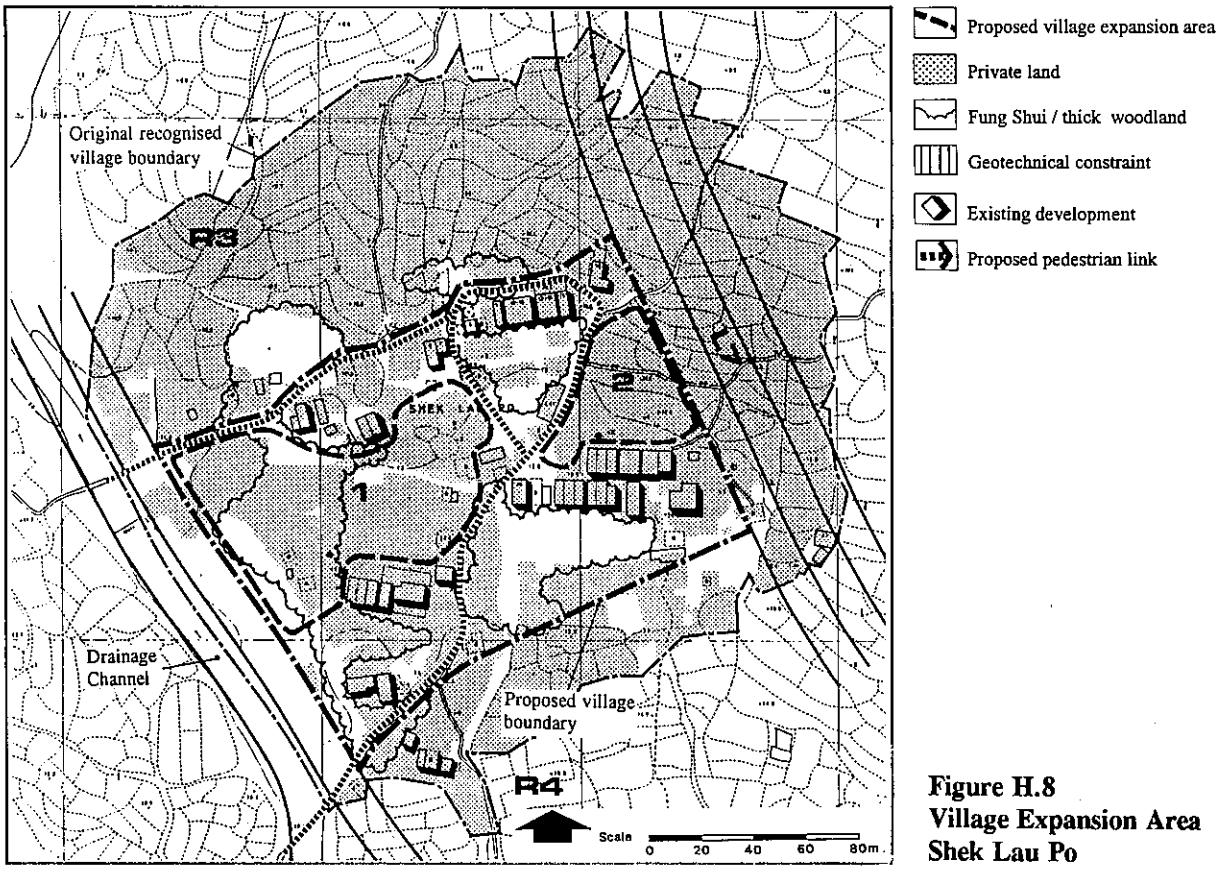


Figure H.8
Village Expansion Area
Shek Lau Po

Ling Pei

Five villages are within Ling Pei village environs. These villages are Lung Tseng Tau, Wong Ka Wai, Sheung Ling Pei, Ha Ling Pei and Fui Yiu Ha. The village environs covers an area of about 7ha. Estimated indigenous population is 302. There are 266 Block Crown Lease and Pre-War New Grant Building Lots and 24 Post-War New Grant Building Lots in the village.

Ling Pei is bounded on the north and west by Tung Chung Road. Tung Chung Fort divides the village into two parts. To the east is Sheung Ling Pei and Fui Yiu Ha where the layout of village houses is almost traditional in form. To the west, village housing in Ha Ling Pei, Wong Ka Wai and Lung Tseng Tau is less formally sited.

A shrine is located north-east of the Tung Chung Fort at the head of a Fung Shui lane. It is recommended that no future structures be approved within an area north of the Tung Chung Fort bounded by the Fung Shui lane, Tung Chung Road and the main access pathway to Tung Chung Fort to preserve views of the Fort from future developments in the New Town.

The major constraints to future allocation of Small House Grant Lots are the relatively closely settled nature of the existing village housing layout which limits development to infill, the steeply sloping land at the rear of existing houses and the extent of woodland of Fung Shui significance at the rear of the village.

The estimated demand for Small Houses upto 2011 is minimal given the projected number of eligible male indigenous villagers and the number of existing Building Lots.

Figure H.9 indicates a number of small sites suitable for Small House Building Lots distributed throughout the village environs.. Capacity of these sites is about 40 Building Lots. About 30 of these are on Crown land mainly in Areas 1, 2, 4, 5 and 6, the remainder on private land.

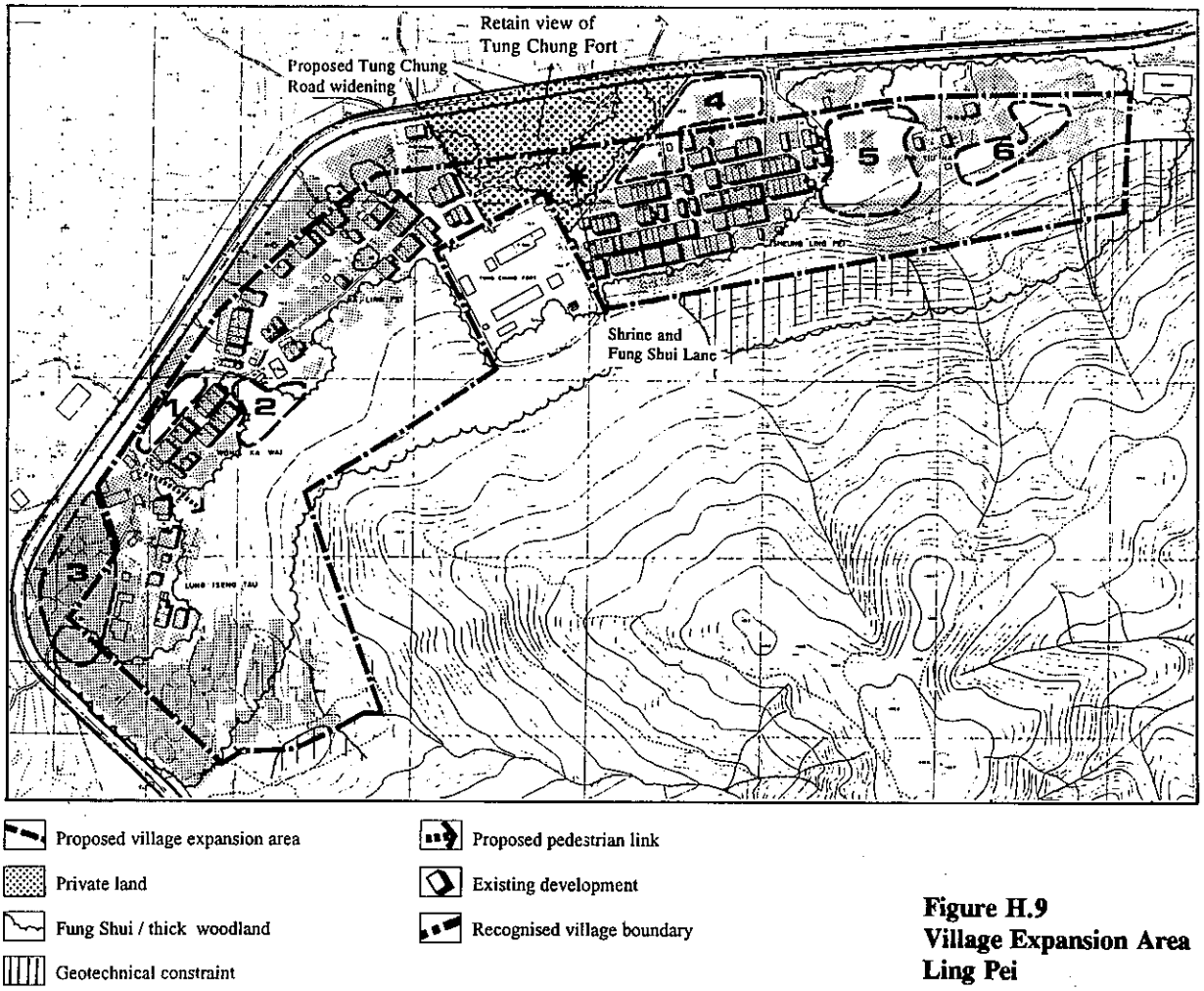


Figure H.9
Village Expansion Area
Ling Pei

Shan Ha

This village is located in the lower reaches of the Wong Lung Hong valley and its southern boundary is defined by the stream draining the valley. The village is 2.7 ha in area and has an indigenous population of 69.

Building Lots within the village include 40 Block Crown Lease House Lots and 3 Post-War New Grant Building Lots. The majority of the Block Crown Lease House Lots are abandoned and located in the south-east of the village within woodland. The existing village houses are mainly located in an informal cluster north of the existing woodland.

Land tenure is a mix of Crown land and private agricultural land. The Crown land lies in the southern part of the village. The remaining land is located in the northern part of the village and is abandoned agricultural land. Access to the existing village houses is by footpath from Tung Chung Road.

Estimated demand for Small Houses upto 2011 is 3 Building Lots. An area of Crown land providing about 10 Small House Lots as shown in Figure H.10, is recommended to accommodate future village expansion entitlements of indigenous Shan Ha villagers and future requirements of San Tung Chung Hang. The residue of the village environs is not required for future Small House grants.

This land, the abandoned agricultural land to the north of Shan Ha and an area to the south-east bounded by the stream draining Wong Lung Hang valley and Wong Lung Hang Road has the potential of providing a major focus for village development in Tung Chung. This area could accommodate the village resite requirements of a number of villages affected by development of the New Town and part of the future Small House entitlements of resited villagers.

To maximise the potential of this area for village housing development, a re-delineation of the Shan Ha village boundary is recommended as shown in Figure H.10. Land excised from the village environs could then be planned and developed in a comprehensive manner with the land to the north to provide a Village Resite Area with substantial Small House Building Lot yield.

Recommended improvements to the existing village infrastructure as Tung Chung New Town develops include the upgrading of footpath access to the village, a village access road to be developed in conjunction with the Village Resite Area to the north and connection with the public utility services of the New Town as they are implemented.

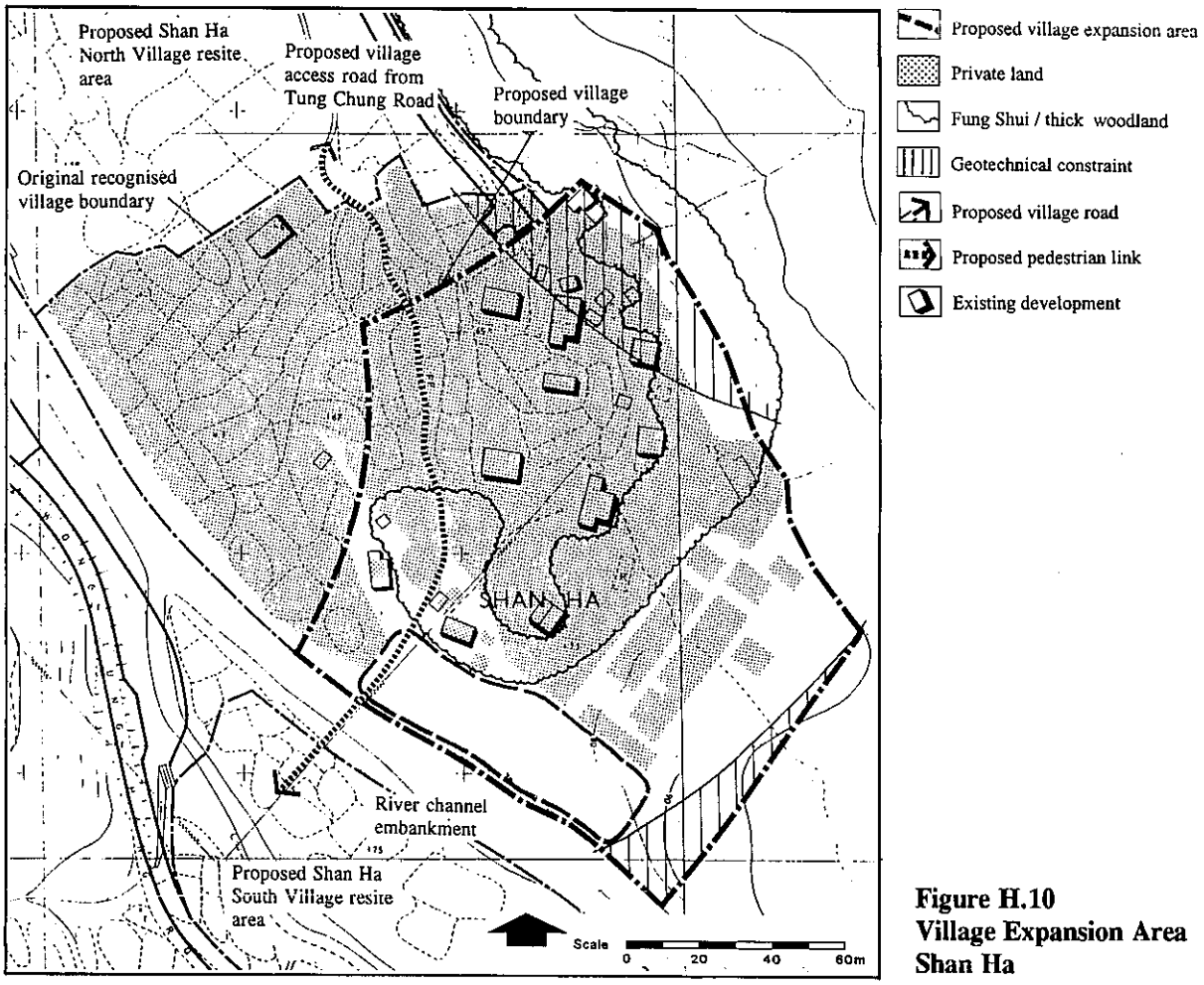


Figure H.10
Village Expansion Area
Shan Ha

H2.4 Tai Ho Wan Villages

Pak Mong

Pak Mong is a Recognised Village with recognised boundary and provides the focus for village life in the Tai Ho Wan area of North Lantau. The village environs is 5.4ha in area and has an estimated indigenous population of 100. Within the village environs there are 44 Block Crown Lease House Lots.

The core of the village lies between Pak Mong creek on the west, an old village wall on the north and Fung Shui woodland to the east and south. This woodland is located on northern slopes of a small knoll rising above the existing village houses. At the top of this knoll is a clearing within which are undeveloped Block Crown Lease House Lots. A Burial Ground is sited in the south eastern corner of the village environs.

Access to the village is by footpath and by sea from the Pak Mong ferry pier. This ferry pier is to be reprovisioned when the North Lantau Expressway is constructed. A footpath along the North Lantau coastline links Pak Mong to Tung Chung valley and footpaths to the east provides a link to Mui Wo through Ngau Kwu Long and Tai Ho San Tsuen villages.

Land suitable for Small House development is located on gently sloping private agricultural land west of Pak Mong creek and north of the existing village. Future Small House grants in these areas would be either by land exchange as on a cost-recovery basis. Vacant Crown land within the village environs is too steep and covered in woodland of Fung Shui significance.

Estimated demand for Small Houses upto 2011 is 21 Building Lots. An area of about 0.4 ha has been identified to the north of the existing built-up area to accommodate this demand and is shown on Figure H.11.

Improvements to village infrastructure proposed under existing North Lantau projects include the reprovisioning of the existing ferry pier and provision of a pedestrian subway under the future North Lantau Expressway. This could be supplemented by upgrading of existing pedestrian links to the village and the provision of a village access road linking Pak Mong to future development is Tai Ho Wan. This access road is proposed along the alignment of the existing footpath south of Pak Mong Hill and also would link Ngau Kwu Lung to future development areas in Tai Ho Wan. The road would be built when development of this part of the New Town is undertaken. Connection of the village to the utility infrastructure of Tai Ho Wan New Town is also recommended.

Pak Mong village falls within the Pak Mong Archaeological Site. This site has been identified as one of considerable potential, with detailed investigation to determine the value of the site not yet undertaken. It is recommended that an archaeological survey of the Pak Mong site be undertaken before further Small House Building Lots are granted within the village environs.

Abandoned agricultural land west of Pak Mong creek within and outwith the village environs could come under pressure for the ad-hoc siting of Small Houses through land exchange or other undesirable development as the New Town develops. A review of the western boundary of Pak Mong is recommended to excise this area from the village environs. This land could be integrated with other abandoned agricultural lands adjacent to the village overwhich future management recommendations are being made within the scope of the RODP and Rural Hinterland Strategy Plan for North Lantau.

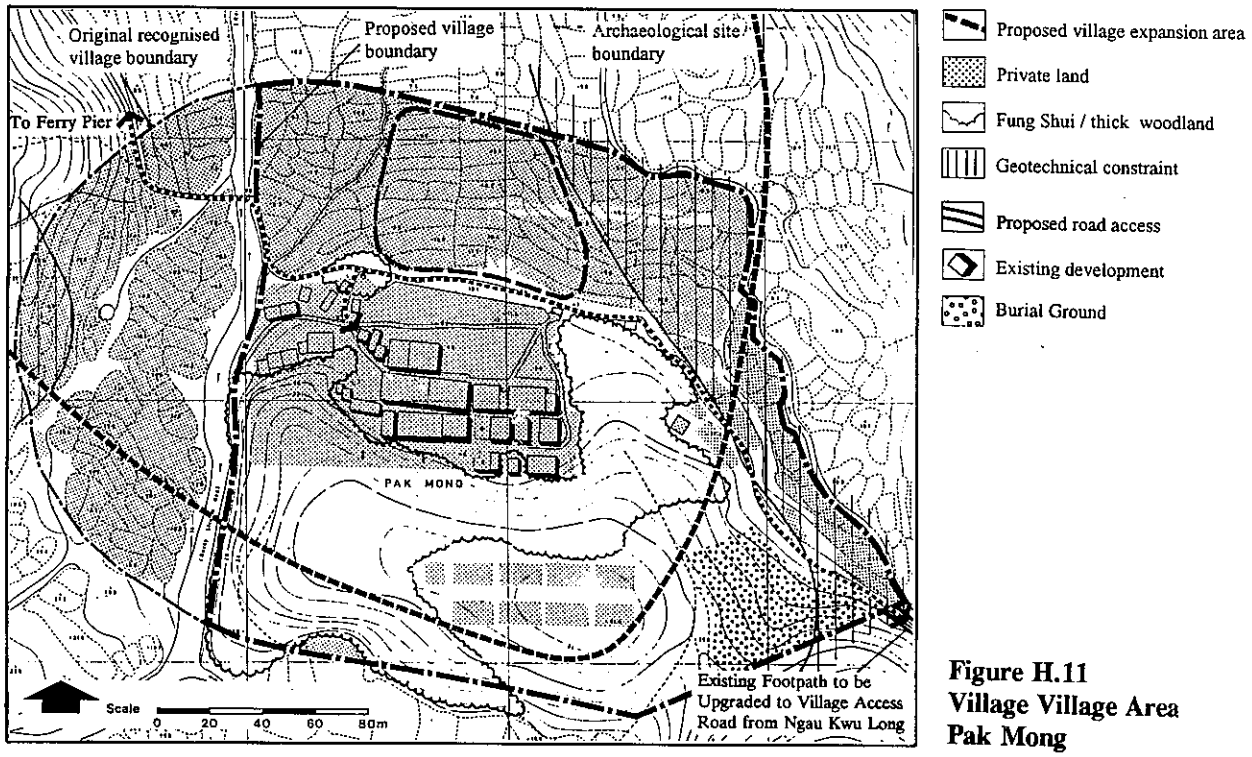


Figure H.11
Village Village Area
Pak Mong

Ngau Kwu Long

Ngau Kwu Long is a Recognised Village with a recognised boundary and is about 11.9ha in area. The village has an estimated indigenous population of 150. There are 40 Block Crown Lease House Lots distributed through the village environs in three main areas. These are in the Ngau Kwu Long village housing cluster in the west, in a small cluster of houses in the centre of the village environs and in the east at Nim Liu where abandoned Building Lots are hidden in thick woodland.

The village environs is divided by several streams which drain the Tai Ho valley through the village and converge near its northern boundary. Almost the whole of the village environs is on colluvium soil, providing a significant constraint to site formation works for future Small Houses. Extensive Small House development is only feasible in the western and southern parts of the village environs on gently sloping agricultural land. The majority of land within the village boundary is private agricultural land. Access to the village is by footpath, linking the village to Tai Ho Sun Tsuen, Mui Wo in the south, Pak Mong in the north-west and to Tai Ho Wan to the north.

Estimated demand for Small Houses upto 2011 is 57 Building Lots. This demand can be satisfied in two areas shown on Figure H.12. Area 1 lies on private agricultural land to the north of Ngau Kwu Long village houses and has a capacity of about 30 Building Lots. Area 2 would provide about 30 Building Lots and lies is the southern part of the village environs adjacent to the footpath linking to Tai Ho San Tsuen. An area of agricultural land south of the boundary of Ngau Kwu Long would provide part of the future village expansion requirements of Tai Ho San Tsuen. Small House grant lots in these areas would be either by land exchange or on a cost-recovery basis.

Improvements to village infrastructure are unlikely to be effected until development of Tai Ho Wan New Town takes place. At this time, a village access road as shown on Figure H.12 would be provided from the New Town and connecting to Pak Mong.

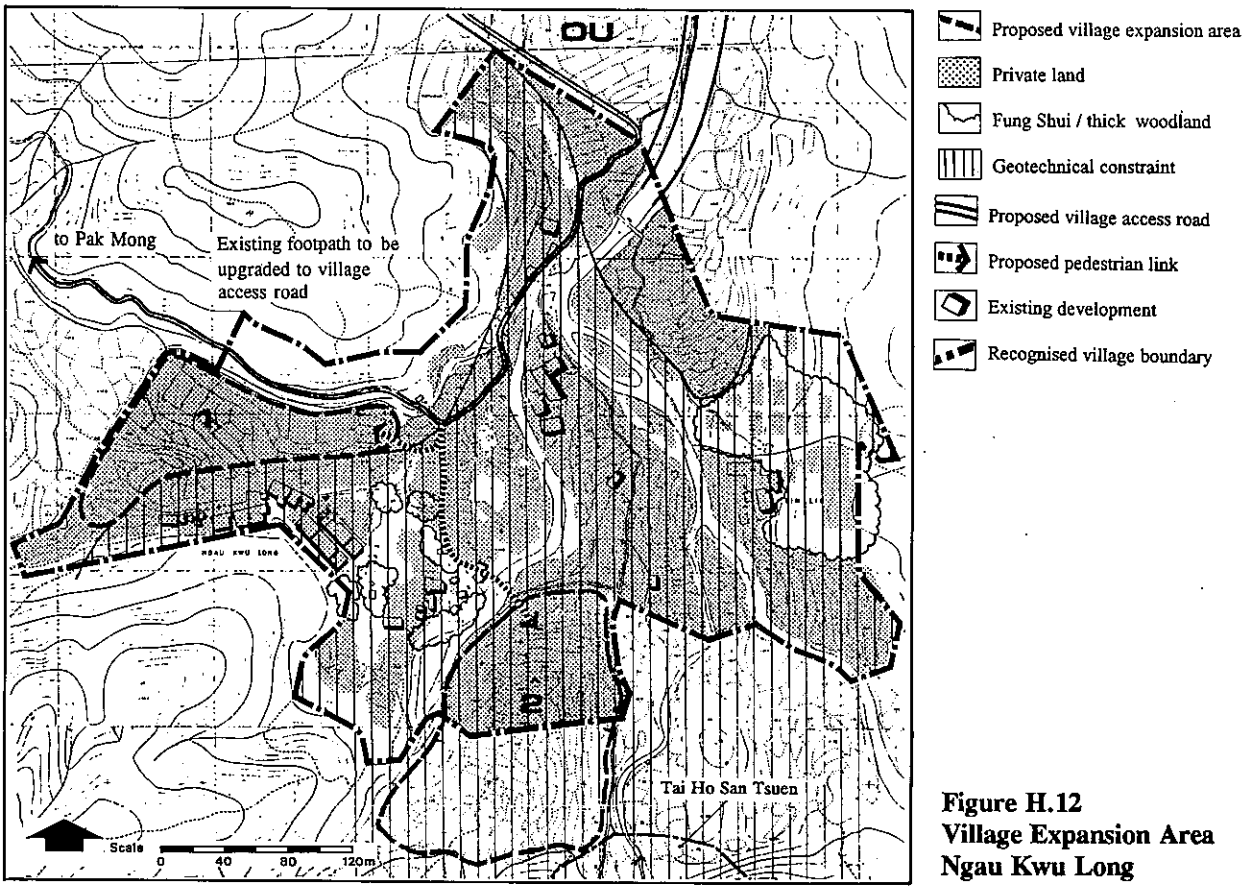


Figure H.12
Village Expansion Area
Ngau Kwu Long

Tai Ho San Tsuen

Located south of Ngau Kwu Long in the head of the Tai Ho valley, Tai Ho San Tsuen is a Recognised Village with recognised boundary. Access to the village is by footpath through Ngau Kwu Long to the north, linking to Pak Mong and Tai Ho Wan.

The village environs is 10ha in area and has an estimated indigenous population of 150. It contains 36 Block Crown Lease House Lots. These lots are in three locations: in the north of the village environs, where the majority of village houses are located; a central location containing about 8 houses and a number of abandoned un-built on lots in the southern part of the village. The remaining land within the village is either abandoned agricultural land, much of it on steep terraces, or Crown land on the steep side slopes of the Tai Ho valley.

Small House demand upto 2011 is estimated at 61 Building Lots. The steep, narrow form of the Tai Ho valley within which Tai Ho San Tsuen is located severely limits the opportunities for a comprehensive village expansion area. Infill sites would be available adjacent to the existing village houses. This is not recommended as ad-hoc siting of future village houses could make the provision of the future extension of utility services to these houses uneconomic and difficult to achieve.

Two areas suitable for Small House Building Lots are shown on Figure H.13. Area 1, located on gently sloping agricultural land in the middle of the village environs, would provide for about 30 Building Lots. Area 2, providing about 40 Building Lots, is located on agricultural land between the northern village boundary and the southern boundary of Ngau Kwu Long. Future allocation of Small House Lots within these areas would be either land exchange or on a cost-recovery basis.

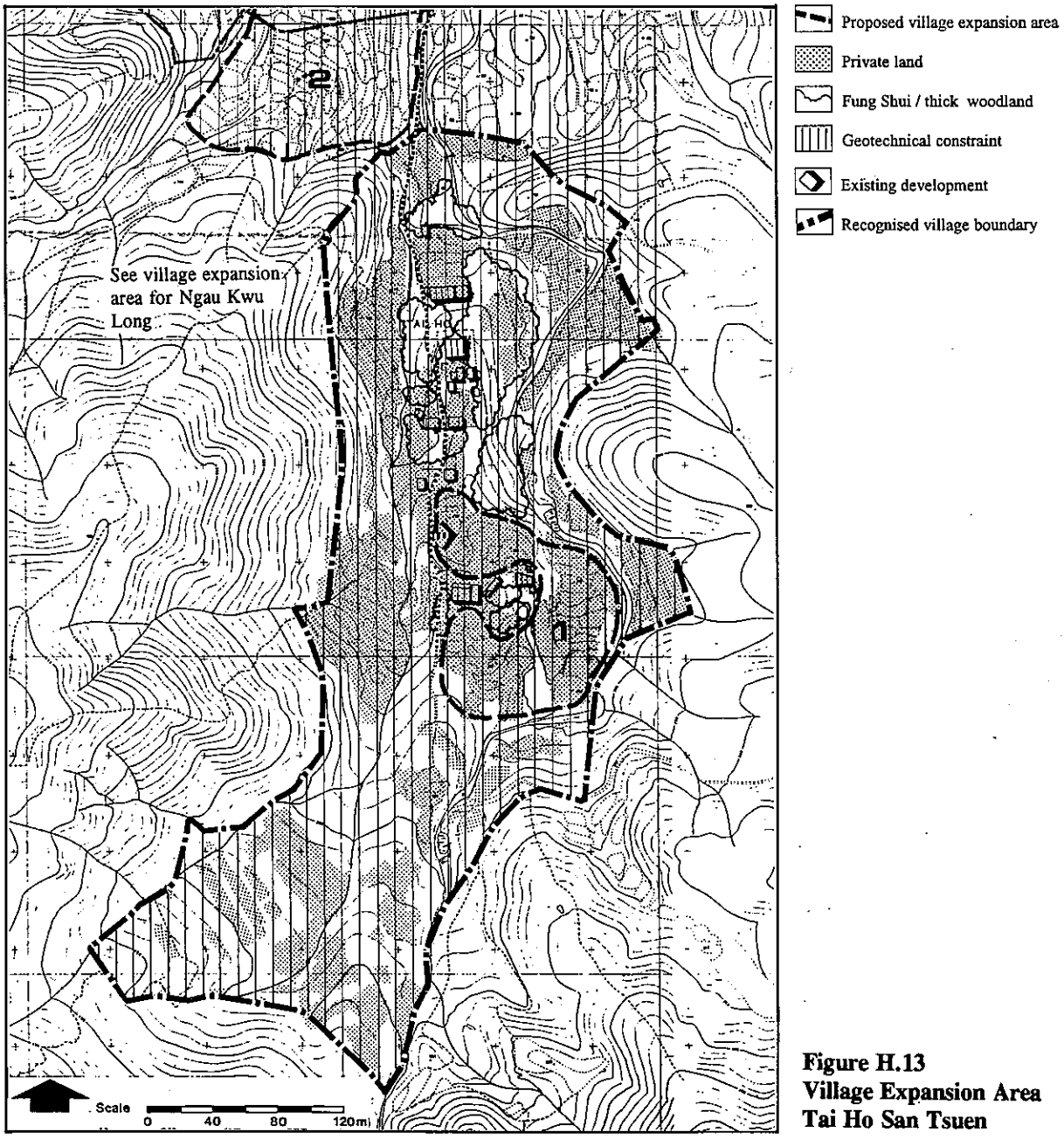


Figure H.13
Village Expansion Area
Tai Ho San Tsuen

H3 Village Resite

H3.1 The Requirement

A total of 93 Building Lots in existing villages and settlements are affected and will require clearance and resiting.

Three areas have been identified on the fringe of the proposed New Town to resite these indigenous clearees and to accommodate future Small House entitlements upto 2011 from those eligible male indigenous villages who have been resited. The village resite areas are located at Shan Ha North, Sha Ha South and adjacent to Mok Ka village.

Concept Plans to guide future layout planning and development of these areas are described in the follow sub-sections.

H3.2 Shan Ha North

Shan Ha North Village Resite Area is located on an area of mainly abandoned agricultural land and is bounded by Tung Chung Road on the north-west, Wong Lung Hung Road to the south-west and the recommended revised Shan Ha village environs on the south.

The south-western boundary of the proposed built-up area of the Village Resite Area is defined by the re-aligned stream draining Wong Lung Hang valley. The alignment of the stream is as proposed in the RODP.

The area could accommodate about 120 Small House Building Lots. A Concept Plan, Figure H.14, shows how in general terms the resite area would be developed into village housing precincts and provide for convenient location of facilities within the village area for future villagers.

Small Houses would be located on the site in four discrete areas, each area linked to centrally located carparking, local open space and G/IC facilities. A village access road within the site provides vehicular access from Tung Chung Road to the carpark and Shan Ha village to the south. Internal pedestrian footpaths would link the village houses with Tung Chung Road, a proposed riverside park adjacent to Wong Lung Hang Road and Sha Ha village. All utility services would be provided as part of the New Town servicing programme.

Area 1 is Crown Land allocated as a temporary works area to GE/HyD. Five Small House Building Lots could be located on this site. Stabilisation of the slope to the east of the building platform may be necessary before this site could be used as a village resite area.

Areas 2, 3 and 4 have the potential to accommodate about 34, 26 and 44 Small House Building Lots respectively, subject to detailed layout planning. The phased build-up of Small Houses in the resite area arising from the village removal requirements of the New Town would be accommodated as demand occurs in later stages of development of the New Town.

Subject to agreement with relocated villagers, and demand, sites could be reserved within particular precincts for future Small House entitlements of relocated villagers families.

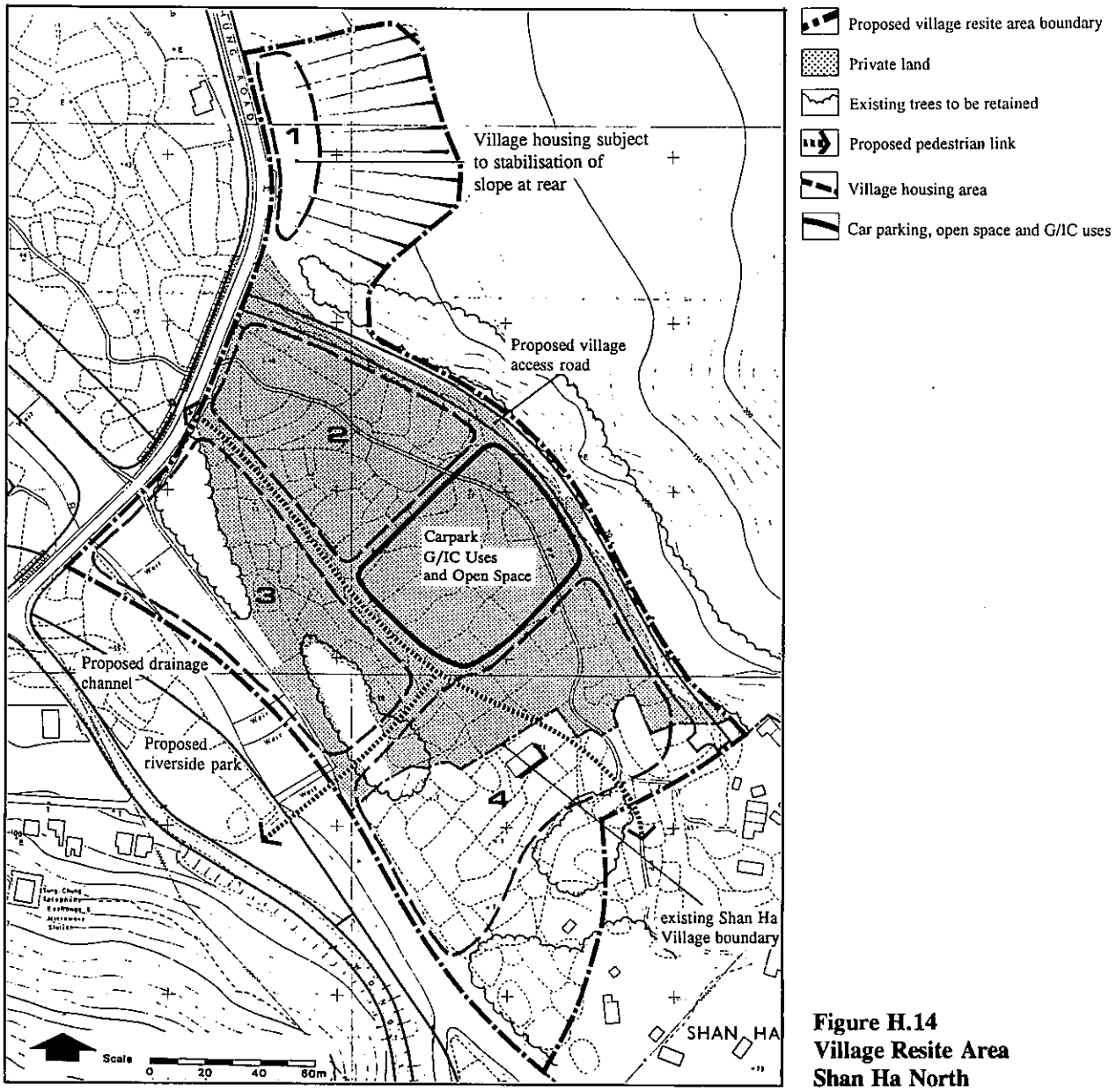


Figure H.14
Village Resite Area
Shan Ha North

H3.2 Shan Ha South

A Village Resite Area south of Shan Ha village is proposed as shown on Figure H.15. This resite area is located in Wong Lung Hang valley adjacent to the Wong Lung Hang Village Resite Area. The site is bounded by Wong Lung Hang Road on the south, the major stream draining Wong Lung Hang valley and is about 1.4 ha in area. Land tenure is a mix of Crown land and abandoned agricultural lots.

The site can accommodate about 40 Small House Building Lots and adequate carparking, local open space and G/IC facilities to serve the future village population. This resite area could be available early in the development of the New Town, possibly before 2001, depending on land resumption and clearance, and site formation requirements.

Phased implementation of this resite area is possible. About 25 Small House sites could be provided in a first phase on Crown land in the south of the resite area, (Area 2 on F.15).

Formation and servicing of this area would involve retraining of, and embankment works for, the Wong Lung Hang valley stream, diversion into the main stream of the minor stream flowing through the site, site formation, the provision of public utility services and extension of the improvements to Wong Lung Hang Road by about 100 metres. A further 15 Small House sites could be provided in Area 1, Figure H.15, subject to resumption of private land, site formation and servicing. Within Area 1, a site for 4 houses to accommodate villagers cleared from Tai Po settlement has been identified and agreed by government. Government has initiated site formation works and discussions with affected villagers to ensure early occupation of this resite area.

Ma Wan and Wong Nai Uk are proposed to be relocated to accommodate Phase 2 (2001) development of the New Town. This resite area could accommodate the majority of existing villagers from these village, subject to their agreement. Small House demands of these villagers upto 2011 could be accommodated in the adjoining Sha Ha North Village Resite Area if appropriate.

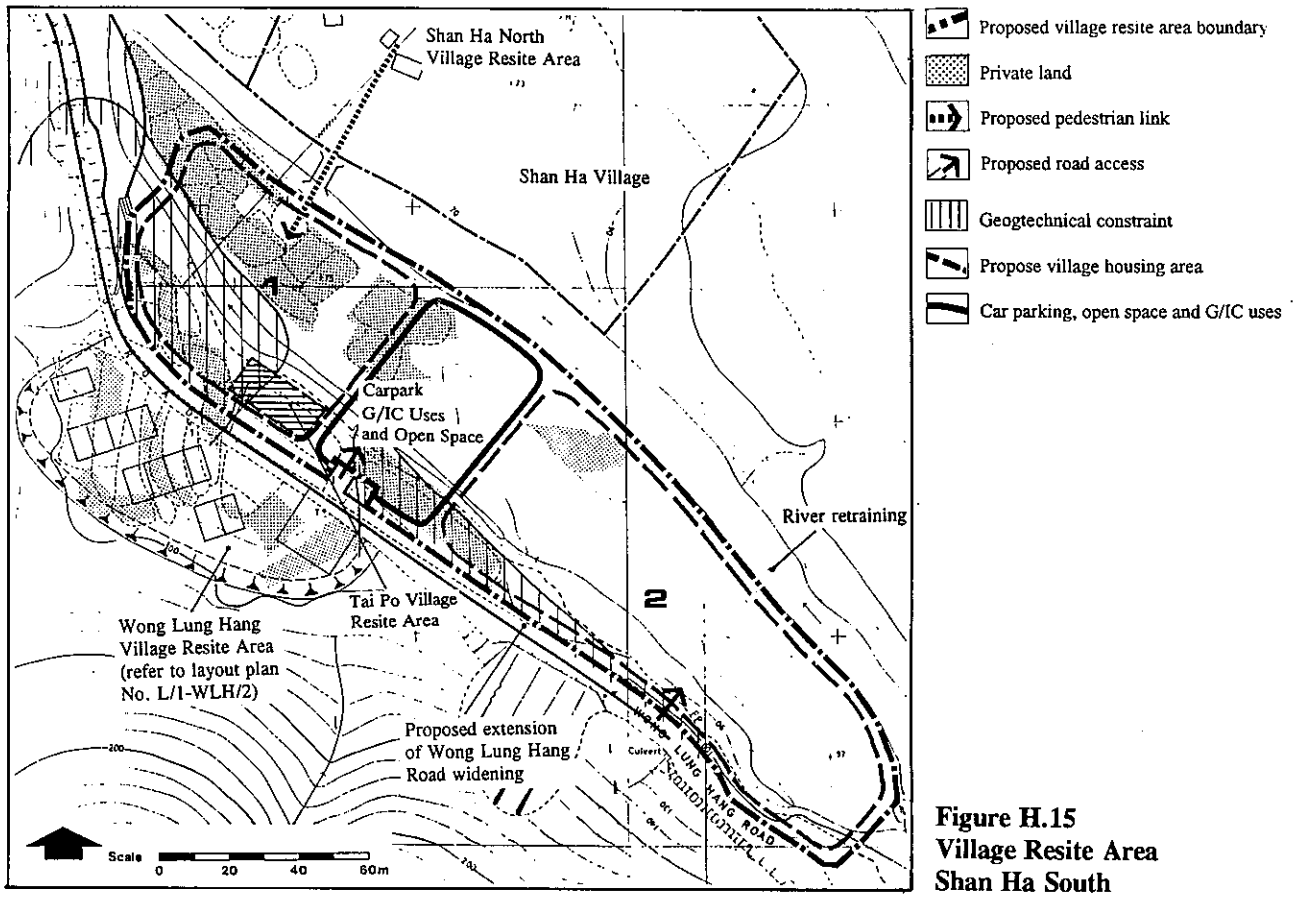


Figure H.15
Village Resite Area
Shan Ha South

H3.3 Mok Ka South

Located to the south of Mok Ka village, this proposed village resite area comprises a mix of Crown land and private agricultural land, some of which is under cultivation, and is about 3.5 ha in area.

The site has a north-easterly aspect, sloping gently down a broad spur towards Mok Ka village. The north-west boundary of the site is defined by the steep side slopes of a parallel

spur on which is sited the Mok Ka Burial Ground (Burial Ground No. 19). The stream draining Nei Lak Shan and the south-western catchment of the Tung Chung valley forms the south-eastern boundary of the resite area. Access is by footpath from Shek Mun Kap Road.

The resite area could accommodate about 120 Small House Building Lots. A Concept Plan, Figure H.16 outlines areas suitable for Small House Building Lots, recreation and community facilities, the proposed vehicular access and pedestrian circulation system linking the resite area with adjacent New Town developments and the rural hinterland.

Future village resite housing would be located in two discrete areas. These areas are located around a core area of carparking, local open space and G/IC uses, providing centrally located facilities serving the resite area as well as Mok Ka. A village access road linking the resite area, Mok Ka and Nim Yuen/Lam Che with Shek Mun Kap Road is proposed and provides vehicular access to other New Town facilities, including schools, shopping centres and employment centres. This road runs through an open space buffer area between Mok Ka and this resite area. The buffer area also acts as a right-of-way for recreational uses, including a possible golf course, proposed in the Rural Hinterland Strategy. Pedestrian footpaths provide links to the village access road, Mok Ka to the north and other pathways accessing the rural hinterland of the New Town and the North Lantau Country Park. Construction of the village access road and the phased resumption, formation and servicing of this resite area would be undertaken as part of the New Town's development programme and as resite demands occur.

Area 1 has a potential Small House Building Lot capacity of 46 lots and could be developed and allocated for resite purposes in the latter stages of the New Town development. Area 2, with a capacity of about 74 Small House Building Lots, could be developed in stages from its northern extent following the construction of the proposed village access road.

The provision of the village access road in the early stages of the New Town's development (i.e. before 2001) may be difficult because of the time needed for resumption, clearance and construction. Therefore, this resite area would be appropriate to resite villages affected by Phase 2 or Phase 3 development of the New Town, in particular Ma Wan Chung, Sha Tsui Tau and Fong Yuen. Accommodation of some of the future Small House entitlements of villagers from Shek Lau Po may also be considered.

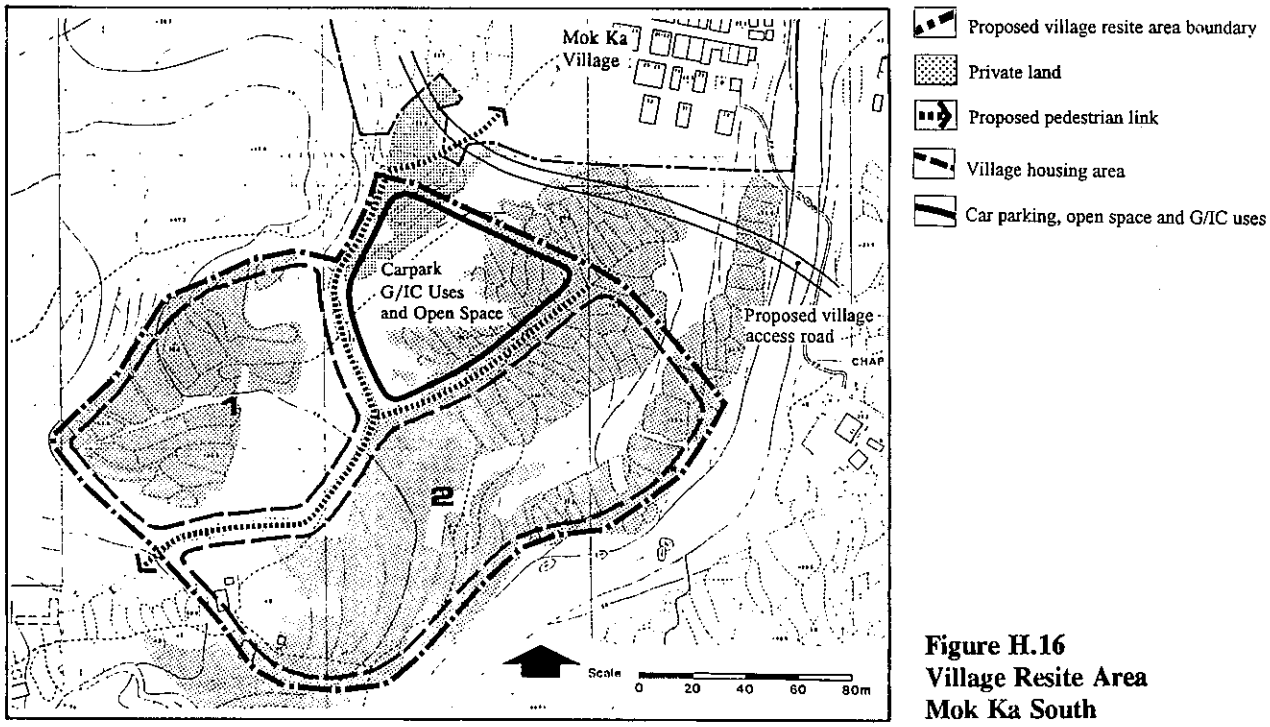
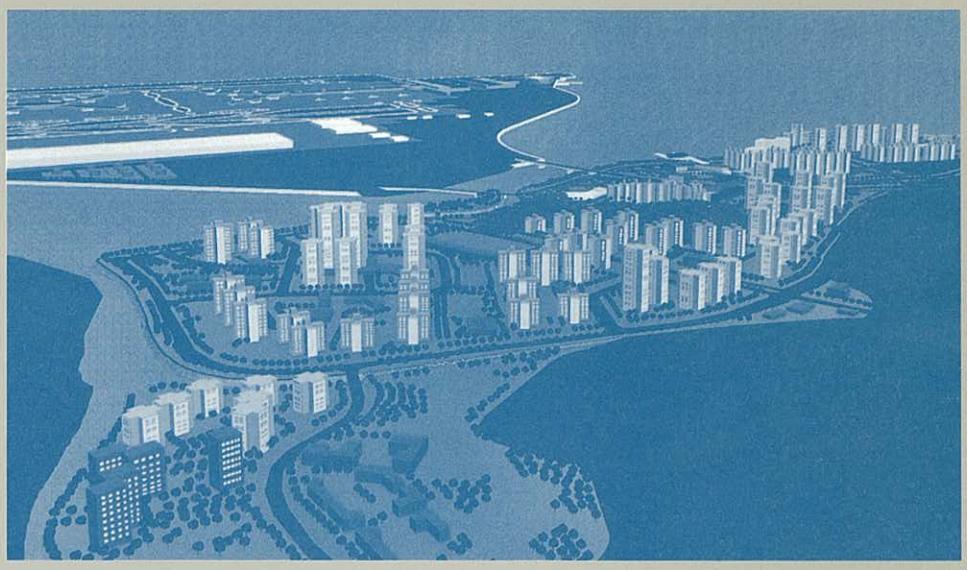


Figure H.16
Village Resite Area
Mok Ka South

North Lantau Development



Appendix I

The Recommended Outline Development Plan, Development Schedule, Unit Rates and Supporting Plans

APPENDIX I

TABLE I - 1A
DEVELOPMENT SCHEDULE - PHASE 1

TUNG CHUNG - PHASE 1

Planning Area	Use	Area (ha)	Population Capacity	Approx. No Living Units	G/IC Facility with Discrete Site		Notes
					Facility	Min. Site Area m^2	
1	O	5.85	-	-	-	-	Part of Town Park
2	G/IC	2.72	-	-	Swimming Pool Complex	25000	Central Recreation Complex, Possible RSD District Office.
3	G/IC	3.00	-	-	Cultural Complex, Library, Post Office Transport Interchange Car Park	30000 20000	Comprehensive Development Site
4	R1	3.32	5690	2070			Town Centre Frame Area. Plot Ratio 8
5	O	1.03	-	-			Neighbourhood Park Includes LAL Reserve
6	C	1.80	-	-			1300m^2 net floorspace office/hotel complex. Future podium over NLE connects to Area 14
7	O	3.65	-	-			Part of Town Park
8	O	0.97					First Phase Neighbourhood Park
9	A	1.50					Includes noise bunds for NLE
10	RS	3.10	6200	1720			1 Primary School, 1 Neighbourhood Centre and 1 Health Clinic located in Area 10/11
11	HOS	4.26	8520	2620			
12	G/IC	4.26			1 Primary School 2 Secondary Schools 1 Indoor Recreation Centre Telephone Exchange	5005 11700 6000 2000	
13	G/IC	1.47	1500	480	Police HQ & Divisional Stn. Fire Station/Ambulance	6000 2959	480 Quarters for Police other ranks
14	C	1.13					Office/hotel/retail complex Podium link over NLE to Area 6
21	A	1.20					Buffer between NLE/AEL and New Town
49	O	1.20					Waterfront promenade
50	OU	0.60			Ferry Pier		

TAI HO - PHASE 1

Planning Area	Use	Area (ha)	Population Capacity	Approx. No Living Units	G/IC Facility with Discrete Site		Notes
					Facility	Min. Site Area m^2	
1	A	0.40					
2	G/IC	2.25			Refuse Transfer Station	22500	Includes possible E&M and RSD depots
3	OU	9.50			Possible Gas Reception Plant		
4	OU	15.80			Water Treatment Plant		
Pt 5	OU	3.99			Sewage Treatment Plant		
Pt 10	OU	32.7					Railway Depot

APPENDIX I

TABLE I - 1B
DEVELOPMENT SCHEDULE - PHASE 2

TUNG CHUNG - PHASE 2

Planning Area	Use	Area (ha)	Population Capacity	Approx. No Living Units	G/IC Facility with Discrete Site		Notes
					Facility	Min. Site Area m^2	
15	R1	7.30	11950	4630			Town Centre Frame Area. Plot Ratio 8
16	O	1.00					Neighbourhood Park
17	G/IC	1.60			1 Primary School 1 Secondary School	5005 5850	
18	O	2.00					Neighbourhood Park
19	R1	8.00	10750	4200			Areas 15/19 include LAL Reserve. Plot Ratio 5
20	G/IC	1.30			1 Primary School 1 Area Community Centre	5005 2145	
22	R2	2.3	2300	840			
23	HOS	7.20	14400	4720	1 Primary School	5005	Includes part of LAL Reserve
24	RS	5.18	10360	3060	1 Primary School 1 District Community Centre	5005 2550	
25	R3	2.30	1050	380			
26	G/IC	0.90			Electricity Sub-station Funeral Depot Petrol Filling Station	- 2500 -	
27	G/IC	0.70			1 Secondary School	5850	
30	R2	5.00	4950	1810			
Pt. 38	R3	4.8	2160	860			
39	O	4.10					District Open Space, active facilities
40	G/IC	1.40			1 Primary School 1 Secondary School	5005 5850	
41	R4	2.47	250	100			
44	G/C	0.60					Existing Microwave Facilities
Pt. 51	C	0.42			WSD Facility		Part site for airport-related commercial uses
58	G/IC	1.25			Indoor Recreation Centre 1 Secondary School Petrol Filling Station	6000 5850 -	
70	VR	2.60					Shan Ha North Resite Area

TAI HO - PHASE 2

Planning Area	Use	Area (ha)	Population Capacity	Approx. No Living Units	G/IC Facility with Discrete Site		Notes
					Facility	Min. Site Area m^2	
Pt. 5	OU	7.04			Sewage Treatment Plant		
Pt. 9	I	21.56					Industrial Park
Pt. 10	OU	4.5					Residue of Railway Depot Site. Use subject to further study

APPENDIX I

TABLE I - 1C
DEVELOPMENT SCHEDULE - PHASE 3

TUNG CHUNG - PHASE 3

Planning Area	Use	Area (ha)	Population Capacity	Approx. No Living Units	G/IC Facility with Discrete Site		Notes
					Facility	Min. Site Area m^2	
31	HOS	2.67	5070	1750			
32	G/IC	1.36			1 Primary School 1 Secondary School	5005 5850	
33	O	10.26			Sports Centre/Stadium Indoor Recreation Centre	50000 6000	District Open Space, active facilities
34	HOS	5.07	9640	3320			
35	RS	6.95	13200	4100	1 Primary School	5005	
36	CR	6.90	10970	4350			District Commercial Centre, Housing at Plot Ratio 8
Pt. 38	R3	4.80	2060	820			
42	R4	4.80	480	190			
43	R4	4.00	400	160			
48	R2	2.25	2000	830			
65	V	2.60	-				Shek Lau Po Village
68	VR	1.18					Shan Ha South Resite Area
70	VR	1.30					Shan Ha North Resite Area

TAI HO - PHASE 3

Planning Area	Use	Area (ha)	Population Capacity	Approx. No Living Units	G/IC Facility with Discrete Site		Notes
					Facility	Min. Site Area m^2	
Pt. 5	OU	4.77			Sewage Treatment Plant		
Pt. 9	I	16.69					Industrial Park
11	OU	9.50			Hospital Polyclinic	88000 4700	
12	O	0.45					Residunce of Railway Depot Site. Use subject to further study

APPENDIX I

TABLE I - 1D
DEVELOPMENT SCHEDULE - PHASE 4

TUNG CHUNG - PHASE 4

Planning Area	Use	Area (ha)	Population Capacity	Approx. No Living Units	G/IC Facility with Discrete Site		Notes
					Facility	Min. Site Area m^2	
28	O	3.30					Town Park, Waterfront Gardens
29	O	16.00					Town Park,Tung Chung Battery
32	G/IC	1.36			1 Primary School 1 Secondary School	5005 5850	
37	G/IC	2.30			1 Primary School 1 Secondary School Indoor Recreation Centre	5005 5850 6000	
45	O	2.30					LAL Reserve, Neighbourhood Park
46	HOS	3.90	7020	2530			
47	R1	5.65	7090	2920			Plot Ratio 5
51	C	1.43					Site for airport-related commercial use
52	O	2.73					Waterfront District Open Space and promenade
53	R2	1.70	1530	610			
54	R1	4.10	5140	2120			
55	R2	4.00	3620	1490			
56	R3	4.30	1760	730			
57	O	3.00					Recreation Reserve & promenade

TAI HO - PHASE 4

Planning Area	Use	Area (ha)	Population Capacity	Approx. No Living Units	G/IC Facility with Discrete Site		Notes
					Facility	Min. Site Area m^2	
6	U	4.00					
7	OU	10.50			Possible aviation fuel storage depot		
8	O	1.35					Sewage outfall through Neighbourhood Park
Pt. 9	I	13.75					Industrial Park
13	G/IC	0.60			1 Secondary School	5850	
14	RS	9.33	16800	5440	1 Primary School 1 Area Community Centre 1 Urban Clinic	5005 2145 2200	
15	HOS	2.45	4410	1590			
16	O	15.00					District Open Space, Lake
17	O	1.02					Neighbourhood Park and promenade
18	R2	1.60	1450	600			
19	HOS	3.43	6170	2220			
20	O	2.20					Neighbourhood Park and promenade
21	R1	3.25	4080	1680			

TUNG CHUNG - PHASE 4 (Cont'd)

Planning Area	Use	Area (ha)	Population Capacity	Approx. No Living Units	G/IC Facility with Discrete Site		Notes
					Facility	Min. Site Area m^2	
22	HOS	5.20	9360	3030			
23	O	1.25					Neighbourhood Park
24	G/IC	1.60			1 Primary School 1 Secondary School	5005 5850	
25	G/IC	1.70			1 Secondary School 1 Indoor Recreation Centre	5850 6000	
26	O	3.00					District Open Space
27	CR	7.20	9800	4040			District Commercial Centre
28	O	1.50					Neighbourhood Park
29	G/IC	1.20			1 Secondary School Sub-divisional Fire/Amb. Station	5850 1800	
30	A	2.00					
31	U	11.34					

APPENDIX I

TABLE I - 1E
DEVELOPMENT SCHEDULE - AREAS NOT YET PROGRAMMED

TUNG CHUNG

Planning Area	Use	Area (ha)	Population Capacity	Approx. No Living Units	G/IC Facility with Discrete Site		Notes
					Facility	Min. Site Area m^2	
59	V	7.50					San Tau
60	V	4.20					Ngau Au
61	V	1.70					Nim Yuen
62	V	2.50					Mok Ka
63	VR	3.00					Mok Ka South Resite Area
64	V	3.90					Shek Mun Kap
65	V	2.60					Shek Lau Po
66	V	7.00					Ling Pei
67	VR	0.50					Wong Lung Heung Resite Area
68	VR	1.18					Shan Ha South Resite Area
69	V	1.80					Shan Ha

TAI HO

Planning Area	Use	Area (ha)	Population Capacity	Approx. No Living Units	G/IC Facility with Discrete Site		Notes
					Facility	Min. Site Area m^2	
32	V	4.14					Pak Mong
33	V	23.00					Ngau Kwu Long, Tai Ho San Tsuen

APPENDIX I

TABLE I - 2A
RATES ADOPTED FOR COST ESTIMATES IN THE NORTH LANTAU DEVELOPMENT PROGRAMME
EARTHWORKS AND SITE FORMATION
[1992]

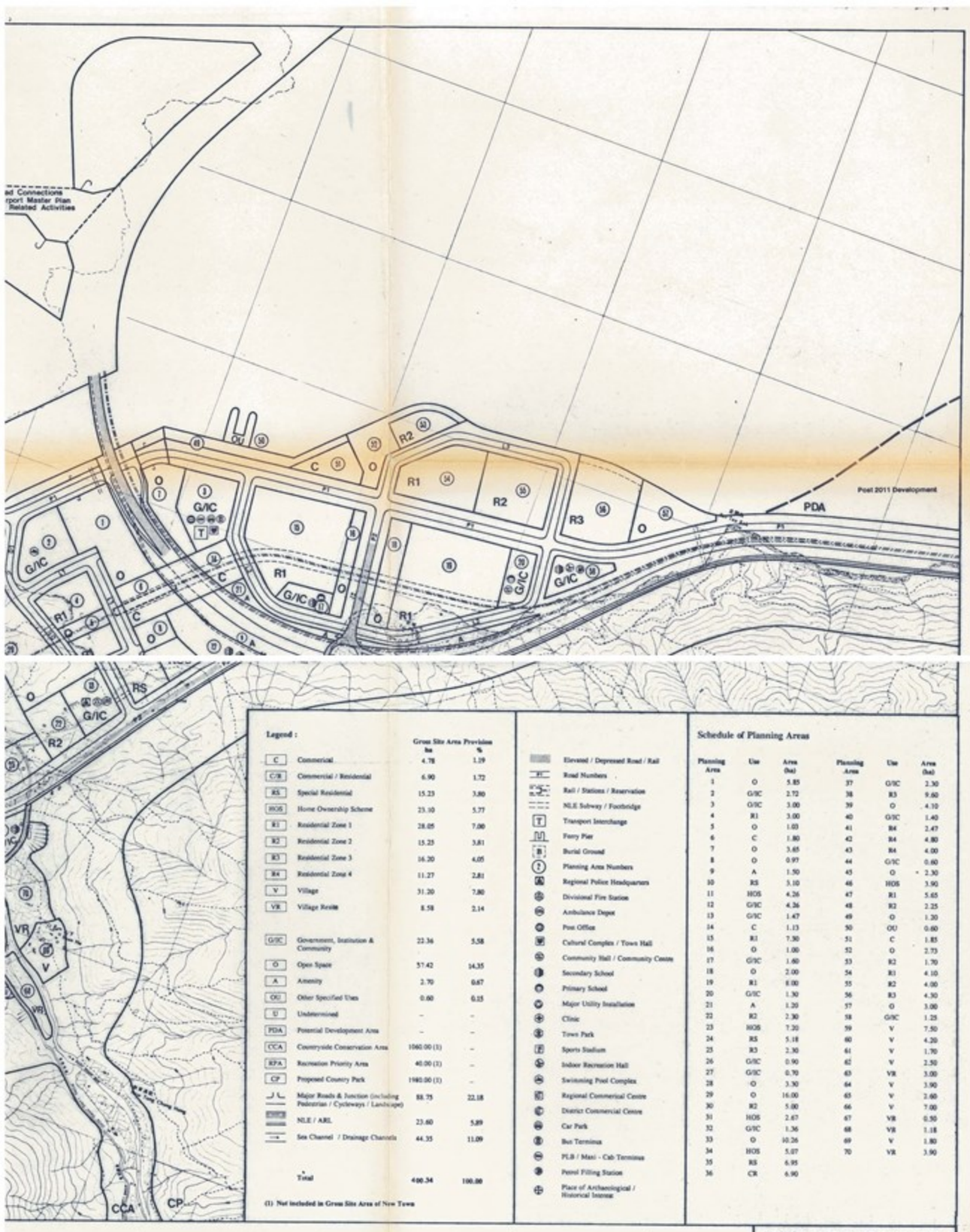
Item Description	Estimate of Rate per unit $HK	Unit	Notes
Reclamation fill placed in areas where the levels are lower than 4 metres below Principal Datum.	19.0	cubic metre	Soft material is assumed as dredged from beneath seawalls.
Reclamation fill placed in areas where the levels are higher than 4 metres below Principal Datum.	23.80	cubic metre	Rate assumes that vertical wick draining and surcharge is used to consolidate the sea bed where drained reclamations are located.
Surcharge filling Surcharge removal	20.0 12.0	cubic metre cubic metre	
Wick draining of reclamation	125	square metre	
Vertical sea wall	110,000	metre	Dredging beneath sea walls is assumed. Refer Note
Sloped face sea wall	49,000	metre	Nominal - Refer Note
Temporary revetment	49,000	metre	Nominal - Refer Note
Place and form rock. Cut from local sites.	50	cubic metre	
Place and form non-rock. Cut from local sites.	20	cubic metre	
Reclamation (land based fill)	20	cubic metre	
Principal drainage	1.0m	ha	

APPENDIX I

TABLE I - 2B
RATES ADOPTED FOR COST
ESTIMATES IN DEVELOPMENT PROGRAMME
FOR NORTH LANTAU 1992
Roads, drains, drainage

Item Description	Estimate of Rate per unit	Unit	Notes
Local roads and drainage	$10m	ha	
Open space areas including landscaping but not adopted for Phase I at Tung Chung	$15m	ha	High rate reflects the quality of landscaping proposed.
Roadside planting	$2m	ha	
River Training			Needed for Phase II at Tung Chung
Channel lining	20,000	linear metre	
Dredging	22	cubic metre	

List of Supporting Plans



Tung Chung Recommende Outline Development Plan

SCALE

Hong Kong Government
Territory Development Department
South West NT Development Office

Legend :

		Gross Site Area ha	Provision %
C	Commercial	4.78	1.19
C/R	Commercial / Residential	6.90	1.72
RS	Special Residential	15.23	3.80
HOS	Home Ownership Scheme	23.10	5.77
R1	Residential Zone 1	28.05	7.00
R2	Residential Zone 2	15.25	3.81
R3	Residential Zone 3	16.20	4.05
R4	Residential Zone 4	11.27	2.81
V	Village	31.20	7.80
VR	Village Resite	8.58	2.14
G/IC	Government, Institution & Community	22.36	5.58
O	Open Space	57.42	14.35
A	Amenity	2.70	0.67
OU	Other Specified Uses	0.60	0.15
U	Undetermined	–	–
PDA	Potential Development Area	–	–
CCA	Countryside Conservation Area	1060.00 (1)	–
RPA	Recreation Priority Area	40.00 (1)	–
CP	Proposed Country Park	1980.00 (1)	–
	Major Roads & Junction (including Pedestrian / Cycleways / Landscape)	88.75	22.18
	NLE / ARL	23.60	5.89
	Sea Channel / Drainage Channels	44.35	11.09
	Total	400.34	100.00

(1) Not included in Gross Site Area of New Town

Elevated / Depressed Road / Rail
Road Numbers
Rail / Stations / Reservation
NLE Subway / Footbridge
Transport Interchange
Ferry Pier
Burial Ground
Planning Area Numbers
Regional Police Headquarters
Divisional Fire Station
Ambulance Depot
Post Office
Cultural Complex / Town Hall
Community Hall / Community Centre
Secondary School
Primary School
Major Utility Installation
Clinic
Town Park
Sports Stadium
Indoor Recreation Hall
Swimming Pool Complex
Regional Commercial Centre
District Commercial Centre
Car Park
Bus Terminus
PLB / Maxi - Cab Terminus
Petrol Filling Station
Place of Archaeological / Historical Interest

Schedule of Planning Areas

Planning Area	Use	Area (ha)	Planning Area	Use	Area (ha)
1	O	5.85	37	G/IC	2.30
2	G/IC	2.72	38	R3	9.60
3	G/IC	3.00	39	O	4.10
4	R1	3.00	40	G/IC	1.40
5	O	1.03	41	R4	2.47
6	C	1.80	42	R4	4.80
7	O	3.65	43	R4	4.00
8	O	0.97	44	G/IC	0.60
9	A	1.50	45	O	2.30
10	RS	5.10	46	HOS	3.90
11	HOS	4.26	47	R1	5.65
12	G/IC	4.26	48	R2	2.25
13	G/IC	1.47	49	O	1.20
14	C	1.13	50	OU	0.60
15	R1	7.30	51	C	1.85
16	O	1.00	52	O	2.73
17	G/IC	1.60	53	R2	1.70
18	O	2.00	54	R1	4.10
19	R1	8.00	55	R2	4.00
20	G/IC	1.30	56	R3	4.30
21	A	1.20	57	O	3.00
22	R2	2.30	58	G/IC	1.25
23	HOS	7.20	59	V	7.50
24	RS	5.18	60	V	4.20
25	R3	2.30	61	V	1.70
26	G/IC	0.90	62	V	2.50
27	G/IC	0.70	63	VR	3.00
28	O	3.30	64	V	3.90
29	O	16.00	65	V	2.60
30	R2	5.00	66	V	7.00
31	HOS	2.67	67	VR	0.50
32	G/IC	1.36	68	VR	1.18
33	O	10.26	69	V	1.80
34	HOS	5.07	70	VR	3.90
35	RS	6.95			
36	CR	6.90			

NORTH LANTAU DEVELOPMENT

Consultants
Mott MacDonald Hong Kong Ltd.
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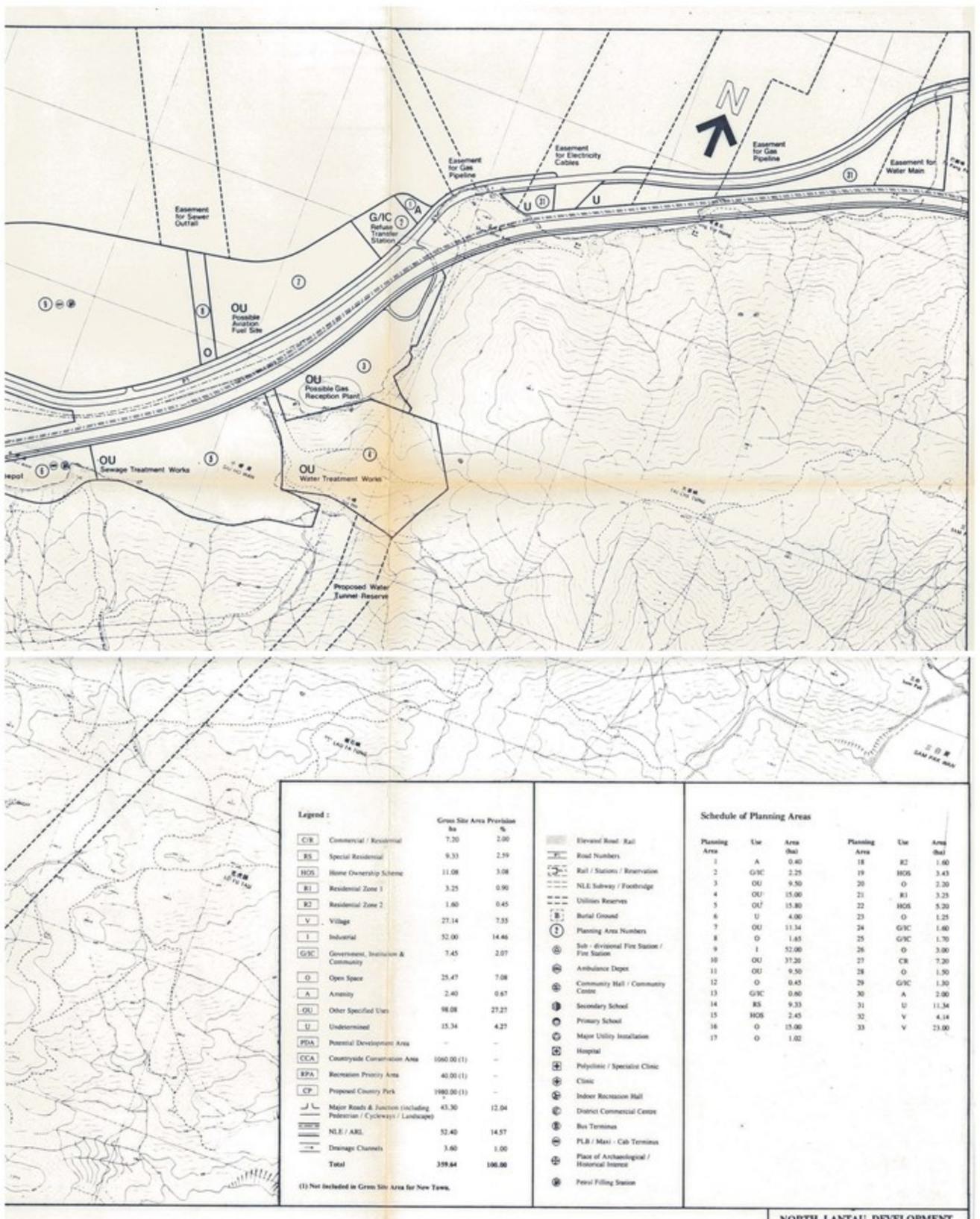
Shankland Cox
Wilbur Smith Associates
EBC Hong Kong

25 March 1992 (Final) Figure No. I1



Tai Ho Wan Recommended Outline Development Plan

SCALE

Hong Kong Government
Territory Development Department
South West NT Development Office

Legend :

		Gross Site Area ha	Provision %
C/R	Commercial / Residential	7.20	2.00
RS	Special Residential	9.33	2.59
HOS	Home Ownership Scheme	11.08	3.08
R1	Residential Zone 1	3.25	0.90
R2	Residential Zone 2	1.60	0.45
V	Village	27.14	7.55
I	Industrial	52.00	14.46
G/IC	Government, Institution & Community	7.45	2.07
O	Open Space	25.47	7.08
A	Amenity	2.40	0.67
OU	Other Specified Uses	98.08	27.27
U	Undetermined	15.34	4.27
PDA	Potential Development Area	–	–
CCA	Countryside Conservation Area	1060.00 (1)	–
RPA	Recreation Priority Area	40.00 (1)	–
CP	Proposed Country Park	1980.00 (1)	–
	Major Roads & Junction (including Pedestrian / Cycleways / Landscape)	43.30	12.04
	NLE / ARL	52.40	14.57
	Drainage Channels	3.60	1.00
	Total	**359.64**	**100.00**

(1) Not included in Gross Site Area for New Town.

- Elevated Road / Rail
- Road Numbers
- Rail / Stations / Reservation
- NLE Subway / Footbridge
- Utilities Reserves
- Burial Ground
- Planning Area Numbers
- Sub - divisional Fire Station / Fire Station
- Ambulance Depot
- Community Hall / Community Centre
- Secondary School
- Primary School
- Major Utility Installation
- Hospital
- Polyclinic / Specialist Clinic
- Clinic
- Indoor Recreation Hall
- District Commercial Centre
- Bus Terminus
- PLB / Maxi - Cab Terminus
- Place of Archaeological / Historical Interest
- Petrol Filling Station

Schedule of Planning Areas

Planning Area	Use	Area (ha)	Planning Area	Use	Area (ha)
1	A	0.40	18	R2	1.60
2	G/IC	2.25	19	HOS	3.43
3	OU	9.50	20	O	2.20
4	OU	15.00	21	R1	3.25
5	OU	15.80	22	HOS	5.20
6	U	4.00	23	O	1.25
7	OU	11.34	24	G/IC	1.60
8	O	1.65	25	G/IC	1.70
9	I	52.00	26	O	3.00
10	OU	37.20	27	CR	7.20
11	OU	9.50	28	O	1.50
12	O	0.45	29	G/IC	1.30
13	G/IC	0.60	30	A	2.00
14	RS	9.33	31	U	11.34
15	HOS	2.45	32	V	4.14
16	O	15.00	33	V	23.00
17	O	1.02			

NORTH LANTAU DEVELOPMENT

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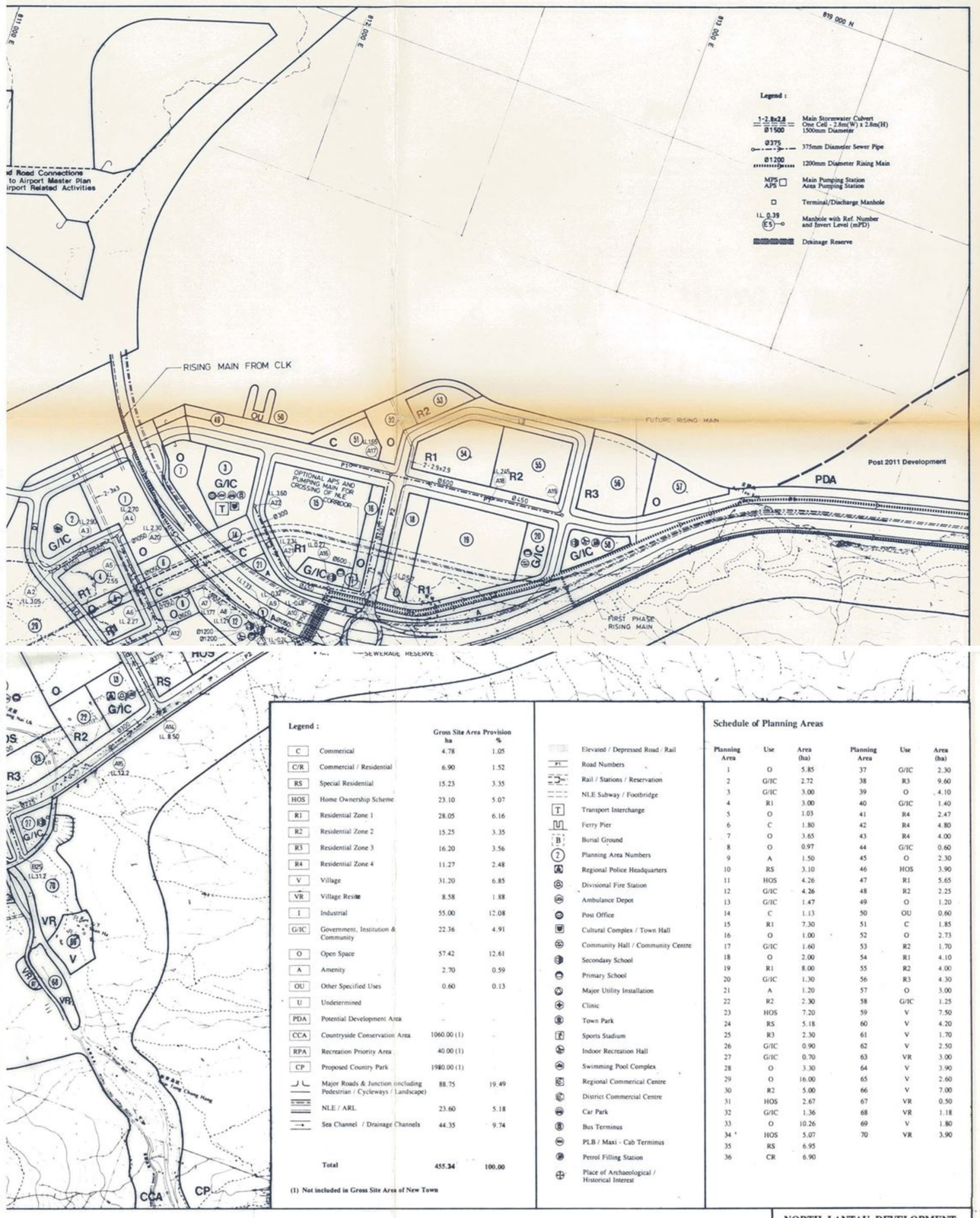
EBC Hong Kong

25 March 1992 (Final) Figure No. 12



Legend :		Gross Site Area ha	Provision %
C	Commerical	4.78	1.05
C/R	Commercial / Residential	6.90	1.52
RS	Special Residential	15.23	3.35
HOS	Home Ownership Scheme	23.10	5.07
R1	Residential Zone 1	28.05	6.16
R2	Residential Zone 2	15.25	3.35
R3	Residential Zone 3	16.20	3.56
R4	Residential Zone 4	11.27	2.48
V	Village	31.20	6.85
VR	Village Resite	8.58	1.88
I	Industrial	55.00	12.08
G/IC	Government, Institution & Community	22.36	4.91
O	Open Space	57.42	12.61
A	Amenity	2.70	0.59
OU	Other Specified Uses	0.60	0.13
U	Undetermined		
PDA	Potential Development Area	-	-
CCA	Countryside Conservation Area	1060.00 (1)	-
RPA	Recreation Priority Area	40.00 (1)	-
CP	Proposed Country Park	1980.00 (1)	-
	Major Roads & Junction (including Pedestrian / Cycleways / Landscape)	88.75	19.49
	NLE / ARL	23.60	5.18
	Sea Channel / Drainage Channels	44.35	9.74
	Total	455.34	100.00

(1) Not included in Gross Site Area of New Town

- Elevated / Depressed Road / Rail
- P1 Road Numbers
- Rail / Stations / Reservation
- NLE Subway / Footbridge
- T Transport Interchange
- Ferry Pier
- B Burial Ground
- (2) Planning Area Numbers
- (A) Regional Police Headquarters
- Divisional Fire Station
- Ambulance Depot
- Post Office
- Cultural Complex / Town Hall
- Community Hall / Community Centre
- Secondary School
- Primary School
- Major Utility Installation
- Clinic
- Town Park
- Sports Stadium
- Indoor Recreation Hall
- Swimming Pool Complex
- Regional Commerical Centre
- District Commercial Centre
- Car Park
- Bus Terminus
- PLB / Maxi - Cab Terminus
- Petrol Filling Station
- Place of Archaeological / Historical Interest

Schedule of Planning Areas

Planning Area	Use	Area (ha)	Planning Area	Use	Area (ha)
1	O	5.85	37	G/IC	2.30
2	G/IC	2.72	38	R3	9.60
3	G/IC	3.00	39	O	4.10
4	R1	3.00	40	G/IC	1.40
5	O	1.03	41	R4	2.47
6	C	1.80	42	R4	4.80
7	O	3.65	43	R4	4.00
8	O	0.97	44	G/IC	0.60
9	A	1.50	45	O	2.30
10	RS	3.10	46	HOS	3.90
11	HOS	4.26	47	R1	5.65
12	G/IC	4.26	48	R2	2.25
13	G/IC	1.47	49	O	1.20
14	C	1.13	50	OU	0.60
15	R1	7.30	51	C	1.85
16	O	1.00	52	O	2.73
17	G/IC	1.60	53	R2	1.70
18	O	2.00	54	R1	4.10
19	R1	8.00	55	R2	4.00
20	G/IC	1.30	56	R3	4.30
21	A	1.20	57	O	3.00
22	R2	2.30	58	G/IC	1.25
23	HOS	7.20	59	V	7.50
24	RS	5.18	60	V	4.20
25	R3	2.30	61	V	1.70
26	G/IC	0.90	62	V	2.50
27	G/IC	0.70	63	VR	3.00
28	O	3.30	64	V	3.90
29	O	16.00	65	V	2.60
30	R2	5.00	66	V	7.00
31	HOS	2.67	67	VR	0.50
32	G/IC	1.36	68	VR	1.18
33	O	10.26	69	V	1.80
34	HOS	5.07	70	VR	3.90
35	RS	6.95			
36	CR	6.90			

Tung Chung Recommend

SCALE 1:5000

Outline Development Plan – Sewerage Layout

Hong Kong Government
Territory Development Department
South West NT Development Office

NORTH LANTAU DEVELOPMENT

Consultants
Mott MacDonald Hong Kong Ltd.
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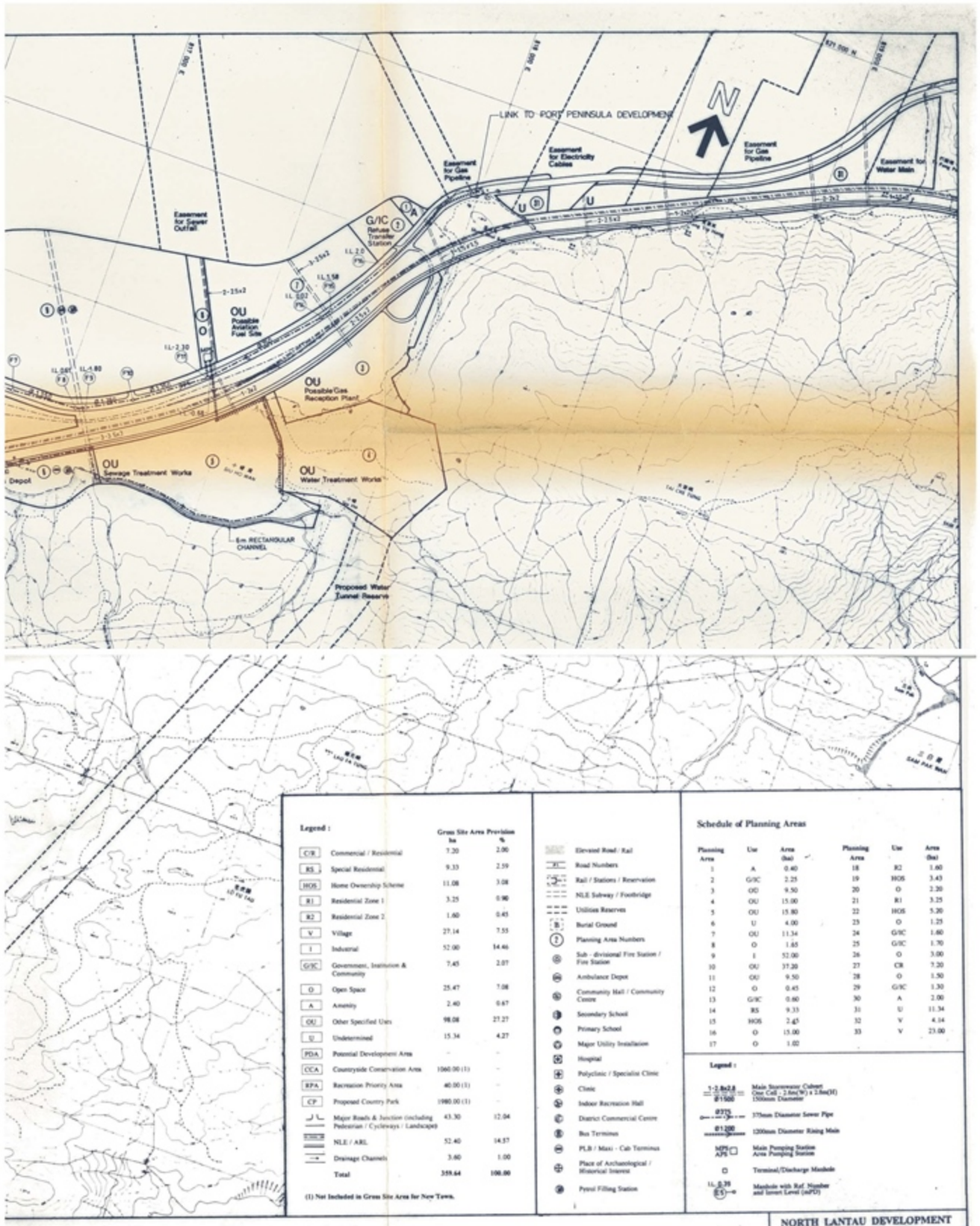
Shankland Cox
Wilbur Smith Associates
EBC Hong Kong

Figure No. 13



Legend :

		Gross Site Area Provision ha	%
C/R	Commercial / Residential	7.20	2.00
RS	Special Residential	9.33	2.59
HOS	Home Ownership Scheme	11.08	3.08
R1	Residential Zone 1	3.25	0.90
R2	Residential Zone 2	1.60	0.45
V	Village	27.14	7.55
I	Industrial	52.00	14.46
G/IC	Government, Institution & Community	7.45	2.07
O	Open Space	25.47	7.08
A	Amenity	2.40	0.67
OU	Other Specified Uses	98.08	27.27
U	Undetermined	15.34	4.27
PDA	Potential Development Area	-	-
CCA	Countryside Conservation Area	1060.00 (1)	-
RPA	Recreation Priority Area	40.00 (1)	-
CP	Proposed Country Park	1980.00 (1)	-
	Major Roads & Junction (including Pedestrian / Cycleways / Landscaped	43.30	12.04
	NLE / ARL	52.40	14.57
	Drainage Channels	3.60	1.00
	Total	359.64	100.00

(1) Not Included in Gross Site Area for New Town.

Elevated Road / Rail
R1 Road Numbers
Rail / Stations / Reservation
NLE Subway / Footbridge
Utilities Reserves
B Burial Ground
? Planning Area Numbers
Sub - divisional Fire Station / Fire Station
Ambulance Depot
Community Hall / Community Centre
Secondary School
Primary School
Major Utility Installation
Hospital
Polyclinic / Specialist Clinic
Clinic
Indoor Recreation Hall
District Commercial Centre
Bus Terminus
PLB / Maxi - Cab Terminus
Place of Archaeological / Historical Interest
Petrol Filling Station

Schedule of Planning Areas

Planning Area	Use	Area (ha)	Planning Area	Use	Area (ha)
1	A	0.40	18	R2	1.60
2	G/IC	2.25	19	HOS	3.43
3	OU	9.50	20	O	2.20
4	OU	15.00	21	R1	3.25
5	OU	15.80	22	HOS	5.20
6	U	4.00	23	O	1.25
7	OU	11.34	24	G/IC	1.60
8	O	1.65	25	G/IC	1.70
9	I	52.00	26	O	3.00
10	OU	37.20	27	CR	7.20
11	OU	9.50	28	O	1.50
12	O	0.45	29	G/IC	1.30
13	G/IC	0.60	30	A	2.00
14	RS	9.33	31	U	11.34
15	HOS	2.45	32	V	4.14
16	O	15.00	33	V	23.00
17	O	1.02			

Legend :

1-2.8x2.8 Ø1500 — Main Stormwater Culvert One Cell - 2.8m(W) x 2.8m(H) 1500mm Diameter
Ø375 — 375mm Diameter Sewer Pipe
Ø1200 — 1200mm Diameter Rising Main
MPS / APS — Main Pumping Station / Area Pumping Station
Terminal/Discharge Manhole
IL 0.39 (ES) — Manhole with Ref. Number and Invert Level (mPD)

Tai Ho Wan Recommended Outline Development Plan – Sewerage Layout

SCALE 1 : 5 000

Hong Kong Government
Territory Development Department
South West NT Development Office

NORTH LANTAU DEVELOPMENT

Consultants
Mott MacDonald Hong Kong Ltd.
in association with
Shankland Cox
Wilbur Smith Associates
ERC Hong Kong

Figure No. 14

Tung Chung Recommende

SCALE 1 : 5 000

Hong Kong Government
Territory Development Department
South West NT Development Office

Legend :

		Gross Site Area ha	Provision %
C	Commercial	4.78	1.05
C/R	Commercial / Residential	6.90	1.52
RS	Special Residential	15.23	3.35
HOS	Home Ownership Scheme	23.10	5.07
R1	Residential Zone 1	28.05	6.16
R2	Residential Zone 2	15.25	3.35
R3	Residential Zone 3	16.20	3.56
R4	Residential Zone 4	11.27	2.48
V	Village	31.20	6.85
VR	Village Resite	8.58	1.88
I	Industrial	55.00	12.08
G/IC	Government, Institution & Community	22.36	4.91
O	Open Space	57.42	12.61
A	Amenity	2.70	0.59
OU	Other Specified Uses	0.60	0.13
U	Undetermined	–	–
PDA	Potential Development Area	–	–
CCA	Countryside Conservation Area	1060.00 (1)	–
RPA	Recreation Priority Area	40.00 (1)	–
CP	Proposed Country Park	1980.00 (1)	–
	Major Roads & Junction (including Pedestrian / Cycleways / Landscape)	88.75	19.49
	NLE / ARL	23.60	5.18
	Sea Channel / Drainage Channels	44.35	9.74
	Total	455.34	100.00

(1) Not included in Gross Site Area of New Town

- Elevated / Depressed Road / Rail
- Road Numbers
- Rail / Stations / Reservation
- NLE Subway / Footbridge
- Transport Interchange
- Ferry Pier
- Burial Ground
- Planning Area Numbers
- Regional Police Headquarters
- Divisional Fire Station
- Ambulance Depot
- Post Office
- Cultural Complex / Town Hall
- Community Hall / Community Centre
- Secondary School
- Primary School
- Major Utility Installation
- Clinic
- Town Park
- Sports Stadium
- Indoor Recreation Hall
- Swimming Pool Complex
- Regional Commercial Centre
- District Commercial Centre
- Car Park
- Bus Terminus
- PLB / Maxi - Cab Terminus
- Petrol Filling Station
- Place of Archaeological / Historical Interest

Schedule of Planning Areas

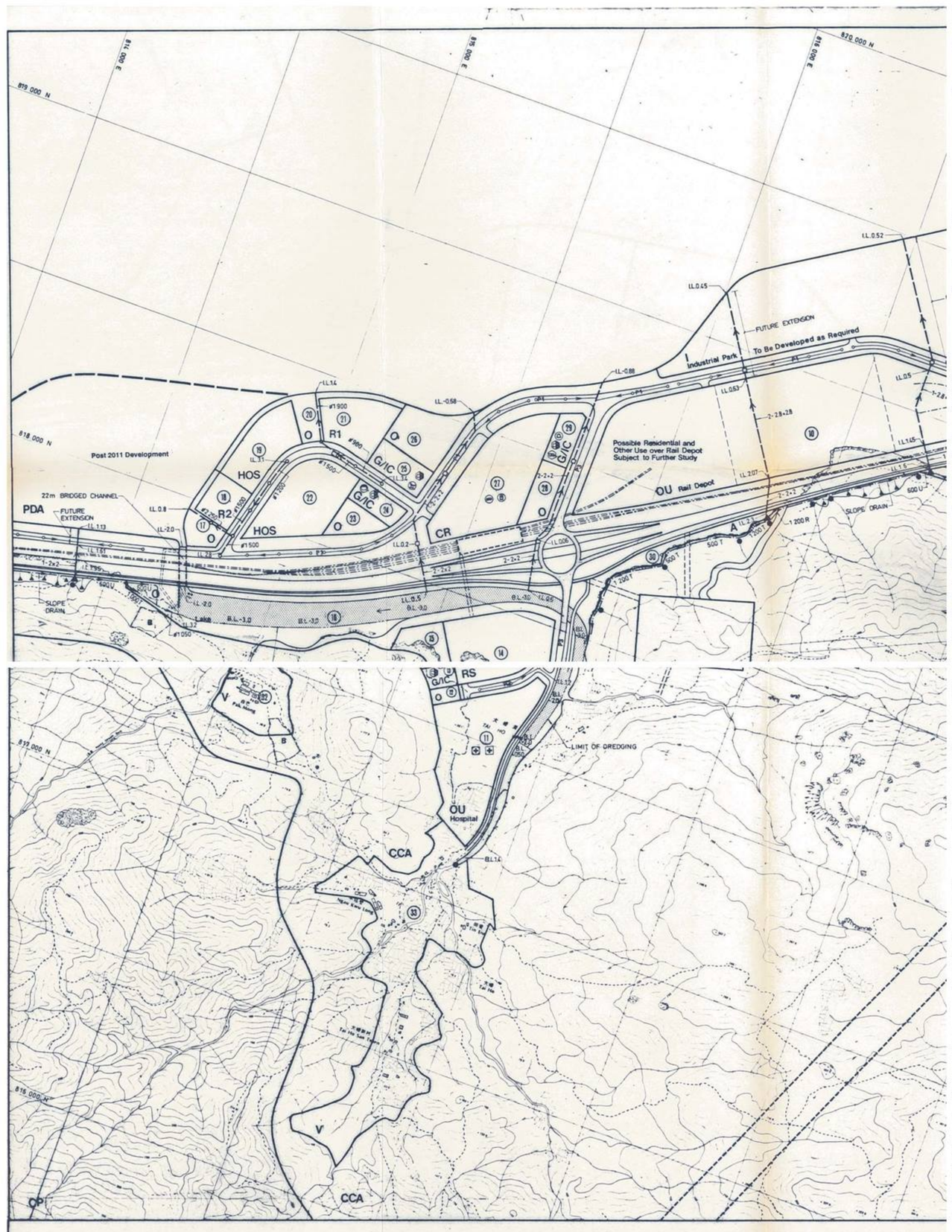
Planning Area	Use	Area (ha)	Planning Area	Use	Area (ha)
1	O	5.85	37	G/IC	2.30
2	G/IC	2.72	38	R3	9.60
3	G/IC	3.00	39	O	4.10
4	R1	3.00	40	G/IC	1.40
5	O	1.03	41	R4	2.47
6	C	1.80	42	R4	4.80
7	O	3.65	43	R4	4.00
8	O	0.97	44	G/IC	0.60
9	A	1.50	45	O	2.30
10	RS	3.10	46	HOS	3.90
11	HOS	4.26	47	R1	5.65
12	G/IC	4.26	48	R2	2.25
13	G/IC	1.47	49	O	1.20
14	C	1.13	50	OU	0.60
15	R1	7.30	51	C	1.85
16	O	1.00	52	O	2.73
17	G/IC	1.60	53	R2	1.70
18	O	2.00	54	R1	4.10
19	R1	8.00	55	R2	4.00
20	G/IC	1.30	56	R3	4.30
21	A	1.20	57	O	3.00
22	R2	2.30	58	G/IC	1.25
23	HOS	7.20	59	V	7.50
24	RS	5.18	60	V	4.20
25	R3	2.30	61	V	1.70
26	G/IC	0.90	62	V	2.50
27	G/IC	0.70	63	VR	3.00
28	O	3.30	64	V	3.90
29	O	16.00	65	V	2.60
30	R2	5.00	66	V	7.00
31	HOS	2.67	67	VR	0.50
32	G/IC	1.36	68	VR	1.18
33	O	10.26	69	V	1.80
34	HOS	5.07	70	VR	3.90
35	RS	6.95			
36	CR	6.90			

Outline Development Plan – Drainage Layout

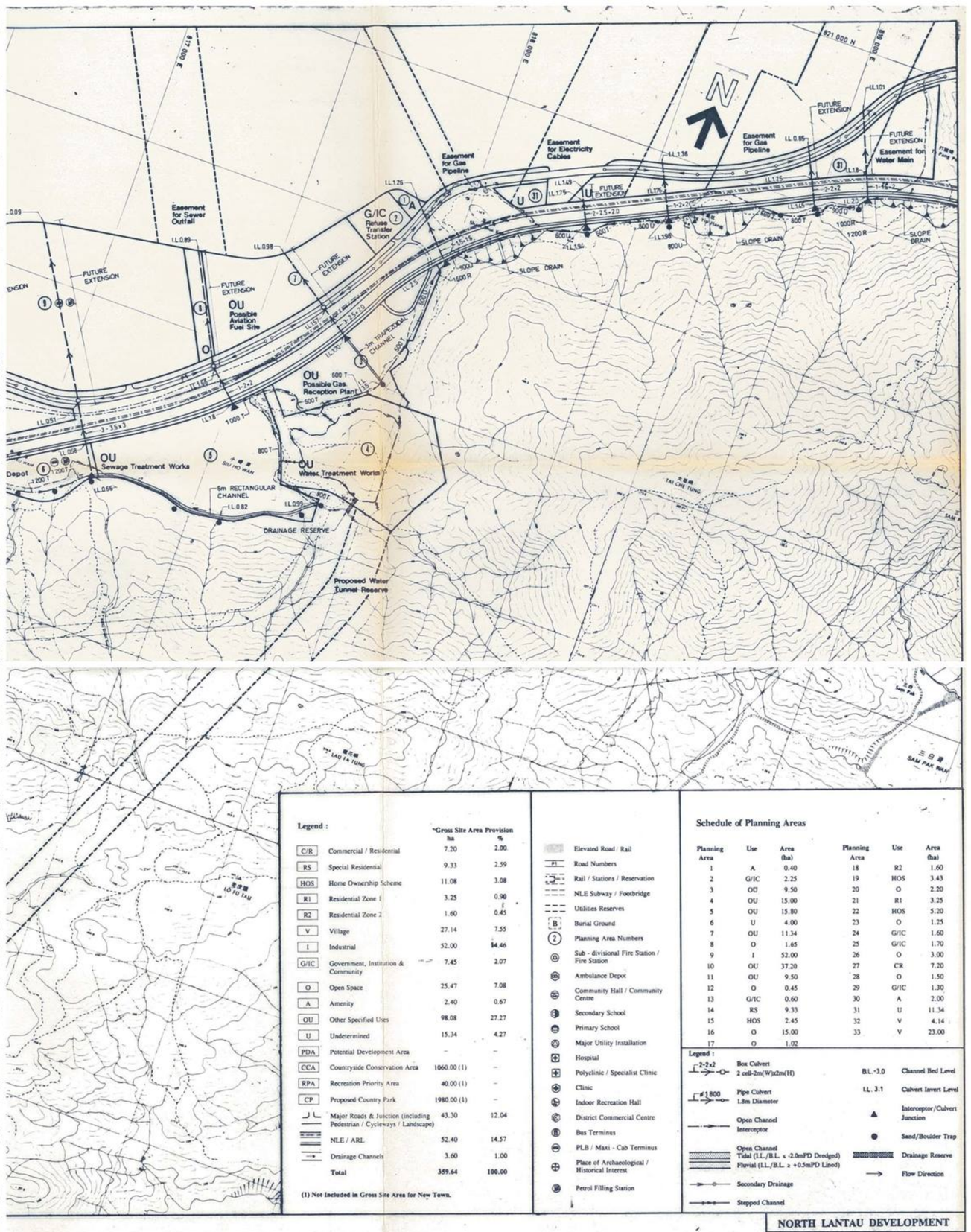
NORTH LANTAU DEVELOPMENT

Consultants
Mott MacDonald Hong Kong Ltd.
in association with
Shankland Cox
Wilbur Smith Associates
EBC Hong Kong

Figure No. 15



Tai Ho Wan Recommended Outline Development Plan – Drainage Layout



Legend :

		"Gross Site Area Provision ha	%
C/R	Commercial / Residential	7.20	2.00
RS	Special Residential	9.33	2.59
HOS	Home Ownership Scheme	11.08	3.08
R1	Residential Zone 1	3.25	0.90
R2	Residential Zone 2	1.60	0.45
V	Village	27.14	7.55
I	Industrial	52.00	14.46
G/IC	Government, Institution & Community	7.45	2.07
O	Open Space	25.47	7.08
A	Amenity	2.40	0.67
OU	Other Specified Uses	98.08	27.27
U	Undetermined	15.34	4.27
PDA	Potential Development Area	–	–
CCA	Countryside Conservation Area	1060.00 (1)	–
RPA	Recreation Priority Area	40.00 (1)	–
CP	Proposed Country Park	1980.00 (1)	–
	Major Roads & Junction (including Pedestrian / Cycleways / Landscape)	43.30	12.04
	NLE / ARL	52.40	14.57
	Drainage Channels	3.60	1.00
	Total	359.64	100.00

(1) Not Included in Gross Site Area for New Town.

- Elevated Road / Rail
- Road Numbers
- Rail / Stations / Reservation
- NLE Subway / Footbridge
- Utilities Reserves
- Burial Ground
- Planning Area Numbers
- Sub - divisional Fire Station / Fire Station
- Ambulance Depot
- Community Hall / Community Centre
- Secondary School
- Primary School
- Major Utility Installation
- Hospital
- Polyclinic / Specialist Clinic
- Clinic
- Indoor Recreation Hall
- District Commercial Centre
- Bus Terminus
- PLB / Maxi - Cab Terminus
- Place of Archaeological / Historical Interest
- Petrol Filling Station

Schedule of Planning Areas

Planning Area	Use	Area (ha)	Planning Area	Use	Area (ha)
1	A	0.40	18	R2	1.60
2	G/IC	2.25	19	HOS	3.43
3	OU	9.50	20	O	2.20
4	OU	15.00	21	R1	3.25
5	OU	15.80	22	HOS	5.20
6	U	4.00	23	O	1.25
7	OU	11.34	24	G/IC	1.60
8	O	1.65	25	G/IC	1.70
9	I	52.00	26	O	3.00
10	OU	37.20	27	CR	7.20
11	OU	9.50	28	O	1.50
12	O	0.45	29	G/IC	1.30
13	G/IC	0.60	30	A	2.00
14	RS	9.33	31	U	11.34
15	HOS	2.45	32	V	4.14
16	O	15.00	33	V	23.00
17	O	1.02			

Legend :

- 2-2x2 — Box Culvert 2 cell-2m(W)x2m(H)
- ≠1800 — Pipe Culvert 1.8m Diameter
- Open Channel Interceptor
- Open Channel Tidal (LL./B.L. ≤ -2.0mPD Dredged) Fluvial (LL./B.L. ≥ +0.5mPD Lined)
- Secondary Drainage
- Stepped Channel
- B.L.-3.0 — Channel Bed Level
- LL. 3.1 — Culvert Invert Level
- Interceptor/Culvert Junction
- Sand/Boulder Trap
- Drainage Reserve
- Flow Direction

Hong Kong Government
Territory Development Department
South West NT Development Office

SCALE 1 : 5 000

NORTH LANTAU DEVELOPMENT

Consultants
Mott MacDonald Hong Kong Ltd.
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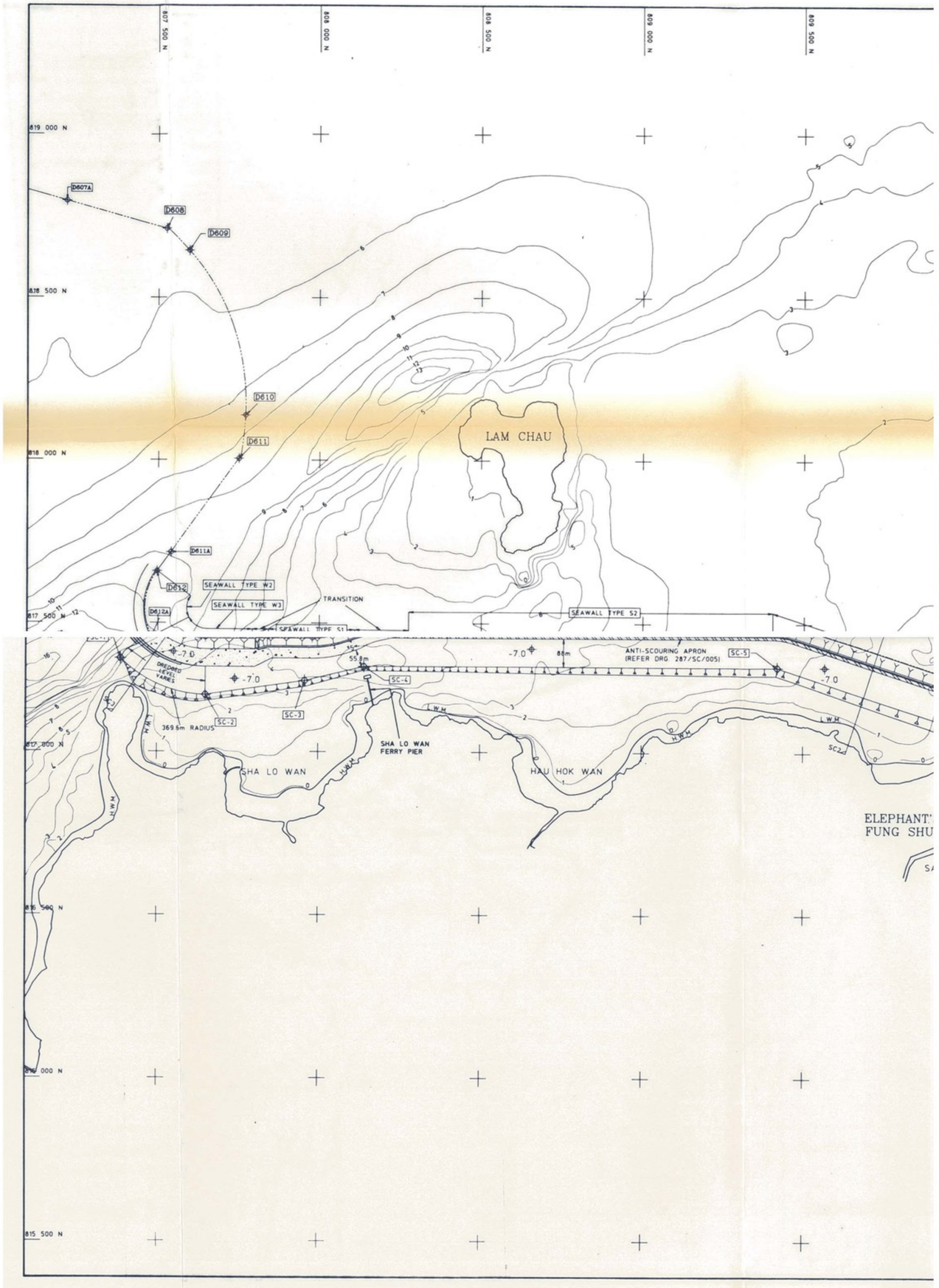
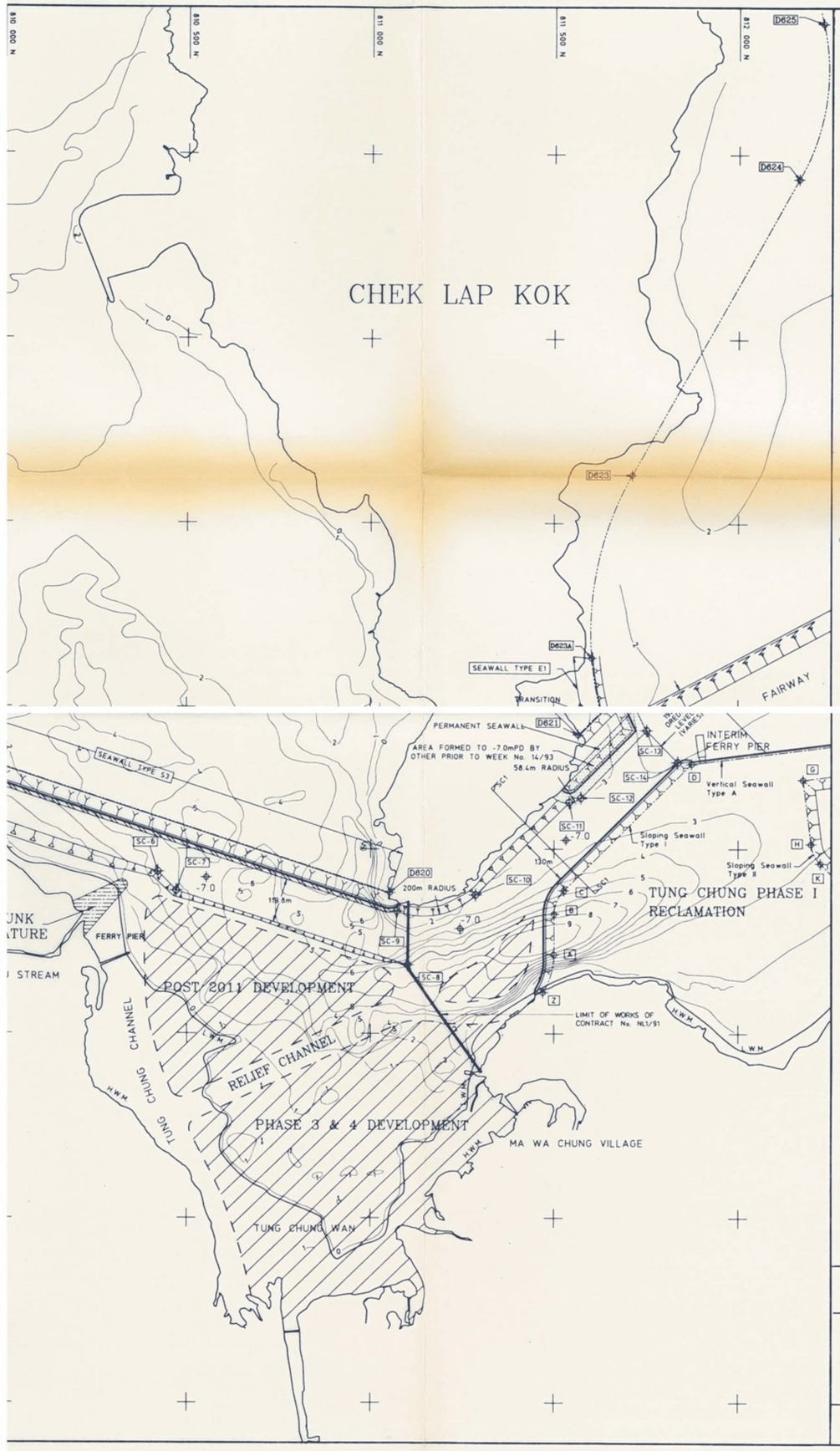
Shankland Cox
Wilbur Smith Associates
EBC Hong Kong

Figure No. 16





Notes

1. All levels refer to Principal Datum (mPD).
2. All dimensions are in millimeters unless otherwise specified.
3. All co-ordinates refer to Hong Kong (1980) metric grid co-ordinate system.
4. For layout of seawall types in Tung Chung Development refer to Drawings No. 287/NL1/014 - 017.
5. Dredged levels may vary as instructed by the Engineer.
6. Dredged tolerance for all dredging in the sea channel shall be 300mm.

Reference Drawings

This drawing shall be read in conjunction with the following drawings:

287/SC/002
287/SC/003
287/SC/004
287/SC/005

SEA CHANNEL SETTING OUT CO-ORDINATES

POINT	EASTING	NORTHING
SC-1	807 388.321	817 286.160
SC-2	807 650.881	817 174.967
SC-3	807 958.042	817 218.054
SC-4	808 142.004	817 262.232
SC-5	809 420.888	817 262.691
SC-6	810 421.388	816 937.608
SC-7	810 471.388	816 886.351
SC-8	811 101.550	816 685.571
SC-9	811 072.500	816 831.650
SC-10	811 287.399	816 875.272
SC-11	811 541.027	817 126.418
SC-12	811 572.656	817 139.063
SC-13	811 751.313	817 321.130
SC-14	811 836.026	817 235.580

LEGEND

- 3 — SEABED CONTOUR IN METRES BELOW PRINCIPAL DATUM
- -7.0 DREDGED LEVEL OF SEA CHANNEL
- SC-1 SETTING OUT POINT OF SEA CHANNEL
- D613 SETTING OUT POINT OF AIRPORT SEAWALL DESIGNED BY OTHERS
- ANTI-SCOURING APRON
- SEA CHANNEL DREDGED SLOPE
- HWM HIGH WATERS MARK
- LWM LOWTIDE WATER LEVEL

North Lantau Development

Sea Channel

Figure No. I7

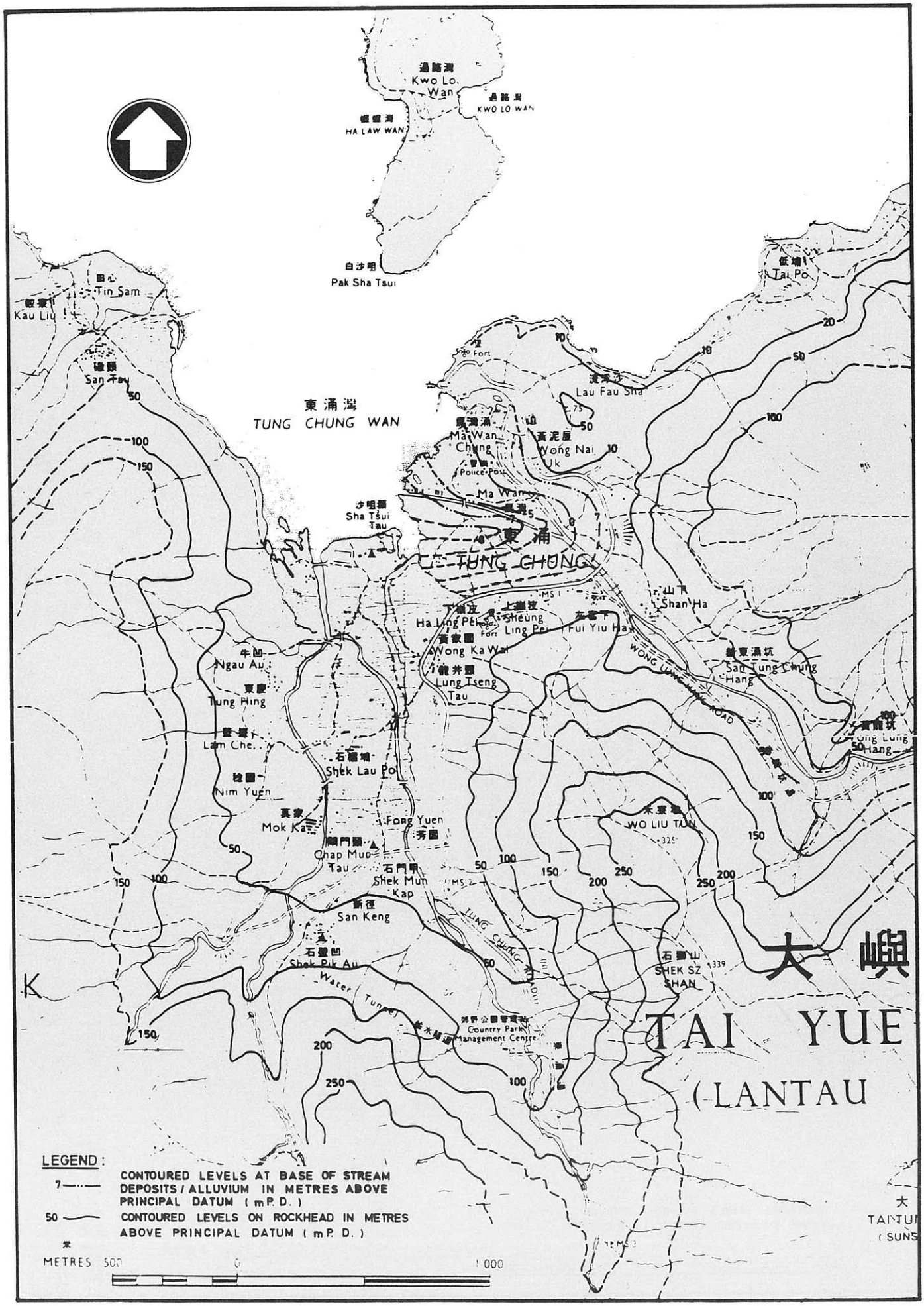


Figure I 8
Rock Head Contours : Tung Chung Area

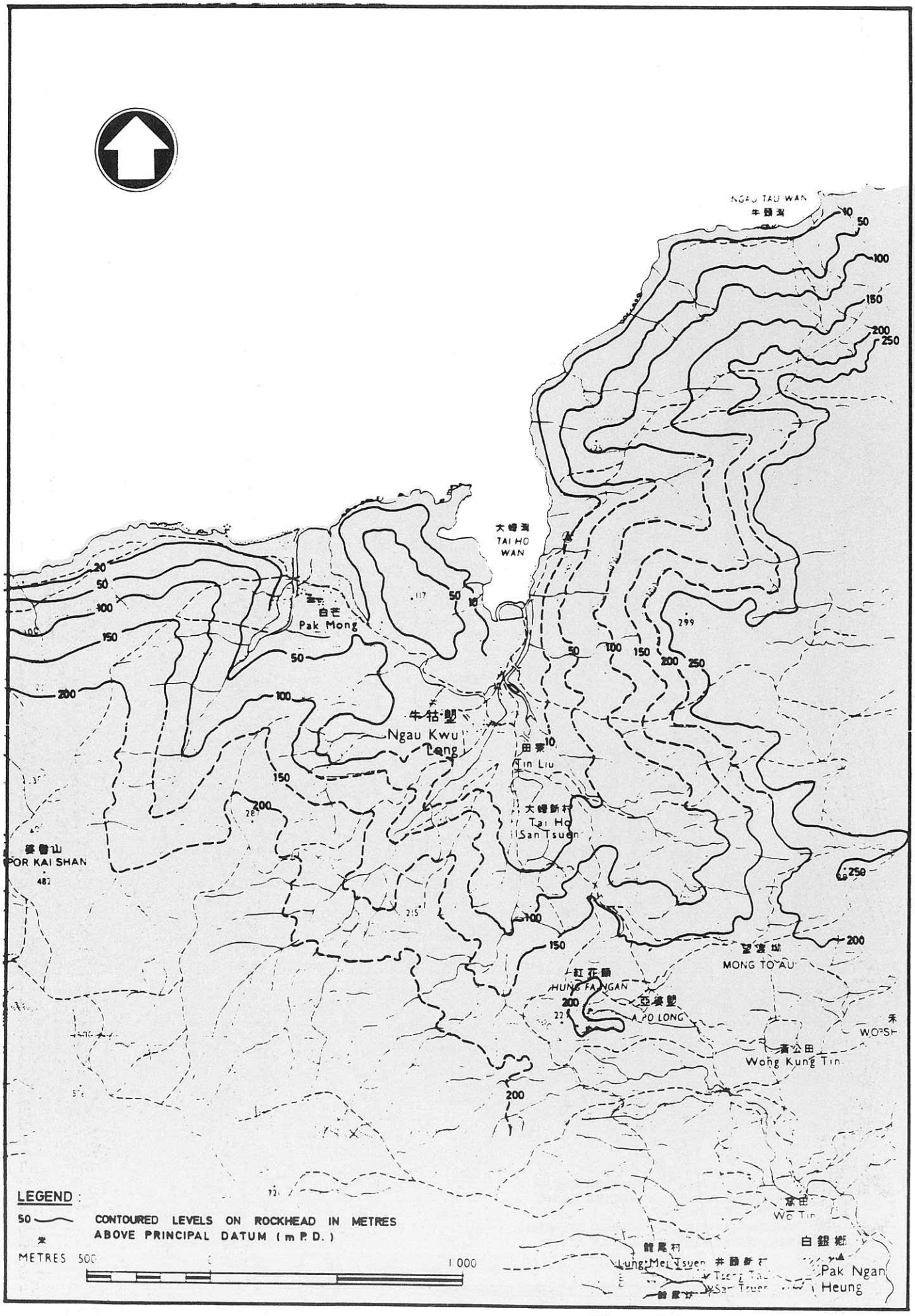


Figure I 9
Rockhead Contours : Tai Ho Area

Figure I 10
Bathymetry

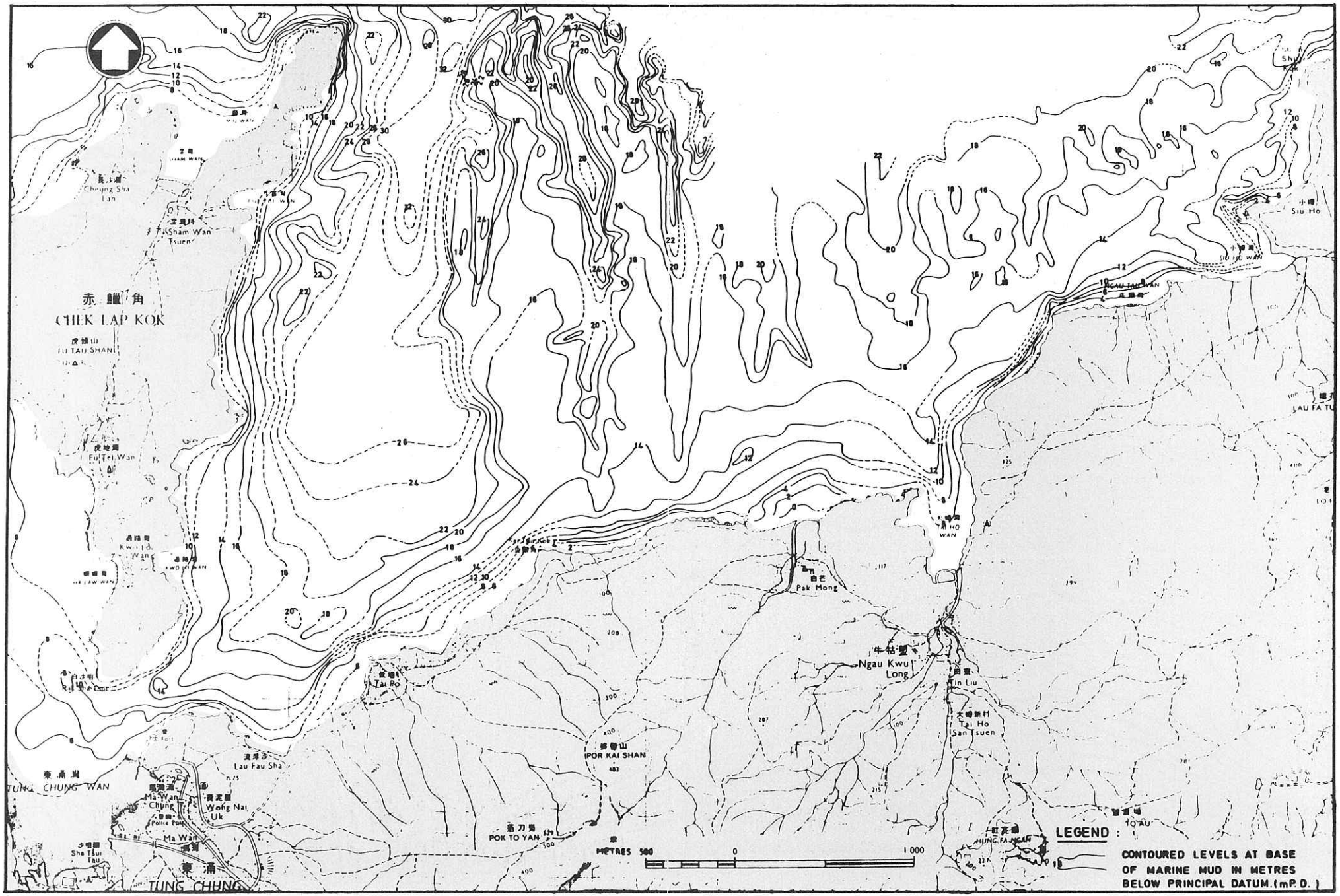


Figure I 11
Base of Marine Mud

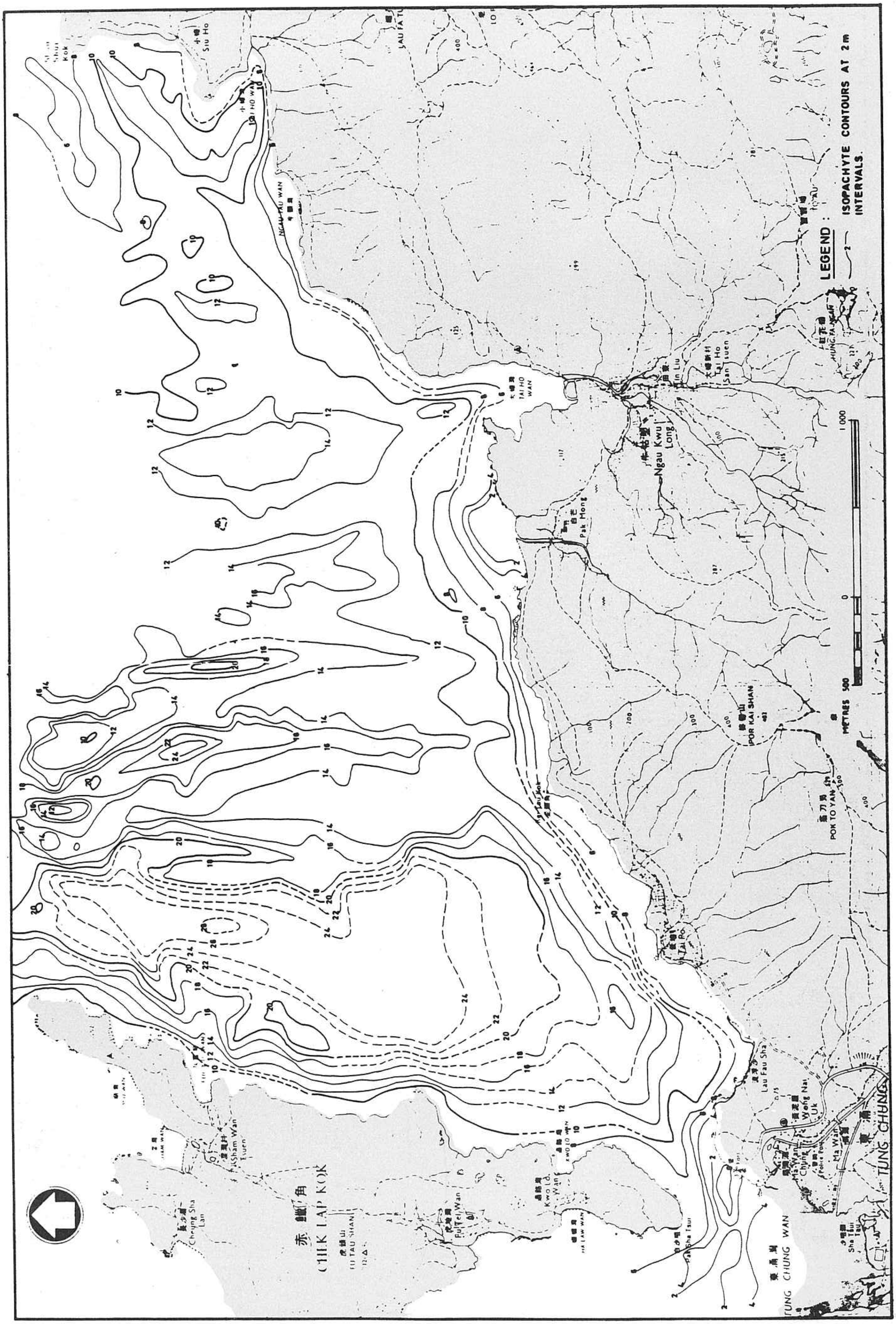


Figure I-12
Thickness of Marine Mud

Legend:

Major Photolineament

Alignment of Existing Tunnels

Land Group	Code	Suitability For Cavern Development	
I		High	Lan at le inst
II		Moderate	Lan at le inst
IIIA		Low	Lan pho
IIIB		Low	Lan und

ound Description
ally above 60mPD and 0m from major underground s or major photolineaments
ally below 60mPD and 0m from major underground s or major photolineaments
100m from major nents
100m from major d installations

Note :

Sources of information on this Figure are from Drg. No. EG333 of the ENGINEERING GEOLOGY SECTION PLANNING DIVISION GEOTECHNICAL CONTROL OFFICE HONG KONG. (Date Jan. / 1991)

CHEK LAP KOK

TUNG CHUNG WAN

PARK

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NORTH LANTAU DEVELOPMENT

Consultants

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in association with
Shankland Cox
Wilbur Smith Associates
EBC Hong Kong

Guide to the General Suitability for Cavern Development

Figure I 13