

PROPOSED RECREATIONAL FACILITIES  
AT AREAS 19 AND 45, TUEN MUN  
ENVIRONMENTAL IMPACT ASSESSMENT

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March 1993

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## 1.0 INTRODUCTION

The Regional Services Department (RSD) in association with the Royal Hong Kong Jockey Club (RHKJC) propose to develop Areas 19 and 45, Castle Peak Foothill West of Lung Mun Road, Tuen Mun into a public recreational centre comprising a Public Golf Course-cum Driving Range and a Horse-Riding School. The objective of this assessment is to address the environmental issues associated with :

- (a) the use of chemicals and their effects on the aquatic ecosystems in the water bodies in the neighbourhood of the site.
- (b) removal, destruction or modification of landform, flora, fauna and habitats arising from the construction and operation of the development,
- (c) noise and dust impacts, and impacts of run-off from construction activities on sensitive receivers identified above,
- (d) odour from stables affecting nearby sensitive users.

This report also proposes mitigation measures aimed to minimize the adverse impacts identified.

## 2.0 THE PROPOSED DEVELOPMENT

### 2.1 The Site

The site is bounded by Lung Mun Road to the east, Tsing Shan Tsuen to the north, San Shek San Tsuen and San Shek San Tsuen Phase II to the west and Shek Kok Tsui to the south. The southern end of the site covers the vacated Pak Kok Temporary Housing Area. Figure 1 shows the location of the site.

### 2.2 Proposed Development

The proposed development comprises recreational facilities on an approximately 40 ha lot below Tsing Shan and includes :

- (a) A 9-hole golf course cum driving range and club facilities. on 20.56 ha of land on the northern section of the site.
- (b) A public riding school covering 5.48 ha of land over the vacated Pak Kok Temporary Housing Area. The school will comprise two stable blocks for 60 horses and ponies together with an administration building, mafoo's rest area and three paddocks. The buildings are simple structures in reinforced concrete founded on

strip footings. The stable blocks are single storey. The administration building and mafoo's quarters are on two levels.

Two private lots will be excised from the development area. Existing tracks and footpaths will be retained for villagers. Layout of the proposed development is shown in Figure 2.

## 2.3 Design Considerations

### 2.3.1 Golf Course

The site is currently used as a storage area by the Hong Kong Government. The proposed usage as a recreation centre serves to enhance the utilization of land in addition to making a positive contribution to the environment by introducing some of the attributes lost to the area through industrialization and urbanization.

Gary Player Design Company is currently designing this 9-hole golf course. The proposed facilities are planned to follow the existing topography of the site. No excavation will be carried out other than landscaping and installation of utilities.

The site is presently free from trees except at the northern end of the site. The layout of the fairways will be designed so that no trees will be felled. On the other hand, RHKJC has planned for more planting of trees and shrubs within the golf course to enhance the quality of the environment (see Figure 2).

The driving range will be designed for day and evening operations. It is about 200m long facing Castle Peak. Floodlighting will be provided in the evening. In order to avoid possible glare, the lighting will be directed towards the mountain side.

Greens and tees usually require turfgrasses which are even in colour, very dense, durable and be able to bear frequent and close cutting and provide a fast and true surface. As a result, the turfs need frequent mowing and irrigation and intense treatment with fertilizers and pesticides. In view of the environmental concerns about the extensive use of chemicals on these areas, artificial turfgrass will be used so that no pesticides and fertilizers will be required.

The fairways, the rough, and the driving range will be covered with carpet grass (*Axonopus Compressus*) which is a commonly used grass for playing fields in Hong Kong. It is a perennial grass, rather coarse but very hardy and resistant to disease and insect attack and requires very little maintenance with the use of sandy loam to loamy sand soils as the topsoil [1]. Experience with RSD shows that practically no pesticides are required for the carpet grass using weed-free and healthy sandy loam as topsoil.

The use of this grass species also ensures that fertilizers when appropriately applied into the soil will be readily uptaken by the roots, thus minimizing leaching of the chemicals into the groundwater and the transport of the chemicals by surface runoff.

Well water will be used for irrigation to avoid the use of treated effluent which may increase the bacterial loadings to the coastal waters.

An open channel drainage system will be provided to collect and drain the surface water into the storm water drains along Lung Mun Road.

### 2.3.2 Riding School

The site was used as a temporary housing area. It consists of a series of concrete platforms which will be kept for the riding school facilities. The buildings for the riding school are simple structures in reinforced concrete founded on strip footings. The stable blocks are located at the foothill of Castle Peak to maximize its buffer distance from Butterfly Estate across Lung Mun Road.

Paddocks will be constructed between the stable blocks and Lung Mun Road. Horses will be taken to the paddocks for riding lessons.

Horse manure will be put in plastic bags for daily disposal off-site. A sub-soil drainage system will be provided to collect and drain the urine from horses to the Government foul sewers along Lung Mun Road.

A limited number of trees are found within the area. All of the trees will be preserved. In addition, under the present planting scheme, more trees and shrubs will be planted in order to enhance the quality of the environment.

The turf areas on both sides of the riding school will be covered also with the carpet grass and be managed as usual RSD venues.

### 2.3.3 Horse Trails in Woodland

As directed by the Regional Services Department, the woodland over the central portion of the site will be preserved. The only construction work within this woodland is a horse riding trail. The exact routing of this trail will be determined with a view to minimizing any impacts on the fauna and habitats in the woodland.

## 2.4 Development Programme

The construction programme is as below :

### Golf Course

- o Driving Range                      March 1993 to December 1993
- o 9-hole Course                      April 1993 to September 1994

### Horse Riding School

- o Stables and Paddocks              March 1993 to November 1993
- o Horse Trails                      May 1993 to November 1993

## 3.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

### 3.1 Physical Environment

Approximately 40% of the site (over the central portion) was formed to a level platform in 1977 by cutting into the toe of Tsing Shan. The levels of the platform vary from +22 to +10m PD, with a gentle gradient of 1 in 20 towards the east. The northern and southern ends of the site are natural grounds with levels between +12 and +40 mPD.

### 3.2 Land Use

The site is zoned O, G/IC, GB, R(C) and R(B) on the Tuen Mun Outline Zoning Plan. At present, the site is uninhabited.

### 3.3 Water Quality

#### 3.3.1 Nutrient Levels

The coastal waters off Tuen Mun, including Butterfly Beach which is a gazetted beach situated to the south west of the Tuen Mun Nullah estuary was declared the North Western Water Control Zone in 1992. The annual mean of inorganic nitrogen in the Control Zone in 1990 was 0.37 mg/l [2]. Since an inorganic nitrogen concentration of between 0.3 and 0.5 mg/l is considered as the nutrient criterion for eutrophication, the control zone had eutrophic potential.

However, the mean organic to inorganic nitrogen ratio in the control zone was about 1, indicative of low algal growth as compared with that in Tolo Harbour and Port Shelter where the ratios were above 5.



For inorganic phosphate, the annual mean in 1990 was 0.03 mg/l. This is the phosphate criterion for eutrophication commonly adopted, and indicates the phosphate level in the water body had eutrophic potential.

The extent of eutrophication in a water body is reflected by the intensity of algal bloom in the area. This intensity can be measured in terms of the amount of chlorophyll-a, which is a substance commonly associated with the presence of microscopic algae. In general, if the chlorophyll-a level is  $> 10 \mu\text{g/l}$ , the eutrophic state of the water is considered unacceptable. In the North Western Waters, the annual mean of chlorophyll-a level in 1990 was  $2.4 \mu\text{g/l}$ , and a maximum surface level of  $7.57 \mu\text{g/l}$ , showing that the eutrophic state of the water was acceptable.

The nutrient levels in the bottom sediments of Hong Kong waters, particularly the Western Waters, are influenced by the input from Pearl River. The background level of nutrients in the sediments should be similar to the that of the Pearl River estuary. The sediments levels for total nitrogen and total phosphorous measured at the marine monitoring station close to Tuen Mun in 1990 were both  $< 600 \text{ mg/kg}$  dry solids, indicating that the nutrient contents in the bottom sediments were acceptable and typical of estuarine waters.

No nutrient levels data is available from the two stream courses running across the site since a recent survey revealed that they were dried up.

### 3.3.2 Escherichia coli

The bacterial water quality in the coastal waters off Tuen Mun was unacceptable in 1988 [3] due to the discharges of animal wastes from the heavily polluted Tuen Mun Nullah. The declaration of the zone and the relocation of a pig farm in San Shek Wan Phase II should reduce the polluting loads entering the Tuen Mun Nullah.

## 3.4 Noise Environment

There are no major noise sources in the site. A recent survey of the site showed that the noise environment in the daytime is dominated by the road traffic and light rail traffic along Lung Mun Road. At night, when the road traffic decreases and the rail traffic ceases, the area is quiet.

## 3.5 Air Quality

There are no major air emissions from the site apart from vehicular emissions from Lung Mun Road. Both the industrial area of Tuen Mun to the north east, and the Castle Peak Power Station and China Cement to the west are so remote from the site as to insignificantly affect the local air quality.

### 3.6 Ecological Environment

A preliminary survey of the existing ecological environment has been carried out to identify the main habitats and species in the site prior to the proposed development. Trees are found mainly on the steep slope at the northern boundary, the woodland over the central portion of the site and on the level platforms of the vacated THA site. The distribution of trees is shown in Figure 3.

Habitats on the riding school site are mainly secondary or planted fruit trees of very common species. A total of 86 trees were identified and the species include :

- o *Crataeva religiosa*
- o *Averrhoa carambola*
- o *Ficus variegata*
- o *Litchi chinensis*
- o *Nerium indicum*
- o *Macaranga tanarius*
- o *Bauhinia variegata*
- o *Mangifera indica*
- o *Aleurites moluccana*
- o *Delonix regia*
- o *Rhus succedanea*
- o *Ficus microcarpa*
- o *Clausena lansium*
- o *Celtis sinensis*
- o *Grewia asiatica*

They may be important for the wildlife habitats, but are not of unique ecological value, as most of them are planted extensively in Hong Kong.

The woodland over the central portion of the site consists mainly of:

- o *Leucaena leucocephala*
- o *Macaranga tanarius*
- o *Araucaria cunninghamii*
- o *Litchi chinensis*

All are common species of widespread existence in Hong Kong.

A woodland of very common tree species is also found on the steep slope at the northern site boundary and comprises the following species :

- o *Litchi chinensis*
- o *Clausena lansium*
- o *Euphoria longan*

- o *Artocarpus heterophyllus*
- o *Sterculia nobilis*
- o *Citrus grandis*
- o *Macaranga tanarius*
- o *Aleurites moluceana*
- o *Araucaria cunninghamii*

The land for the proposed golf course has been invaded by pioneer grass; only one tree *Farnesiana willd* was identified.

No large mammals were identified. The woodlands may support a limited variety of amphibians and reptiles. Individual species have not been identified due to the short duration of this survey.

Birds of very common species were found in the woodlands. They include:

- o Magpie (*Pica pica*)
- o Tree Sparrow (*Passer montanus*)
- o Spotted Dove (*Streptopelia chinensis*)

However, due to the short duration of the survey, no extensive bird observations were made on site.

Aquatic habitats were not found in the dried up stream courses.

#### 4.0 USE OF CHEMICALS

##### 4.1 Pesticides

In Hong Kong, the use of pesticides is controlled by the Pesticide Ordinance (Cap 133). Under the ordinance, pesticides which are registered may be used subject to a maximum concentration for retail sale and permitted formulation. However, Technical Memorandum on Effluent Standards, issued under section 21 of the Water Control Ordinance (Cap 358), prohibits the discharge of pesticides into streams which enter the sea at gazetted beaches and coastal waters including the North Western Water Control Zone.

Although the stream running over the riding school should drain into a lagoon adjacent to the Tuen Mun Sewage Treatment Plant to avoid direct impacts on the water quality in Butterfly Beach, which is a gazetted beach, the other stream should drain into the Tuen Mun Nullah which then enters the North Western Water Control Zone. As a result, any discharge of pesticides into either of these stream courses is either undesirable or prohibited under the legislation although the maximum allowable concentrations of the active ingredients of pesticides in the effluent have not been defined. In view of the very stringent control of the water quality

near the beach and the general environmental concerns over the use of pesticides in golf courses, artificial turf for the greens and tees has been proposed in order to eliminate the use of pesticides on these areas. The use of carpet grass for the fairways, the rough and the driving range also makes pesticides unnecessary. Any foreign weeds will be eliminated mechanically during the mowing process.

#### 4.2 Fertilizers

Technical Memorandum on Effluent Standards sets standards for the discharge of effluent containing nutrients into streams and storm water drains which enter the sea at gazetted beaches and the North Western Water Control Zone. In view of the stringent standards which may apply to effluents in the form of rainfall permeation and surface runoff, a very common slow-released compound fertilizer, "Greensome" with 14% N, 11% P and 11% K, will be applied to the carpet grass. The chemical will be applied in pellet form to the grass once every two to four months at a rate of 5.0-7.5 Kg per 100 square metres. The exact dosage will depend on the fertility level of the soil and will be determined based on soil test results. The use of this fertilizer with low mobility and of a slow release nature ensures that the nutrients will be released gradually over an extended period of time, thus avoiding the need for frequent application and excessive leaching into the groundwater.

To control the spread of the chemical, only the fairways and the driving range will be applied with the fertilizer.

### 5.0 WATER QUALITY IMPACT ASSESSMENT

#### 5.1 Sensitive Receivers

Sensitive receivers include the streams running across the site and around the site limit, Tuen Mun Nullah, and the coastal waters off Tuen Mun including Butterfly Beach.

#### 5.2 Construction Impacts

The site for the riding school is well served by the existing storm and foul water drainage systems left behind by the old temporary housing. During the construction stage, the existing drainage will be retained to collect and dispose of rainfall. Toilet facilities will be provided for the labour force and the effluent will be drained to the existing foul water drainage system. As the work force will be no more than 60 labours, the existing drainage system should be sufficient to accommodate the flow.

The site formation work will be confined to at-grade preparation and as such there will not be any scope for major soil erosion which may eventually lead to siltation of the water courses nearby. The construction will not produce any harmful liquid effluent. Other than curing of concrete or washing down, little water will be used.

However, the work could lead to contamination of run-off waters which could have detrimental effects on the water quality in the stream courses during wet seasons, Tun Mun Nullah and Butterfly Beach. For example, the drainage from the work site and the unwanted surface water can become contaminated with some of the following :

- o washout from concrete mixing or ready-mixed deliveries,
- o soil and spoil,
- o fuel and oil spill,
- o construction chemicals.

However, in view of the small scale of construction involving low-rise buildings and single-storey stables, no water quality impacts are expected.

### 5.3 Operational Impacts

The main effluent source during the operation of the centre will be the sewage from the staff and the visitors. As storm and foul water drainage systems will be provided to the centre, no water quality impacts arising from sewage effluent are envisaged.

Given the high adsorption quality of the proposed fertilizer and the fast uptake rate of the chemical by the carpet grass, it is very unlikely that leaching of the chemicals will be significant. Application of fertilizer near the private pond bordering the site will be prevented by the erection of a fence around the pond. As usual, no fertilizing will be made prior to rainfall to avoid contaminating the surface run-off which will be collected in the open channels, and hence degrading the water quality in the coastal waters off Tuen Mun.

Surface waters running into the lagoon by the Tuen Mun Sewage Treatment Plant will be pumped to the Plant for treatment before discharge.

## 6.0 NOISE IMPACT ASSESSMENT

### 6.1 Sensitive Receivers

Noise sensitive receivers likely to be affected by construction noise and operation noise include some of the closest residents and schools to the site in Melody Garden, Siu Shan Court, Butterfly Garden, and New Tuen

Mun Centre to the east, dwellings close to the site boundary in Tsing Shan Tsuen to the north, dwellings in San Shek Wan San Tsuen and San Shek Wan San Tsuen Phase II although the latter are separated from the site by the natural topography and wooded areas. The most affected receivers are likely to be the few dwellings in Hung Lau which is adjacent to the vacated Pak Kok THA.

## 6.2 Construction Impacts

Construction activities associated with the proposed development could have a minor impact on the noise levels at the retained private lots and the schools and dwellings in the immediate neighbourhood of the site. Site formation and building construction using powered mechanical equipment and the associated construction traffic will generate noise.

Construction work will be carried out Monday to Saturday from 8 a.m. to 6 p.m. from late March 93 until November 1993. No work will be done on Public Holidays including Sundays.

Noise impact arising from the formation of the golf course is expected to be very minimal as the course will follow the existing topography and hence minimal cut and fill work will be required. It is expected that no more than two backhoes/ excavators will be required for the work. Dwellings at Tsing Shan Tsuen and San Shek Wan San Tsuen are screened from the site by the natural topography.

Construction of the riding facilities will be made on existing level platforms to reduce the need for extensive site formation. No heavy equipment will be used and no piling will be undertaken since the buildings will be founded on strip footings. Excavation will be confined to the strip footings for the buildings, the at-grade concrete slab and the drainage trenches.

A maximum number of three excavators and two lorries for removal of materials will be used on site and these will produce a total sound power level of about 120 dB(A). As the nearest dwellings at Melody Garden are over 200 m from the building work, it is estimated that the maximum facade noise level will be no more than 70 dB(A) Leq(5-min.). Because San Shek San Tsuen is over 400m from the building work and there is a natural barrier between the site and the village, the effect of any construction noise should be negligible.

Dwellings at Hung Lau are likely to be affected during the building construction. Noise mitigation may be required.

## 6.3 Operational Phase

The golf course is expected to generate minimal traffic since limited public parking will be provided. Rather, RSD will encourage access to the course

via public transport. Thus, increases in traffic noise levels due to site-generated traffic are expected to be insignificant.

Golf playing and the associated activities are relatively quiet and should have no impact on the background noise. Horses and ponies in the stable blocks are not expected to generate significant amounts of noise.

## **7.0 AIR QUALITY IMPACT ASSESSMENT**

### **7.1 Sensitive Receivers**

The same receivers as for noise above apply.

### **7.2 Construction Impacts**

Earth moving, material handling, excavation, vehicular movements over unpaved roads, and wind erosion of unprotected surfaces and unpaved ground during the construction of the golf course and the riding school could generate dust and increase the particulate level in air. Lorries removing materials off-site could release dust on the way if uncontrolled. However, given the scale of the construction work involved, no significant dust impacts are expected.

Other than dust, emissions from the construction equipment and lorries are insignificant.

### **7.3 Operational Impacts**

During the operation of the riding facilities, odour from the stable blocks could be a source of nuisance if uncontrolled. However, experience with RHKJC shows that no odour nuisance will be envisaged within about 10m from the stable blocks with the proposed management of horse manure and daily cleaning of horses and stables. As the area is well flushed by sea breeze and the nearest sensitive receivers are well over 200 m from the stable blocks, no odour impacts are envisaged. Hung Lau will be 50 m from the nearest stable block, and therefore odour nuisance should be very minimal.

## **8.0 ECOLOGICAL IMPACT ASSESSMENT**

### **8.1 Construction Impacts**

No direct impact on the terrestrial ecology is envisaged during the construction of the recreation centre as all woodlands will be well preserved and no trees will be felled. There might be indirect impacts such as the migration of some of the birds to other woodlands, re-

habitation of some small mammals, amphibians and reptiles temporarily outside the site because of the mechanical disturbance of the site. Also, there might be siltation of the stream courses during the wet seasons leading to the destroy of some of the common aquatic habitats e.g. pond skaters, damselfly and dragonfly larvas.

Fire hazard could be a problem during the construction phase. Uncontrolled burning of construction waste could devastate the woodlands.

## 8.2 Operational Impacts

Limited ecological impacts can be identified. Minor infiltration of the fertilizer into the stream may affect the nutrient level of the streams and the private ponds. However, it is very unlikely that the prescribed dosage would lead to eutrophic conditions in the streams.

Apart from this, the recreation centre should produce a positive impact on the terrestrial ecology as the development should promote if not contribute directly to the local biological diversity. The planting of more trees should attract more birds and bird species to migrate to the woodlands in the site.

## 9.0 MITIGATION MEASURES

### 9.1 General

Mitigation measures have been incorporated in the Master Layout Plan and the preliminary design in order to minimize any adverse environmental impacts. These are summarized in the following paragraphs together with additional recommendations :

### 9.2 Water

Appropriate control measures should be applied to run-off waters given the potential impacts on water quality during the construction stage.

In addition, control clauses as given in Appendix A should be included in the construction contracts requiring these measures to be carried out.

The operational impacts may arise mainly from the uncontrolled application of fertilizers. Stringent measures should be implemented to ensure safe use of these chemicals and minimal impacts on the water quality. Other measures which will be incorporated in the design include :

- o Cover the greens and tees with artificial turfgrass and the fairways, the rough and the driving range with carpet grass to eliminate the use of pesticides.



- o Apply "Greensome" at the proposed dosage rate and frequency of application to only the fairways and the driving range.
- o Install sub-soil drainage for the paddocks.
- o Remove foreign weeds by mechanical means.
- o Use sandy loam to loamy sand soil for topside.
- o Use well water for irrigation.

### 9.3 Noise

Noise mitigation for the few dwellings in Hung Lau is necessary. This could be in the form of proper site hoarding to screen off the site from the receivers during the construction period. In general, prolonged work near the site boundaries should be avoided and quiet equipment should be employed for construction.

In order to safeguard adequate noise control during construction, noise control clauses should be included in the construction contract. Relevant clauses for inclusion are included in Appendix B.

The stable blocks should incorporate suitable noise control measures in the design. Any openings facing Melody Garden should be as small as possible to contain noise.

### 9.4 Air Quality

Dust control should be implemented during the construction period. Where necessary, unpaved areas should be frequently damped to suppress dust emissions. Relevant dust control clauses as given in Appendix C should be included in the construction contract.

Good housekeeping should be enforced to ensure that the stables are clean.

### 9.5 Ecology

No further mitigation measure is needed given the design of the facility.

## 10.0 MONITORING REQUIREMENTS

### 10.1 Water Quality

The site should be inspected regularly to ensure that the drainage system is in good working condition.

A water quality monitoring programme should be implemented during the construction and operational phases where necessary to monitor the water quality of the stream courses and the ground water. Standards for effluent discharged into North Western Water Control Zone should be observed.

## 10.2 Noise

Construction noise should be monitored by an integrating sound level meter regularly to ensure that the noise level does not exceed 75 Leq(5-min) at the facade of the most affected sensitive receivers.

## 10.3 Air Quality

A dust monitoring programme should be implemented to ensure that the construction dust concentrations as measured at the site boundary by a High Volume Sampler do not exceed the Hong Kong Air Quality Objectives in respect of air borne dust when averaged over any 24 hour period.

## 11. RECOMMENDATIONS

- (a) The landform should be contoured such that the streams and the private ponds are uphill of all fertilized areas to avoid possible contamination.
- (b) Automatic irrigation system should be installed to prevent over-irrigation.
- (c) The use of the fertilizer should be under stringent control. For example, no fertilizer should be applied within 5m of the streams and the pond edge; only the minimal dosage of the fertilizer should be applied in wet seasons.
- (d) A mixed planting of fast growing deciduous trees and shrubs, e.g. *Hibiscus spp.*, *Bauhinia spp.*, *Erythrina spp.*, and the existing vegetation should be provided along the periphery of the fertilized area to intercept any transport of residual fertilizers to the streams and storm water drains.
- (e) The golf course should be managed by well-qualified personnel employed by RSD.

## 12.0

## CONCLUSION

In planning terms, Tuen Mun is in urgent need of a recreational centre which can provide a golf course and a horse-riding school for the general public. Golfing has been very popular in recent years; however, a public one is at present unavailable in Hong Kong. The proposed development aims to convert a piece of unsightly barren land into a well managed green area for recreational uses.

Golf courses can contribute positively to the environment by providing an additional source of oxygen and help redress the balance that is lost through urbanization. They absorb air pollutants and provide a haven for rare and endangered plant species, natural vegetation, insects, birds, small mammals and reptiles.

Given the careful and thorough design considerations proposed by the proponents, the minimal impacts of the recreation centre identified, and the implementation of appropriate mitigation measures and monitoring programmes, it can be concluded that the proposed development is environmentally acceptable.

REFERENCES

1. "Grasses & Sedges of Hong Kong", Urban Council Publication, 1983
2. "Marine Water Quality in Hong Kong", EPD, 1991 [unpublished]
3. "Microbiological Water Quality of Bathing Beaches", EPD, 1988.

APPENDIX

- A. CONTROL CLAUSES FOR WATER AND WASTE
- B. CONTROL CLAUSES FOR CONSTRUCTION NOISE
- C. CONTROL CLAUSES FOR CONSTRUCTION DUST

## APPENDIX A

### Removal of Waste Material

- a) The Contractor shall not permit any sewage, waste water or effluent containing sand, cement, silt or any other suspended or dissolved material to flow from the site onto any adjoining land, or allow any waste matter or refuse to be deposited anywhere within the site or onto any adjoining land, and shall have all such matter removed from the site.
- b) The Contractor shall be liable for any damages caused to adjoining land through his failure to comply with clause a).
- c) The Contractor shall be responsible for temporary draining, diverting or conduiting of open streams or drains intercepted by any works, and for reinstating these to their original courses on completion of the works.
- d) The Contractor shall be responsible for adequately maintaining any existing site drainage system at all times, including removal of solids in sand traps, manholes and stream beds.
- e) Any proposed stream course or nullah temporary diversions shall be submitted to the Engineer for agreement one month prior to the commencement of such diversion works. Diversions shall be constructed to allow the water flow to discharge without overflow, erosion or washout. The area through which the temporary diversion runs is to be reinstated to its original condition, or as agreed by the Engineer, after the permanent drainage system has been completed.
- f) The Contractor shall furnish, for the Engineer's information, particulars of the Contractor's arrangements for ensuring that material from any earthworks does not wash into the drainage system. If at any time such arrangements prove to be ineffective, the Contractor shall take such additional measures as the Engineer shall deem necessary and shall remove all silt which may have accumulated in the drainage system, whether within the site or not.
- g) The Contractor shall segregate all inert construction waste material suitable for reclamation or land formation, and shall dispose of such material at such public dumping area(s) as may be specified from time to time by the Director of Civil Engineering Services.
- h) All non-inert construction waste material deemed unsuitable for reclamation or land formation, and all other waste material, shall be disposed of at a public landfill.
- i) The Contractor's attention is drawn to the Waste Disposal Ordinance, the Public Health and Municipal Services Ordinance, and the Water Pollution Control Ordinance.

Discharge into Sewers and Drains

- a) The Contractor shall not discharge directly or indirectly (by runoff) or cause or permit or suffer to be discharged into any public sewer, storm-water drain, channel, stream-course or sea any effluent or foul or contaminated water or cooling or hot water without the prior consent of the Engineer, who may require the Contractor to provide, operate and maintain at the Contractor's own expense, within the premises or otherwise, suitable works for the treatment and disposal of such effluent or foul or contaminated or cooling or hot water. The design of such treatment works shall be submitted to the Engineer for approval not less than one month prior to the commencement of construction or as agreed by the Engineer.
- b) If any office, site canteen, or toilet facility is erected, foul water effluent shall be directed to a foul sewer or to a sewage either directly or indirectly by means of pumping treatment facility.
- c) The Contractor's attention is drawn to the Buildings Ordinance and to the Water Pollution Control Ordinance.

Prevention of Erosion

- a) Sections of permanent cut slope excavation at final cut face grade larger than 100 sq.m. shall be hydroseeded within one week of completion or as agreed by the Engineer.

## A P P E N D I X B

### Recommended Noise Pollution Control Clauses

1. In addition to the requirements imposed by the Noise Control Ordinance 1988, the following requirements shall also be complied with:

a. The noise level generated from equipment and tools used in any construction operations, when measured at 1m from the closest external facade of the nearby noise sensitive receivers during any 30 minute period, shall not exceed an equivalent sound level ( $L_{eq}$ ) of 75 dB(A).

b. During school examination periods, the  $L_{eq}$  noise level measured over any 30 minute period due to the Contractor's equipment and construction operations shall not exceed 65 dB(A), as measured at 1m from the closest external facade of the school.

The Contractor shall liaise with schools and the Examination Authority to ascertain the exact dates and times of all examination periods during the course of the contract.

c. Should the limits stated in the above sub-clauses (a) and (b) be exceeded, the construction operation(s) causing the excesses shall stop and shall not recommence until the Contractor has taken whatever measures acceptable to the Engineer that are necessary for compliance.

Any stoppage or reduction in output resulting from compliance with this clause shall not entitle the Contractor to any extension of time for completion or to any additional costs whatsoever.

d. Notwithstanding the requirements and limitations set out in (c) above, the Engineer may, upon application in writing by the Contractor, allow the use of any equipment and the carrying out of any construction activities for any duration provided that he is satisfied with application which, in his opinion, to be of absolute necessity or of emergency nature, or adequate noise insulation has been provided to the noise sensitive receivers to be affected, and not in contravention with the Noise Control Ordinance in any respect.

e. For the purposes of the above clauses, any domestic premises, hotels, hostel, temporary housing accommodation, hospital, medical clinic, educational institution, place of public worship, library, court of law, or performing arts centre shall be considered a noise sensitive receiver.



## Recommended Pollution Control Clauses

### Noise from Equipment

1. a) The Contractor's attention is drawn to the Summary Offences Ordinance and to the Noise Control Ordinance 1988.
- b) Before the commencement of any work, the Contractor shall submit for the Engineer's agreement the proposed sound-reducing measures for all plant and equipment to be used on the Site.
- c) The Contractor shall ensure that all plant and equipment to be used on the site shall be effectively sound-reduced by means of silencers, mufflers, acoustic linings or shields, acoustic sheds or screens or other means, to avoid disturbance to any nearby noise sensitive receivers. Measured sound levels from 0700 to 1900 hours on any day not being a general holiday shall not exceed an equivalent continuous A-weighted sound level ( $L_{eq}$ ) of 75 dB(A) measured over any 5-minute period at 1 metre from the external facade of the nearest noise sensitive receiver. Any works causing excessive noise, e.g., operation of jack hammers, may be prohibited notwithstanding the above mentioned noise level restriction.
- d) The Contractor shall make available an approved integrating sound level meter, to IEC 804:1985 or BS6698:1986 Type 1, for the exclusive use of the Engineer at all times during the duration of the Contract. The meter shall be maintained by the Contractor in proper working order throughout the Contract.
- e) If the sound level from 0700 to 1900 hours on any day not being a general holiday, from the Contractor's machines or his construction process, measured at 1 metre from the external facade of the nearest noise sensitive receiver, exceeds an equivalent continuous A-weighted sound level ( $L_{eq}$ ) of 75 dB(A) measured over any 5-minute period, then the construction operation shall stop, and shall not recommence until effective quietening means have been employed or the machines have been replaced by quieter models which will reduce the sound to a level not exceeding the above limit. Any stoppage which may be ordered by the Engineer on account of failure to comply with this Clause will not entitle the Contractor to any extension of time for completion or any compensation whatsoever.
- f) The only equipment that shall be allowed on the Site of drilling holes for excavation works will be hydraulically-driven drilling rigs with dust collection equipment. Pneumatically driven drilling rigs are specifically prohibited.
- g) If a school is in close proximity to site, the Contractor shall liaise with school authorities to determine when examinations will be in progress. The Contractor shall then programme the works to minimise disruption to the schools during examination periods. Rock drilling and rock breaking works will not be permitted during public examination periods.
- h) Measures that are to be taken to protect adjacent schools and other adjacent noise sensitive receivers shall include, but shall not be limited to, the following:
  - (i) *Adequate noise barriers:* The barriers shall be of substantial construction and designed to reduce transmission of noise; simple plywood hoarding will not be sufficient for this purpose. The barriers shall be surmounted with baffle boxes designed to reduce transmission of noise. The barriers shall be designed to BS5228: 1984. The location and details of the barriers shall be submitted to the Engineer for approval before works commence adjacent to schools and other occupied buildings.

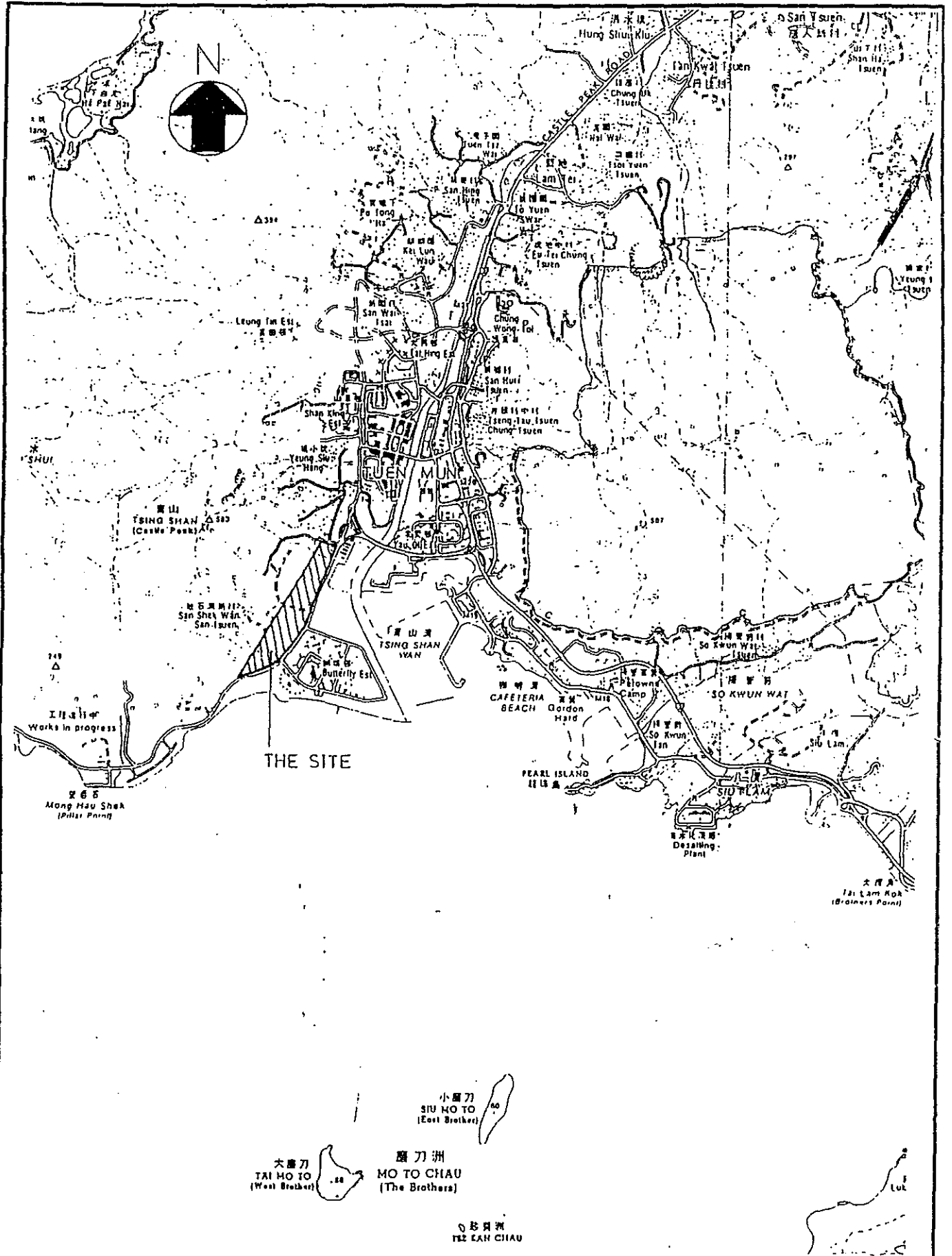
- (ii) *Location of Unused or Excavated Material:* The Contractor is required to submit the proposed method of working to the Engineer before commencing any excavation works. The method of working shall be designed, as far as is practicable, to ensure that a bund of material is located between the works and any schools and other occupied buildings in order to block transmission of noise.
  
- i) *Proper Maintenance of Silenced Equipment:* The Contractor shall take reasonable precautions as instructed by the Engineer, to maintain all plant and silencing equipment in good condition in order to minimize noise emission during construction works.

## A P P E N D I X C


### Dust Suppression Measures

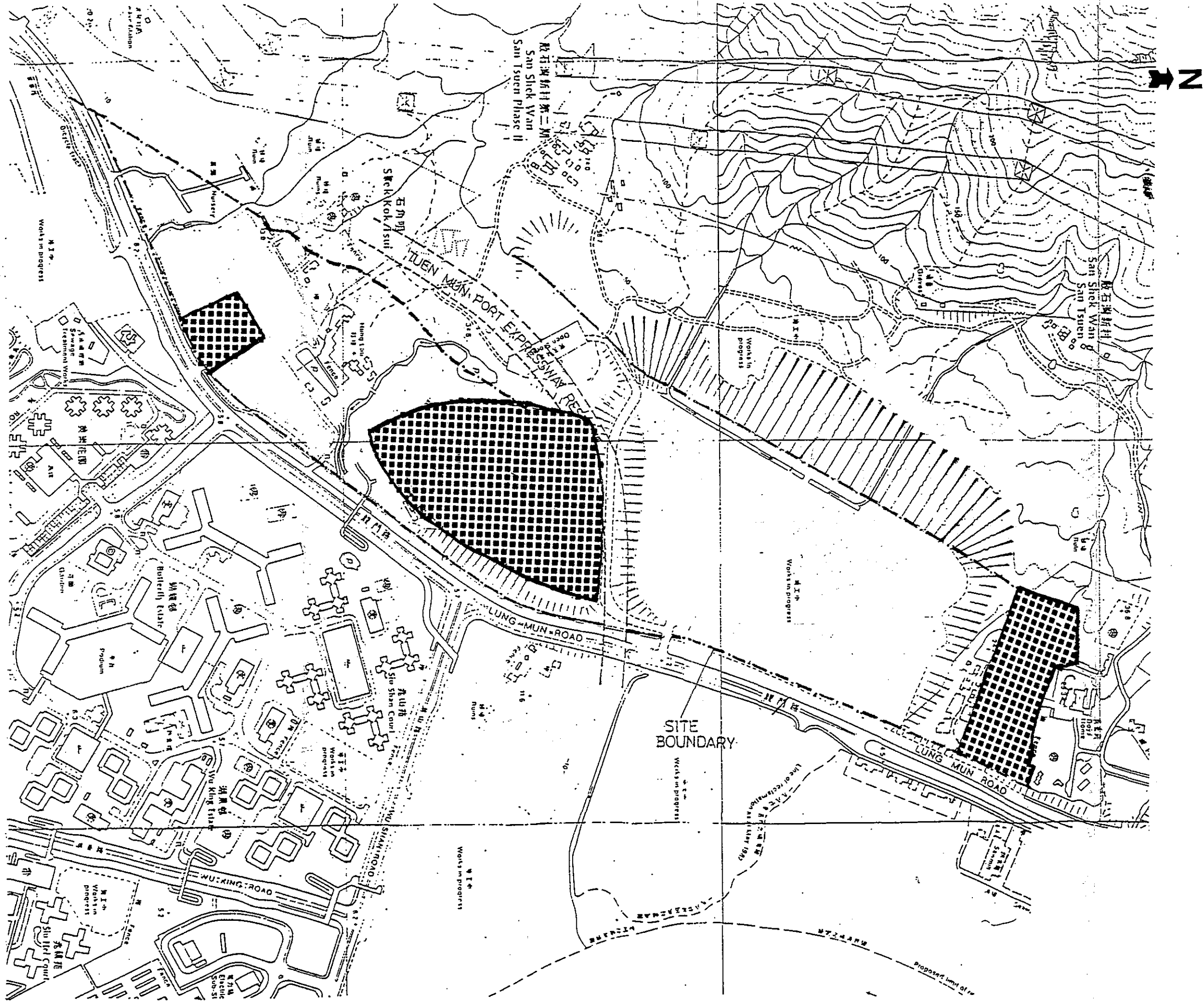
- a) The Contractor shall undertake at all times to prevent dust nuisance as a result of his activities. The air pollution control system installed shall be operated whenever the plant is in operation.
- b) The Contractor shall at his own cost and to the satisfaction of the Engineer install effective dust suppression equipment and take such other measures as may be necessary to ensure that at the Site boundary and any nearby sensitive receiver the concentration of air-borne dust shall not exceed 0.5 milligrams per cubic meter, at standard temperature (25°C) and pressure (1.0 per bar) averaged over one hour, and 0.26 milligrams per cubic metre, at standard temperature (25°C) and pressure (1.0 bar) averaged over 24 hours.
- c) In the process of material handling, any material which has the potential to create dust shall be treated with water or wetting agent sprays.
- d) Where dusty materials are being discharged to a vehicle from a conveying system at a fixed transfer point, a three-sided roofed enclosure with flexible curtain across the entry shall be provided. Exhaust should be provided for this enclosure and vented to a fabric filter system.
- e) Any vehicle with an open load-carrying area used for moving materials, and having the potential to create dust, shall have properly fitting side and tail boards. Materials having the potential to create dust shall not be loaded to a level higher than the side and tail boards, and shall be covered by a clean tarpaulin. The tarpaulin shall be properly secured and shall extend at least 300mm over the edges of the side and tail boards.
- f) Stockpiles of sand and aggregate greater than 20m<sup>3</sup> shall be enclosed on three sides, with walls extending above the pile and 2 metres beyond the front of the pile. In addition, water sprays shall be provided and used, both to dampen stored materials and when receiving raw material.
- g) The Contractor shall frequently clean and water the site to minimize the fugitive dust emissions.
- h) The Contractor shall restrict all motorized vehicles to a maximum speed of 8 km per hour and confine haulage and delivery vehicles to designated roadways inside the site. Areas of roadway longer than 100 m where movement of motorized vehicles exceeds 100 vehicular movements/day, or as directed by the Engineer, shall be furnished with a flexible pavement surfacing.
- i) Wheel washing facilities shall be installed and used by all vehicles leaving the site. No earth, mud, debris, dust and the like shall be deposited on public roads. Water in the wheel cleaning facility shall be changed at frequent intervals and sediments shall be removed regularly. The Contractor shall submit details of proposals for the wheel cleaning facilities to the Engineer prior to construction of the facility. The wheel washing facility shall be usable prior to the start of any earthworks excavation activity on the site. The Contractor shall also provide a hard-surfaced road between the washing facility and the public road.
- j) Conveyor belts shall be fitted with windboards, and conveyor transfer points and hopper discharge areas shall be enclosed to minimize emission of dust. All conveyors carrying materials which have the potential to create dust shall be totally enclosed and fitted with belt cleaners.

- k) Cement or pulverised fuel ash delivered in bulk shall be stored in closed silos fitted with a high level alarm indicator. The high level alarm indicators shall be interlocked with the filling line such that in the event of the hopper approaching an overfull condition, an audible alarm will operate, and after 1 minute the pneumatic line to the filling tanker will close.
- l) All air vents on cement silos shall be fitted with fabric filters provided with either shaking or pulse-air cleaning mechanisms. The fabric filter area shall be determined using the air to cloth ratio (0.01-0.03 m/s) or the filtering velocity.
- m) Weigh hoppers shall be vented to a suitable filter.
- n) The filter bags in the cement silo dust collector must be thoroughly shaken after cement is blown into the silo to ensure adequate dust collection for subsequent loading.
- o) Dry mix batching should be done inside a total enclosure, with exhaust to a fabric filter.
- p) All cement and concrete trucks are to be effectively washed down after loading and prior to leaving the worksite.
- q) The Contractor shall provide and operate two high volume air samplers and associated equipment and shelters in accordance with the USA standard Title 40, Code of Federal Regulations, Chapter 1 (part 50), Appendix B. Sampling shall be carried out 1 day in every 6 days at ten sampling points on the Site boundary for such periods and in a manner as instructed by the Engineer. The samplers, equipment and shelters shall be constructed so as to be transferable between sampling points to enable monitoring of "dust in air" levels at any sampling point required by the Engineer. The Contractor shall provide all necessary protection fences and the like at sampling points. Testing and analysis of sampled materials shall be carried out by a laboratory approved by the Engineer.




SCALE 1: 50 000

Project Proposed Recreational Facilities at Areas 19 & 45, Tuen Mun	Figure 1	Title Site Location
		



Revision      Date      Details

 Existing Trees

Drawn By	Date
Scale 1 : 5000	Date
Approved By	Drg No. 3

Title  
Distribution of Existing Trees

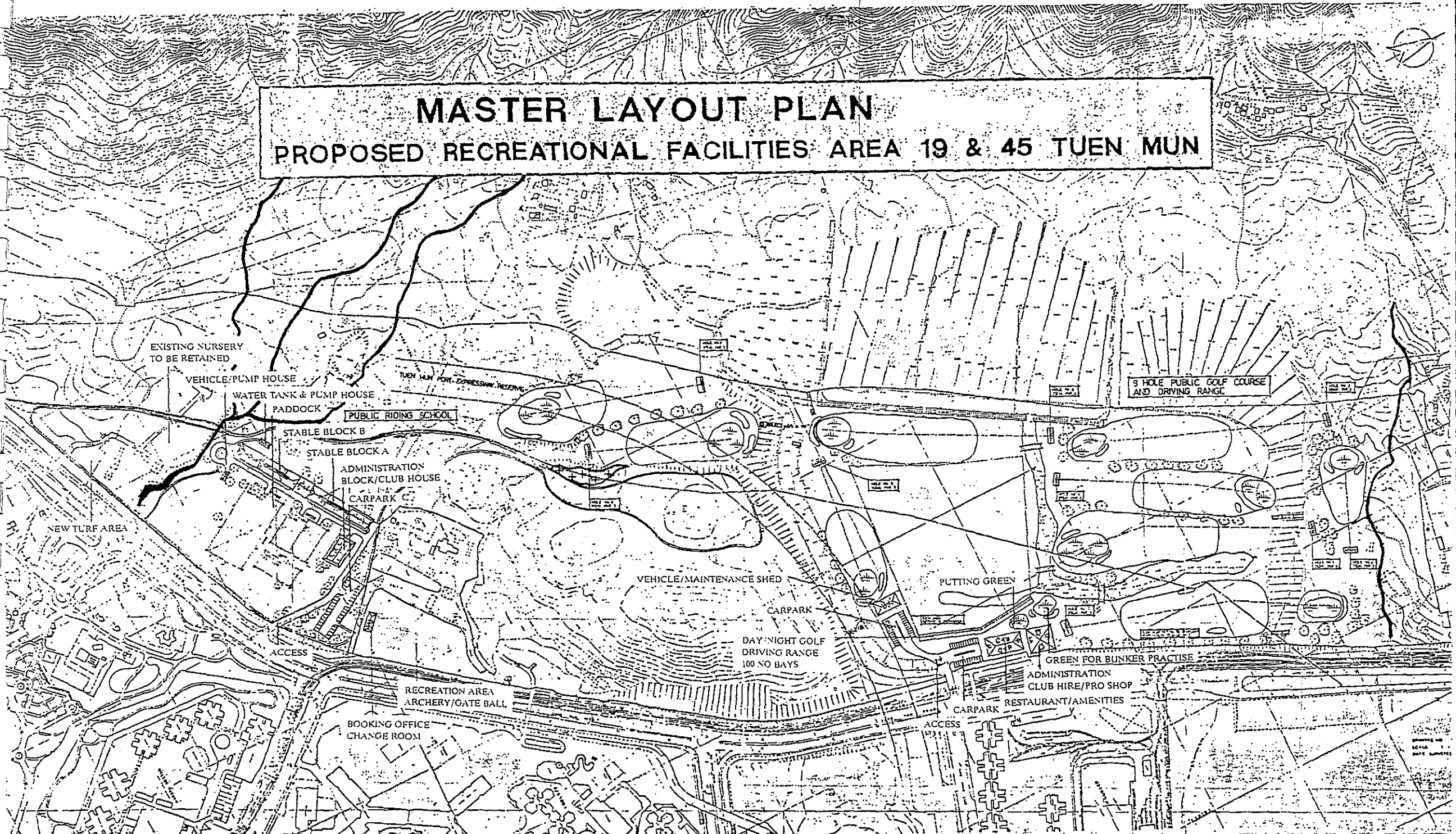
Project  
Proposed Recreational Facilities at 19 & 45 Tuen Mun

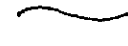
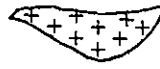





Environmental Assessment & Pollution Control

# MASTER LAYOUT PLAN

## PROPOSED RECREATIONAL FACILITIES AREA 19 & 45 TUEN MUN



Revision	Date	Details
		 Stream
		 Private Pond
		 Green
		 Tee
		 New Planting

Drawn By	Date
Scale	Date
Approved By	Drg No. 2

Title  
Layout of Proposed Recreational Facilities

Project  
Proposed Recreational Facilities at Areas 19 & 45 Tuen Mun

