PROJECT PROFILE
工程項目簡介

FLAG Telecom Asia Limited

FLAG North Asian Loop
FLAG 北亞光纖環系統

28 March 2001
二零零一年三月廿八日

For and on behalf of 代表 Environmental Resources Management 香港環境資源管理顧問有限公司	
Approved by: 批核 ：	_____
	Dr Andrew Jackson 簡信安 博士
Position: 職位 ：	Managing Director 事總經理
Date: 日期 ：	28 March 2001 二零零一年三月廿八日

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1 BASIC INFORMATION

1.1 PROJECT TITLE

FLAG North Asian Loop

1.2 PURPOSE AND NATURE OF THE PROJECT

FLAG Telecom Asia Limited (FLAG) is developing network systems to meet the growing demand for international communications services and to provide over 90 international carriers and Internet Service Providers with a world-class broadband superhighway. To increase broadband facilities for accessing application service providers and Internet Service Providers in the Hong Kong Special Administrative Region (HKSAR), the company plans to install a submarine fibre optic telecommunications cable system called the FLAG North Asian Loop (FNAL). FNAL will connect the HKSAR with South Korea. The proposed cable network will facilitate network communications and ultimately enhance the HKSAR's capability as a communications and service centre in Asia.

FLAG proposes to land the cable at Tong Fuk, South Lantau Coast, Hong Kong. There are already several other submarine cables landing at the site which would tend to indicate that the cable installation work would result in no insurmountable impacts to the local environment.

This Project Profile includes an assessment of the potential environmental impacts associated with the installation of the submarine telecommunications cable system. The assessment has been based on information compiled by the Project Proponent describing the construction activities. Once installed, the cable will not result in any impact to the environment during its operation.

1.3 NAME OF PROJECT PROPONENT

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1.4 LOCATION AND SCALE OF PROJECT

1.4.1 Location

The cable landing site will be on Lot 591 SA in DD 328, Tong Fuk, South Lantau Island, situated near the coast of Tong Fuk Miu Wan (see *Figure 1.4a*). The proposed cable route starts from Tong Fuk and extends southward beyond the Hong Kong SAR boundary and enters the South China Sea (see *Figure 1.4b*).

1.4.2 Scale of Project

The project involves the installation of the FNAL, with an intended burial depth of not less than 3 m, starting due south of the landfall at Tong Fuk and extending to the edge of Hong Kong SAR waters. The total length of the cable in Hong Kong SAR waters is approximately 10 km.

The cable laying process will only require minor works within the marine environment which will not adversely affect water quality or the marine ecology of the area. Only small scale construction works are required at the cable landing site to enable the cable to enter the existing manhole system.

1.4.3 Marine Route Planning Considerations

There are some existing physical constraints to the FNAL cable route, which have confined the alignment of the cable to a narrow corridor (*Figure 1.4c*). The following constraints have been avoided, as far as practicable.

- Multiple crossings with other submarine cables situated along the proposed FNAL cable route, thereby ensuring that cable laying operations do not compromise the integrity of other cable systems.
- The horseshoe crab nursery sandflat at Shui Hau Wan, South Lantau.
- The gazetted bathing beaches on the southern coast of Lantau Island.
- The gazetted open seafloor disposal facility for uncontaminated dredged material located to the south of Cheung Chau.

1.5 DESIGNATED PROJECTS TO BE COVERED BY THE PROJECT PROFILE

This Project Profile covers one classification of a Designated Project under the *Technical Memorandum on Environmental Impact Assessment Process (TM-EIAO)*:

- Schedule 2 (Part I), C.12 - A dredging operation which is less than 500 metres from the nearest boundary of a Coastal Protection Area.

1.6 NAME AND TELEPHONE NUMBER OF CONTACT PERSON

Environmental Resources Management (ERM) has been appointed by FLAG to undertake the environmental permitting for this Project.

All queries regarding the project can be addressed to:

2 OUTLINE OF PLANNING AND IMPLEMENTATION PROGRAMME

2.1 PROJECT PLANNING AND IMPLEMENTATION

The project will be led and managed by FLAG Telecom Asia Limited. Planning and construction of the submarine cable system will be undertaken by Alcatel Submarine Networks on behalf of FLAG Telecom Asia Limited.

The Project will be constructed in the following stages:

- ***Submarine Cable Laying:*** Most of the marine cable burial works will be conducted using the injection jetting technique. This method uses an "injector" which is designed to simultaneously lay and bury the cable (*Figure 2.1a*). With a diver in the water to ensure proper functioning and positioning, the injector is lowered to the seabed. Once the diver confirms that the injector and the cable are in the right position, the cable laying and burial commences simultaneously.

  The cable is to be buried for the majority of the route at approximately -5 m below the seabed. Burial depth at the approach to the landing point will be approximately -3 m below the seabed. Cable burial in the nearshore area will be undertaken by divers using jet probes to sink the cable into the sediment. There are no cable crossings along the proposed FNAL route.

- ***Shore-end Cable Laying:*** The shore-end section (ie from approximately 175 m offshore to the beach manhole) will be installed by directional drilling. A steel conduit (of 13.5 cm in diameter) will be directionally bored seaward from the beach manhole to approximately 175 m offshore beyond the cable landing point. Although the drilling could potentially cause turbidity disturbance to the seabed, the impact is expected to be of small scale and transient and thus, unlikely to pose adverse impacts to the marine environment. In addition, appropriate precautions will be taken to prevent the escape of drilling fluid through the walls of the borehole to the seabed, the drilling operations will be continuously monitored. The directional drilling technique is considered to be preferable to the traditional trenching method of shore end operation at this particular site.

- ***Post Lay Inspection:*** Post lay inspection will be conducted to ensure that the cable has been properly buried. Offshore inspection will be undertaken by a remote controlled burial vehicle (ROV) and nearshore inspection will be conducted manually by divers.

All nearshore and onshore installation works are expected to be undertaken during normal working hours. If evening or night-time works are later found to be necessary, a Construction Noise Permit (CNP) will be applied for.

2.2 PROJECT PROGRAMME

The FLAG North Asian Loop submarine cable system is provisionally scheduled to be landed and installed at Tong Fuk in October 2001. The expected construction schedule within Hong Kong waters is as follows:

Cable Landing at Tong Fuk	3 days
Cable Laying	7 days
Post Lay Inspection	7 days

3 MAJOR ELEMENTS OF THE SURROUNDING ENVIRONMENT

The various major elements of the area surrounding the site are shown in *Figure 3.0a*.

3.1 COASTAL PROTECTION AREA

The FNAL cable route is proposed to land at Tong Fuk, which is within a Coastal Protection Area (CPA). The CPA zone covers virtually all the area between the sea and the South Lantau Road from Cheung Sha to Tong Fuk. As stipulated in the Explanatory Statements attached to the statutory notes for the CPA, the intention of such zoning is "t*o protect the natural character of the shore-line, to safeguard the beaches and their immediate hinterland, and to prevent ribbon development in a haphazard manner along the South Lantau Coast*". It should be noted that the CPA zone allows uses such as telecommunications cables and that such systems are already in place and in operation in this area.

3.2 GAZETTED BATHING BEACHES

There are four gazetted bathing beaches along the coast at South Lantau at varying distances from the project site. The closest beach to the landing site is the Tong Fuk beach which is about 500 m to the east. Further away still are the beaches at Cheung Sha Upper, Cheung Sha Lower and Pui O, which are all more than 1,000 m away from the landing site.

3.3 SHUI HAU INTERTIDAL FLATS

The sand flats at Shui Hau are well-protected from strong oceanic waves and occupy an area of ~0.2 km^2. The soft, sheltered, nature of the intertidal flats, together with the accumulation of organic detritus, have encouraged a rich diversity of inhabitants. The area is fairly remote, being far from urbanised areas and recreational beaches. The environment is relatively intact and free from pollution and the area is only occasionally visited by study groups and tourists. The sand flats are of high conservation interest as they represent one of the few known nursery areas for the endangered horseshoe crab. The eastern edge of the Shui Hau sand flats is over 700 m from the landing site.

3.4 HUNG SHING TEMPLE

The historic Hung Shing Temple, on Lot 591 RP, to the south of the beach manhole was established in 1802, later rebuilt in 1965 and refurbished in 1990. The temple is still active and is popular with local people worshipping "Hung Shing Yeh". The building itself is in the 1999 survey record of the Antiquities and Monument Office, awaiting assessment on grading by the Antiquity Advisory Board. Although the Temple is neither a Declared nor Graded

monument, its long history and significance to the local community is acknowledged.

3.5 LEVEL (3) COMMUNICATIONS SUBMARINE CABLE LANDING STATION

The Level (3) Communications submarine cable landing station is on Lot 591SA in DD 328 and is located near the coast of Tong Fuk Miu Wan. The landing station is expected to be in service in the first half of 2001. The station will comprise a 2-storey, rectangular shaped building, with a floor area of about 2,246 m^2 on a site area of 2,428 m^2. It will contain telecommunications equipment for submarine cable landing, workshops, cable stores, staff facilities, pump rooms and a sprinkler tank. There is an open area for vehicular circulation, parking and landscaping. The section of paved road from this cable station to the intersection with the South Lantau Road has been upgraded to a width of approximately 4.5 m for emergency vehicular access. The FNAL cable will enter the beach manhole (see *Figure 1.4a*) and be linked to the Level (3) Communications submarine cable landing station.

4 POSSIBLE IMPACTS ON THE ENVIRONMENT

4.1 SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS

The construction impacts associated with the proposed FNAL cable system are summarised in *Table 4.1a* and are described in further detail in the following *Sections*. There are no environmental impacts that are expected to occur during the operation of the submarine cable system.

Table 4.1a Potential Sources of Environmental Impacts

Potential Impact	
• Liquid Effluents, Discharges, or Contaminated Runoff	×
• Generation of Waste or By-products	×
• Disruption of Water Movement or Bottom Sediment	✓
• Unsightly Visual Appearance	×
• Cultural & Heritage	✓
• Ecological Impacts:	
- Terrestrial	×
- Marine	✓
- Fisheries	✓
• Dust	×
• Noise	✓
• Gaseous Emissions	×
• Odour	×
• Night-time Operations	×
• Traffic Generation	×
• Manufacturing, Storage, Use, Handling, Transport, or Disposal of Dangerous Goods	×
• Hazardous Materials or Wastes	×
• Risk of Accidents Which Result in Pollution or Hazard	×
• Disposal of Spoil Material, Including Potentially Contaminated Materials	×

Notes: ✓ = Potential to result in adverse impacts, × = Not expected to result in adverse impacts

4.2 WATER QUALITY

The potential for impacts to water quality during the land-based cable installation activities primarily relate to surface water run-off. However the following measures will be incorporated into the land based construction activities to prevent any adverse impacts to water quality.

- stockpiles of materials will be covered with tarpaulin or similar fabric to minimise runoff during the rainy season;

- care will be taken during the cable landing and construction to avoid any spillage of materials to the adjacent marine waters and to ensure that spoil materials are not discharged into adjacent waters; and
- all construction waste will be handled and disposed of in accordance with the *Waste Disposal Ordinance*.

The above measures will be sufficient to prevent adverse impacts to water quality during the shore-based cable installation activities. Therefore, there are no predicted adverse impacts (either direct or indirect) to water quality from these activities.

The marine based construction activities involve burying the cables below the existing sea bed. The cable will be buried to at least 3 m using a barge mounted injection tool. This burial depth is necessary to provide protection to the cable. The injection jetting tool utilises water injection technology to fluidise the sediments, which enables the tool to penetrate the sea bed to the desired depth and so to lay the cable. The cable is expected to be installed over a 17 day period. The maximum speed during cable laying will be approximately 1 km $hour^{-1}$.

Cable laying will result in the formation of an area of high suspended sediment concentrations around the injection tool, which will remain close to the seabed and settle out quickly. The sediment disturbed during cable laying will remain in suspension for a very short period of time, and hence the potential for the release of any contaminants from sediments and exertion of an oxygen demand on the receiving waters will be limited and are not expected to cause adverse impacts to water quality.

Analysis of the potential transport of fine sediments suspended in the water column was undertaken and it was determined that the sediments would settle onto the sea bed in less than 3 minutes. The maximum distance of transport for the suspended sediments would be 64.5 m (see *Annex A*).

Although directional drilling could potentially cause turbidity disturbance to the seabed, the impact is expected to be of small scale and transient. Appropriate precautions, such as casing the boring equipment in some areas, will be taken to prevent the escape of drilling fluid through the walls of the borehole to the seabed. In addition, the drilling operations will be continuously monitored to ensure that these precautions are effective. Escape of fluid will be indicated by a sudden loss of pressure in the drilling fluid and / or by a sudden loss in the return fluid flow, both of which are monitored at the rig. A person in a vessel will be stationed along the drill route during drilling operations to assist with the detection of any fluid escape. Therefore, unacceptable impacts to the marine environment as a result of the drilling operations are not anticipated.

No long term disruption of bottom sediment will occur and no disruptions to water movement will result from this Project. No adverse impacts to water quality will occur during or after the marine works.

The operation of the cable will not result in any pollutant emissions into the surrounding waters.

4.3 DISRUPTION OF WATER MOVEMENT OR BOTTOM SEDIMENT

There will be small scale temporary displacement of bottom sediment during the laying of the FNAL cable using the injection tool. Once the cable is installed, the bottom sediment will naturally resettle.

4.4 MARINE ECOLOGY

A review of the existing information on the marine ecological resources surrounding the cable route has identified the area as supporting benthic fauna which are of low ecological value (see *Annex B*). Although these soft bottom assemblages will be disturbed during the cable laying works, the area of disturbance is small and rapid reinstatement of the seabed will result in the area being available for prompt recolonisation, and hence, no permanent impacts are likely to occur.

Intertidal rocky or sandy habitats in the vicinity of the landing site have been classified as typical of Hong Kong intertidal habitats and are considered to be of low to medium ecological value (see *Annex B*). The intertidal mudflats at Shiu Hau Wan are known to be a breeding / nursery habitat for the locally threatened horseshoe crabs and they are located over 700 m west of the proposed cable route (see *Figure 1.4c*). Unacceptable impacts to these intertidal habitats as a result of the proposed cable installation works are not anticipated.

No coral communities of ecological importance have been identified along the cable route or in the vicinity of the cable landing site (see *Annex B*). Coral assemblages of medium abundance / diversity have been identified on Siu A Chau which is over 1,400 m from the proposed cable route (see *Figure 1.4c*). The coral communities are considered to be at a sufficient distance from the alignment of the cables to indicate that impacts will not occur (see *Annexes A* and *B*).

It is unlikely that the South Lantau waters which the proposed cable passes through are critical habitats for either the Finless Porpoise or the Indo-Pacific Hump-backed Dolphin species, as the number of sightings recorded in these waters is low (see *Annex B*). Based on this, and the predicted localised and very short term impacts to water quality, no impacts are predicted to occur to marine mammals.

As there are no unacceptable impacts predicted to occur to marine ecological resources, no mitigation measures are recommended other than those proposed to minimise potential impacts to water quality.

4.5 FISHERIES

A review of the existing information on the fisheries resources and fishing operations surrounding the cable route has identified the area as supporting a fishery of medium ranking in terms of fisheries production. Suspended sediment concentrations in the immediate vicinity of the injection tool will be low and transient and is therefore not expected to result in any unacceptable impacts to water quality and subsequently fisheries resources or fishing operations (see *Annex C*). There are no AFCD gazetted Fish Culture Zones within the vicinity of the proposed route. No specific mitigation measures have been recommended as no impacts to fisheries resources have been identified.

4.6 NOISE

During the construction phase, powered mechanical equipment will be required for installing the shore end of the cable by directional drilling which may generate noise impacts at sensitive receivers. Construction noise impacts may only affect the Hung Shing Temple which is approximately 60 m from the work site. However, based on the noise assessment conducted for the proposed drilling works at Tong Fuk (see *Annex D*), no adverse noise impacts to the temple are anticipated.

It is expected that no excessive noise will be generated during the underground drilling work for the cable installation. Cable laying and burial is at present not expected to take place at night. If evening or night-time works are later found to be necessary, a Construction Noise Permit (CNP) will be applied for.

4.7 CULTURAL AND HERITAGE

As the Hung Shing Temple is over 60 m from the cable landing site, adverse impacts on cultural heritage resources as a result of the proposed installation works are not expected.

The proposed landing method will only have a minimal impact on the top layer of seabed sediments. As no debris have been identified in the survey corridor of the FNAL cable route, based on the results from various previous geophysical surveys conducted in the area, no impacts to marine archaeological resources are expected.

4.8 OTHERS

Terrestrial Ecology: No impacts to terrestrial ecology will arise from the construction and operation of the submarine cable.

Dust: There will not be significant dust impacts during construction because the cable will be connected from the shore-end landing point to the station via underground directional drilling from the station manhole. Hence no dust impact assessment is considered necessary.

Waste Management: During the cable landing work, the materials excavated during drilling will be used for *in-situ* backfilling and therefore no waste material for disposal will be generated at the site.

Landscape and Visual: Since the cable conduit is drilled under the sea-shore and the submarine cable is buried in the seabed, it will not cause any visual obstruction or inconvenience to the public.

Gaseous Emissions: Only a small amount of gaseous emissions (SO_2 and NO_x) from diesel-powered equipment for directional drilling works and barge would be generated during construction of the submarine cable and will therefore not impact Air Sensitive Receivers. No gaseous emissions will be generated during the operation of the submarine cable system FNAL.

Odour: No odour impacts are expected during either the construction or operation phases of the proposed project.

Traffic Generation: Very little traffic generation is expected during the construction phase and minimal traffic generation is envisaged during the operation phase of the proposed project.

Dangerous Goods: No dangerous goods will be involved in this project in either the construction or operation phases.

Night-time Operations: It is expected that all cable laying and burial work will be performed during normal working hours. If works are proposed during the evening or night-time hours, a Construction Noise Permit will be applied for.

Hazardous Materials or Wastes: No hazardous materials or wastes are expected from the construction or operation of the proposed project.

Risk of Accidents Resulting in Pollution or Hazard: No pollution or hazard generating accidents are expected during either the construction or operation phases.

Disposal of Spoil or Contaminated Material: As the materials excavated during drilling operations will be used for *in-situ* backfilling, no disposal of spoil or contaminated materials is expected. Hence, related impacts are not anticipated during either the construction or operation phases of the proposed project.

5 PROTECTION MEASURES AND ANY FURTHER IMPLICATIONS

5.1 POSSIBLE SEVERITY, DISTRIBUTION AND DURATION OF ENVIRONMENTAL EFFECTS

The installation of the submarine cable system in Hong Kong SAR waters is expected to take approximately 17 days. The residual environmental impacts of the works activities are predicted to be localised to the immediate vicinity of the cable alignment, of low severity and acceptable.

No environmental impacts are predicted during the operation of the submarine cable.

5.2 CUMULATIVE IMPACTS

There are a number of concurrent projects within the Western Harbour area that will be undertaken during the laying of the submarine cables. These projects include: reclamation works at Penny's Bay and Container Terminal 9; disposal of uncontaminated mud at the South Cheung Chau Disposal Area. The sediment disturbed during cable laying will remain close to the sea bed, and is predicted to remain in suspension for less than 3 minutes. Any sediment was predicted to settle onto the sea bed within approximately 65 m of the cable route (see *Annex A*). No cumulative impacts are predicted to occur with other concurrent projects.

5.3 FURTHER IMPLICATIONS

As Tong Fuk is already the landing site of a number of submarine cable systems, the geotechnical environment at the proposed landing point is considered to be suitable for submarine cable installation. The site has already been used for other systems and there has been no record of complaint or incident that indicates adverse effects to the surrounding environment from the installation or operation of the submarine cables.

The methods used for burying the FNAL, as described above, have been used around the world for more than one century and are widely accepted to have no impact on the surrounding environment. The working period is normally very short and no waste or contaminant disposal issues or excessive noise will be generated by such an operation.

5.4 USE OF PREVIOUSLY APPROVED EIA REPORTS

Tong Fuk is already the landing site of four submarine cable systems, FLAG APCN, NAC and APCN2, which provide connectivity between major countries in Asia Pacific and Europe. EIA Reports were not prepared for the

FLAG and APCN cable systems and it is assumed that permissions were given before the *EIAO* process was instigated in 1997. The cable systems were gazetted under the *Foreshore and Seabed (Reclamations) Ordinance (Chapter 127)* on 5 July 1996 (Gazette No 2948).

The project profile of the Level (3) Communications' NAC project, entitled "*Telecommunication Installation at Lot 591SA in DD 328, Tong Fuk, South Lantau Coast and the Associated Cable Landing Work in Tong Fuk, South Lantau for the North Asia Cable (NAC) Fibre Optic Submarine Cable System,* was submitted to the EPD in March 2000 (AEP-064/2000). The study concluded that there would be no adverse long term or cumulative effects/impacts to the environment and the Environmental Permit was granted on 5 June 2000 (EP-064/2000).

For the APCN 2 cable system, the project profile for the study entitled "*Submarine Cable Landing Installation in Tong Fuk Lantau for Asia Pacific Cable Network 2 (APCN 2) Fibre Optic Submarine Cable System*" was submitted to the EPD in May 2000. The study concluded that there would be no adverse long term or cumulative effects/impacts to the environment and the Environmental Permit was issued on 26 July 2001 (EP-069/2001).

Similar recent projects that have been conducted in the HKSAR include the following:

- *C2C Cable Network - Hong Kong Section: Chung Hom Kok, GB21(Hong Kong Limited.* The Project Profile for this Study was submitted to EPD in December 2000 (AEP-087/2000). The Study concluded that there would be no adverse long term or cumulative effects/impacts on the environment and the Environmental Permit was granted on 16 February 2000 (EP-087/2000).

- *New T&T Hong Kong Limited: Domestic Cable Route, New T&T*. The Project Profile for this Study was submitted to EPD in December 2000 (AEP-086/2001). The Study concluded that there would be no adverse long term or cumulative effects/impacts on the environment and the Environmental Permit was granted on 16 February 2001 (EP-086/2001).

- *East Asian Crossing (EAC) Cable System (TKO), Asia Global Crossing.* The Project Profile for this Study was submitted to EPD in July 2000 (AEP-081/2000). The Study concluded that there would be no adverse long term or cumulative effects/impacts on the environment and the Environmental Permit was granted on 4 October 2000 (EP-081/2000).

- *East Asian Crossing (EAC) Cable System, Asia Global Crossing.* The Project Profile for this Study was submitted to EPD on 21 June 2000 (AEP-079/2000). The Study concluded that there would be no adverse long term or cumulative effects/impacts on the environment and the Environmental Permit was granted on 6 September 2000 (EP-079/2000).

- *Cable Landing Work in Deep Water Bay for SEA-ME-WE 3 Fibre Optic Submarine Cable System, Hong Kong Telecom*. The Project Profile for this study was submitted to the EPD in May 1998 (AEP-001/1998). The study concluded that there would be no adverse long term or cumulative effects/impacts to the environment. The Environmental Permit was granted July 1998 (EP-001/1998).

5.5 ENVIRONMENTAL MONITORING & AUDIT

No environmental monitoring and audit measures have been recommended for this project.

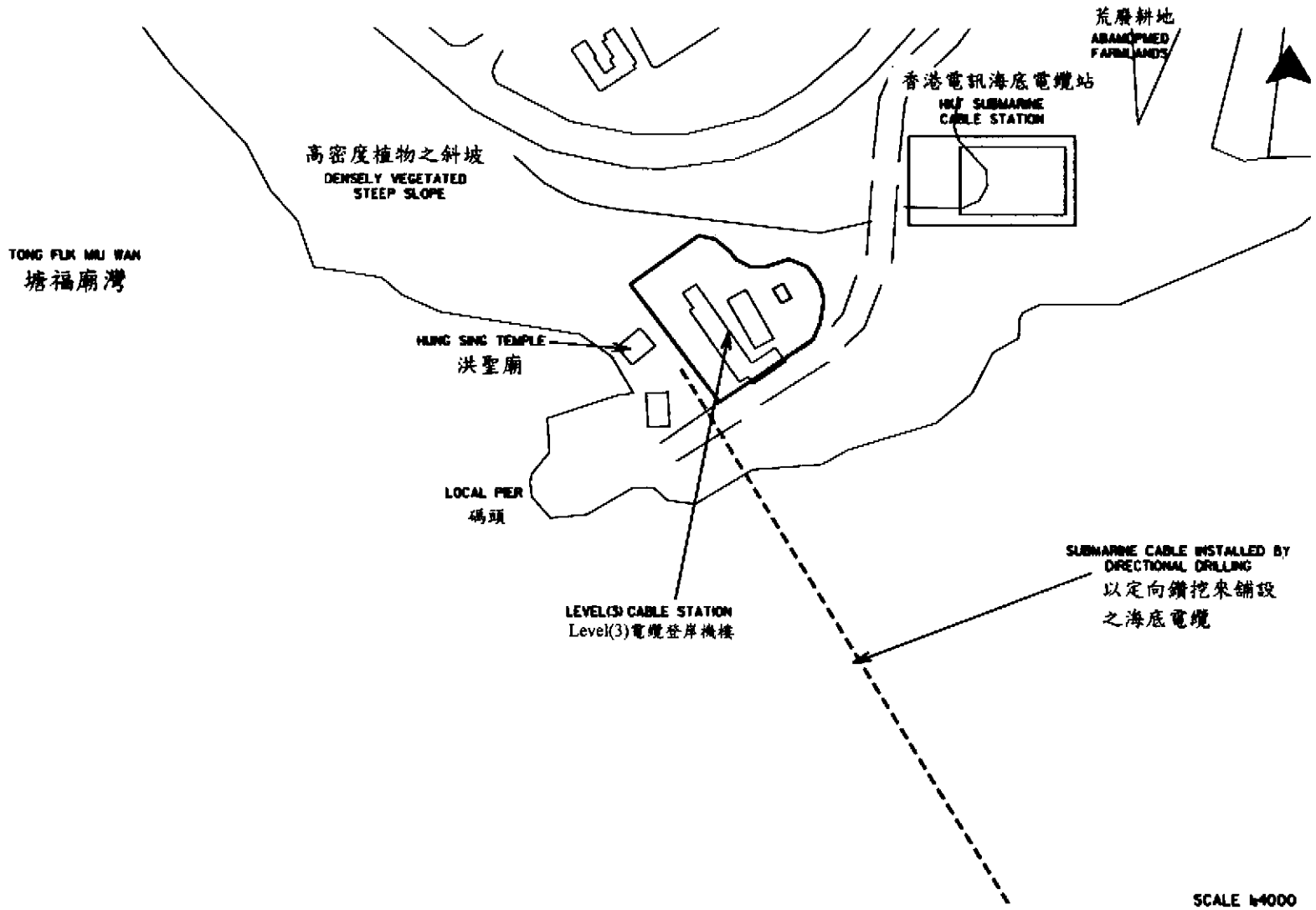


FIGURE 1.4a
圖 1.4a

PROJECT SITE AND LOCAL PLANNING CONTEXT
工程地點及地區規劃藍圖

Environmental Resources Management

ERM

FILE: C2195h
DATE: 27/03/01

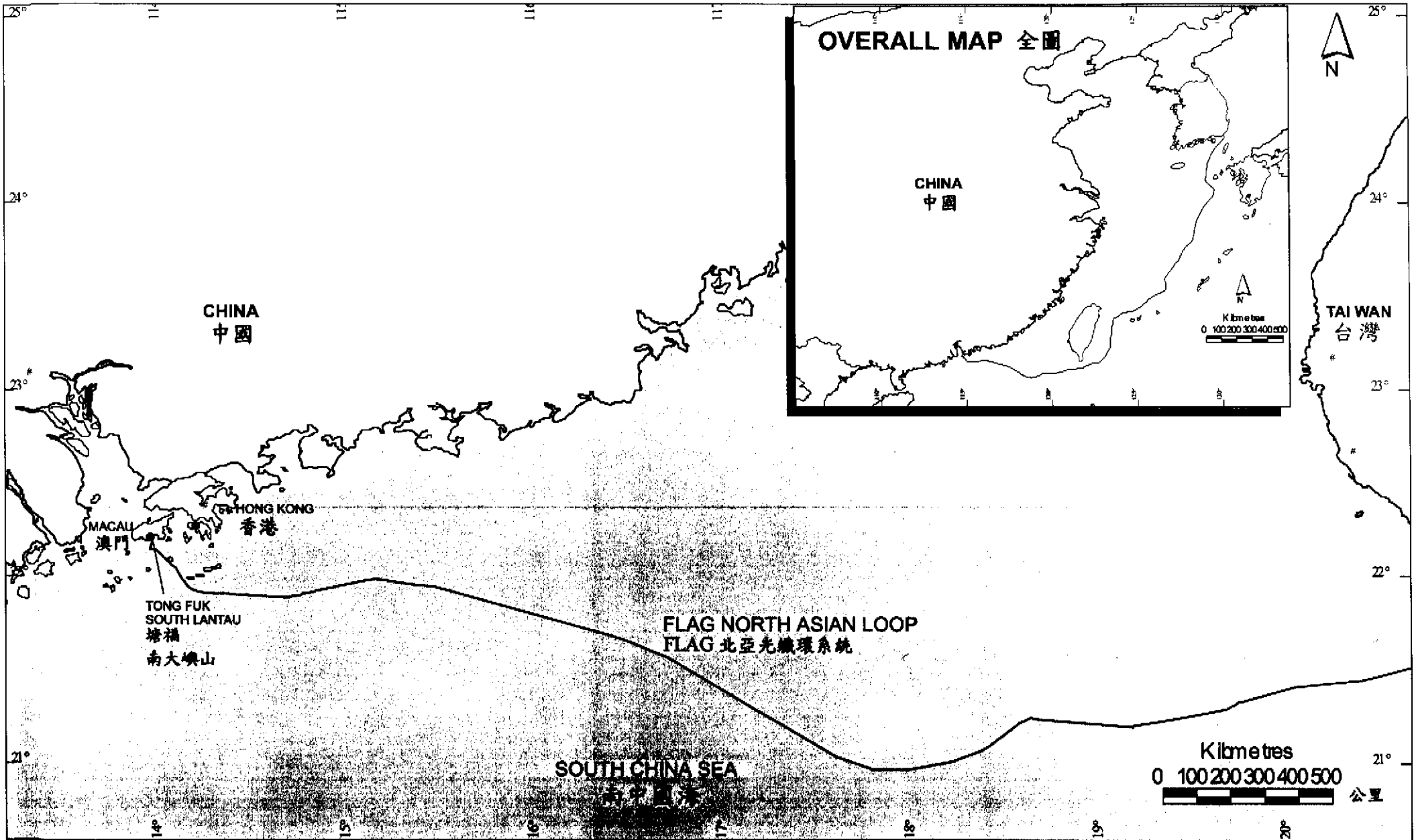


FIGURE 1.4b
圖 1.4b

FLAG NORTH ASIAN LOOP
FLAG 北亞光纖環系統

FILE: C2195/
DATE: 21/03/01

Environmental Resources Management
ERM

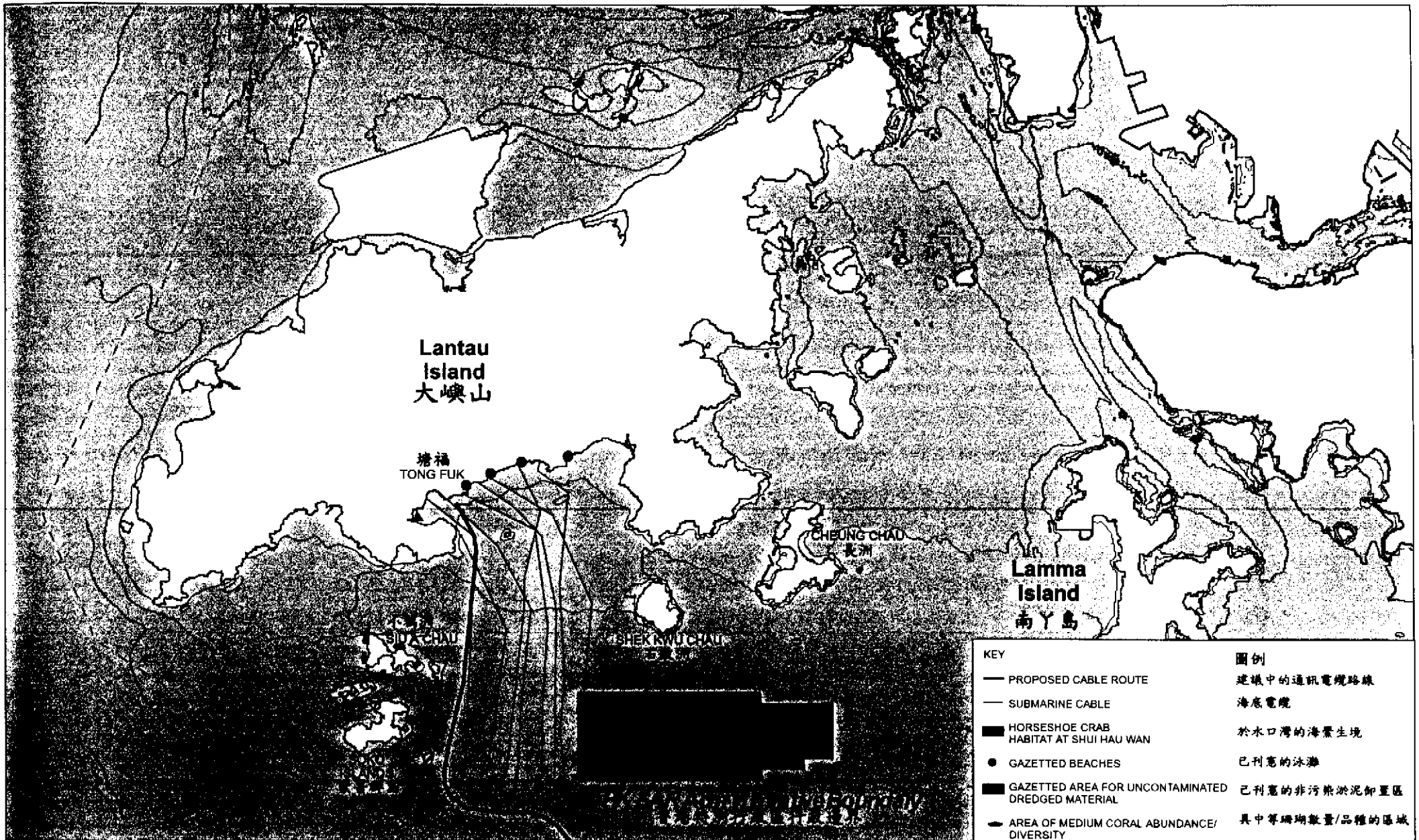
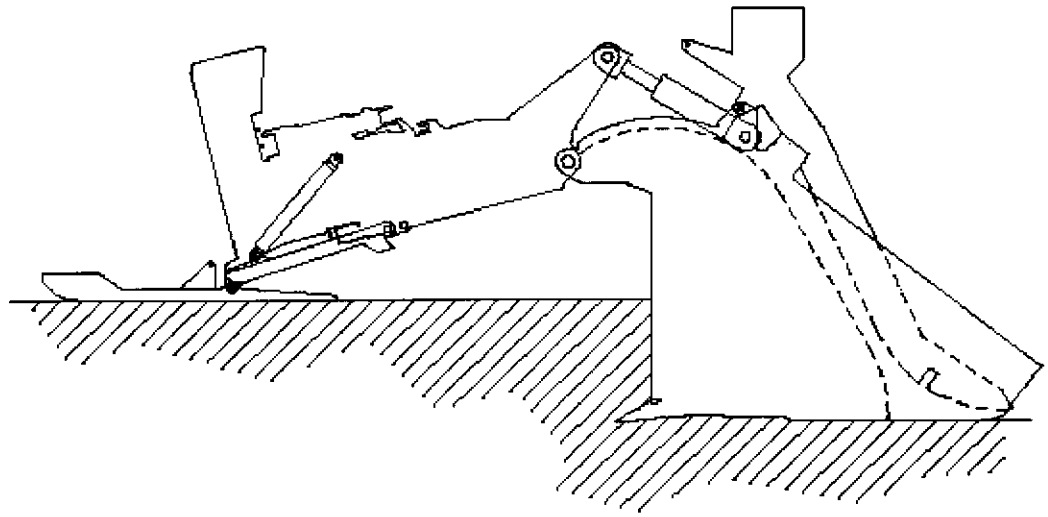


FIGURE 1.4c
圖 1.4c

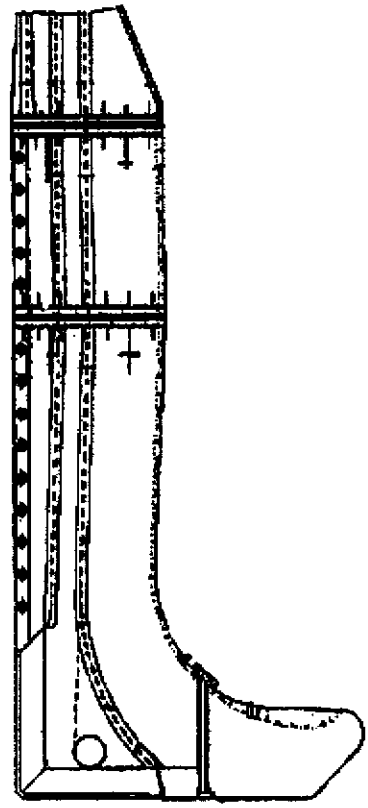
PHYSICAL CONSTRAINTS FOR THE PROPOSED FLAG NORTH ASIAN LOOP
建議中的 FLAG 北亞光纖環系統的物理性限制

FILE: C2195a
DATE: 21/03/01

Environmental Resources Management
ERM



BURIAL USING THE MULTI DEPTH PLOUGH
運用多層深度犁泥機將電纜埋藏



CONCEPTUAL DIAGRAM OF CABLE DEEP BURIAL INJECTOR
電纜深層埋藏注射器概念圖

FIGURE 2.1a
圖 2.1a

MULTI DEPTH PLOUGH AND DIAGRAM OF CABLE DEEP BURIAL INJECTOR
多層深度犁泥機及電纜深層埋藏注射器概念圖

FILE: C2196b
DATE: 21/03/01

Environmental Resources Management

ERM

Annex A
附件 A

FLAG North Asian Loop - Assessment of Potential Impacts to Water Quality

FLAG 北亞光纖環系統 - 水質潛在影響評估

A1 INTRODUCTION

This *Annex* presents an evaluation of the potential water quality impacts associated with the construction of the Hong Kong section of the proposed FNAL fibre optic submarine telecommunications cable system. The cable will pass from Pusan, South Korea into Hong Kong waters and land at Tong Fuk, South Lantau. Once installed, the cable would not result in any environmental impacts during operation and hence the focus of the assessment is on the construction phase.

A2 RELEVANT LEGISLATION AND ASSESSMENT CRITERIA

The following pieces of legislation are applicable to the evaluation of water quality impacts associated with the construction and operation of the proposed fibre optic submarine cable system.

- *Environmental Impact Assessment Ordinance (Cap. 499. S.16)* and the *Technical Memorandum on EIA Process (EIAO TM), Annexes 6* and *14*;
- *Water Pollution Control Ordinance (WPCO)*; and
- *Technical Memorandum for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM ICW).*

The *WPCO* is the primary legislation for the control of water pollution and water quality in Hong Kong. Under the *WPCO* Hong Kong waters are divided into 10 Water Control Zones (WCZs). Each WCZ has a designated set of statutory Water Quality Objectives (WQO). The route for the proposed fibre optic submarine cable system passes through the Southern WCZ, which was first appointed on 1 August 1988. The WQOs for the Southern WCZ are applicable as evaluation criteria for assessing the compliance of any discharges during the construction phase of the proposed submarine cable system.

All discharges during the construction of the proposed fibre optic submarine cable system are required to comply with the *TM ICW* issued under Section 21 of the *WPCO*, which defines acceptable discharge limits to different receiving waters. Under the *TM ICW* effluents discharged into the drainage and sewerage systems, inshore and coastal waters of the WCZs are subject to pollutant concentration standards for particular volumes of discharge. These are defined by EPD and specified in licence conditions for any new discharge within a WCZ.

A3 DESCRIPTION OF THE ENVIRONMENT

A3.1 HYDRODYNAMICS

The majority of the proposed cable route is sheltered from significant tidal currents by the Soko Islands and the land features of southern Lantau Island. To the south and west of the Sokos Islands the currents flow in a north west to south east direction around the south western tip of Lantau Island. Further to the south the currents are dominated by the oceanic current of the Lema Channel, which flow in a north easterly direction in the wet season and a south westerly direction in the dry season. Tidal current speeds along the majority of the cable route are low, particularly for the inshore portion. Current direction is likely to be perpendicular to the cable route for the sections to the south of Luk Keng Shan peninsula, while in the vicinity of the Tong Fuk landing point the current directions will be less predictable.

The cable route is outside of the region directly influenced by the strong outflow from the Pearl River in the wet season. This means that large seasonal changes in salinity profiles are not expected to occur, with little stratification present during the wet season. There is the potential for localised changes in salinity close to the coast due to runoff from the surrounding hillsides.

A3.2 WATER QUALITY

The proposed route for the proposed fibre optic submarine cable system passes through the Southern WCZ. There are two EPD routine water quality monitoring stations in the vicinity of the cable route. Water quality data for these stations, which were collected in 1999(1) and are the most up to date published data, are summarised in *Table A3a.* The locations of the stations are shown in *Figure A3a.*

Table A3a EPD Routine Water Quality Monitoring Data for the Southern WCZ for Stations Along the Cable Route

WQ Parameter	SM13	SM17
Temperature (°C)	23.8 (18.6 - 27.3)	23.7 (18.9 - 27.0)
Salinity	30.4 (24.7 - 33.4)	31.3 (27.8-33.4)
DO	6.3 (4.7 - 8.0)	6.5 (5.3 - 8.6)
DO Bottom	6.4 (5.2 - 8.2)	6.3 (4.7 - 8.1)
BOD	0.7 (0.3 - 1.2)	0.6 (0.4 - 0.8)
SS	9.7 (2.0 - 20.7)	14.6 (1.7 - 52.5)
TIN	0.19 (0.02 - 0.37)	0.15 (0.03 - 0.38)
Unionised Ammonia	0.002 (<0.001 - 0.004)	0.001 (<0.001 - 0.001)
Chlorophyll-*a* (μg L^{-1})	2.4 (0.6 - 5.4)	1.8 (1.0 - 3.0)
E. coli (cfu $100mL^{-1}$)	2 (1 -15)	1 (1-3)

(1) EPD (2000). Marine Water Quality in Hong Kong in 1999.

WQ Parameter	SM13	SM17

Notes:
a) Except as specified, data presented are depth-averaged.
b) All units are mg L^{-1}, unless stated.
c) Data presented are annual arithmetic means except for *E. coli* which are geometric means.
d) Data enclosed in brackets indicate the range.
e) Shaded cells indicate non-compliance with the WQOs.

The data show that compliance with the WQOs for dissolved oxygen and unionised ammonia was achieved at both stations. The WQO for total inorganic nitrogen, however, was breached at both stations. The non-compliance with the WQO for total inorganic nitrogen was found at Station SM13 for the last 10 years, while at Station SM17 compliance was only achieved once in the last 10 years. The data for chlorophyll-*a* show a wide variation between the maximum and minimum values, which indicate that at certain times of the year algal growth may be significant. The *E. coli* concentrations are low and indicate the lack of sewage effluent discharges in the vicinity of the monitoring stations.

A3.3 SEDIMENT QUALITY

There is one EPD routine sediment quality monitoring station in the vicinity of the cable route. Sediment quality data for this station are available for 1997(2) and are summarised in *Table A3b*. The location of the sediment quality monitoring station is shown on *Figure A3a*.

Table A3b EPD Routine Sediment Quality Monitoring Data in the Vicinity of the Cable Route

Parameter	SS6
COD (mg kg^{-1})	9,000 (8,000 - 10,000)
TKN (mg kg^{-1})	320 (190 - 480)
Cadmium (mg kg^{-1})	0.2 (0.1 - 0.5)
Chromium (mg kg^{-1})	21 (17 - 24)
Copper (mg kg^{-1})	12 (10 - 16)
Mercury (mg kg^{-1})	0.1 (<0.1 - 0.1)
Nickel (mg kg^{-1})	13 (11 - 15)
Lead (mg kg^{-1})	25 (22 - 28)
Zinc (mg kg^{-1})	61 (49 - 67)
PAHs (µg kg^{-1})	61 (39 - 218)
PCBs (µg kg^{-1})	5 (<5 - 5)

Notes:
a) Data presented are arithmetic mean; ranges are enclosed in brackets.
b) Results are based on laboratory analysis of bulk samples, which are collected twice per year from each sampling location.
c) All determinands are reported on a dry weight basis, unless otherwise stated.

The above data show that the sediment would not be classed as contaminated, based on the existing sediment classification guidelines. The sediments have relatively low chemical oxygen demand and total Kjeldahl nitrogen concentrations.

(2) EPD (1998). Marine Water Quality for Hong Kong in 1997.

A3.4 SENSITIVE RECEIVERS

Sensitive receivers in the vicinity of the cable route and landing station have been identified under the broad designations of gazetted bathing beaches and areas of ecological interest. The identified sensitive receivers in these two categories, shown on *Figure A3b*, are summarised as follows.

- **Gazetted Bathing Beaches:** The Gazetted Bathing Beaches in the vicinity of the cable route are Tong Fuk, Cheung Sha Upper, Cheung Sha Lower and Pui O. The closest Gazetted Bathing Beach to the cable is Tong Fuk which is over 500 m from the cable landing site.

- **Sites of Ecological Interest:** Horseshoe Crab habitat at Shui Hau Wan which is over 700 m from the cable landing site. Area of medium coral abundance / diversity on Siu A Chau which is approximately 1,400 m from the cable alignment.

The South Lantau Potential Marine Park / Marine Reserve has not been included as a sensitive receiver because it is unlikely to be designated prior to the construction of the submarine cable system.

A4 IMPACT ASSESSMENT

There will be no impacts to water quality from the operation of the proposed fibre optic submarine cable system. The potential for any adverse direct and indirect impacts to water quality from the construction of the submarine cable system have been assessed below.

A4.1 INSTALLATION OF THE MARINE SECTION OF THE CABLE

Apart from a short distance at the approaches, the cable will be laid on the seabed using an injection jetter designed to bury submarine cables. In this method, the cable and injection tool are lowered to the seabed. The injection tool fluidises a trench using high pressure water jets and the cable is immediately laid within the trench. The sides of the trench slip around the cable, burying it and leaving a small depression in the seabed, which is infilled by natural sedimentation. The maximum width of the seabed fluidised by the injection jetter is 0.25 m and the cable is buried to a maximum depth of 5 m.

The cable laying process will result in the formation of a dense cloud of high suspended sediment concentrations around the injector, which will remain very close to the seabed. The sediments will settle rapidly, owing to their proximity to the seabed. An analysis of the potential transport of fine sediments suspended into the water column during the cable laying process has been carried out and is described in *Attachment A1*. The analysis has been undertaken based on the highest tidal current speed recorded in the South

Lantau area (up to 0.5 m s^{-1}) and hence the sediment would be transported the greatest distances. The analysis has determined that the maximum distance of transport for the suspended sediments would be 64.5 m.

The closest sensitive receivers to the inshore section of the cable are the Tong Fuk gazetted bathing beach and the Horseshoe Crab habitat at Shui Hau Wan, which are 500 m and 700 m from the cable route respectively. The closest sensitive receiver to the offshore portion of the cable is the area of medium coral abundance / diversity assemblage on Siu A Chau, which is 1,400 m from the cable route. The distance of the sensitive receivers from the cable route indicates that adverse water quality impacts at these locations are not predicted to occur.

The seabed sediments in which the cable will be laid would be classed as uncontaminated, which is not unexpected given that there are no sources of industrial pollution in proximity to the cable route. The COD values are relatively low, as are the nutrient contents. The low levels of contamination in the sediment, coupled with the short duration for disturbed sediment to remain in suspension (calculated as less than 3 minutes in *Attachment A1*), will mean that the effects on water quality (ie dissolved oxygen levels, nutrient concentrations and the release of micro-pollutants) will be negligible. Therefore, the potential release of contaminants to the receiving waters will be limited and would not cause adverse impacts on the water column and no unacceptable impacts to water quality would occur during installation of the cable.

A4.2 LAYING OF THE CABLE AT THE LANDING SITES

Approximately 175 m from the shoreline at Tong Fuk, cable laying by the barge mounted special injection tool will cease and directional drilling will be used to lay the cable up to the onshore landing point. Directional drilling will have little impact on water quality as it would be undertaken from an onshore facility and would occur below the surface of the seabed.

A5 MITIGATION MEASURES

No adverse impacts to water quality were predicted and, as such, mitigation measures will not be required.

A6 SUMMARY AND CONCLUSIONS

The marine based construction activities relate to burying the cable below the existing seabed levels. The offshore section of the cable will be laid using

injection jetting construction methods, which would only give rise to minimal, short term, elevations in suspended sediment concentrations, if any, in the immediate vicinity of the cable. The shore end section of the cable will be installed using directional drilling which would have little impact on water quality. No adverse impacts were found to occur to sensitive receivers from this activity.

No impacts were predicted to occur from land based activities.

ATTACHMENT A1 - CALCULATION OF THE TRANSPORT OF SEDIMENT IN SUSPENSION

INJECTION JETTING

The cable laying in Hong Kong waters will be carried out using an underwater injection tool deployed from a lay barge. The injection tool uses utilizes water injector technology to fluidise the seabed sediments, which enables the cable to be safely and accurately inserted to the specified burial depth. Since there is no separation between the vessel and the burial tool (ie the cable is fed directly down to the injector from the cable vessel), residual tension is minimized, thereby providing safe and effective full-depth burial.

INJECTION PROCEDURES

The injection tool is mounted on a barge and the cable is loaded directly into the injector and is lowered to the seafloor. Once the tool is on the seafloor, the water injectors are turned on and the barge moves ahead while the tool penetrates the sea floor, and buries the cable. Burial depth can be adjusted by raising or lowering the tool from the barge. The expected burial speed will be a maximum of 1 km $hour^{-1}$.

WATER QUALITY SENSITIVE RECEIVERS

The distances between the cable route and the identified representative sensitive receivers are summarised in *Table 1*.

Table 1 Closest Approach of the Proposed Cable Route to Sensitive Receivers

Marine Sensitive Receiver	Distance to Cable Route
Shui Hau Wan Horseshoe Crab Habitat	700 m
Tong Fuk Gazetted Beach	500 m
Cheung Sha Upper Gazetted Beach	1,300 m
Siu A Chau Corals	1,400 m

During the cable laying process the seabed sediments will be initially disturbed and a small percentage will enter to suspension in the marine waters in the immediate vicinity of the injection tool. This small amount of suspended sediment will be advected away from the cable route by tidal currents. In order to demonstrate that suspended sediment will not impact the identified sensitive receivers, the following calculation has been carried out to determine the maximum potential transport for the sediments disturbed during the cable laying process and can be used to provide an estimate of the likely quantities of sediment entering suspension and the potential distance this sediment may be transported. The maximum depth of cable burial has been used.

The rate of sediment entering suspension may be calculated as follows :

Release Rate = cross section area of disturbed sediment x speed of cable laying machine x material density x percentage loss

depth of disturbance	=	5 m (maximum burial depth of cable)
width of disturbance	=	0.25 m (width of seabed disturbance as cable buried)
maximum cross sectional area	=	1.25 m^2
loss rate	=	20% (majority of sediment not disturbed)
speed of machine	=	0.278 m s^{-1} (1 km $hour^{-1}$)
in situ dry density	=	600 kg m^{-3} (typical of Hong Kong seabed sediment)
Release Rate	=	41.7 kg s^{-1}

During cable laying, the seabed sediment will be released at the bottom of the water column which will result in high localised suspended sediment concentrations and high settling velocities. This is because at high concentrations suspended sediment will tend to form large aggregations of sediment particles, the process of flocculation, which have a higher settling velocity than the individual sediment particles.

It is expected that the suspended sediments will remain within 1 m of the seabed, which is independent of the water depth. Although the current speeds at the seabed are lower than those near the water surface, due to such effects as bottom friction, it is assumed that the current speed is 0.5 m s^{-1}, which is an upper bound estimate of surface current speeds in the vicinity of the cable route. It is assumed that the sediment will initially spread to a maximum of 6 m along the centre-line of the cable route, which represents the longitudinal dimension of the injection tool, and that the worst case is a cross-current carrying the sediment towards the sensitive receivers.

Based on the above, and given the worst case scenario that the sediment mixes evenly over the lower 3 m of the water column and over the initial length of spread of the sediment, the initial concentration of the suspended sediment is as follows:

Initial Concentration = release rate / (current speed x height of sediment x width of sediment)

Where:

loss rate	=	41.7 kg s^{-1}
current speed	=	0.5 m s^{-1}
height of sediment	=	3 m
width of sediment	=	6 m
Initial Concentration	=	4.63 kg m^{-3}

The settling velocity has been calculated by the following relationship which was derived during the WAHMO studies and successfully applied to a number of assessments in order to determine the behaviour of sediment disturbed during dredging works in Hong Kong, which are similar to the sediment disturbance during the cable laying process.

Settling Velocity = $0.01\ C^1$ (where C is the suspended sediment concentration)
= $0.0463\ m\ s^{-1} = 46.3\ mm\ s^{-1}$

However, as the sediment settles onto the seabed, concentrations will gradually reduce. In order to account for this reduced concentration the above settling velocity is halved, which gives a value of $23.2\ mm\ s^{-1}$.

The time taken for the sediment to settle onto the seabed will thus be the maximum height of the sediment divided by the average settling velocity.

Settling Time = $3 / 0.0232 = 129\ s$

The distance travelled by the sediment will thus be the time multiplied by the current speed.

Distance Travelled = $129 \times 0.5 = 64.5\ m$

The above calculation indicates that the sediments disturbed during laying of the cable will settle onto the seabed within 64.5 m of the cable route. The closest approach of the cable route to the sensitive receivers is more than 500 m from the closest cable segment. Therefore, suspended sediments from the cable laying are not expected to adversely impact the identified water quality and marine ecology sensitive receivers.

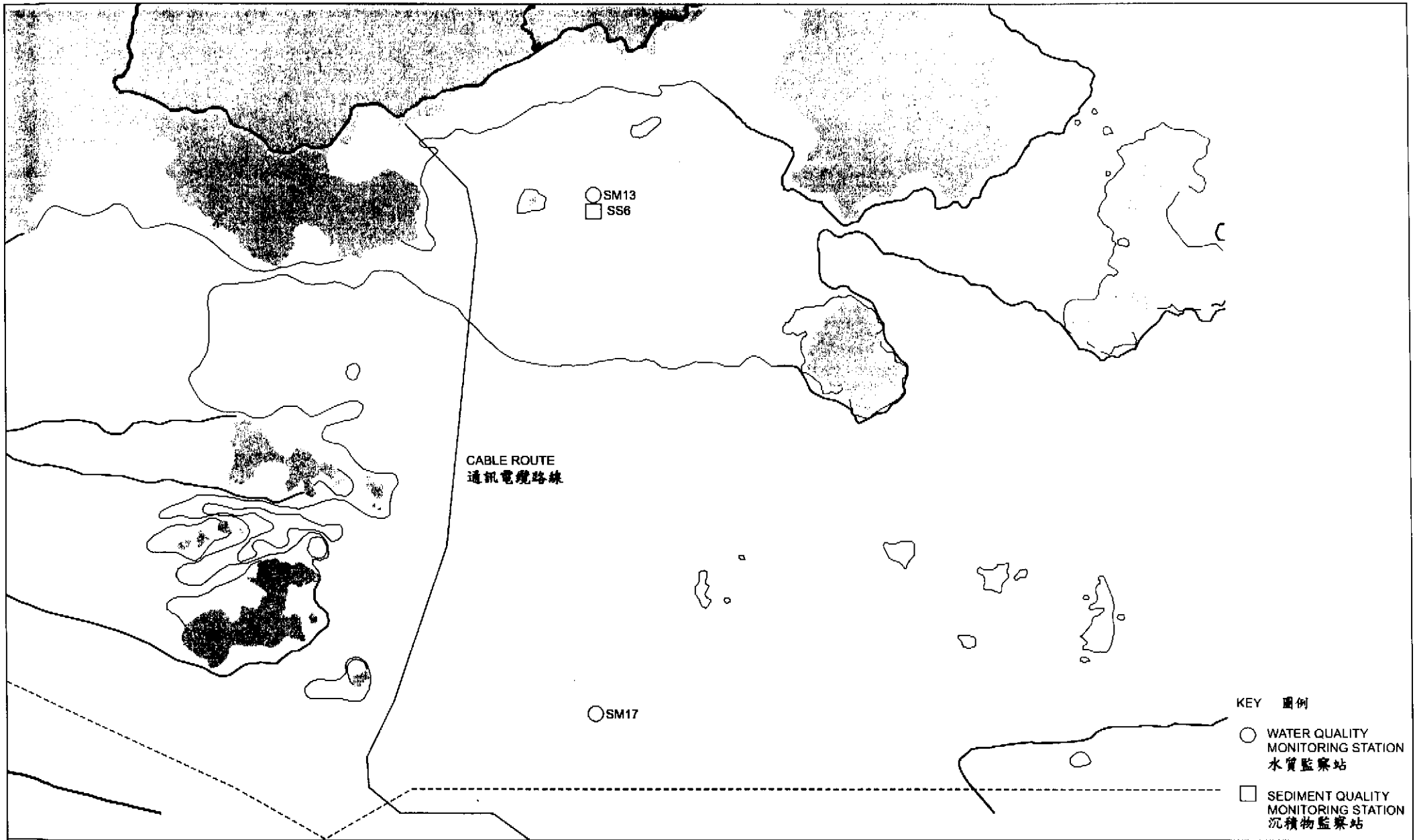


FIGURE A3a
圖 A3a

LOCATIONS OF EPD ROUTINE WATER AND SEDIMENT QUALITY MONITORING STATIONS
環境保護署定期水質及沉積物監察站地點

FILE: C2105d
DATE: 22/03/00

Environmental Resources Management

ERM

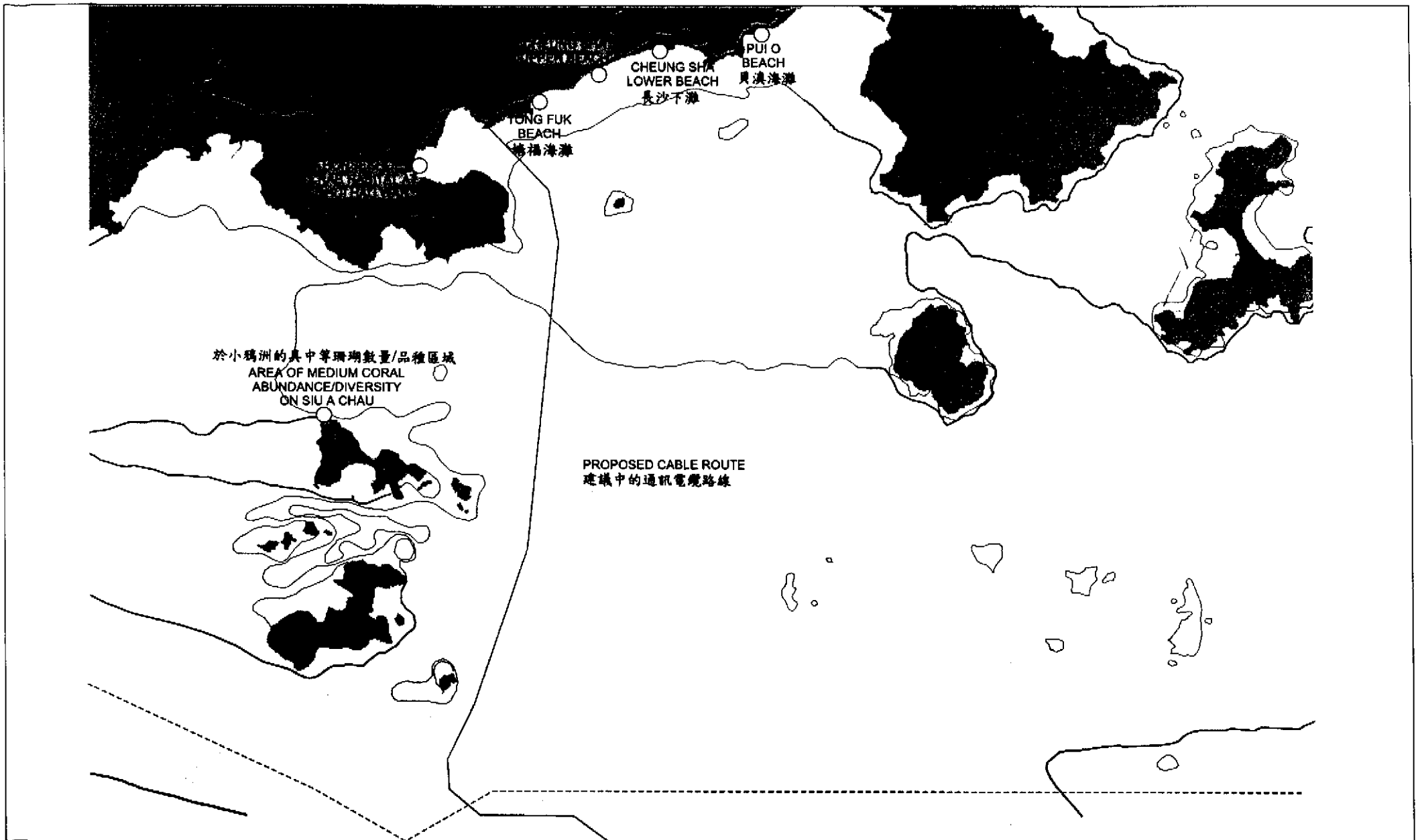


FIGURE A3b
圖 A3b

LOCATIONS OF SENSITIVE RECEIVERS
敏感受體地點

Environmental
Resources
Management

ERM

FILE: C2195c
DATE: 21/03/01

Annex B
附件 B

FLAG North Asian Loop - Assessment of Potential Impacts to Marine Ecological Resources

FLAG 北亞光纖環系統 - 海洋生態資源潛在影響評估

B1 INTRODUCTION

This *Annex* presents the existing marine ecological resources within and adjacent to the waters around the proposed cable route and evaluates the potential for direct and indirect adverse impacts to these resources.

B2 RELEVANT LEGISLATION AND GUIDELINES

The criteria for evaluating marine ecological impacts are laid out in the *EIAO TM*. *Annex 16* of the *EIAO TM* sets out the general approach and methodology for the assessment of marine ecological impacts arising from a project or proposal, to allow a complete and objective identification, prediction and evaluation. *Annex 8* of the *EIAO TM* recommends the criteria that can be used for evaluating such impacts.

Other legislation which applies to marine ecology includes: *The Wild Animals Protection Ordinance (Cap. 170) 1980*, which protects all cetaceans.

B3 DESCRIPTION OF THE ENVIRONMENT

B3.1 SUBTIDAL SOFT BOTTOM ASSEMBLAGES

There appears to be little information on the subtidal soft bottom assemblages in the direct vicinity of cable route; although a number of surveys have been undertaken at the nearby South Cheung Chau open seafloor disposal site, which is in close proximity to the proposed cable alignment. As these surveys were conducted in waters in close proximity to the proposed area of works, the assemblages recorded at South Cheung Chau can be considered to be representative of the assemblages along the proposed cable alignment.

The most recent of these surveys involved grab sampling as part of the *Seabed Ecology Studies* (1). As part of this study, sampling was undertaken at numerous stations in and around the South Cheung Chau open seafloor disposal site. These surveys found a total of 11,082 specimens, belonging to 70 families in seven phyla. Polychaetes were the most abundant group present, representing 96% of identified individuals and 33% of the total biomass. By contrast, molluscs constituted less than 1% of the identified individuals but provided 60% of the total biomass recorded.
The overall mean abundance recorded from the study site was high (200 individuals grab^{-1} ie 2,100 individuals m^{-2}). In comparison to other sites

(1) ERM-Hong Kong, Ltd (1999) Seabed Ecology Studies: Composite Report. For the Civil Engineering Department, Hong Kong Government.

surveyed under the *Seabed Ecology Studies*, the South Cheung Chau site was generally ranked in the mid-range of the eight sites for all parameters except the total biomass, for which it recorded the highest value at 4.7 g $grab^{-1}$ or 48.9 g m^{-2}.

In summary, in comparison to other areas of Hong Kong, the soft bottom assemblages in the vicinity of the proposed cable route have been found in historical surveys to be characterised by a high abundance of individuals and a high overall biomass. No species that are considered rare were identified in the review, therefore, the benthos can be classified as of low ecological importance.

B3.2 SUBTIDAL HARD BOTTOM ASSEMBLAGES

Recent dive surveys at Tong Fuk indicated that few organisms of ecological interest are present in the area as only two individual colonies of gorgonian sea whips were observed during the survey (2). Although the presence of these gorgonian sea whips is of ecological interest, they are common in Hong Kong waters and are not considered to be rare. No other species of conservation interest were recorded. The majority of the hard substrate surfaces in shallow regions were found to be encrusted with barnacles (*Capitulum* sp, *Tetraclita* sp and *Balanus* sp), with the degree of coverage appearing to be a factor of the degree of exposure (the more exposed the site the higher percent cover of barnacles). Based on this, the subtidal hard surface communities within proximity to the proposed landing site at Tong Fuk are considered to be of low ecological value.

The results from the dive surveys conducted in early 1997 along the northern side of Siu A Chau showed that the subtidal habitat supported medium abundance and diversity of hard coral assemblages (3). Coral species that were found common in the area include *Favia pallida*, *Leptastrea purpurea* and *Porites lobata*. Although the subtidal hard surface communities at Siu A Chau are considered as of ecological interest, they are located over 1,400 m from the proposed cable route (see *Figure 1.4c*). Therefore, the coral communities are considered to be at a sufficient distance from the cable alignment to indicate that impacts will not occur (see *Annexes A* and *B*).

B3.3 INTERTIDAL HARD SURFACE AND SOFT SHORE ASSEMBLAGES

The coastline in the vicinity of the proposed cable landing site at Tong Fuk is mainly composed of natural sandy beaches and boulder/rocky shores. The

(2) ERM - Hong Kong, Ltd (2000) Telecommunication Installation at Lot 591SA in DD 328, Tong Fuk, South Lantau Coast and the Associated Cable Landing Work in Tong Fuk, South Lantau for the North Asia Cable (NAC) Fibre Optic Submarine Cable System. For Level (3) Communications Limited.

(3) Binnie Consultants Limited (1997) Coastal Ecology Studies. Soko Islands Qualitative Survey. Final Report , April 1997. For the Civil Engineering Department, Hong Kong Government.

sand flat at Shui Hau (700 m west to the Tong Fuk landing site) is known to be a breeding/nursery habitat for the locally threatened horseshoe crabs [4].

The results obtained from recent field surveys conducted at Tong Fuk indicated that the intertidal assemblages recorded on the boulder/rocky shores were mainly composed of snails, bivalves, limpets and barnacles[5]. These communities were found to be typical of semi-exposed intertidal assemblages in Hong Kong. No species of conservation importance have been recorded on these intertidal hard shores. Due to the abundance of organisms recorded and the generally undisturbed nature of the natural boulder/rocky shores, the assemblage was considered to be of medium ecological value.

Recent field surveys conducted on the intertidal sandy/pebble shore habitats at Tong Fuk have shown that the assemblages recorded on were mainly composed of snails, bivalves and barnacles. No species of conservation interest were recorded. The abundance of assemblages recorded was generally low in comparison to other sites in Hong Kong, and can generally be considered as typical of a semi-exposed sandy/pebble shore. These sandy/pebble shore is mainly covered with hard pebbles which are considered unsuitable for the locally endangered horseshoe crabs to breed as, in general, horseshoe crabs prefer undisturbed, sheltered sandy beaches or protected sandy-mud/mud flats to breed [6]. Based on these findings, the ecological importance of these sandy/pebble shores was considered to be low.

B3.4 MARINE MAMMALS

The Indo-Pacific Hump-backed Dolphin (*Sousa chinensis*) and the Finless Porpoise (*Neophocaena phocaenoides*) are the only species of marine mammal regularly sighted in Hong Kong waters. The South Lantau waters which the proposed cable routing passes through appear to be mostly utilised by *Sousa chinensis* [7]. This species was observed in these waters most commonly during the summer and autumn months, with the western part of the south Lantau waters near the Soko Islands and Fan Lau used more heavily than the eastern area, near Cheung Chau. However during a two and a half year survey, conducted between September 1995 and March 1998, less than twenty sightings of *Sousa chinensis* were recorded in these waters [8]. The findings from this study could not verify the exact use of these waters with respect to the life cycle of these marine mammals, ie breeding, calving or feeding, as it appears that dolphins engage in a full range of activities in each of areas surveyed throughout the waters of Hong Kong.

(4) Chiu HMC and Morton B (1999) The Biology, Distribution, and Status of Horseshoe Crabs, *Tachypleus tridentatus* and *Carcinoscorpius rotundicauda* (Arthropoda: Chelicerata) in Hong Kong: Recommendations for Conservation and Management. Final Report to China, Light and Power.

(5) ERM-Hong Kong Ltd (2000) *Op cit.*

(6) Chiu HMC and Morton B (1999) *Op cit.*

(7) Jefferson T A (1998) Population Biology of the Indo-Pacific Humpbacked Dolphin (*Sousa chinensis* Osbeck, 1765) in Hong Kong Waters: Final Report. Submitted to the Agriculture, Fisheries and Conservation Department, Hong Kong Government.

(8) Jefferson T A (1998) *Op cit.*

It is unlikely that the South Lantau waters which the proposed cable routing passes through are critical habitats for either marine mammal species given the low number of sightings and the fact that the waters are busy shipping lanes that are used frequently by high speed ferries.

B4 IMPACT ASSESSMENT

B4.1 CONSTRUCTION PHASE

B4.1.1 Direct Impacts

No long term direct impacts are expected to occur due to the laying of the cable. Short term impacts will arise to the soft bottom benthic assemblages present along the cable route. As discussed in *Annex A* the majority of the cable will be laid using the injection jetting method which will only result in a minor, localised disturbance to the seabed. Once the cable laying operations have ceased, the sediments will be rapidly recolonised by similar benthic fauna and consequently direct impacts to these assemblages are not regarded as severe.

The shore approach of the cable works will be performed by directional drilling. The drilling will take place within the bedrock and will commence 175 m from the shore. Consequently the rocky and sandy shores at Tong Fuk will not be affected by these construction works.

B4.1.2 Indirect Impacts

Indirect impacts may occur through seabed disturbance, resulting in increases in suspended solids in the water column. Such elevated suspended sediment levels may cause smothering of filter feeders such as corals and bivalves and clogging of gill filaments in other organisms. Another potential indirect impact involves reduction in dissolved oxygen concentrations caused by elevated levels of suspended sediment. An increase in solids in the water column will potentially result in a reduction in sunlight penetration, decreased rate of photosynthesis of phytoplankton (primary productivity) and thus a lower rate of oxygen production in the water column.

As discussed in *Annex A*, the proposed injection jetting method for cable deployment will result in the formation of a localised cloud of high suspended sediment concentrations around the plough. As these suspended sediments are predicted to remain close to the seabed, the sediments are expected to settle rapidly back onto the seabed leaving little trace of disruption. Due to the small scale, short term and localised nature of the impacts, no unacceptable adverse impacts to marine ecological resources are predicted to occur.

B4.2 OPERATION PHASE

No substantial impacts to ecological resources are predicted to occur during the operation of the cable. The cable is unlikely to be damaged as it will be buried at a depth of not less than 3 m beneath the surface of the seabed.

B4.3 IMPACT EVALUATION

An evaluation of the impact in accordance with the *EIAO TM Annex 8 Table 1* is presented below.

- *Habitat Quality*: Short term impacts are predicted to occur to subtidal soft-bottom habitats of low ecological value.

- *Species*: No species of ecological importance are predicted to be impacted due to the cable laying operations.

- *Size:* The total length of the cable within Hong Kong waters is about 10 km which will be layed by injection. The shore end (175 m from the coast) will be installed using directional drill cut to the beach manhole.

- *Duration*: The works associated with the cable laying within Hong Kong waters are expected to last for a period of 17 days.

- *Reversibility*: Impacts to the assemblages inhabiting the soft bottom assemblages along the cable alignment are expected to be short term and recolonisation of the sediments is expected to occur once the cable is laid.

- *Magnitude*: No impacts to ecologically important or sensitive habitats are predicted to occur. The magnitude of impact during cable laying is likely to be of low severity and acceptable, given that the disturbances are short term and localised. The cable laying will affect only assemblages of low ecological value and the fauna will recolonise once construction works cease.

B5 MITIGATION MEASURES

No adverse impacts are expected to occur to marine ecological resources. Therefore, no mitigation measures have been recommended.

B6 CONCLUSION

A review of existing information on marine ecological resources has shown that the subtidal soft bottom assemblages that will be disturbed during the construction of the cable routing are of low ecological value and commonly recorded elsewhere in Hong Kong waters. Therefore, the short term loss of benthic organisms directly along the cable route is not considered to represent an unacceptable ecological impact. The rapid reinstatement of the seabed will result in the area being available for prompt recolonisation, and hence, no permanent impacts are likely to occur.

Intertidal rocky or sandy habitats in the vicinity of the landing site have been classified as typical of Hong Kong intertidal habitats and are considered to be of low to medium ecological value. The intertidal mudflats at Shiu Hau Wan are known to be a breeding/nursery habitat for the locally threatened horseshoe crabs and they are located over 700 m west of the proposed cable route. Unacceptable impacts to these intertidal habitats as a result of the proposed cable installation works are not anticipated.

No coral communities of ecological importance have been identified along the cable routes or in the vicinity of the cable landing site. Coral assemblages of medium abundance/diversity have been identified on Siu A Chau which is over 1,400 m from the proposed cable route. The coral communities are considered to be at a sufficient distance from the alignment of the cables to indicate that impacts will not occur.

It is unlikely that the South Lantau waters which the proposed cable routing passes through are critical habitats for either the Finless Porpoise or the Indo-Pacific Hump-backed Dolphin species as their number of sightings recorded in these waters are low. Based on this, and the predicted localised and very short term impacts to water quality, no impacts are predicted to occur to marine mammals.

Annex C
附件 C

FLAG North Asian Loop - Assessment of Potential Impacts to Fisheries

FLAG 北亞光纖環系統 - 漁業潛在影響評估

C1 INTRODUCTION

This *Annex* presents the existing fisheries resources and fishing operations within and adjacent to the proposed cable alignment and an evaluation of the potential impacts to these resources associated with the construction and operation of the cable system.

C2 RELEVANT LEGISLATION AND ASSESSMENT CRITERIA

The criteria for evaluating marine ecological and fisheries impacts are laid out in *Annex 17* of the *EIAO TM* and *Annex 9* of the *EIAO TM* recommends some general criteria that can be used for evaluating fisheries impacts.

Other legislation which apply to fisheries resources include: the *Fisheries Protection Ordinance (Cap 171) 1987* which provides for the conservation of fish and other aquatic life and regulates fishing practices; and the *Marine Fish Culture Ordinance (Cap 353) 1983* which regulates and protects marine fish culture and other related activities.

C3 DESCRIPTION OF THE ENVIRONMENT

In Hong Kong, the commercial marine fishing industry is divided into capture and culture fisheries. As a result, the following baseline information has been presented under the headings *Capture Fisheries* and *Culture Fisheries*. The baseline information has been derived from the most up-to-date information on the Hong Kong fishery(1). Information from other relevant studies was also reviewed in order to determine if the waters of the proposed cable routes are important spawning grounds or nursery areas for commercial fisheries(2). Mariculture information was obtained from the Agriculture, Fisheries and Conservation Department (AFCD) Annual Reports(3)(4).

C3.1 CAPTURE FISHERIES

C3.1.1 Fishing Operations

In 1989 - 1991 AFCD devised a system whereby the waters of Hong Kong were divided up into individual Fishing Zones(5). Data were gathered at that

(1) Agriculture, Fisheries and Conservation Department (1998) Port Survey 1996 - 1997.
(2) ERM - Hong Kong, Ltd (1998) Fisheries Resources and Fishing Operations in Hong Kong Waters. Final Report. For the Agriculture, Fisheries and Conservation Department, Hong Kong Government.
(3) Agriculture, Fisheries and Conservation Department (1998) Annual Report 1996 - 1997.
(4) Agriculture, Fisheries and Conservation Department (2000) Annual Report 1998 - 1999.
(5) Agriculture, Fisheries and Conservation Department (1991) Port Survey 1989 - 1991.

time on the catches of the Hong Kong fleet derived from these Fishing Zones. Since this first Hong Kong wide survey, AFCD have updated the information which now indicates that the number of Fishing Zones equates to 189, down from the original 210 listed in 1991[6]. However, of those 189 Fishing Zones, only 179 are actively fished by vessels from the Hong Kong fleet. Two of these fishing zones are proximate to the proposed cable routing. They are Tong Fuk (AFCD Code 0012) and Soko Islands (AFCD Code 0026) as shown in *Figure C3a*. The catches in these fishing zones are mainly derived from fishermen operating P4/7s and shrimp trawlers[7]. Some pair trawling operations have also been recorded operating close inshore between Tong Fuk and Pui O[8].

C3.1.2 Fishing Resources

The findings of a recent study conducted for AFCD have determined that commercial fish species reproduce throughout the year, though spawning for the majority of species appears to be concentrated during the period from June to September [9]. The southern waters, through which the proposed cable routing will pass, have been identified as both a spawning area and nursery ground for fisheries resources. Commercial species that have been identified as using the waters for spawning are the Moray Eel *(Gymnothorax reevesi)*, the Scorpionfish *(Inegocia japonicus)*, the Scad *(Caranx kalla)*, the Flatfish *(Platycephalus indicus)*, the Bream *(Mylio macrocephalus)*, the Croakers *(Nibea diacanthus* and *Johnius belengeri)*, the Blue Crab *(Portunus pelagicus)* and the Mantis Shrimp *(Oratosquilla spp)*. Commercial species that have been found to use the area as a nursery ground for fry are the Mantis Shrimps *(Oratosquilla anomala)* and *(Dictyosquilla foveolata)* as well as both Sciaenid and Serranid fry.

C3.2 CULTURE FISHERIES

The closest Fish Culture Zone (FCZ) to the proposed cable routing is located at Cheung Sha Wan, Southeast Lantau, approximately 10 km away, and, as it will not be affected by the proposed project, it is not discussed further.

C4 IMPACT ASSESSMENT

C4.1 CONSTRUCTION PHASE

C4.1.1 Direct Impacts

The proposed cables will be submerged through the injection jetting burial method (0.25 m width) to a depth of 5 m below the seabed. Through the

(6) Agriculture, Fisheries and Conservation Department (1998) *Op cit.*
(7) ERM - Hong Kong, Ltd (1998) Fisheries Resources and Fishing Operations in Hong Kong Waters. *Final Report.* For the Agriculture, Fisheries and Conservation Department, Hong Kong Government.
(8) ERM - Hong Kong, Ltd (1998) *Op cit.*
(9) ERM - Hong Kong, Ltd (1998) *Op cit.*
(6) Agriculture, Fisheries and Conservation Department (1998) Annual Report 1997/1998.

employment of this burial technique, the seabed will be left virtually undisturbed and available for immediate recolonisation by benthic infauna and associated bottom dwelling organisms. Minor interruptions to fishing operations are expected to occur only during the deployment phase of the cables. These disruptions are, however, minimal as the deployment of the cable from the landing point to the SAR boundary has been predicted to require only 17 days. Therefore, no long term direct impacts to fisheries resources or fishing operations are expected to occur but minor short term disturbances to the seabed in the immediate vicinity of the cable laying operations. These disturbances are not predicted to affect fisheries resources or fishing operations.

Indirect Impacts

Indirect impacts may occur through elevation in suspended solids (SS) resulting from the disturbance of the seabed through the burial of the cables. However, the proposed injection jetting method of burial will disturb only a 0.25 m area narrow trench, resulting in only short term elevations in SS in the immediate vicinity of the cable. Sediments that may be lost in suspension are likely to remain in the lower part of the water column and settle back onto the seabed within a short period of time. The majority of any disturbed sediment will be immediately replaced in its original location through the cable laying technique. As a result, impacts to fisheries resources are predicted to be minimal, if any.

C4.2 OPERATION PHASE

No impacts to fisheries resources and fishing operations are predicted to occur during the operation of the cable. The cable is unlikely to be damaged by fishing activity as it will be jetted to a depth of not less than 3 m beneath the surface of the seabed. Consequently, no unacceptable impacts to fisheries resources and fishing operations are anticipated to occur.

C4.3 FISHERIES IMPACT EVALUATION

An evaluation of the impact in accordance with the *EIAO TM Annex 9* is presented as follows.

- *Nature of Impact*: As a result of the small scale and localised disturbances to the seabed, no adverse impacts to fisheries resources and subsequently fishing operations, are predicted to occur during either the cable laying or operation.

- *Size of Affected Area*: The total length of the cable within Hong Kong waters is about 10 km, of which the majority will be layed through injection. The shore approach (175 m from shore) of the cable will be installed using directional drill cutting and will not affect fisheries resources or fishing operations.

- *Size of Fisheries Resources/Production*: Ranking of the affected areas is medium compared to other areas in Hong Kong in terms of catch weight and value.

- *Destruction and Disturbance of Spawning and Nursery Grounds*: The cable route passes through previously identified spawning grounds and nursery areas for commercially important species. The impacts associated with construction will be short in duration and will be in the immediate vicinity of the cable laying equipment. Therefore, impacts to these areas are expected to be minimal and short term.

- *Impact on Fishing Activity*: The proposed cable passes through two AFCD fishing zones, of which both are of medium fisheries production in comparison to other fishing zones in Hong Kong. Impacts to fishing activities in either zone are not expected to occur.

- *Impact on Aquaculture Activity*: Impacts to the closest Fish Culture Zones at Cheung Sha Wan (located almost 10 km away) are not predicted.

C5 MITIGATION MEASURES

During cable laying, it is expected that no adverse impacts to water quality so as to fisheries resources. As such, no mitigation measures will be required.

C6 CONCLUSION

A review of existing information on the fisheries resources and fishing operations surrounding the cable route has identified the area as supporting a fishery of medium ranking in terms of fisheries production. The waters have been identified as a spawning area and nursery ground for commercial fisheries within Hong Kong waters. Due to the proposed method of cable deployment and installation and short duration of works, no unacceptable impacts have been predicted to occur to fisheries resources or fishing operations.

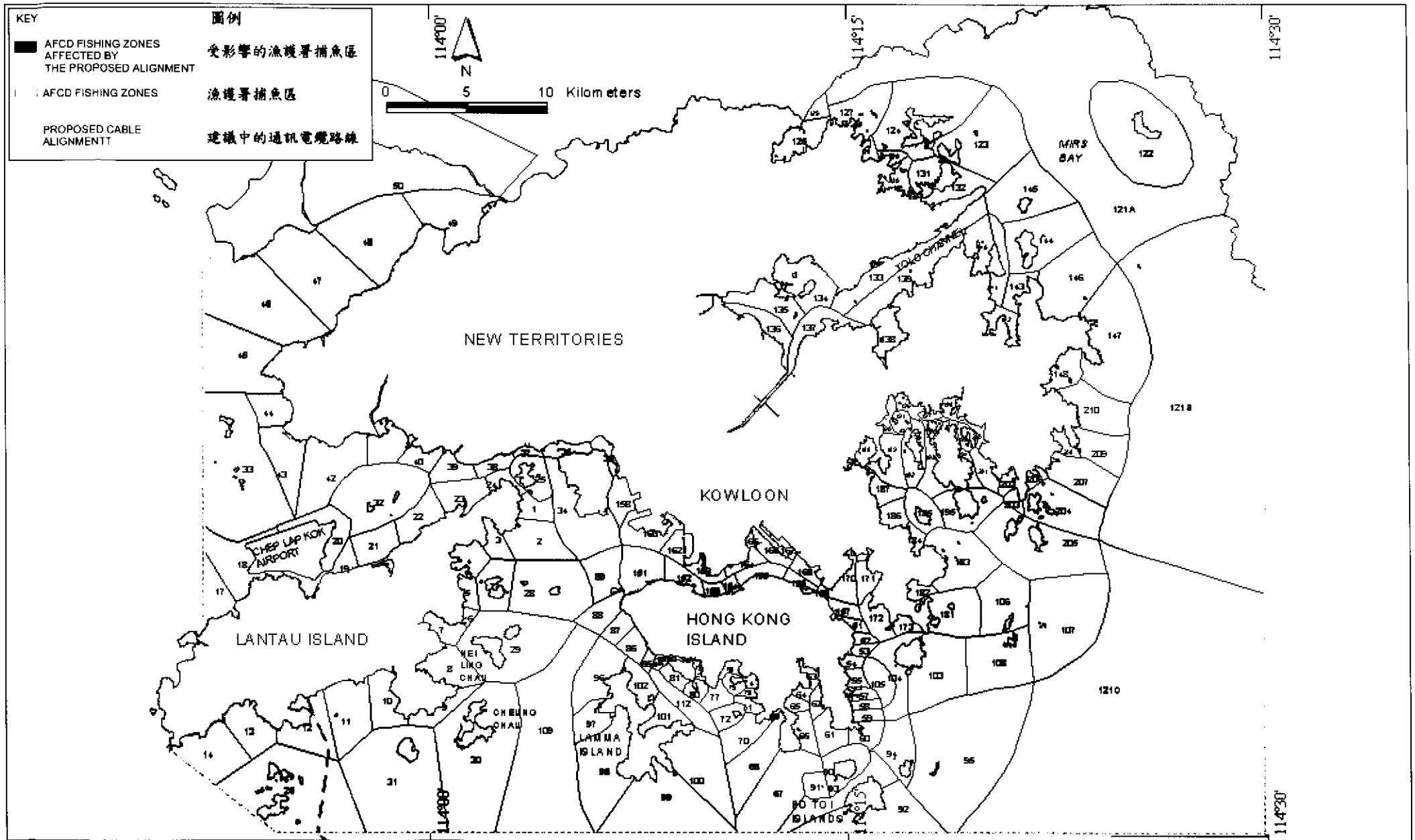


FIGURE C3a
圖 C3a

DISTRIBUTION OF AFCD FISHING ZONES IN HONG KONG WATERS AND LOCATION OF THE PROPOSED CABLE ALIGNMNET

漁農自然護理署捕魚區在香港水域的分佈和建議中的通訊電纜路線位置

FILE: C2195g
DATE: 21/03/01

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Annex D
附件 D

FLAG North Asian Loop - Assessment of Potential Noise Impacts

FLAG 北亞光纖環系統 - 噪音潛在影響評估

D1 INTRODUCTION

This *Annex* describes and evaluates the potential noise impacts arising from the construction of the onshore works associated with cable installation at Tong Fuk, Lantau.

D2 ASSESSMENT CRITERIA

The construction work associated with the onshore cable installation will only occur during normal working hours (ie 0700 to 1900 hours on any day not being a Sunday or public holiday). With reference to the *Technical Memorandum on Environmental Impact Assessment Process* (TM-EIA), there are no recommended construction noise standards provided for places of public worship. Therefore, a comparable type of land use criterion, those specified for education institutions, has been applied as an indication of potential noise impacts. For the purpose of this Study, the daytime construction noise criterion of $L_{eq,\ 30\ min}$ 70 dB(A) will be adopted for places of public worship.

D3 ASSESSMENT METHODOLOGY

The assessment of noise impact from the associated cable installation works was undertaken based on the procedure outlined in the *Technical Memorandum on Noise from Construction Work other than Percussive Piling* (GW-TM). In general, the procedure to undertake a construction noise assessment is as follows:

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

Based on the proposed construction methods, the installation of the shore end cable will be by directional drilling. *Table D13* presents the predicted noise levels. Locations of the NSR and the works area are shown in *Figure D3.*

Table D3 Predicted Noise Levels ($L_{eq, 30\ min}$ dB(A))

Plant Required	SWL	NSR	Distance between NSRs and works area (m)	Distance Correction (dB(A))	Predicted Noise Levels at NSRs (dB(A))
Bore pile, reverse circular drill (CNP 166)	100	Hung Shing Temple	60	44	68
Generator (CNP 101)	108				
Total	**109**				

As indicated in *Table D3*, the temple would be exposed to construction noise in the region of $L_{eq, 30\ min}$ 68 dB(A), ie within the daytime construction noise criterion of 70 dB(A).

D4 CONCLUSION

It is expected that no excessive noise will be generated during the underground drilling work for the cable installation. Cable laying and burial is at present not expected to take place at night. If evening or night-time works are later found to be necessary, a Construction Noise Permit (CNP) will be applied for.

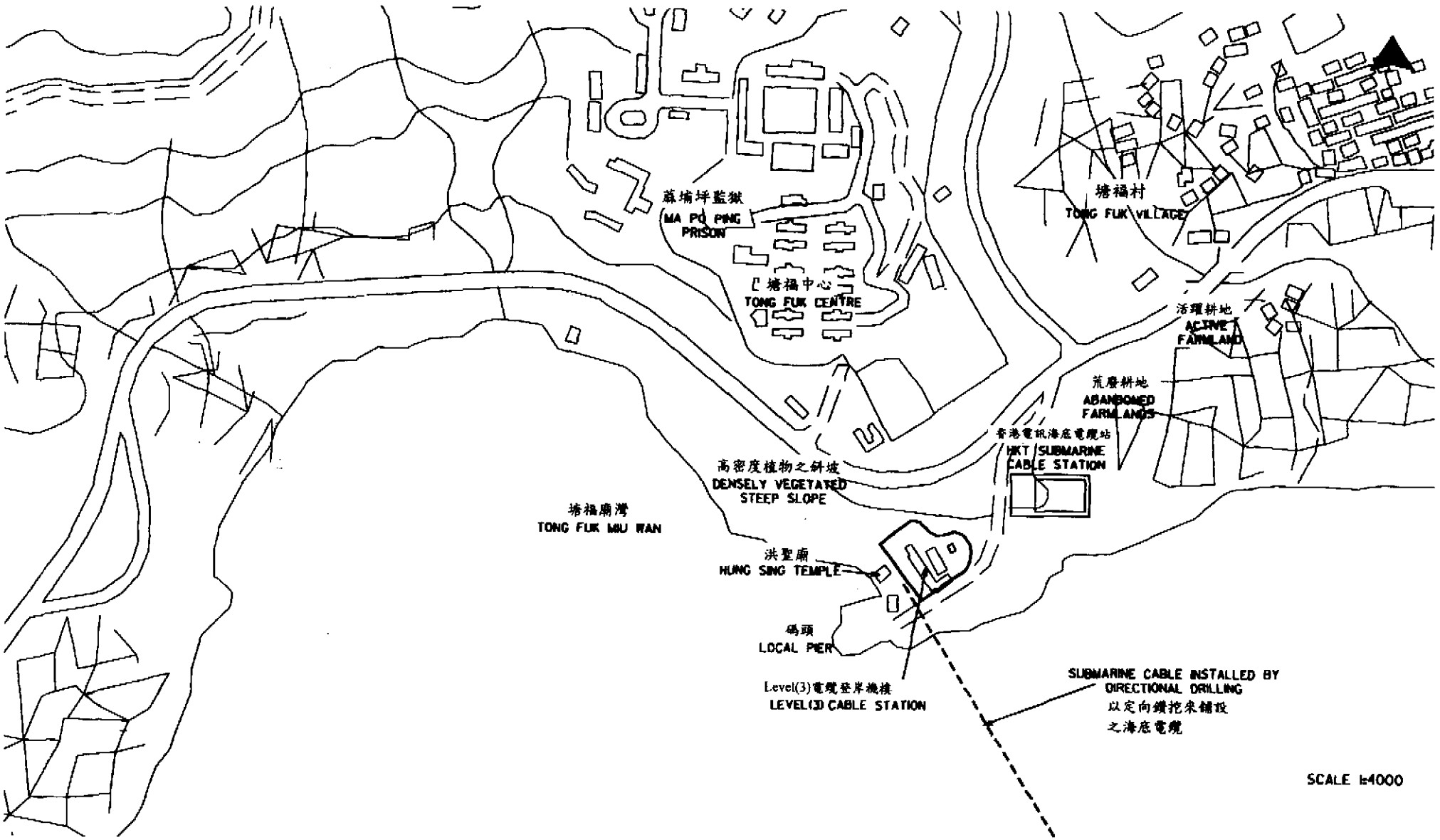

FIGURE D3a
圖 D3a

THE LOCATION OF NOISE SENSITIVE RECEIVERS
噪音敏感受體地點

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