

Asia-America Gateway (AAG) Cable Network, South Lantau

PROJECT PROFILE

October 2007

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1. BASIC INFORMATION

1.1 Project Title

Asia-America Gateway (AAG) Cable Network, South Lantau.

1.2 Purpose and Nature of the Project

The Asia-America Gateway is the first submarine cable system linking South East Asia directly with the USA (see Figure 1). AAG will provide direct access and diverse routing between South East Asia and the USA. The AAG system has advantages over the traditional trans-Pacific routes (via the North Pacific) as it avoids the areas most prone to seismic activity off the Taiwan region, which have previously resulted in damage to undersea cables and network disruptions. The cable system will span 20,000km and will use the latest Dense Wavelength Division Multiplexing (DWDM) technologies with a minimum design capacity of 1.28 terabits per second.

The project scheduled to be completed in year 2008 and is expected to meet the forecasted growth in bandwidth requirements in the Hong Kong Special Administrative Region (HKSAR) for new and revolutionary broadband applications such as IP, video, data, and other multimedia services. Furthermore, the project will provide connectivity and has the ability to be expanded in the future to Australia, India, Africa, and Europe.

AAG propose to land the cable system at Tong Fuk, South Lantau Coast, HKSAR. Within this area there are already several other submarine cables landing at the site that have been reviewed under the Environmental Impact Assessment Ordinance (EIAO) and have been found to be environmentally acceptable with no insurmountable impacts to the local environment.

An assessment of the potential environmental impacts associated with the installation of the submarine cable system has been provided in the following Project Profile. The construction and installation of the system is very similar to previous telecommunication cable system projects and once installed the cable will not result in any impact to the environment during its operation.

1.3 Name of Project Proponent

Reach Networks Hong Kong Ltd ("Reach"), as the Hong Kong Landing Party on behalf of the AAG Purchasers.

Reach Networks Hong Kong Ltd
20th Floor, Telecom House
3 Gloucester Road
Wanchai, Hong Kong SAR

1.4 Location and Scale of Project

The proposed cable system include two cables; one cable leading from the existing manhole at Tong Fuk Beach and another from the existing manhole south west of Tong Fuk Village (see Figure 2). Both cables will extend southwards out to sea beyond the boundary of HKSAR waters (approximately 10km) to connect with the rest of the AAG which extends out into the South China Sea (see Figure 3).

Only small scale excavation works will be required on the cable landing sections in order to enable to cables to enter the existing manholes.

The offshore cable laying will be by injection jetting techniques, similar to previous cable installations in this area. The intended burial depth for the offshore burial of the cable will be approximately 7m below seabed with a shallower burial depth from the beach manhole to approximately 400m off shore.

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.

1.5 Cable Route Selection Process

Several existing physical features exist within the study area (see Figures 3 and 4) that constrain the route selection and cable-laying process. As such, the final cable routes follow a narrow corridor in order to either avoid or reduce impacts to these features as far as possible. These features include:

- Existing cable systems along each of the cable alignments have been avoided and the cable routes have been selected to minimise effects on other cable systems in the area;
- The most direct route is preferred to the Tong Fuk landing site and receiving manholes;
- Avoiding the areas of incompatible seabed (such as rocky areas);
- Minimising impacts to the gazetted bathing beach at Tong Fuk, South Lantau;
- Avoiding the South Cheung Chau open sea mud disposal area for uncontaminated mud, and;
- Avoiding the intertidal sand flats of Shui Han Wan, an important horseshoe crab nursery.

1.6 Designated Projects to be Covered by the Project Profile

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

- Schedule 2 (Part I), C12 - A dredging operation which is (a) less than 500 metres from the nearest boundary of an existing or planned (iii) bathing beach; and (vii) coastal protection area.

1.7 Name and Telephone Number of Contact Person

All queries should be primarily submitted to EGS (Asia) Ltd.

EGS (Asia) Ltd.

9th Floor South, Somerset House, Taikoo Place,
979 King's Road, Quarry Bay,
Hong Kong SAR

Telephone: +852 2894 8622
Fax: +852 2576 3590
Contact Person: Lau Siu Pong
Telephone(Direct): +852 2911 9302
Mobile: +852 9038 9682
Email: bonglau@egssurvey.com

Secondary queries to Atkins China Ltd.

5th Floor, Wharf T&T Centre, Harbour City,
Tsim Sha Tsui, Kowloon,
Hong Kong SAR.

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Fax: +852 2890 6343
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Email: susana.bezy@atkins.com.hk

2. OUTLINE OF PLANNING, IMPLEMENTATION PROGRAMME & FEATURES OF ENVIRONMENT

2.1 Project Planning and Implementation

The project is to be led by EGS (Asia) Limited who are the contracted consultants for marine surveying, installation and facilitation on behalf of the AAG purchasers. Atkins China Ltd is supporting EGS (Asia) Ltd on this project.

The initial cable-laying operations are targeted to commence with the shore end cables in as early as possible in year 2008. The full completion of both routes is predicted to take less than two months within HKSAR waters.

Cable Route Descriptions

Route 1 (S1) connects with the South East Asian Segment of the system and covers a total length of approximately 9.6km in HKSAR waters. The cable starts at a manhole on the headland at Tong Fuk; close to several other existing cable-landing sites (see Section 2.5). The cable then heads in a south-easterly direction for approximately 1.1km following the contour of the Luk Keng Shan headland (though located at least 1 km from this landfall) and then follows a southerly direction for 8.5km until the cable leaves the HK SAR waters and enters the South China Sea to link up the SE Asian Segment.

Route 2 (S2) connects with the Pacific Segments under the La Union connection and covers a total length of approximately 10km in HKSAR waters. The cable starts at a manhole close to the bathing beach at Tong Fuk then travels in a south-easterly direction for 2.3km, passing the eastern side of Cha Kwo Chau Island where it then takes a southerly direction for approximately 7.4km until the cable leaves the HKSAR waters and enters the South China Sea to link up with the La Union, Philippines.

Shore End Cable Installation

The land-based cable installation activities comprise only minor excavation of a single trench from each of the beach manholes to the Low Water Mark (LWM), using a small backhoe. The trenches will be backfilled with the excavated materials. Each trench section will take between 1-2 days to complete and backfilling will be undertaken as the cable is laid in the trench. The 38mm, single-armoured fibre-optic cable (see Diagram 1), is to be encased with cast iron articulated pipe (see Diagram 2) for additional protection and will be buried to a depth of 2m below ground. The shore end works are expected to be undertaken during daytime hours but should work be required in the evening or night time hours a construction noise permit will be applied for.

Diagram 1 : Typical example of the cross sectional view of typical fibre optic cable

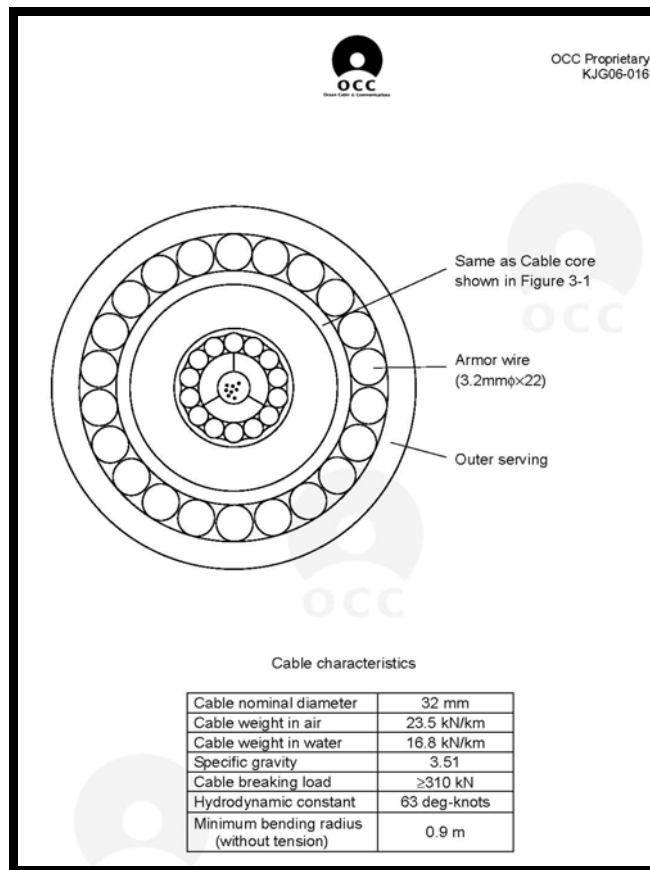
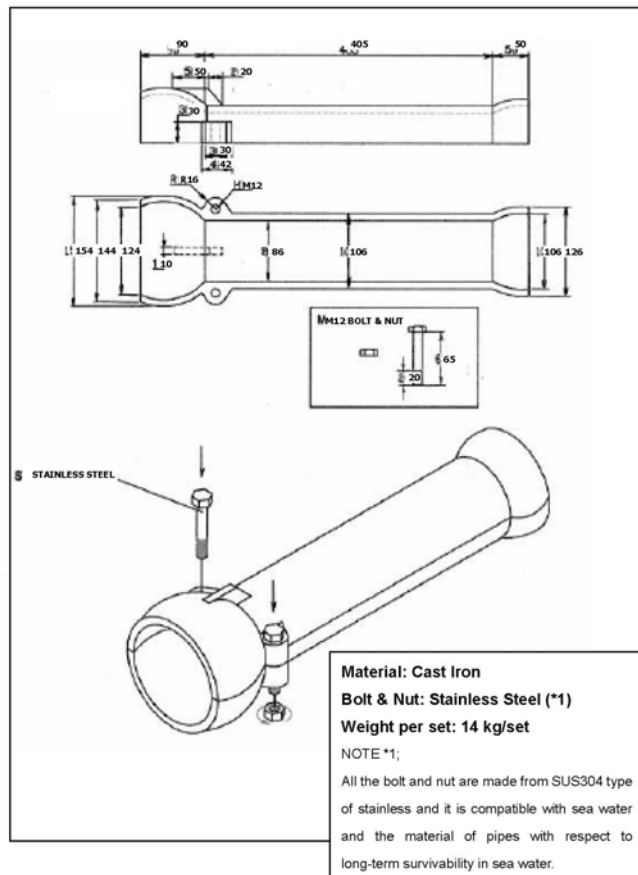


Diagram 2 : Typical example of articulated piping for shore end cable laying



Near Shore Cable Installation

From the LWM the cable-laying and burial will be carried out by divers using jet probes to sink the cable into the sediment for a distance of about 400m offshore, to such a point as to where the barge can safely access the cable without disturbing the seabed with sufficient clearance from the sea bed. The target burial depth will be 2m and articulated pipe will also be used in this section for additional protection. For this segment, the burial duration is predicted to take 7-14 days to complete each 400m section.

The shore end works are expected to be undertaken during daytime hours but should work be required in the evening a construction noise permit will be applied for.

Offshore Cable Installation

The offshore cable laying process within HKSAR waters will involve installation by injection jetting techniques. The cable is placed in an injector that is carefully laid into the seabed to the desired depth (see Figure 3A). The injection jetting helps to liquefy the sediments at the desired installation level to aid with the burial at the target depth (which will be approximately 7m below the sea bed). This method is designed to simultaneously lay and bury the cable within minimal disturbance to the seabed and with only localised impacts to the marine water quality. A dive team will be on standby during the installation to ensure proper functioning and positioning of the injector. Once in the correct position, the cable laying barge travels slowly (approximately 200-300m hr⁻¹) along the planned cable route. The offshore cable laying within HKSAR waters is expected to take about 5-7 days for each of the routes.

Once out of HKSAR waters, the first cable laying route will be completed (approximately 70km of cable) before returning to begin the second cable route after a period of 10-14 days.

In addition, two short sea earth cable / plate segments are proposed to be installed within 400m of the shore. These would extend up to 50m to the east of the Route S1 alignment (see location map) and would be installed by divers using jet probes. The cables and plates would be comprised of composite materials, all of which are inert within the marine environment.

2.2 Programme

The AAG system is provisionally scheduled to be landed and installed as early as possible in year 2008. The expected construction schedule within HK SAR waters is as follows:

Route S1

Beach - LWM works	1-2 days
Diver assisted cable laying	7-14 days
Injection Jetting to HKSAR Boundary	5-7 days

Route S2

Beach - LWM works	1-2 days
Diver assisted cable laying	7 -14 days
Injection Jetting to HKSAR Boundary	5-7 days

As mentioned, Route S1 and S2 will be undertaken sequentially and S1 is expected to be installed first with S2 to be installed approximately 2 weeks after the installation of S1 is complete in HKSAR waters.

2.3 Major Elements of the Surrounding Environment

Gazetted Marine Fairways

The cables pass through the two marine fairways of the Adamasta Channels and the West Lamma Channel.

Cable, Pipelines and Outfalls

There are nine existing submarine telecommunication cables located within the vicinity of the proposed new cable system.

The cable system crosses five existing cables that have been carefully identified and accounted for in the cable-laying methodology. The alignment for the S1 Route will cross three cables (FLAG, APCN and NACS submarine cables) before it leaves HKSAR waters. The Route S2 alignment crosses two cables (APCN and FLAG submarine cables) before leaving HKSAR waters.

During installation of the AAG cables, the existing cables will not be affected and the AAG cables will cross above the existing cables at a minimum of 2m to allow for sufficient cushion between the systems. Additional protection (such as concrete covering) will be provided for the cable systems in these segments where the burial depth is less than 5m to achieve the requirements of Marine Department and the Civil Engineering and Development Department. The cable crossings are shown on Figure 4. The concrete coverings will be set after the new cable is laid, and will cover an area of approximately 10m long (5m either side of the crossing) and 1m wide. These coverings are only 0.3m in height and would be expected to sink into the soft seabed sediment. Should any protrusion occur above the seabed, this would be the maximum amount. There will be no cable crossings within the marine fairway.

Other Proposed Facilities or Amenities

There is a proposed Marine Park located around the Soko Islands that was initially proposed in year 2001 along with a Marine Park for West Lantau. These Marine Parks have not yet been designated and they are still being reviewed by government. At present, government does not yet have a timetable for the designation of the proposed Marine Park or the proposed boundaries.

There are no other proposed marine facilities or amenities known to be present in the area that will be affected by the cables.

Coastal Protection Area

The beach manholes and beach sections of the two cable routes fall within land zoned as Coastal Protection Area (CPA) and stretches along the length of the coastline in this part of South Lantau (see Figure 3.). It has been zoned to "protect and retain the natural coastlines and the sensitive coastal natural environment, including attractive geological features, physical landform or area of high landscape, scenic or ecological value, with a minimum of built development. It is also intended to safeguard the beaches and their immediate hinterland and to prevent haphazard ribbon development along the South Lantau Coast".

Within the CPA telecommunications systems are permitted and several systems have already been installed and are in operation in the proximity of the project. The cables require soft sand for their landing and have avoided the natural rock coastline.

Gazetted Bathing Beaches

There are four gazetted bathing beaches along the south coast of Lantau and one of the cables (Route 2) lands within the boundary of the Tong Fuk Gazetted Bathing Beach, where the manhole and an existing cable is located. Minor works will be required for the on shore and shallow water installation works within this area and these impacts are further discussed in the following sections.

Other gazetted beaches on the South Lantau coast include Upper Cheung Sha, Lower Cheung Sha and Pui O, all of which are over 500m from the nearest proposed cable route alignment and these beaches will not be adversely affected by this project.

Shui Hau Intertidal Flats

The eastern edge of the Shui Hau Intertidal flats is over 1km from the landing site of the cable alignment for Route 1 (S1). These sand flats occur in an eastward facing bay, and are well-protected from oceanic currents. The area is fairly remote and as a result, ecological studies conducted in Shui Hau have received relatively scant attention. The sand flats are considered to be of high ecological value as they are one of the few known breeding sites for the horseshoe crab, a species of conservation interest in Hong Kong. However, due to the distance of the Shui Hau Intertidal flats from the project works, no adverse impacts will result from the project at this area.

Coral Communities

The western waters of Hong Kong do not have substantial areas of coral reefs, as there is a wide range of fluctuation in salinity and turbidity, from the Pearl River¹. The few coral communities that do occur are generally of low coverage and species diversity (less than 20 species)¹. No recognised coral communities exist along either of the cable alignments; the closest community is located in the waters to the north of the Soko Islands (Siu A Chau) which is more than 500m away from the closest proposed route alignment (see Figure 2). A dive survey of the cable area has been undertaken and the findings are described in the following sections.

Sites of Cultural Heritage

The closest site of Cultural Heritage interest is the Hung Shing Temple, some 300m to the west of the S1 manhole site. The Temple itself is neither a Declared nor Graded Monument, but has a long history and is significant to the local community, where active worshipping still occurs. The temple will not be affected by the cable installation.

To the north-east of the Hung Shing Temple are two area Kam-Tap (grave jars) sites and a small grave site is located on the headland in between the two proposed cable routes, approximately 280m from the proposed Route S1 alignment. The cables will avoid these sites and will not adversely affect them.

¹ Lun, CY (2003). Hong Kong Reef-building Corals. Cosmos Books Ltd. Hong Kong

3. POSSIBLE IMPACTS ON THE ENVIRONMENT

3.1 Summary of Potential Environmental Impacts

The construction and operational impacts associated with the submarine cables are summarised in Table 3-1 below and are described in details in the following Sections.

Table 3.1 : Potential Sources of Environmental Impacts

Potential Impact	Cons.*	Ops.*
• Gaseous emissions	x	x
• Dust	x	x
• Odour	x	x
• Noise	✓	x
• Night-time operations	x	x
• Traffic generation	x	x
• Liquid effluents, discharges, or contaminated runoff	✓	x
• Generation of waste or by-products	x	x
• Manufacturing, storage, use, handling, transport, or disposal of Dangerous Goods, hazardous materials or wastes	x	x
• Risk of accidents which result in pollution or hazard	x	x
• Disposal of spoil materials* ¹	x	x
• Disposal of potentially contaminated materials	x	x
• Disruption of water movement or bottom sediment	✓	x
• Unsightly visual appearance	x	x
• Ecological impacts		
- Terrestrial	x	x
- Marine	✓	x
- Fisheries	✓	x
• Cultural heritage	x	x

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

*: Cons. = Construction phase Ops. = Operation phase

*¹ There will not be any dredged or spoil materials that will require disposal.

3.2 Water Quality

A water quality assessment is provided in Annex A.

The land-based cable installation activities will involve the excavation of a trench, approximately 2m deep by 1m wide, from each of the beach manholes to the LWM using a small excavator. The trench will be backfilled with the excavated sand material after the cable is installed. Surface water run-off of sand material and disturbance of the near shore sediments are the main potential impacts that could occur to water quality. For surface water run-off, any potential impacts can be readily prevented by the implementation good site practice (such covering of excavated material). For disturbance of near shore sediments at the LWM, the works will be undertaken during the low tide and installation and backfilling will be completed within a very short time period to reduce the amount of disturbance from the rising tide. Suspended sand or sediments would be expected to settle

to the seabed very quickly and would be localised. It is therefore considered that the land based construction activities will have only short term, localised impacts to water quality at the works area which would settle out quickly and will not significantly affect the marine environment.

For the first 400m of the marine section the cable laying is to be completed by divers using jet probes to place and bury the cable within the articulated pipe to a depth of 2m. The installation process is similar to other submarine cables systems in the area and is carefully controlled by divers in the water to ensure that the cable is placed in the correct position. Suspended solids generated during the diver assisted installation are expected to be localised and short term in duration. As such, only minimal disturbance to water quality are expected to result which will not significantly affect the marine environment.

For the offshore section, where the water is deep enough for a barge to operate without affecting the marine sediments (approximately 400m from the shore) the injection jetting technique will be used, burying the cables to depths of 7m below the seabed. The injector (see Figure 3A) is lowered onto the seabed and is placed at the desired burial depth. During the cable laying process the sediment is fluidised at the burial depth level to assist with the laying process and the cables are simultaneously immediately backfilled by the sediment. The injection tool is approximately 15cm in width and only minimal disturbance is anticipated to the seabed. The injection jetting process will be completed at a speed of approximately 200-300m hour⁻¹.

The injection jetting will create the temporary formation of localised suspended sediments around the immediate area of disturbance, which is predicted to remain close to the seabed and based on previous similar projects have been found to be localised to the bottom of the water column and will settle out very quickly. As such, the cable-laying procedures are not expected to have significant adverse impacts to water quality. Suspended fine sediments in the water column are expected to resettle onto the seabed within about 3 minutes and are not expected transport more than about 100m (see Annex A).

There are no predicted adverse impacts that would occur to the flow of water from the project. Only short term disturbance to sea bed sediments would result of the cable laying and burial activity. Although no unacceptable impacts are predicted to occur to marine water quality, the following measures are proposed to be incorporated into the project:

- Works carried out within 200m of the Tong Fuk gazetted beach are scheduled to avoid the peak bathing season. However, should it be necessary to install cable S2 during the bathing season (April through October), advanced approval for these works would be required from LCSD;
- Water quality protection measures will be incorporated as part of good working practices. Backfilling will be undertaken for trenched areas on the shore as the cable is installed to avoid exposed areas and reduce stockpiles. Stockpiles will be covered to reduce run off of materials entering the marine water.

In addition to the above measures, verification monitoring of water quality during the cable installation process will be undertaken as outlined in Annex A2.

3.3 Marine Ecology

A marine ecological assessment is provided in Annex B.

Based on literature reviews of past surveys in the vicinity of the cables, are two areas of medium to high ecological value, including the sandy beach at Tong Fuk Mui Wan²³ and the

² Morton, B., Morton, J. (1983) The Sea Shore Ecology of Hong Kong. Hong Kong University Press. 350pp.

³ Shin P.K.S. and Cheung S.G. (1999) A study of soft shore habitats in Hong Kong for conservation and education purposes. Final Report ECF Project 23/99., HKSAR.

intertidal mudflat at Shui Hau⁴ (both are situated more than 500m from the proposed cable routes).

Based on the results of a subtidal (dive) survey of the area and review of existing information on the marine communities surrounding the cable routes, the area of the route alignments are considered to be of low ecological value, supporting a low diversity of intertidal and subtidal sessile and soft bottom assemblages, which are commonly found elsewhere in Hong Kong. Direct loss of benthic organisms along the cable routes will occur during the construction phase. This is, however, not considered to be an adverse, irreversible ecological impact as colonization of benthic organisms on benthic substrates is expected to occur promptly after the cable installation work and no habitat will be lost permanently.

Recent monitoring reports⁵ reveal that the waters of South Lantau have had significantly lower observations of marine mammals than waters to the west or north of Lantau and, as such, the area through which the two cable alignments pass through are not considered being a habitat of major importance for cetaceans within Hong Kong.

As there are no unacceptable impacts predicted to occur to marine ecology, no specific mitigation measures are recommended. However, as part of the baseline documentation of the project and sub tidal engineering review, the cable alignment will be surveyed by divers for the first 400m prior to installation. As part of this survey a marine biologist should be included in the survey team to provide input on any refining of the route alignment and the results of this survey and photo documentation shall be deposited with the Director of Agriculture, Fisheries and Conservation (AFCD) and the EIAO Register at least one month prior to cable installation.

3.4 Fisheries

A fisheries assessment is provided in Annex C.

A literature review of the fisheries resources and operations within the Study Area show that areas adjacent to the two cable routes support fisheries of low-medium ranking. There are no Fish Culture Zones within the Study Area and, no predicted impacts to fisheries resources or operations as a result of the cable-laying work or operation of the cable systems. Any disturbance of seabed sediment will be temporary and localised and the cables will be buried to a sufficient depth to prevent any accidental interference from fisheries operations.

As there are no unacceptable impacts predicted to occur to fisheries, no specific mitigation measures are recommended.

3.5 Noise

A noise assessment is provided in Annex D.

A single backhoe will be utilised to excavate the land based trench for the two cables and a temporary generator may be required for the onshore and nearshore works. Some noise will be generated from this work but noise levels are minimal and short term in nature (less than 2 days at each site) and will be located more than 100m from noise sensitive receivers. Adverse impacts are not expected to occur to noise sensitive receivers in the area during daytime hours and a construction noise permit will be applied for during restricted hours, if required.

As there are no unacceptable impacts predicted to occur to noise sensitive receivers, no specific mitigation measures are recommended.

⁴ Chiu, H. M. C., Morton, B. (1999) Final Report. The biology, distribution and status, of horseshoe crabs, *Tachyplesus* and *Carcinoscorpius* (Arthropoda: Chelicerata), in Hong Kong: recommendations for conservation and management. A Final Report to China Light & Power Co. Ltd.. The Swire Institute of Marine Science, The University of Hong Kong.

⁵ Hung, SKY (2006). Monitoring of Chinese White Dolphins (*Sousa chinensis*) in Hong Kong Waters – Data Collection. Report to Agriculture, Fisheries and Conservation Department.

3.6 Cultural Heritage and Archaeological Resources

A cultural heritage assessment is provided in Annex E.

The Hung Shing Temple is approximately 300m away from any excavation work for the shore section of Route S1 and grave sites are located about 280m from the site. It is considered that there will be no adverse impact on the Temple or grave sites as a result of the small-scale and temporary excavation work required on the beach.

A marine archaeological assessment was undertaken by a qualified marine archaeologist. A total of 13 sonar contacts were identified and were found to be modern debris. There were no other features on the seabed which could be indicative of archaeological resources. As such, no impacts are expected to result from the project to marine archaeology.

As there are no unacceptable impacts expected to result from the project to cultural heritage and archaeological resources, no specific mitigation measures are recommended.

3.7 Others

Gaseous Emissions - Exhaust emissions from construction plant will be insignificant due to the limited plant required for excavation. As such, adverse impacts on air quality will not result from the construction activities.

Dust - Dust is expected to be negligible due to the limited site area, the small quantity of earth to be excavated sand or moved and short duration of the works.

Odour - No odour impacts will result from the construction activities.

Night-time operations - It is expected that work will be undertaken during daytime hours; however, should evening or night-time operations be necessary, a construction noise permit will be applied for.

Traffic Generation - No major traffic will be generated from the cable installation.

Generation of Waste and By-products - All trenches excavated will be backfilled with the excavated material once the cable has been laid; thus, waste materials are not expected to be generated.

Manufacture Storage, Use, Handling, Transport, or Disposal of Dangerous Goods, Hazardous Materials or Wastes - Dangerous goods and hazardous materials are not anticipated to be used or generated during the construction process.

Risk of Accidents Resulting in Pollution or Hazard - No pollution or hazard generating accidents are expected to result from cable installation process.

Disposal of Spoil or Contaminated Material - No spoil or contaminated material will be excavated or generated from the construction work.

Landscape and Visual - The cable is to be buried under the beach and under the seabed. As such, no visual or landscape impacts are predicted.

Terrestrial Ecology - There will be no impacts to terrestrial ecology resulting from the construction and operation of these two submarine cables.

Nuisance / Others - The S2 cable will be located within the Tong Fuk Gazetted Beach. The cable has been routed to avoid the designated bathing area (within the shark net) but will be installed on the eastern end of the gazetted beach area. The Leisure and Cultural Services Department (LCSD) has been contacted with regard to the project and has requested that if works are within the gazetted beach area cannot be avoided, these works should be carried out between November and March, when the beach is officially closed. The cables are provisionally scheduled to be installed in early 2008 (outside the bathing season); however, this will be dependant upon the receipt of other permits required for installation. Should the installation be required between April through October, approval would need to be obtained from LCSD prior to installation of the S2 cable.

4. PROTECTION MEASURES AND FURTHER IMPLICATIONS

4.1 Possible Severity, Distribution and Duration of Environmental Effects

Potential environmental impacts are considered to be minimal, temporary and localised. No impacts from operation are expected.

4.2 Cumulative Impacts

There are no anticipated works proposed within the cable route alignments during their installation. The CLP Liquefied Natural Gas (LNG) receiving terminal and facilities are proposed to be located within the Soko Islands. The works would be located approximately 1km to the west of the nearest proposed cable alignment and cumulative impacts are not anticipated.

4.3 Further Implications

The landing points at Tong Fuk for the two cable routes have been utilised by several other cable systems which provide worldwide and region connectivity and no records of adverse impacts to the environment have been identified from the installation of these systems.

4.4 Use of Previously Approved EIA Reports

- Submarine Cable Landing Installation in Tong Fuk Lantau for Asia Pacific Cable Network 2 (APCN2) Fibre Optic Submarine Cable System (AEP-069/2000). The Environmental Permit was approved in July 2000 (EP-069/2000). This cable is installed in the same area as the proposed AAG system.
- Telecommunication installation at Lot 591SA in DD328, 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, Level 3 Communications Ltd (AEP-064/2000). The Environmental Permit (EP-064/2000) was granted in June 2000. This cable is installed in the same area as the proposed AAG system.
- Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities (AEP 257/2006). The Environmental Permit (EP 257/2007) was granted in April 2007.
- Proposed 132kV Submarine Cable Route for Airport "A" to Castle Peak Power Station Cable Circuit (AEP 267/2007). The Environmental Permit (EP-267/2007) was granted in March 2007.
- Hong Kong Electric Co Ltd 132kV Submarine Cable Installation for Wong Chuk Hang - Chung Hom Kok 132kV Circuits (AEP-132/2002). The Environmental Permit (EP-132/2002) was granted in April 2002.
- FLAG North Asian Loop (AEP-099/2001). The Environmental Permit (EP-064/2000) was granted in June 2001.
- C2C Cable Network - Hong Kong Section: Chung Hom Kok, GB21 (Hong Kong Limited) (AEP-087/2000). The Environmental Permit (EP-087/2000) was granted in February 2000.
- New T&T Hong Kong Limited: Domestic Cable Route, New T & T (AEP-086/2000). The Environmental Permit was granted in February 2001.
- East Asian Crossing (EAC) Cable System (TKO) (AEP-081/2000). The Environmental Permit (EP-081/2000) was granted in October 2000.
- East Asian Crossing (EAC) Cable System (AEP-079/2000). The Environmental Permit (EP-079/2000) was granted in September 2000.

4.5 Measures Proposed

As there are no unacceptable impacts predicted to occur, no specific mitigation measures are required. However, as part of the project works, the following will be undertaken:

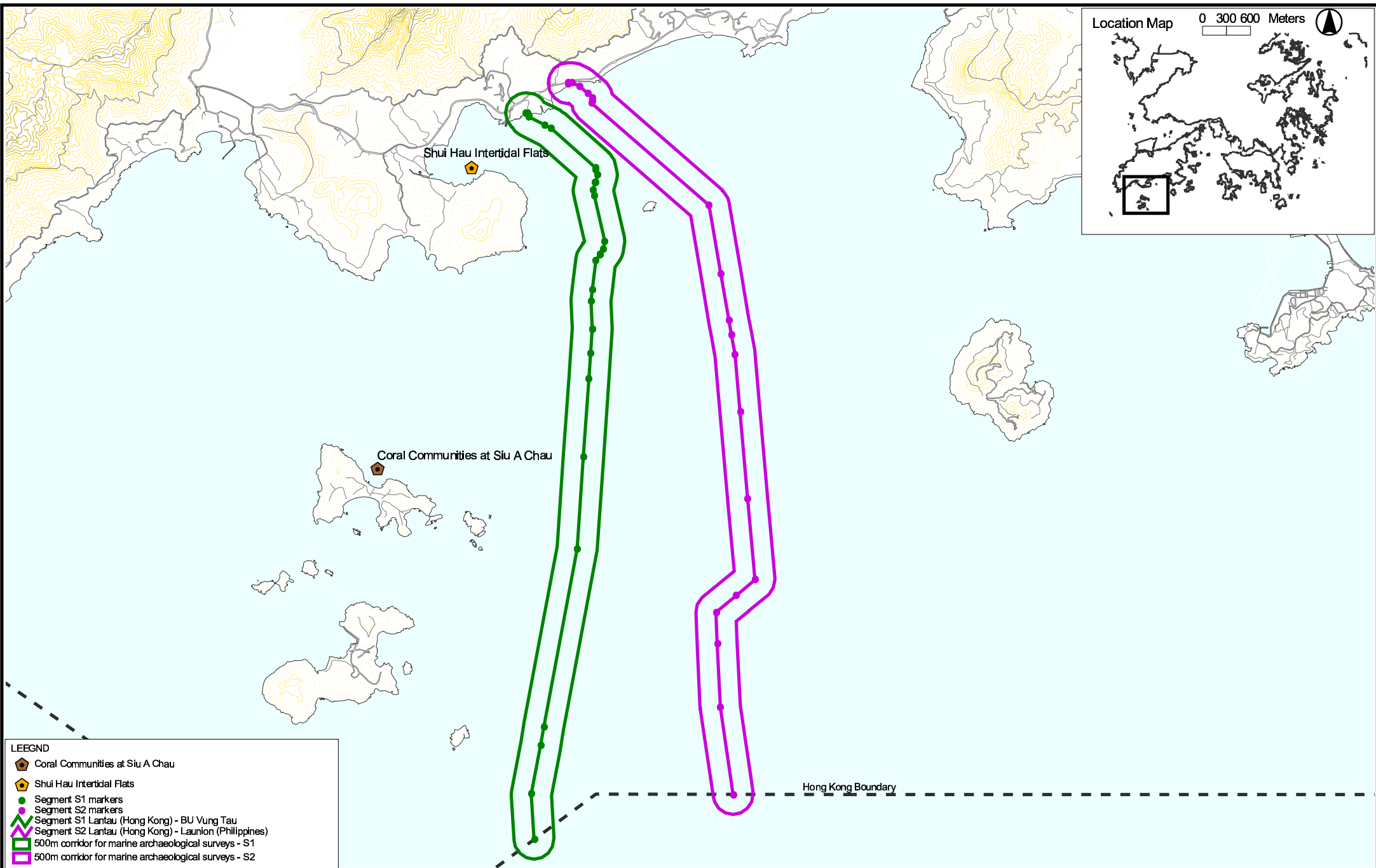
1. As part of the baseline documentation of the project and sub tidal engineering review, the cable alignments will be surveyed along the specific cable route (along the full alignment, not in transects) by divers for the first 400m prior to installation. As part of this survey a marine biologist shall be included in the survey team to provide input on any refinements of the route alignment in the field. The results of this survey and photo documentation will be deposited with the Director of Agriculture, Fisheries and Conservation (AFCD) to their satisfaction and the EIAO Register at least one month prior to cable installation.
2. The following measures will also be undertaken:
 - Works carried out within 200m of the Tong Fuk gazetted beach are provisionally scheduled to avoid the peak bathing season and will avoid impacts to bathers. However, should it be necessary to install cable S2 during the bathing season (April through October), advanced approval for these works would be required from LCSD;
 - Water quality protection measures will be incorporated as part of good working practices. Backfilling on the beach will be undertaken for trenched areas on the shore as the cable is installed to avoid large segments of exposed areas and reduce stockpiles. Stockpiles will be covered to reduce run off of materials entering the marine water.

4.6 Environmental Monitoring & Audit









Although no significant impacts have been identified for the project, water quality verification monitoring during the installation of the cable system has been proposed and is detailed in Annex A2.



			Asia-America Gateway (AAG) Cable Network, South Lantau	Title : Overview of AAG System in South East Asia
				Date : Oct 2007 Figure : 1



LEGEND

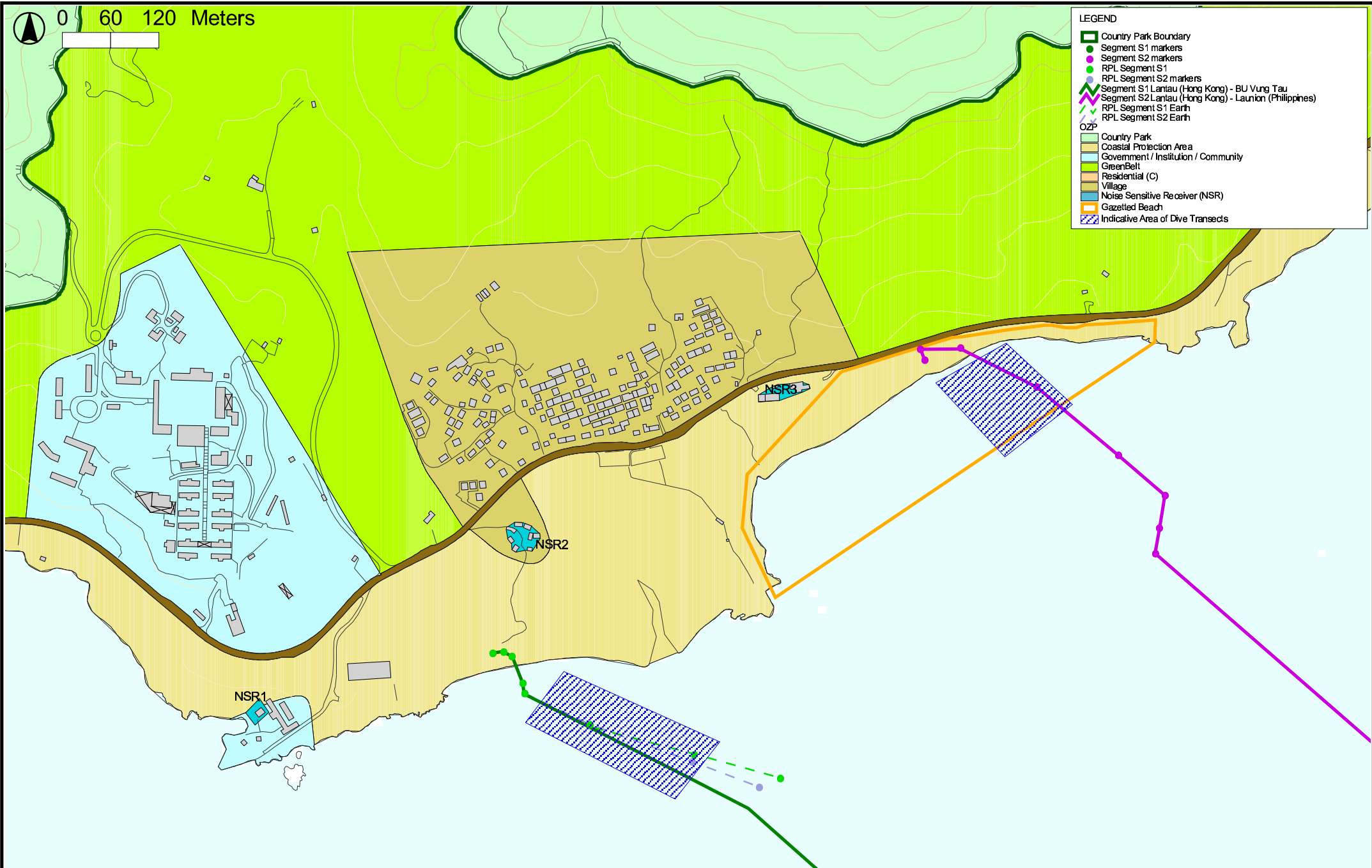
-  Coral Communities at Siu A Chau
-  Shui Hau Intertidal Flats
-  Segment S1 markers
-  Segment S2 markers
-  Segment S1 Lantau (Hong Kong) - BU Vung Tau
-  Segment S2 Lantau (Hong Kong) - Launion (Philippines)
-  500m corridor for marine archaeological surveys - S1
-  500m corridor for marine archaeological surveys - S2



Asia-America Gateway (AAG) Cable Network,
South Lantau

Title:	Location of alignments in HKSAR waters		
Date:	October 2007	Figure:	2

0 60 120 Meters



- LEGEND**
- Country Park Boundary
 - Segment S1 markers
 - Segment S2 markers
 - RPL Segment S1
 - RPL Segment S2 markers
 - Segment S1 Lantau (Hong Kong) - BU Vung Tau
 - Segment S2 Lantau (Hong Kong) - Launion (Philippines)
 - RPL Segment S1 Earth
 - RPL Segment S2 Earth
 - OZP
 - Country Park
 - Coastal Protection Area
 - Government / Institution / Community
 - Green Belt
 - Residential (C)
 - Village
 - Noise Sensitive Receiver (NSR)
 - Gazetted Beach
 - Indicative Area of Dive Transects



Asia-America Gateway (AAG)
Cable Network,
South Lantau

Title :

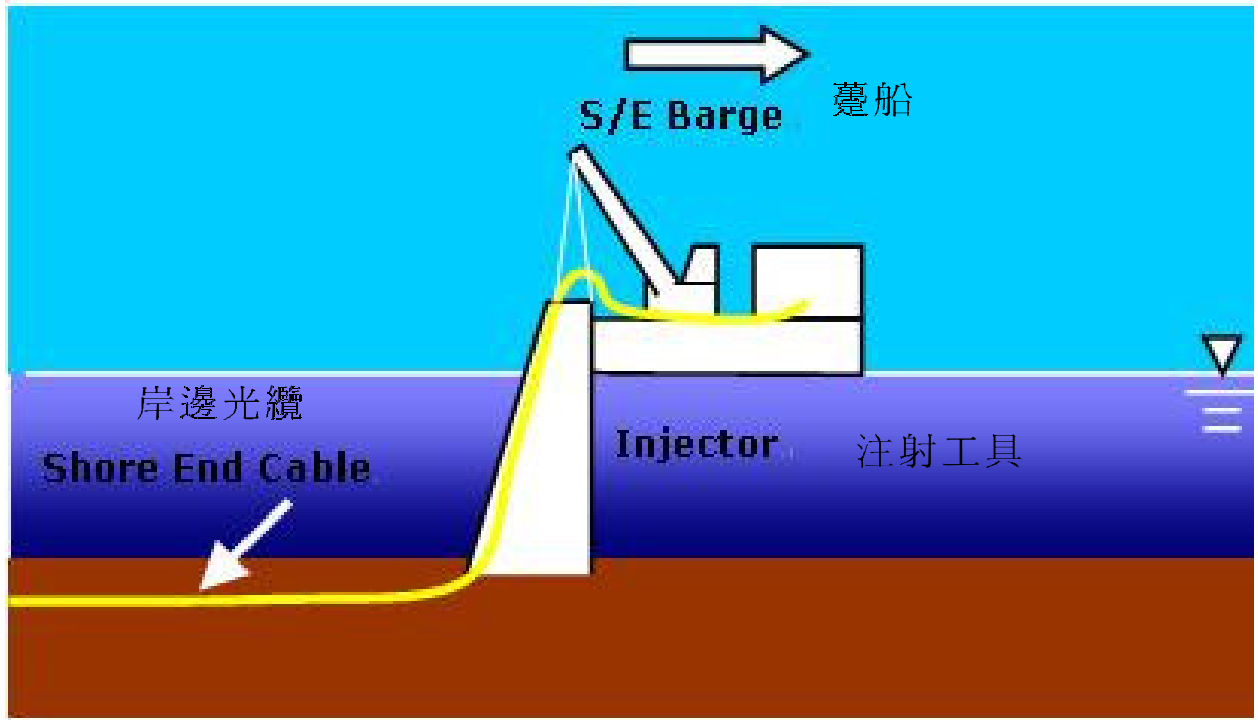
Layout Plan

Date :

October 2007

Figure :

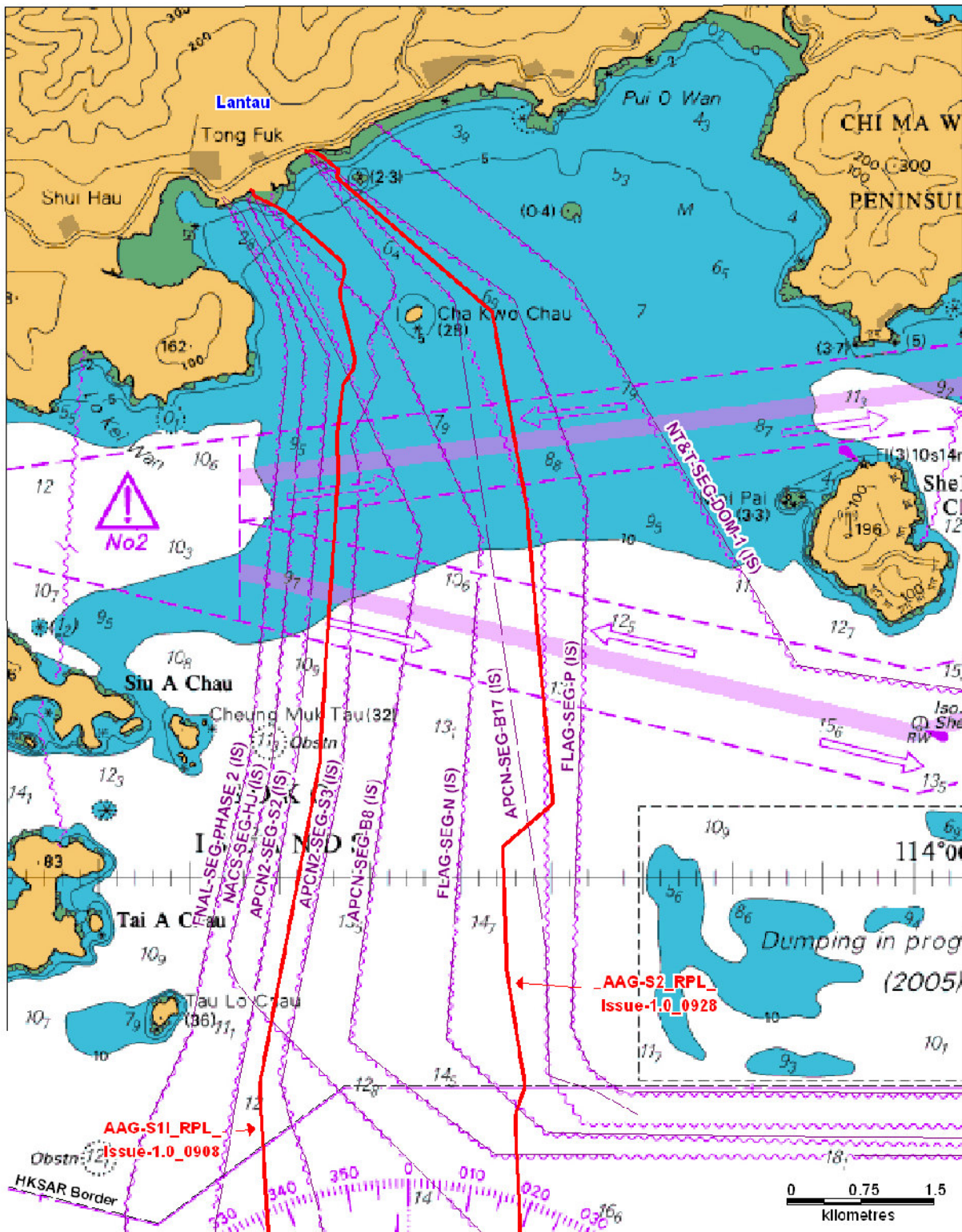
3



Cable laying process using injector tool 利用注射工具進行光纜鋪設過程



Cable laying barge with injector tool 裝有注射工具的光纜鋪設躉船



ATKINS

Asia-America Gateway (AAG)
Cable Network,
South Lantau

Title: Proposed locations of cables
S1 and S2 and existing cables
landing at Tong Fuk

Date: Oct 2007 Figure: 4



Route S1: Beach Landing Point S1部份:沙灘登陸點



Route S2: Beach Landing Point S2部份:沙灘登陸點



**Asia-America Gateway (AAG)
Cable Network,
South Lantau**
南大嶼山亞美海底光纜系統

Title :

Beach Landing Points
沙灘登陸點

Date :

Oct 2007

Figure :

5

Annex A

Assessment of Potential Impacts to Water Quality

ANNEX A ASSESSMENT OF POTENTIAL IMPACTS TO WATER QUALITY

A1 Relevant Legislation and Assessment Criteria

The Technical Memorandum for the Environmental Impact Assessment Ordinance (EIAO-TM) Annex 14 sets out the relevant guidelines for assessing impacts to water quality. In order to evaluate impacts to water quality, further criteria are provided in Annex 6 of the EIAO-TM.

In addition, the following pieces of legislation need to be properly considered:

- Water Pollution Control Ordinance (WPCO);
- Technical Memorandum for Effluents Discharge into Drainage and Sewerage Systems, Inland and Coastal Waters (TM ICW);
- Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN 1/94).

A2 Description of Environment

Hydrodynamics

For part of the cable routes, there is protection from significant tidal currents from the Soko Islands to the south-west and the land features of Southern Lantau. Beyond the Soko islands, to the south and west, the currents flow in a north-west to south-east direction around the south-western tip of Lantau Island.

Water Quality

The proposed routes for the submarine cables pass through the Southern Water Control Zones (WCZ) and pass by two of the EPD routine water quality monitoring stations (SM13 and SM17). A summary of water quality from these stations is provided in the following Table⁶.

Table A1 : Summary of Marine Water Quality Readings between 1998- 2005 from EPD Monitoring Stations SM13 and SM17

Water Quality Parameter	SM13			SM17		
	Mean	Min	Max	Mean	Min	Max
Temperature	23.62	15.5	29.8	23.26	15.6	29.8
Salinity (psu)	30.69	12.7	33.9	31.68	10.2	34.8
pH	8.2	7.6	9.1	8.1	7.2	9.3
Dissolved Oxygen (% saturation)	97	27	158	92.5	36	207
Dissolved Oxygen (mg/L)	6.8	1.8	10.3	6.56	2.4	14.1
Total Inorganic Nitrogen (mg/L)	0.21	0.02	1.28	0.15	0.01	1.17
Suspended Solids (mg/L)	8.5	1	72	8.22	0.8	120
Escherichia coli (cfu/100ml)	13.83	<1	470	3.21	<1	200
Chlorophyll-a (microgram/L)	5.26	0.3	27	3.25	0.2	30

⁶ Environmental Protection Department website
http://www.epd.gov.hk/epd/english/environmentinhk/water/marine_quality/mwq_home.html Accessed 24 September 2007.

Sediment Quality

The project is within the vicinity of the routine sediment quality monitoring stations SS6 operated by EPD. Marine sediment data has been collected from this station between 1998 and 2005⁷ as shown below, which shows the sediment is not classified as contaminated.

Table A2 : Summary of Marine Water Quality Readings between 1998- 2005 from EPD Monitoring Station SS6

WQ Parameter	Mean Value	Minimum value	Maximum Value
Nickel (mg/kg)	18.75	11	29
Arsenic (mg/kg)	6.89	5.4	11
Chromium (mg/kg)	29.09	16	48
Copper (mg/kg)	17.31	8	31
Cadmium (mg/kg)	<0.1	<0.1	<0.1
Total Kjeldahl Nitrogen (mg/kg)	336.25	200	440
Mercury (mg/kg)	0.08	0.05	0.16
Zinc (mg/kg)	80.03	52	120
Lead (mg/kg)	32.59	22	55

Marine Sensitive Receivers

The sensitive receivers identified within the proximity of the proposed project include:

- (a) Gazetted bathing beaches -Tong Fuk, Cheung Sha Upper and Lower and Pui O;
- (b) Sites of Ecological Interest - intertidal habitats of Shui Hau Wan; Coral communities at Siu A Chau, and;
- (c) Fisheries - Spawning Grounds and Nurseries.

⁷ Environmental Protection Department website
http://www.epd.gov.hk/epd/english/environmentinhk/water/marine_quality/mwq_home.html Accessed 24 September 2007.

Distances to the Sensitive Receivers

Water Quality Sensitive Receivers	Approx Distance to Proposed Cable Route S1	Approx Distance to Proposed Cable Route S2
Gazetted Beachs <ul style="list-style-type: none"> • Tong Fuk • Lower Cheung Sha • Upper Cheung Sha • Pui O 	<ul style="list-style-type: none"> • 400m • 850m • >1km • >4km 	<ul style="list-style-type: none"> • 0m • 450m • >1km • 4km
Sites of Ecological Interest <ul style="list-style-type: none"> • Shiu Hau Wan • Siu A Chau 	<ul style="list-style-type: none"> • 1km • >1.5km 	<ul style="list-style-type: none"> • >1.5km • >1.5km
Fisheries	Alignment passes through the edges of Fisheries Zones of low-medium ranking fisheries	Alignment passes through areas of low ranking fisheries

A3 Impact Assessment

Laying of the Cables at Landing Sites

Preparation of Landing Site - These activities will involve a excavations between the beach manhole at each of the two sites down to the Low Water Mark (LWM). On the beach, the cable will be buried in the trench from the manhole to the LWM and then backfilled using a backhoe. The main impacts of this type of work on land are primarily concerned with surface water run-off and can be readily controlled by good site working practices (such as covering of stockpiled materials to prevent runoff).

Installation of the Marine Sections of Cable

The first 400m (approximately) of cable will be installed by divers using jet probes to bury the cable to a depth of 2m in articulated pipe. It is anticipated that the burying by divers will not cause significant water quality impacts in regard of a small area that will be disturbed. From the 400m area off shore, an injector tool will be lowered onto the seabed off of a barge to the desired burial depth of 7m. The integrity of the cable will be confirmed by divers, and the injector will commence to fluidise the sediment to assist will ease of burial. The barge will then slowly commence moving forward along the appropriate planned cable route, laying the cable at between 200-300m hour⁻¹. This operation will carry on through the extent of HKSAR waters.

The potential water quality impacts are expected to be localised and of short term duration as shown in Attachment A1 (Based on experience of other similar projects) and the sediment plume would be limited to 100m at most and would be localised within the bottom of the water column and would settle out within about 3 minutes. As such, no impacts are expected to result.

A4 Mitigation Measures

It is considered that there will be no adverse effects to water quality arising from the installation of the marine sections of cables and therefore, however the following measures will be incorporated into the project works;

- Works carried out within 200m of the Tong Fuk gazetted beach will be scheduled to avoid the peak bathing season (April through October). Should it be necessary to install cable S2 during the peak bathing season, approval for these works would be required in advance from LCSD;

- Water quality protection measures will be incorporated as part of good working practices. Backfilling will be undertaken for trenched areas on the shore as the cable is installed to avoid exposed areas and reduce stockpiles. Stockpiles shall be covered to reduce run off of materials entering the marine water.

A5 Monitoring

Although impacts are not predicted to occur to water quality from the installation of the project, a verification monitoring programme has been proposed to be undertaken prior to and during cable installation as outlined in Annex A2.

A6 Summary and Conclusions

The installation of the marine sections of the system required the cable to be buried using injection tool to an approximate depth of 7m under the seabed. The methodology used will result in temporary disturbance of the seabed and plumes of suspended sediment concentrations will be localised along the cable route. It is predicted that there will be no adverse impacts to the sensitive receivers identified.

ATTACHMENT A1 CALCULATION OF THE TRANSPORT OF SEDIMENT IN SUSPENSION

1. Injection Jetting

This method has been implemented on several other studies within Hong Kong SAR with success and no impacts reported. These projects include;

- 1,800MW Gas-fired Power Station for Lamma Extension. (EIA-009/1998);
- New T&T Hong Kong Limited: Domestic Cable Route, New T & T (AEP-086/2000);
- FLAG North Asian Loop. (AEP-099/2001); and
- C2CCable Network - Hong Kong Section: Chung Hom Kok, GB21 (Hong Kong Limited) (AEP-087/2000).

Figures and formulas from these projects have been adapted for use in this study. The calculations have been made for Release Rate, Settling velocity and Settling time and also the Distance Travelled for Suspended Sediment. Upper limits for the parameters have been used to account for a worse case scenario.

2. Release Rate

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

$$\text{Release rate} = 1.75 \times 0.083 \times 600 \times 0.2 = \mathbf{17.43 \text{ kg s}^{-1}}$$

Depth of disturbance = 7m (maximum burial depth of cable)

Width of disturbance = 0.25m (width of seabed disturbance to bury cable)

Cross Section area = 1.75m^2

Loss Rate = 20% (majority of sediment not disturbed)*

Speed of machine = 0.083ms^{-1} (300m hour^{-1})

In situ dry density = 600 kg m^3 (typical of Hong Kong seabed sediment)*

* = figures used from previous Project Profiles with similar injection jetting methodologies.

3. Initial Concentration of Suspended Sediments

During the cable laying process, 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.

It is assumed that the suspended sediments will remain within 1m of the seabed, which is independent of the water depth. Although the current speeds at the sea bed are lower than those near the water surface the further assumption that the current speed is 0.5m s^{-1} (See FLAG North Asian Loop AEP-099/2001- where an upper bound estimate of surface current speeds of the same area is used) to calculate a worse case scenario. A maximum spread of 6m along the centre line of the alignment is also assumed.

If the sediment mixes over the lower 1m of the water column (a conservative assumption to accommodate worse case scenario as typical sediment plumes for this tool are generally limited to 30 cm from the seabed) and over the initial length of spread of the sediment, the initial concentration of the suspended sediment is as follows:

$$\text{Initial concentration} = \frac{\text{Release rate}}{\text{(current speed x height of sediment x width of sediment)}}$$

$$\text{Initial Concentration} = \frac{17.43}{0.5 \times 1 \times 6} = 5.81 \text{ kg m}^{-3}$$

$$\text{Current speed} = 0.5 \text{ m s}^{-1}$$

$$\text{Height of sediment} = 1 \text{ m}$$

$$\text{Width of Sediment} = 6 \text{ m}$$

4. Settling Velocity and Settling Time

Typically the settling velocity of suspended solids is determined by examining the relationships between the initial suspended solid concentrations and the cohesive nature of the sediment disturbed. It is generally accepted that an increase in sediment concentration also increases the settling velocity, a result of flocculation leading to gain in mass and therefore they settle faster. However when concentrations exceed 1 kg m^{-3} this theory is not true. As the Initial concentration for this project is predicted to be greater than this value, a conservative settling velocity of 10 mm s^{-1} is adopted.

Previous studies have shown that as sediment settles on the seabed, the concentrations gradually reduce. In order to account for this factor, the settling velocity is halved to give a value of 5 mm s^{-1} .

$$\text{Settling Time} = 1 \text{ m} / 0.005 \text{ m s}^{-1} = 200 \text{ s}$$

5. Distance Travelled

Combining this Settling time with the speed of the tidal currents allows an estimate of how far the sediment will spread during the cable laying process. In this case, a tidal current of 0.5 m s^{-1} has been assumed.

$$\text{Distance Travelled} = 200 \text{ s} \times 0.5 \text{ m s}^{-1} = 100 \text{ m}$$

No sensitive receivers are within 100m metres of the injection jetting operations when using the injection tool and sensitive receivers identified are generally over 400m from the works area. The cable-laying barge requires will begin operations at a distance of 400m from the shore for both alignments. Therefore, adverse water quality impacts are not expected to result from the project.

ATTACHMENT A2 PROPOSED WATER QUALITY VERIFICATION MONITORING

1. WATER QUALITY VERIFICATION MONITORING

The following Section provides details of the water quality verification monitoring to be undertaken immediately prior to and during the installation of the submarine cable system. The monitoring will be undertaken for two activities, the diver assisted jet probe installation and during injection jetting. The detailed monitoring programme shall be submitted to EPD for approval prior to the installation works and commencement of the monitoring.

2. SAMPLING AND TESTING METHODOLOGY

Parameters Sampled

Parameters to be measured in situ are:

- dissolved oxygen (DO) (%saturation and mg/L)
- temperature (C)
- turbidity (NTU)
- salinity (ppt)

The only parameter to be measured in the laboratory will be:

- suspended solids (SS) (mg/L)

Other information shall be measured and recorded in field logs, including the location of the sampling stations and cable burial activities at the time of sampling, water depth, time, weather conditions, sea conditions, tidal state, current direction and speed, and works that may influence the monitoring results.

Equipment

For water quality monitoring, the following equipment will be used:

- Dissolved Oxygen and Temperature Measuring Equipment - The instrument shall be a portable, weatherproof dissolved oxygen measuring instrument complete with cable, sensor, comprehensive operation manuals, and shall be operable from a DC power source. It shall be capable of measuring: dissolved oxygen levels in the range of 0 - 20 mgL-1 and 0-200% saturation; and a temperature of 0-45 degrees Celsius. It shall have a membrane electrode with automatic temperature compensation. Sufficient stocks of spare electrodes and cable shall be available for replacement where necessary (for example, YSI model 59 meter, YSI 5739 probe, YSI 5795A submersible stirrer with reel and cable or an approved similar instrument).
- Turbidity Measurement Equipment - Turbidity should be measured from a split water sample from the SS sample. A suitable turbidity test kit should be used to measure the turbidity level.
- Salinity Measurement Instrument - A portable salinometer capable of measuring salinity in the range of 0-40 ppt shall be provided for measuring salinity of the water at each monitoring location.
- Water Depth Gauge - No specific equipment is recommended for measuring the water depth.
- Current Velocity and Direction - No specific equipment is recommended for measuring the current velocity and direction.
- Positioning Device - A Global Positioning System (GPS) shall be used during monitoring to ensure the accurate recording of the position of the monitoring vessel before taking measurements.

- Water Sampling Equipment - A water sampler, consisting of a transparent PVC or glass cylinder of not less than two litres, which can be effectively sealed with cups at both ends, shall be used (Kahlsico Water Sampler 13SWB203 or an approved similar instrument). The water sampler shall have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth.

Sampling / Testing Protocols

All in situ monitoring instruments shall be checked, calibrated and certified by a laboratory accredited under HOKLAS or any other international accreditation scheme before use. Responses of sensors and electrodes shall be checked with certified standard solutions before each use. For the on-site calibration of field equipment, the BS 1427: 1993, Guide to Field and On-Site Test Methods for the Analysis of Waters shall be observed. Sufficient stocks of spare parts shall be maintained for replacements when necessary. Backup monitoring equipment shall also be made available so that monitoring can proceed uninterrupted even when equipment is under maintenance, calibration etc.

Water samples for SS measurements shall be collected in high density polythene bottles, packed in ice (cooled to 4°C without being frozen), and delivered to a HOKLAS laboratory as soon as possible after collection.

Laboratory Analysis

All laboratory work shall be carried out in a HOKLAS accredited laboratory. Water samples of sufficient quantity specified by the laboratory shall be collected at the monitoring and control stations for carrying out the laboratory determinations. The analysis shall start within the next working day after collection of the water samples. The SS laboratory measurements shall be provided within 2 days of the sampling event (48 hours). The analyses shall follow the standard methods as described in APHA Standard Methods for the Examination of Water and Wastewater, 19th Edition, unless otherwise specified (APHA 2540D for SS).

The QA/QC details shall be in accordance with requirements of HOKLAS or another internationally accredited scheme.

3. VERIFICATION MONITORING PROGRAMME

Monitoring shall be undertaken for each of the cable routes at two locations along the cable route alignment; a point approximately 200m from the shore (Point A) to enable sufficient water depth and at the area designated for the injection jetting works (approximately 400m from the shore) (Point B).

The monitoring shall be undertaken immediately prior to and 20 minutes from commencement of the cable installation works at each location mentioned above. At point A, the monitoring shall include sampling points in a semi circle either side of the cable works area from the shore (9 points in total in a radius around the cable working point) stationed 50m (3 points), 100m (3 points) and 150m (3 points) from the installation works area. At point B, the sampling should include sampling points in a radius around the cable installation point (see figure at end of section). Sampling shall occur immediately prior to and after passing of the injection jetting works to verify the water quality monitoring predictions. Replicate samples will be taken at each sampling point.

Monitoring will be undertaken at Point A at mid depth of the water column (due to the shallow water depth) and at 1m from the bottom for Point B. Sampling should be undertaken during the most optimal tidal state to ascertain the extent of the sediment plume (eg. mid ebb to ebb tide for Point A and during mid flood to flood tide for Point B).

For Point A, a comparison in the field of turbidity levels at each station before after commencement of the cable installation will be undertaken to review significant changes to the water quality at the three incremental distances. The review will be undertaken in the field as follows:

1. Pre-installation monitoring will be undertaken and the data will be logged on record sheets, including tidal conditions and current speed and direction.
2. Once the information is logged, the boat will position at the downstream sampling station 50m from the cable installation area. Once positioned, the cable installation works will commence and sampling will be undertaken at the first station about 20 minutes from the commencement of the work. The sampling will proceed with the downstream stations and then complete the remaining stations while the works are being undertaken.
3. The data will be reviewed in the field with regard to the predicted extent of the sediment plume reach (100m). Should turbidity levels be more than 130% the value of the pre installation monitoring and during installation at the 100m station, and be attributed to the cable installation works, then working practices will be reviewed and amended to reduce turbidity.
4. Monitoring works will continue and adjustments until suitable near shore cable installation working practices can be undertaken without exceeding the above criteria.

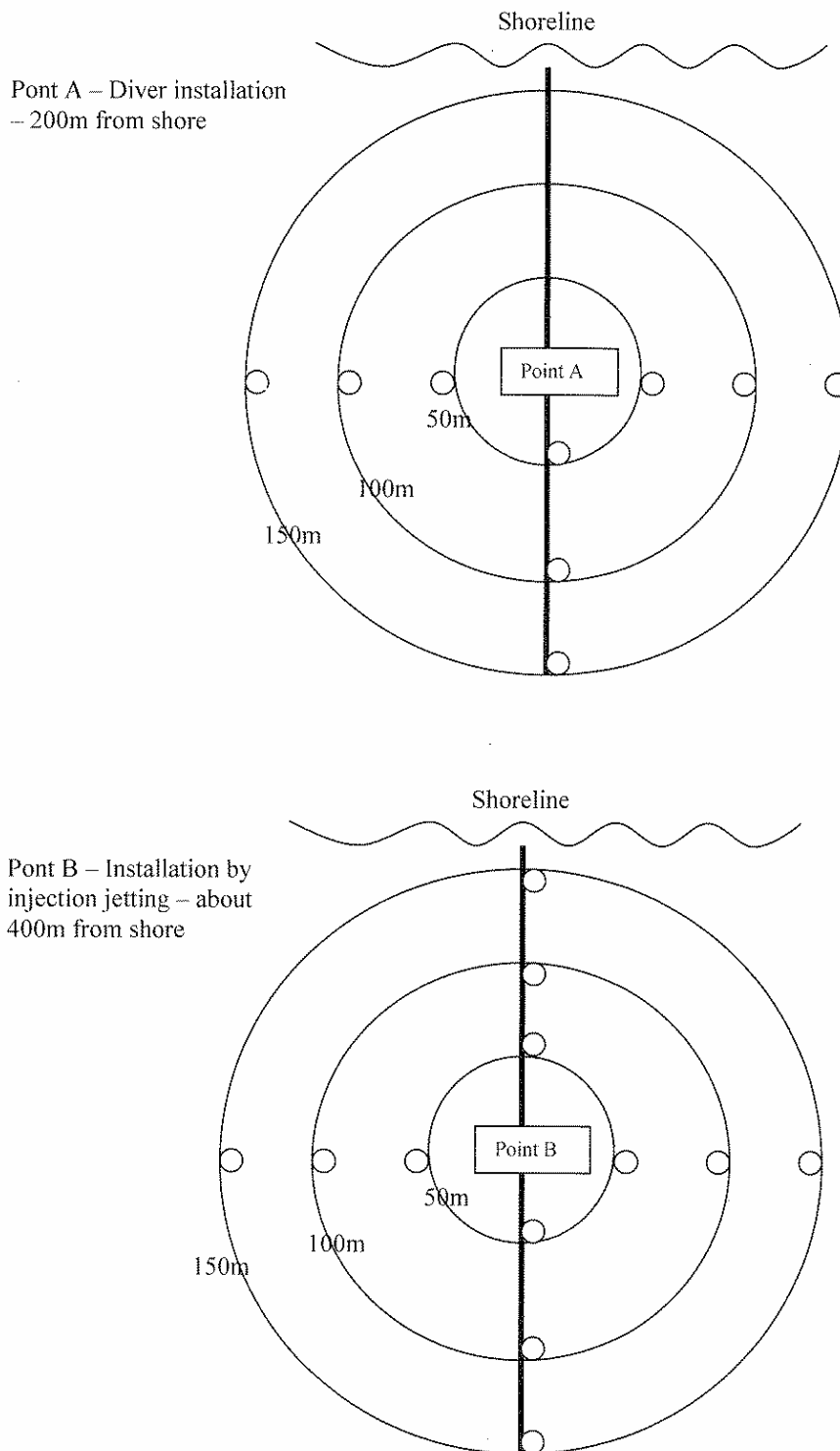
With regard to the laboratory data, including SS and other information collected during the survey, this information will be reviewed with regard to the cable installation practices and reported to EPD as detailed below.

A similar approach will be taken for sampling Point B, during Injection jetting. Should turbidity levels exceed the above criteria, the installation speed will be reduced and sampling will continue with amendments to the installation practice until the above criteria are achieved.

4. REPORTING

As the sampling will be undertaken for verification purposes only, a letter report shall be provided to EPD that shall include the monitoring results in addition to operating practices of the cable installation process during sampling (including: position, speed, cable burial depth) and an interpretation of monitoring results. The report will be provided within 1 week of the sampling activities.

Figure A2.1 : Example of Monitoring Station Configuration



Annex B

Assessment of Potential Impacts to Marine Ecology

ANNEX B ASSESSMENT OF POTENTIAL IMPACTS TO MARINE ECOLOGY

B1 Relevant Legislation

The EIAO-TM Annex 16 sets out the relevant guidelines for assessing impacts to ecology. In order to evaluate impacts to ecology, further criteria are provided in Annex 8 of the EIAO-TM.

All cetaceans are protected under *The Wild Animals Protection Ordinance (Cap.170)*.

B2 Description of the Environment

Intertidal Shore Assemblages

The two landing sites in the Tong Fuk area are located on a semi-exposed pebble beach (Route S1) and a sandy beach (Route S2), which are typical of the South Lantau coastline. In addition, both beaches are sandwiched between rocky/boulder headlands at each end.

Studies have been carried out on the sandy/pebble beach of the Route S1 in 2000⁸. The results of this surveys indicated that the beach was typical of a natural, semi-exposed sandy/pebble shore in Hong Kong and no species of conservation interest were recorded⁸.

The landing point for Route S2 is located on Tong Fuk gazetted Bathing beach and is a typical sandy shore that would be associated with recreational use. It is well used in the summer, and there is very little evidence of intertidal fauna observed along, or adjacent, to the cable alignment other than several burrows of ghost crabs *Ocypode* spp. It is considered that this beach is of low ecological value.

Local Species of Conservation Interest

It is known that Shui Wan, a sheltered intertidal sandflat over 1km to the west of the landing sites, is a breeding site for the horseshoe crabs. The habitats found at the two landing points for this project are unlikely to provide suitable breeding requirements or nursery grounds for these animals due to either the beach substrate is of inappropriate material (Route S1 - sandy/pebbles/boulders) and the amount of human disturbance that would be present (particularly Route S2).

Subtidal Assemblages

Previous dive studies in the area⁸ have highlighted that the subtidal areas around Tong Fuk are of relatively low ecological interest with two individual colonies of gorgonian sea whips observed in during a dive survey in year 2000, and no other species of conservation interest was observed. The Gorgonian sea whips are of ecological interest though are not considered to be rare in Hong Kong waters⁹.

Surveys were carried out on the 15,16 and 17 September 2007 to update the status of corals in these areas; the methodology and results of these surveys can be seen in *Attachment B1*.

In summary, the surveys found no rare species of conservation interest was found. Although patches of hard corals were found, the abundance of these organisms was very low.

⁸ Environmental Permit (EP-064/2000) Project Profile for Level 3 Communications. Telecommunications Installation at Lot 591SAin DD328, Tong Fuk, South Lantau Coast and the Associated Cable Landing Works in Tong Fuk, South Lantau for the North Asia Cable (NAC) Fibre Optic Submarine Cable System.

⁹ Clark, TH (1995). The distribution of ahermatypic corals at Cape d'Aguilar, Hong Kong. *The Marine Flora and Fauna of Hong Kong and Southern China IV. Proceedings of the Eighth International Marine Biological Workshop; the Marine Flora and Fauna of Hong Kong and Southern China*, Hong Kong, 2-20 April1995. Edited by Brian Morton. Hong Kong University Press.

In the vicinity of Site S1, hard coral cover was below 5% and only 16 small colonies (1 to 25 cm²) from one species, *Oulastrea crispata*, was recorded in the REA transects. The species is commonly found in local shallow sea with turbid water¹⁰.

In the vicinity of Site S2, sessile species including hard coral was absent. The sandy bottom at deeper water was characterized by numerous holes made by burrowing animals. Although little information on the subtidal soft bottom assemblages in the proposed cable routes is available, previous projects/ studies have identified these sites as of low ecological value¹¹.

Marine Mammals

Up to 18 species of cetacean have been recorded from Hong Kong waters (though two species are unconfirmed)¹². Of these 18 species, two species, the Indo-Pacific Hump-backed Dolphin *Sousa chinensis* (locally known as the Chinese White Dolphin) and the Finless Porpoise *Neophocaena phocaenoides*, are the most regularly occurring cetaceans in Hong Kong waters.

Recent monitoring surveys conducted on behalf of AFCD have not recorded the presence of the Chinese White Dolphins along the cable alignment during surveys in 2005-06¹³, with recent studies showing the majority of observations of this marine mammal to use the waters around the western and northern coasts of Lantau. The few observations of the 2005-06 surveys of Chinese White Dolphins in southern waters refer to five sightings around the Soko Islands in the summer 2005¹³.

Finless Porpoise have been recorded in the waters south of Lantau, with three observations in the bay around Tong Fuk and in the deeper water towards to Hong Kong SAR boundary from the Monitoring Study of 2005-06¹³.

Though both Chinese White Dolphins and Finless Porpoises have been recorded in the area, from the results of these studies, it would appear that the southern waters of Lantau along which the cable alignments are proposed are of limited use to marine mammals due to the relatively low records of sightings in this area compared to the waters around northern and western Lantau.

B3 Impact Assessment

Construction Phase

Direct Impacts

During the construction phase, there will be temporary, localised disturbances to the seabed and foreshore due as a result of the trench excavation and also the installation of the cables within the articulated pipe and grounding system by the divers. Based on this subtidal (dive) baseline survey and a review of the existing information on the marine communities surrounding the cable routes, the study sites are of low ecological value, supporting a low diversity of subtidal sessile and soft bottom assemblages, which are commonly found elsewhere in Hong Kong. Direct loss of benthic organisms along the cable route will occur during the construction phase. This is, however, not considered as an adverse, irreversible ecological impact as colonization of benthic organisms on benthic substrates is likely to occur promptly after the constructive work as no habitat will be lost permanently.

¹⁰ Chan ALK, Choi, CLS, McCorry, D, Chan KK, Lee, MW, Ang, P. (2005) Field guide to hard corals of Hong Kong. Agriculture, Fisheries and Conservation Department. Hong Kong.

¹¹ Environmental Permit (EP-064/2000) Project Profile. Telecommunication installation at Lot591SA 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 Systems, Level 3 Communications Ltd. (EP-064/2000).

¹² Jefferson, TA (2005). Monitoring of Indo-Pacific Humpback Dolphins (*Sousa chinensis*) in Hong Kong Waters – Data Analysis Final Report. Report to Agriculture, Fisheries and Conservation Department.

¹³ Hung, SKY (2006). Monitoring of Chinese White Dolphins (*Sousa chinensis*) in Hong Kong Waters – Data Collection. Report to Agriculture, Fisheries and Conservation Department.

Indirect Impacts

There will be a small increase in suspended solids (see Annex A. Suspended solids can affect filter feeding organisms, temporarily decreasing dissolved oxygen levels and also increase turbidity at local levels.

It is envisaged that the suspended solids generated by the injection jetting process will remain close to the seabed, and combined will be localised and short term in duration. As such, significant impacts are not expected to result.

Following the guidelines in the EIAO TM Annex 8 the potential impacts to marine are as follows:

Aspect	Notes
Habitat Quality	The Subtidal seabed is considered to be of low ecological value
Species	No species of ecological value have been identified during the Subtidal dive surveys. Chinese White Dolphin <i>Sousa chinensis</i> and Finless Porpoises <i>Neophocaena phocaenoides</i> are known to infrequently occur in the waters south of Lantau.
Size	Two cables are to be laid, each of approximately 10km in length within Hong Kong SAR waters, and will be laid in the marine environment by divers and using an injection jetting methodology.
Duration	The period of work is programmed to last less than 2 months.
Reversibility	Direct loss of benthic organisms along the cable route will occur during the construction phase. This is not considered as an adverse, irreversible ecological impact. Re-colonization of benthic organisms on benthic substrates is likely to occur prompt after the constructive work as no habitat will be lost permanently. Other impacts are not expected.
Magnitude	No areas of high ecological value are to be impacted. The cable alignments pass through areas considered to be of low ecological value, which are predicted to be re-colonized by benthic organisms shortly after construction. The magnitude of the impact is considered to be Low .

Operation Phase

It is considered that there will be no negative impacts to marine ecology during the operational phases of the two submarine cables.

B4 Mitigation Measures

As it is predicted no negative impacts are likely to occur to the marine ecological resources during the construction and operational phases of this project, no mitigation measures are proposed. However, as part of the baseline documentation of the project and subtidal engineering review the cable alignment will be surveyed by divers for the first 400m prior to installation. As part of this survey a marine biologist shall be included in the survey team to provide input on any refining of the route alignment and the results of this survey and photo documentation shall be deposited with the Agriculture, Fisheries and Conservation Department (AFCD) and EIAO Register.

B5 Summary and Conclusions

Dive surveys and review of available literature has identified the intertidal and subtidal regions of the alignments support fauna of low ecological value, typical of similar habitats in Hong Kong. Due to the relatively low numbers of marine mammals observed from recent monitoring surveys from waters to the south of Lantau when compared to western and northern waters of Lantau, it is considered that the waters through which the cable routes pass are of limited importance to cetaceans in Hong Kong.

The cable laying will result in temporary and localised direct loss of benthic organisms along the cable routes. This is not considered as an adverse, irreversible ecological impact. Re-colonization of benthic organisms on benthic substrates is likely to occur prompt after the constructive work as no habitat will be lost permanently. As such, impacts are not found to be significant.

ATTACHMENT B1 SUBTIDAL BENTHIC SURVEY RESULTS

1. Introduction

This section presents the results of ecological assessment of benthic cover at two sites (Sites S1 and S2) at Tong Fok, Lantau Island.

2. Methodology

Assessment of benthic substrate and community using the semi-quantitative, Rapid Ecological Assessment (REA) method was conducted within the areas of both Sites S1 and S2. The dive surveys were conducted on 15, 16 and 17 September 2007.

REA has been adopted in many regions to examine baseline information on coral reefs, such as the Great Barrier Reef¹⁴. This method can be applied to a wide range of coral reef and community types and were also used in a coral community study in Hong Kong with some modification¹⁵.

At each site selected for REA study, five 50m-long transect tape (T1 to T5) was laid. Each transect was positioned at an approximately constant depth range in the vicinity of the proposed cable routes. Survey was performed along the transect tape. On each transect, a belt area of 100m² (2m wide x 50m long) was surveyed.

Two types of information were recorded: (1) Cover of the major benthic groups; and, (2) Inventory of sessile benthic taxa

These were performed according to Tier I and Tier II levels of information. Tier I: involves the categorization of ecological (benthic cover) and environmental variables.

Tier II: Taxonomic inventories to define types of benthic communities. An inventory of benthic taxa was compiled during each swim. Taxa were identified either *in situ* or with the aid of photographs to confirm identification afterward.

Hard corals (Order Scleractinia) - to genus and species level whenever possible.

Soft corals (Subclass Octocorallia) - genus level

Other benthos (such as sponges, zoanthids, bryozoans, macroalgae etc) - high taxonomic level (usually phylum plus growth form)

Each taxon in the inventory was given a rank (0 to 5) on the basis of its abundance in the community at the site. These broad categories rank the taxa in terms of the relative abundance of individuals, rather than the contribution to benthic cover, at each site.

3. Results

The survey area in Site S1 was mainly composed of large and small boulders with overall percentage cover of 40% and 23%, respectively. The dominant sessile organisms were mussels and tube worms with overall percentage cover of 15% and 35%.

The first three transects were composed of large and small boulders with percentage cover of >50% and >30%, followed by fine sand (< 10%). The rock surface along the first two transects was mainly covered by small mussels (35 - 40%) and tube worms (35 - 40%). T3, in contrast, was dominated by tube worms (~ 55%) with low abundance of mussels (< 5%). Few small patches of coralline algae, encrusting algae, bryozoans, barnacles and sponges were recorded (all < 5%) along these transects. One species of hard coral was recorded along these three transects, but abundance was low (< 5%),

¹⁴ DeVantier, L. M., De'Ath G., Done, T. J., Turak, E. (1998) Ecological Assessment of a complex natural system: A case study from the Great Barrier Reef, *Ecological Applications* 8, pp.480-496.

¹⁵ Oceanway Corporation Ltd. (2003) Corals and coral communities of Hong Kong: Ecological values and status 2001-02. Report submitted to Agriculture, Fisheries and Conservation Department. Hong Kong.

only few small colonies (1 - 25 cm²) of *Oulastrea crispata* were recorded.

The fourth transect was also dominated by large and small boulders but rock surface was mainly covered by tube worms (~ 40%) and bare surface with sediments (~ 55%), with few small patches of barnacles and bryozoans. Few small colonies (1 - 5 cm²) of hard coral, *O. crispata*, were recorded in this area. The last transect, in contrast, was sandy bottom with few small boulders and no coral was found..

In Site S2, the transects were mainly composed of fine sand. The cable alignment has been realigned to the east, to avoid the shark net on the gazetted Tong Fuk beach east of the transect area. The substrate in this area is of similar composition. Sessile animals found in Site S1 were absent in Site S2. The last two transects were characterized by holes made by burrowing animals, which were absent along the first three transects. Hard corals were absent along all transects and few animals were recorded on sand surface.

4. Coral community

Only 1 species of hard coral was observed in Site S1 and no hard coral was recorded in Site S2. The only sampled hard coral species was *Oulastrea crispata* (Family Faviidae). The species is characterized by its encrusting growth form and small size of only a few centimetres across. *O. crispata* mainly inhabit subtidal turbid water, attached to wave washed rock; and the abundance is generally not high within its distribution range¹⁶.

A total of 16 colonies were found over the 5 REA transects in Site S1. Sizes of the colonies were small, ranged from 1 to 25 cm². The colonies were generally healthy, with no evidence of being suffered from sedimentation, bleaching and mortality.

No soft coral, gorgonian or sea whip was recorded in both Sites S1 and S2.

¹⁶ Veron J. (2000) Corals of the world. AIMS. Townsville.

Annex C

Assessment of Potential Impacts to Marine Fisheries

ANNEX C ASSESSMENT OF POTENTIAL IMPACTS TO FISHERIES

C1 Relevant Legislation

The Technical Memorandum for the Environmental Impact Assessment Ordinance (EIAO-TM) Annex 17 sets out the relevant guidelines for assessing impacts to fisheries. In order to evaluate impacts to fisheries, further criteria are provided in Annex 9 of the EIAO-TM.

Destructive fishing practices such as the use of explosive, toxic substances, electricity, dredging and suction devices for the purpose of fishing are detrimental to fisheries and the marine ecosystem and are prohibited under the Fisheries Protection Ordinance (Cap 171).

Marine fish culture is protected and regulated by the Marine Fish Culture Ordinance (Cap. 353) which requires all marine fish culture activity to operate under licence in designated fish culture zones.

C2 Description of the Environment

In Hong Kong, the marine fisheries are split into Culture and Capture fisheries. The most up-to-date data for these fisheries has been sourced from the AFCD website in order to assess any potential impacts on the fishing grounds that occur along the proposed cable alignments.

Capture Fisheries

During 2001-02, AFCD carried out a comprehensive Port Survey to collect updated data on the fisheries production and fishing operations in Hong Kong waters¹⁷. Through the survey, useful information for the formulation and implementation of effective fisheries management strategies and assessment of potential environmental impact of marine development projects on fisheries can be obtained. The southern waters of Hong Kong, namely the Fishing Zones of South Lantau and South Cheung Chau have been identified as good spawning grounds and nursery areas for both fish and crustaceans¹⁸. These fishing zones are outside of both of the proposed cable alignments. Generally, the seasonal abundance of fry in Hong Kong is at its highest between March and September for most commercial fish species with a peak between June and August; the majority of spawning of these species is concentrated between June and September¹¹. Commercially important crustaceans spawn between April and November¹¹.

Culture Fisheries

The closest culture fishery to the cable alignments is at Cheung Sha Wan, approximately 10km from the sites, in southeast Lantau. It is considered that the construction and operational phases of this project will not affect this FCZ.

C3 Fisheries Impact Assessment

Construction Phase

Direct Impacts

Both of the submarine cables are to be laid and buried using the injection jetting methodology. Injection jetting equipment will bury the cable to a maximum depth of 7m, operating over an area of width of 0.15m.

The seabed will be receiving minimal disturbance for a temporary period, allowing immediate recolonisation by benthic fauna following the burial of the cables.

¹⁷ Agriculture, Fisheries and Conservation Department Website.
<http://www.afcd.gov.hk/english/fisheries/fish_cap/fish_cap_latest/fish_cap_latest.html> Downloaded on 24 September 2007.

¹⁸ ERM-Hong Kong, Ltd (1998). Fisheries Resources and Fishing operations in Hong Kong Waters. Final Report. For Agriculture, Fisheries and Conservation Department.

The cable is provisionally planned to be installed in early 2008.

There are no long-term impacts predicted to fisheries resources or operations, though there will be some minor, short-term impacts along the respective cable alignments on the sea bed during the cable-laying operation.

Indirect Impacts

There will be some minor, short-term impacts by way of elevated suspended solids during the cable-laying operations. As discussed in Annex A, only a narrow corridor is required for burial of cables along the route alignments, and much of the suspended sediments resulting from the injection jetting will settle on the seabed in a short period of time over a relatively small distance.

It is considered that these indirect effects of the cable-laying operation will create negligible, if any, impacts to fisheries resources or operations.

Following the guidelines in the EIAO TM Annex 9 the potential impacts to fisheries are set out in the following table.

Criteria	
Nature of Impact	Small and localised disturbances will occur as a result of the cable-laying and burial along the alignment of the cable routes. Both cables alignments are approximately 10km long in Hong Kong SAR waters.
Size of affected area	The two cable routes each cover approximately 10km through HKSAR waters. Only a very narrow portion of the sea bed will be temporarily affected, the width of the injector and a small area either side. The duration of impact to the sea bed will only be for a few seconds as the injector passes.
Size of the Fisheries Resources/Production	The two cable routes pass through areas of low-medium fisheries value, when compared to other areas of Hong Kong (see Figures C1 and C2). Route S1 passes along the edges of fishing zones of both low and medium production. Route S2 only passes through areas of low production.
Destruction and Disturbance of Spawning and Nursery Grounds	The cable routes do pass close to Fishing Zone (Figure C2) which are as spawning/nursery grounds for commercially important species. Any impacts arising from the cable-laying and burial are considered being minimal and short term and that the sea-bed will be readily recolonised by benthic fauna.
Impact on fishing activity	The cable alignments do pass through fishing zones of low-medium fisheries production. However, the work is short in duration and as such; it is considered that no impacts to fisheries operations are expected.
Impacts on Aquaculture Activities	There are no impacts to Fish Culture Zones (FCZ) predicted from this project. The closest FCZ is 10km away at Cheung Sha Wan.

Operational Phase

During the operational phase of the project, no impacts to either fisheries resources or to fisheries operations are predicted. The cable, buried at some 7m below the sea-bed, is unlikely to be damaged by any fishing activity.

C4 Mitigation Measures

No adverse impacts to fisheries resources or operations are predicted from the cable-laying or operational phases of this project and therefore, no mitigation measures are proposed.

C5 Summary and Conclusions

The waters through which the two cable alignments are to pass are considered to be of low-medium value as fishing grounds, and they are also important areas for spawning grounds and nursery areas for several commercial species. The proposed construction work will be temporary and localised and any sediment dispersal resulting from the injection jetting process is considered to be negligible for mobile species, such as fish. Cables are to be laid at approximately 7m under the seabed and are not considered to inhibit any fisheries operations. No negative impacts are expected to arise from this project.

Figure C1 : Distribution of fisheries production (adult fish) in Hong Kong SAR in relation to the two proposed cable alignments (Base Map from AFCD Port Survey 2001-02)

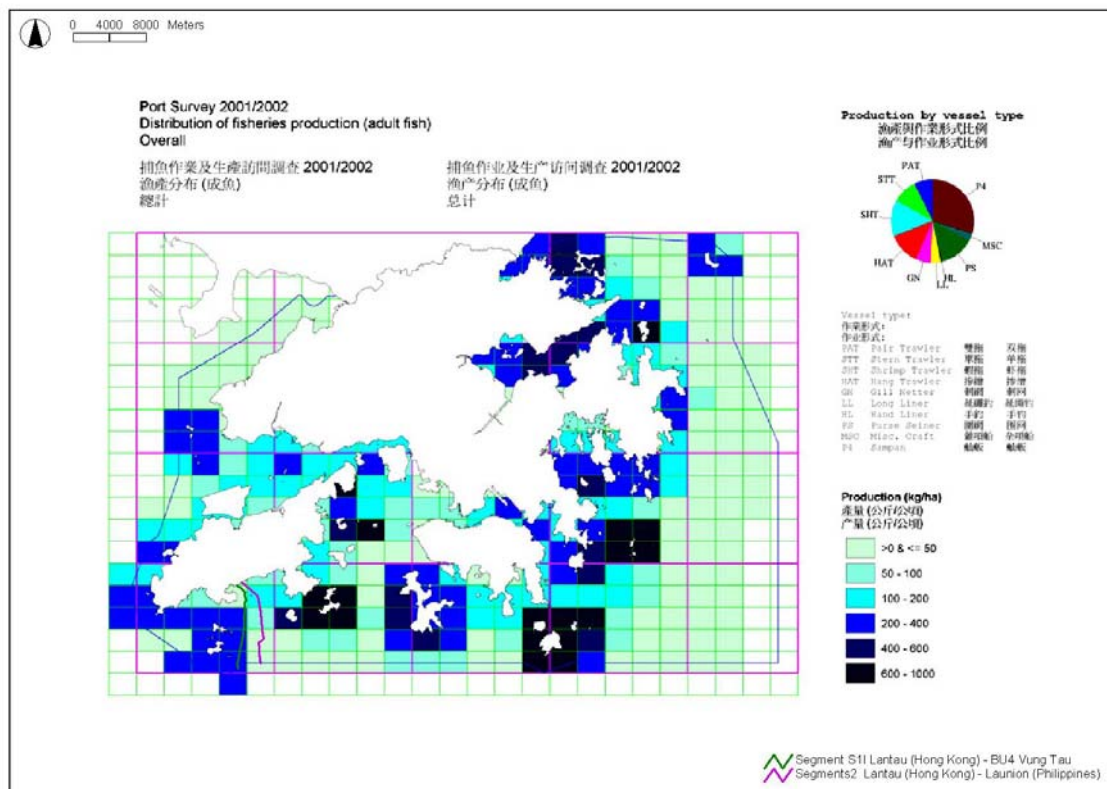
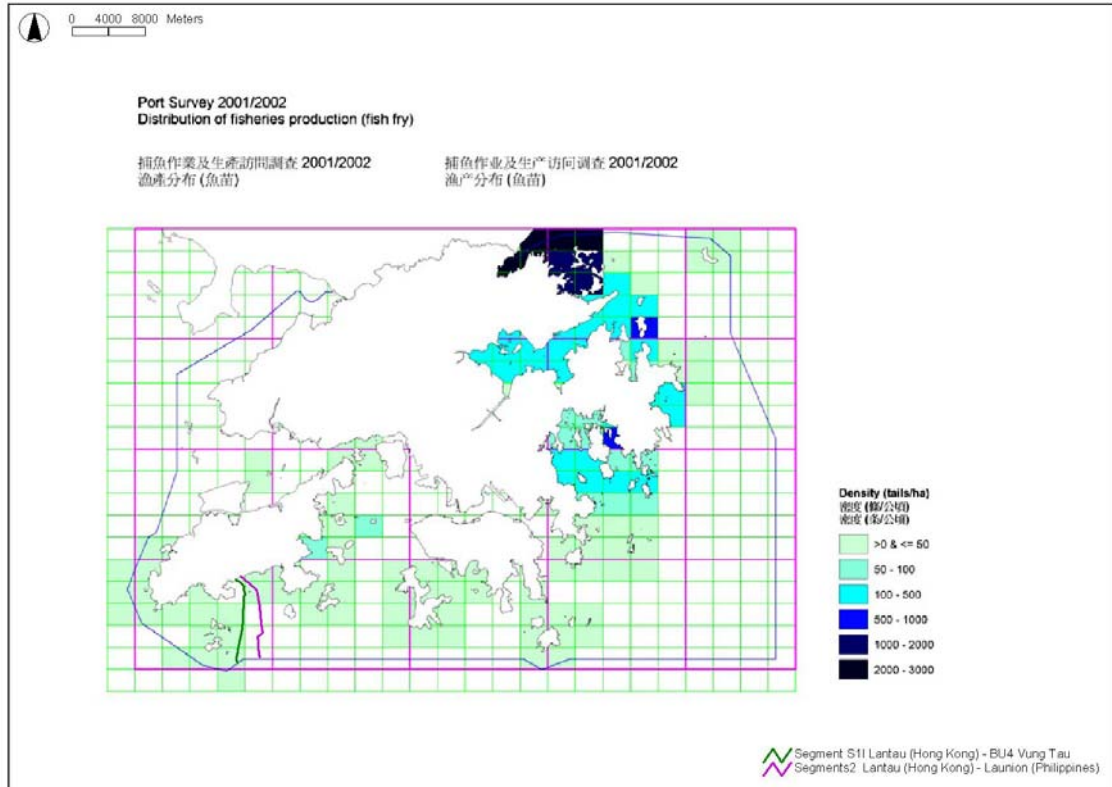


Figure C2 : Distribution of fisheries production (Fish fry) in Hong Kong SAR in relation to the two proposed cable alignments (Base Map from AFCD Port Survey 2001-02)



Annex D

Assessment of Potential Impacts to Noise

ANNEX D ASSESSMENT OF POTENTIAL IMPACTS TO NOISE

D1 Relevant Legislation

EIAO-TM stipulates a noise standard of $L_{eq(30 \text{ minutes})}$ 75 dB(A) for all domestic premises for daytime (0700 to 1900 hours on any days not being a Sunday or public holiday) construction activities. Thus, noise generated from the construction activities is required to comply with this noise standard.

It is not anticipated that there will be evening or night-time (1900 to 0700 hours) construction activities at the works site. However, should there be any construction activities involving use of PME or Prescribed Construction Work (PCW) during these restricted hours, the Contractor will be responsible for applying to EPD for a Construction Noise Permit (CNP) under the Noise Control Ordinance (NCO), Cap. 400.

D2 Description of the Environment

Table D1 : Location of Noise Sensitive Receivers (NSRs)

NSR	Description	Type of use	Distance between NSR and works area -onshore	Distance between NSR and works area -offshore
NSR 1	Hung Shing Temple	Place of Worship	291m (S1) 930m (S2)	>300m (S1 + S2)
NSR 2	Residential dwellings of Tong Fuk Village	Residential	124m (S1) 523m (S2)	>300m (S1 + S2)
NSR 3	Holiday Homes in Tong Fuk	Residential	440m (S1) 145m (S2)	>300m (S1 + S2)

D3 Impact Assessment

Potential Sources of Impact

The key noise sources will be Powered Mechanical Equipment (PME) used during the trench excavation along the foreshore from the existing beach manholes down to the Low Water Mark (LWM).

The majority of the cable-laying will be by injection jetting. The marine equipment that will be required for the cable laying operation will be located between about 400m from the shore, where the depths of water allows the equipment to operate and manoeuvre.

No adverse impacts to NSRs are predicted from the operational phase of this project.

Assessment Methodology

The predicted noise levels due to construction activities have been calculated in accordance with the methodology prescribed in the Technical Memorandum on Noise from Construction Work Other than Percussive Piling (GW-TM) under the NCO.

Table D2 : Construction Plant Inventory

Equipment (PME)	GW-TM reference	Number of plant	Sound Power Levels
Excavator	CNP 081	1	112

Table D3 : Predicted Noise Levels

NSR	Separation Distance	Distance Correction (dB(A))	Barrier Correction (dB(A))	Predicted Noise Levels (dB(A))
1	291	57	0	58
2	124	50	0	65
3	145	51	0	64

The predicted noise levels for all of the NSRs are within the statutory noise limit $L_{eq(30 \text{ minutes})}$ 75 dB(A).

D4 Mitigation Measures

It is expected that there will be only minimal disturbances to the NSRs as a result of the beach excavation work, due to the temporary and low-scale nature of the trenching and backfilling exercise combined with the distance from the NSRs. As noise levels will be within the acceptable criteria, no mitigation measures are required.

D5 Conclusions

No adverse impacts are expected to sensitive receivers as a result of the cable laying and operational processes required for this project. On-shore works are minimal, localised and temporary and a significant distance from NSRs to require no mitigation measures.

Annex E

Cultural & Heritage

ANNEX E CULTURAL & HERITAGE

E1 RELEVANT LEGISLATION AND ASSESSMENT CRITERIA

Annexes 10 and 19 of the EIAO-TM outline the criteria for evaluating the impacts on sites of cultural heritage and guidelines for impact assessment, respectively.

The EIAO-TM provides guidelines for the protection and conservation of sites of cultural heritage and requires impacts upon sites of cultural heritage to be 'kept to a minimum'. There is no quantitative standard for determining the relative importance of sites of cultural heritage, but in general sites of unique, archaeological, historical or architectural value should be considered as highly significant.

The Antiquities and Monuments Ordinance

The Antiquities and Monuments Ordinance (Chapter 53 of the Laws of Hong Kong), which came into force on January 1st 1976, provides statutory protection against the threat of development on declared monuments, historical buildings and archaeological sites to enable their preservation for posterity and applies equally to sites on land and underwater.

The Ordinance defines an antiquity as a relic (a moveable object made before 1800) and a place, building, site or structure erected, formed or built by human agency before the year 1800. Archaeological sites are classified into three categories, as follows:

- Declared Monument - those that are gazetted in accordance with Cap. 53 by the Antiquities Authority and are to be protected and conserved at all costs;
- Recorded Archaeological Sites - those which are considered to be of significant value but which are not yet declared as monuments and should be either protected, or if found not possible to protect these sites mitigation measures should be proposed and implemented to preserved the archaeological resources.

The Legislation sets out the procedures for the issuing of Licenses to Excavate and Search for Antiquities, the effect of which is to forbid all such activities being undertaken without such a License. It also provides for the penalties exacted for infringement of the Ordinance, including fines and imprisonment.

E2 Description of the Environment

Cultural Resource

Approximately 300m to the west of the proposed cable route S1 is the Hung Shing Temple. The temple is constructed in the traditional Quangtong style which comprises two halls and an open courtyard. The temple god "Hung Shing Yeh" (South Sea God) is placed in the middle of the Hall. Though the temple is neither a "Declared" nor a "Graded" monument, its long history and significance to the local community is well recognized.

Near the temple is a local pier, which together with Hung Shing Temple forms an important worship and gathering area for nearby fishermen and local villagers.

There are two small local Kam-Tap (grave jars) situated northeast of the Temple. It is expected that these Kam-Tap sites belong to the Tong Fuk Villagers and a grave site approximately 280m from Route S1.

Marine Archaeological Resources

A Marine Archaeological Investigation (MAI) was carried out for the project by SDA Marine Ltd.

The aim of the investigation was to locate and assess underwater archaeological resources which may be impacted by the cable installation. In accordance with the Antiquities and Monuments Office (AMO) Guidelines, the MAI consisted of a Baseline Review and Geophysical Survey.

The Baseline Review indicated a low archaeological potential based on absence of historical records and intensity of previous disturbance. There are nine existing submarine cables within the study area and the area is trawled by fishermen.

The geophysical survey provided 100% coverage of the seabed and sub-surface sediments. The results of the survey data indicated the presence of 13 sonar contacts within the survey area. Close examination of the data indicated that these were all surface debris and therefore of no archaeological significance. There were no magnetic or buried contacts associated with any of the sonar contacts.

E3 IMPACT ASSESSMENTS

Cultural Resources

Due to the distance (290m) from the shore work required to land the cable for Route S1, it is considered that there will no adverse impacts to the Hung Shing Temple or the grave sites over 280m away as a result of the cable landing and laying works.

Marine Archaeological Resources

The survey data identified 13 sonar contacts. These were accurately identified as modern debris. There were no other features on the seabed which could be indicative of archaeological resources.

E4 Mitigation Measures

Based on the assessment there are no adverse impacts associated with the proposed cable laying activities.

E5 Conclusion

Based on the findings of this assessment and the implementation of the recommended mitigation measures, there are predicted to be no adverse impacts on cultural heritage or archaeological resources from the proposed cable system.

The proposed landing method will only have a minimal impact on the seabed and as no debris was identified to be impacted by the construction of the cables, no adverse impacts on marine archaeological deposits are expected.

ATTACHMENT E1 ASSESSMENT OF MARINE ARCHAEOLOGICAL RESOURCES

E1 Introduction

A Marine Archaeological Investigation (MAI) was carried using standard MAI techniques described below that follow Guidelines issued by the Antiquities and Monuments Office (AMO) by a marine archaeologist.

E2 Methodology

Baseline review

A comprehensive review was carried out to determine the archaeological potential of the study area. This included archaeological and historical publications.

Archive Search

All archives holding information on shipwrecks in Hong Kong were explored for relevant data.

Geophysical Search

Route Surveys were required to provide detailed information for use in the engineering, construction and subsequent maintenance of the submarine cables. The specifications for the site investigation matched those for a MAI. It was therefore possible to re-interpret the data without the need for additional data collection.

EGS (Asia) Ltd carried out a marine geophysical survey of the study area in the summer of 2007 (Contract Number R13807).

The raw data set was re-examined by SDA Marine Ltd.

The archaeological objective of examining the data was:

- To map shipwrecks and anomalous seabed features
- To map the underlying significant geological horizons

Study Area

The three seabed features charts appended to this report set out the area of seabed covered by the geophysical survey.

Survey Scope

EGS (Asia) Ltd collected the following data:

- Side scan sonar
- Seismic profiling
- Echo Sounding
- Magnetometer

EGS (Asia) Ltd Report No. Number R13807 presents in detail the methodology used to complete the survey. Below is a summary of the equipment relevant to the archaeological assessment.

Single-Beam Echo sounder:

- Knudsen Echo Sounder w/ Power Supply
- Deso 25 Echo Sounder w/ Power Supply
- Single Frequency Transducer
- TSS DMS2-05 Heave Motion Sensor
- TSS Meridian Surveyor Gyrocompass

Navigation & Positioning:

- CNAV DGPS 2050 Receiver
- C-view NAV Navigation Software
- Navigation Computers
- D.C. Power Supply

Sub-Bottom Profiling & Side scan Sonar System:

- Klein 3000 Side Scan Sonar - Towfish
- EG&G DF-1000 Side Scan Sonar - Tow fish
- C-Boom Sub Bottom Profiler
- C-View Logging Software & Computers

Magnetometer System:

- SeaSpy-1000m
- Magnetic Data Logging Program & Computer
- Depth Sensor

The table below details the deployment of the equipment listed above.

Depth Range	Survey Corridor	Survey Line Spacing	No of Survey Lines	Side Scan Sonar Range	Type/Equipment
BMH to 0m	250m	- 50m	- 1	N/A	Land topographic/Total stations/levels Bar Probing/2m bar
BMH to 0m	250m	- 50m	- -1	N/A	Land topographic/Total stations/levels Bar Probing/2m bar
0 to -3m	-	50m	1	N/A	Diver Swim/diving bottles, video camera and 2m bar for probing
	250m	25m	11		Sounding/Portable echo sounder, C-Nav GcGPS
-3m to -15m	500m	75m	7	100m	Small boat survey/Single beam echo sounder, side-scan sonar and sub-bottom profiler , GcGPS
		1km	1	N/A	Grab Sampler
-3m to 15m	500m	250m	3	N/A	Cable and Pipe Crossing/Marine Magnetometer

Horizontal Positioning Fixing

The survey vessel was located by Differential Global Positioning System (DGPS) throughout the survey. The EGS computerized navigation system was added to the DGPS positioning system to control the steering of the boat along the traverses specified, and to log all horizontal and vertical control data.

An overall system check was carried out by calibrating the positioning system at a coordinated point. An accuracy of ± 1 m or better was ensured by carrying out the above quality assurance checking procedure at the beginning of the survey.

E3 Results

Baseline Review

The seabed within the study area is characterized by extensive disturbance. There are nine existing submarine cables within the current study area. The impact associated with their installation would have already caused extensive disturbance on the seabed. The archaeological potential of the seabed is further reduced by evidence of scars from trawling and boat anchors. These factors combine to give the study area a very low archaeological potential.

1. Shipwreck Data

Practically nothing is known about the archaeological potential of the seabed deposits in Hong Kong. The only marine archaeological discovery is that of a late Sung/early Ming Dynasty (1368-1644) boat uncovered during the construction of the High Island Reservoir, near Sai Kung (Frost, 1974). Since then, no other historic shipwreck has been found. However, this is probably because there were no dedicated marine archaeological surveys until the introduction of the 1998 EIA Ordinance.

Formation of archaeological sites underwater is mainly due to shipwrecks (Muckelroy, 1978). Since these are random and haphazard events it is difficult to predict their exact location if there are no written references. The aim of this review is to examine the evidence for maritime activity within the study area to predict the potential for shipwrecks.

2. Archive Search

The UK Hydrographic Office (UKHO), Taunton holds a database of surveyed shipwrecks in Hong Kong, including many not shown on Admiralty Charts. The database does not contain any records of shipwrecks within the study area. However, the Hydrographic Office only charts wrecks which are a potential hazard to navigation. It is therefore possible that there are other wrecks within the study area which are partially or totally buried and thus not recorded.

3. Historical Research

Despite a comprehensive review, it was not possible to find any maritime historical information specifically related to the small village of Tong Fuk and the surrounding seabed.

Geophysical Survey

The raw side scan sonar and seismic profiler data were examined by SDA Marine Ltd using the C-View playback system. The table below presents a list of the sonar contacts located during the survey.

4. Sonar Contact List from Cable Route S2

Contact number	Latitude Longitude	Easting Northing	Dimensions (m)	Description
S2-WH2-SC001	22° 12.981' N 113° 56.931' E	1806855.5E 2466629.7N	2.1x1.2xnmh	Debris
S2-WH2-SC002	22° 10.783' N 113° 57.397' E	1807701.3E 2462345.9N	1.8x0.7xnmh	Debris
S2-WH2-SC003	22° 10.623' N 113° 57.427' E	1807755.0E 2462034.6N	2.0x09xnmh	Debris
S2-WH2-SC004	22° 10.421' N 113° 57.432' E	1807763.5E 2461641.1N	3.2x1.9xnmh	Debris
S2-WH2-SC005	22° 10.288' N 113° 57.451' E	1807798.3E 2461382.3N	1x09xnmh	Debris

Contact number	Latitude Longitude	Easting Northing	Dimensions (m)	Description
S2-WH2-SC006	22° 9.507' N 113° 57.255' E	1807442.4E 2459860.0N	1.6x1.2xnmh	Debris
S2-WH2-SC007	22° 8.689' N 113° 57.304' E	1807532.0E 2458265.9N	1.3x1.0x0.3	Debris

5. Sonar Contact List from Cable Route S1

Contact number	Latitude Longitude	Easting Northing	Dimensions (m)	Description
S11-WH2-SC001	22° 13.139' N 113° 56.174' E	1805480.9E 2466937.8N	6x1xnmh	Debris
S11-WH2-SC002	22° 9.113' N 113° 55.933' E	1805043.6E 2459091.6N	2x2xnmh	Debris
S11-WH2-SC003	22° 8.983' N 113° 56.004' E	1805172.8E 2458837.9N	5x2xnmh	Debris
S11-WH2-SC004	22° 8.970' N 113° 55.862' E	1804914.8E 2458813.2N	6x1.5xnmh	Debris
S11-WH2-SC005	22° 8.802' N 113° 55.817' E	1804831.9E 2458485.4N	2x1x0.4	Debris

None of the above sonar contacts were also associated with a magnetic or seismic contact. This further facilitates their identification as modern debris.

The magnetometer data was used to accurately locate the existing cables and associated infrastructure associated with them in order to ensure avoidance during installation of AAG.

There were no features found to be directly within the route of the cables.

The cable laying process is an extremely accurate process which is confined to a narrow linear strip, less than 1 m (0.25 m), with back-filling occurring simultaneously leaving the seabed undisturbed. Therefore, there will be no disturbance to the contacts identified during the cable installation.

The diver surveys using a 2m probe along S1 segment showed coarse sand and rock on the seabed, with probe penetration less than 25cm, while S2 covered with sand with probe penetration 7-23 cm. This means that it is impossible that there is buried material within the submarine sediments and further reduces the archaeological potential of the study area.

E4 Conclusion

The geophysical survey provided 100% coverage of the seabed and sub-surface sediments. The survey data identified twelve sonar contacts. These were accurately identified as modern debris. There were no other features on the seabed which could be indicative of archaeological resources.

E5 Recommendation

There is no need for any further archaeological investigation or mitigation measures to be implemented during the construction of the cable system.

