South-East Asia Japan Cable System (SJC) Hong Kong Segment

Project Profile

June 2011

ATKINS

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1 BASIC INFORMATION

1.1 Project Title

South-East Asia Japan Cable System (SJC) Hong Kong Segment.

1.2 Purpose and Nature of the Project

South-East Asia Japan Cable System (SJC) is a submarine cable system linking South-East Asia to Japan. SJC will provide direct access and diverse routing between Singapore, the Philippines, Hong Kong, China, Brunei and Japan. The cable system will span approx. 8,900km and will be mainly composed of a seven-fibre pair high capacity submarine cable system with a design capacity of 17.9 terabits per second. The project will increase the broadband capacity of Hong Kong.

The system has been designed to bypass the earthquake zone south of Taiwan to protect it from earthquake related cable cuts and to provide greater reliability of service to Hong Kong.

SJC will land at Sha Shek Tan Beach in Chung Hom Kok. 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 this Project Profile. The construction and installation of the system is 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

China Telecom (Hong Kong) International Limited.

Room 3801-3806,
38th Floor, Dah Sing Financial Centre,
108 Gloucester Road,
Wanchai, Hong Kong SAR

1.4 Location and Scale of Project

The route of the SJC submarine cable system is showed in **Figure 1**. The cable will land at the existing manhole of another previously laid cable GB21, at Chung Hom Kok (see **Figures 2 and 3**). This manhole is already in place and is connected to the cable station at the hill above the landing beach area. An existing conduit leads from the manhole to the cable station. This conduit will be used and the cable will be pulled from this conduit to the station. As such, no disturbance or impacts will result from the beach manhole to the station.

The offshore cable will extend southwards out to sea and along the East Lamma Channel and traverse south of Po Toi Island. The cable will then travel eastward along the boundary of HKSAR waters to connect with the rest of the SJC cable system which extends out into the South China Sea.

The installation works associated with the cable are of small scale, only shallow excavation works will be required at the on shore cable landing section in order to enable the cable to enter the existing manhole and install the earthing system.

The offshore cable laying will be undertaken by direct cable burial techniques using a cable burial machine, similar to previous cable installations and pipelines in this area. The intended burial depth for the offshore burial of the cable will be approximately 3 to 5 m below seabed to the end of HKSAR waters. The total length of the cable in Hong Kong SAR waters is approximately 37 km.

The cable laying process will only require minor works within the marine environment which are not expected to have noticeably adverse implications to water quality or the marine ecology of the area.

1.5 Cable Route Selection Process

The most direct route to the Chung Hum Kok landing side and the receiving manhole has been preferred, however, several existing physical and environmental features within the study area have constrained the route selection and cable-laying process to the proposed alignment (see **Figure 4**). As such, the final cable route follows a narrow corridor in order to either avoid or reduce impacts to these features as far as possible. These features include:

- Reducing the number of crossings with the other existing cable systems;
- Reducing the crossing of the gas pipeline of Hong Kong Electric Company;
- Avoiding marine vessel fairways such as East Lamma Channel;
- Avoiding areas of incompatible seabed (such as rocky areas);
- Ensuring sufficient distance from gazetted bathing beaches near the landing site, including Chung Hom Kok beach and St. Stephen's Beach;
- Avoiding areas with high ecological values (e.g. coral communities);
- Maintaining distance from fish culture zone in Po Toi Island and other fishery areas;
- Avoiding the marine borrow area (e.g. gazetted dredging and sediment disposal area and sand deposit area at West of Po Toi Island);
- Avoiding anchorage areas; and
- Avoiding the deep water and spoil ground between Po Toi and Beaufort Islands.

Given the above, the route selected is based on preferred engineering and environmental conditions.

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 (ii) site of cultural heritage, (iii) bathing beach; and (vii) coastal protection area.

1.7 Name and Telephone Number of Contact Person

All queries should be primarily submitted to **Atkins China Ltd.**

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

Telephone:	+852 2972 1000
Fax:	+852 2890 6343
Contact Person:	Susana Halliday
Email:	susana.halliday@atkins.com.hk

Secondary queries to **NEC Submarine Systems Malaysia Project Office**

No. 217, Blok 3, No. 7, Persiaran Sukan, Laman Seri Business Park,
Seksyen 13, 40100 Shah Alam, Seloangor Darul Ehsan,
Malaysia

Telephone:	+60 3 5518 3888
Fax:	+60 3 5518 4848

Contact Person: Ronnie Lim
Email: rlim@wen.com.my

2 OUTLINE OF PLANNING, IMPLEMENTATION PROGRAMME & FEATURES OF ENVIRONMENT

2.1 Project Planning and Implementation

The project is to be led by NEC Corporation who is the contractor for marine surveying, installation and facilitation on behalf of China Telecom (Hong Kong) International Limited. Atkins China Ltd is supporting NEC Corporation on this project.

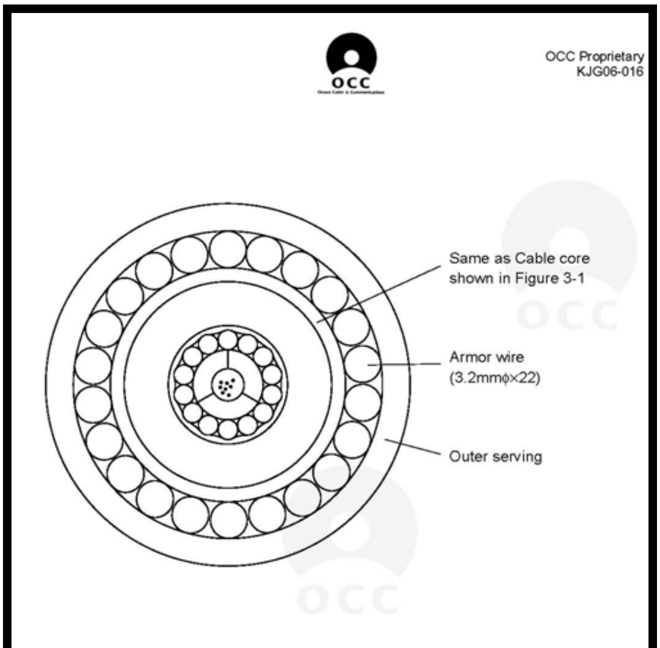
The initial cable-laying operation is targeted to commence with the shore end cable as early as possible in year 2012. The full completion of the proposed cable is predicted to take about one month within HKSAR waters.

2.1.1 Shore End Cable Installation

The land-based cable installation activities comprise only shallow excavation of a single trench from the beach manhole to the Low Water Mark (LWM), using a small backhoe. The trench will be backfilled with the excavated materials. The trench section will take between 1-2 days to complete. The 38 mm 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 approx. 2m below ground.

The shore end works are expected to be undertaken during daytime hours but should any works be required in restricted hours (evening, night time or on general holiday) a construction noise permit will be applied for.

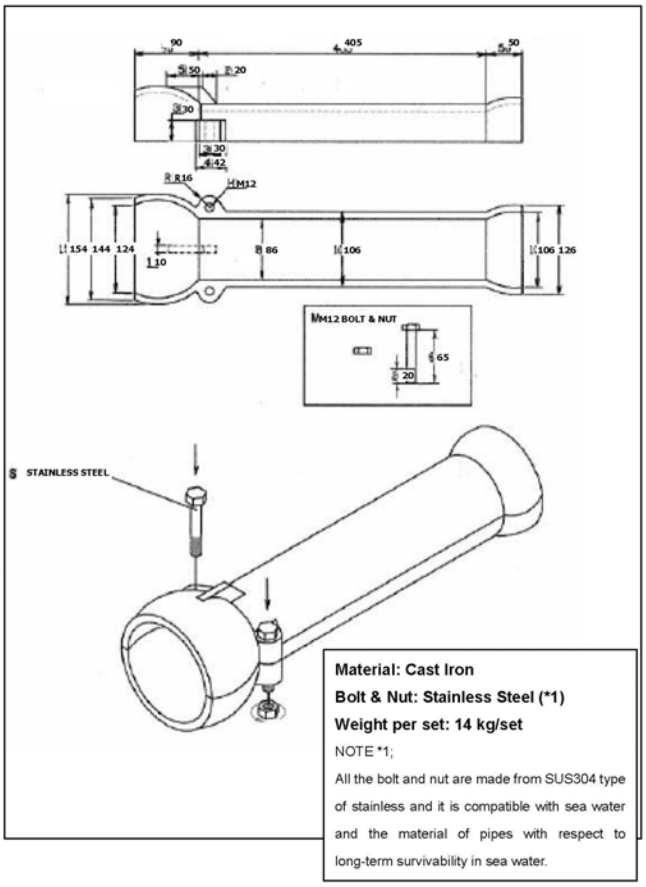
Diagram 1: Typical Example of the Cross Sectional View of Typical Fibre Optic Cable



Cable characteristics

Cable nominal diameter	32 mm
Cable weight in air	23.5 kN/km
Cable weight in water	16.8 kN/km
Specific gravity	3.51
Cable breaking load	≥310 kN
Hydrodynamic constant	63 deg-knots
Minimum bending radius (without tension)	0.9 m

Diagram 2: Typical Example of Articulated Piping for Shore End Cable Laying



2.1.2 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 150 m 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 1 to 3 m 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.

The shore end works are expected to be undertaken during daytime hours but should any works be required in restricted hours (evening, night time or on general holiday) a construction noise permit will be applied for.

2.1.3 Offshore Cable Installation

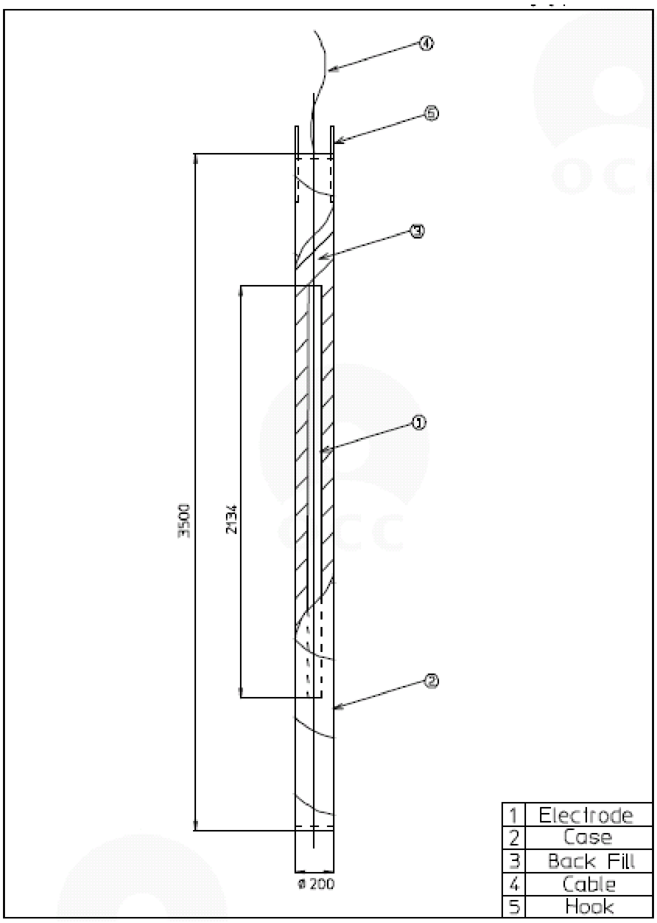
The offshore cable laying process within HKSAR waters will involve installation by direct burial techniques using a cable burial tool. The route is first checked with the tool to ensure that there is no obstruction with the cable alignment. The cable is then placed in the tool which is carefully laid into the seabed to the desired depth. Passive jetting then helps to liquefy the sediments at the desired installation level to aid with the burial at the target depth (which will be approximately 3 to 5 m below the sea bed) as the tool is pulled along the route alignment by barge. This method is designed to simultaneously lay and bury the cable within minimal disturbance to the seabed and resulting only localised impacts to the marine water quality at the seabed.

The width of the trench created by the tool will be very narrow, expected to be 250 mm or less, and the disturbed area of the seabed will be generally limited to this width. A dive team will be on standby during the installation to ensure proper functioning and positioning of the installation tool. Once in the correct position, the cable laying barge travels slowly (approximately 800 metres per hour or less) along the planned cable route. The offshore cable laying within HKSAR waters is expected to take 5-7 days.

2.1.4 *Earth Electrode System Installation*

The earth electrode system is an ancillary structure to provide earth grounding system for the submersible repeaters. The system consists of 4 electrodes, each 20 cm in diameter and 3.5 m in length (see **Diagram 3**). The system is designed to be buried about 2 m below ground within Sha Shek Tan Beach by a small backhoe and vertical drilling tools, and the total area for the installation is 20m x 5m. The excavated area will be backfilled with the excavated materials. The electrodes will be encased and covered by a concrete layer and warning markers for additional protection. It is expected the earth electrode system will take 5 – 7 days to install and will be installed concurrently with the cable installation.

Diagram 3: Illustration of an Earth Electrode



2.2 Programme

The SJC system is provisionally scheduled to be landed and installed as early as possible in year 2012. The expected construction schedule within HK SAR waters is as follows:

Beach - LWM works	1 - 2 days
Diver assisted cable laying	7 - 14 days
Cable installation to HKSAR Boundary	5 - 7 days
Earth electrode system	5 - 7 days

2.3 Major Elements of the Surrounding Environment

2.3.1 Gazetted Marine Fairways

The proposed cable will traverse outside the marine fairway of the East Lamma Channel.

2.3.2 Cable, Pipelines and Outfalls

There are numbers of existing submarine telecommunication cables and pipelines located within the vicinity of the proposed cable system.

The proposed routing of cable system crosses existing cables that have been carefully identified and accounted for in the cable-laying methodology. During installation of the SJC cable, the existing cables will not be affected. The SJC cable will cross above the existing cables, but below the seabed, at a minimum of 1 m to allow for sufficient cushion between the systems. The cable crossings are shown on **Figure 5**. These cables will be positioned below seabed level.

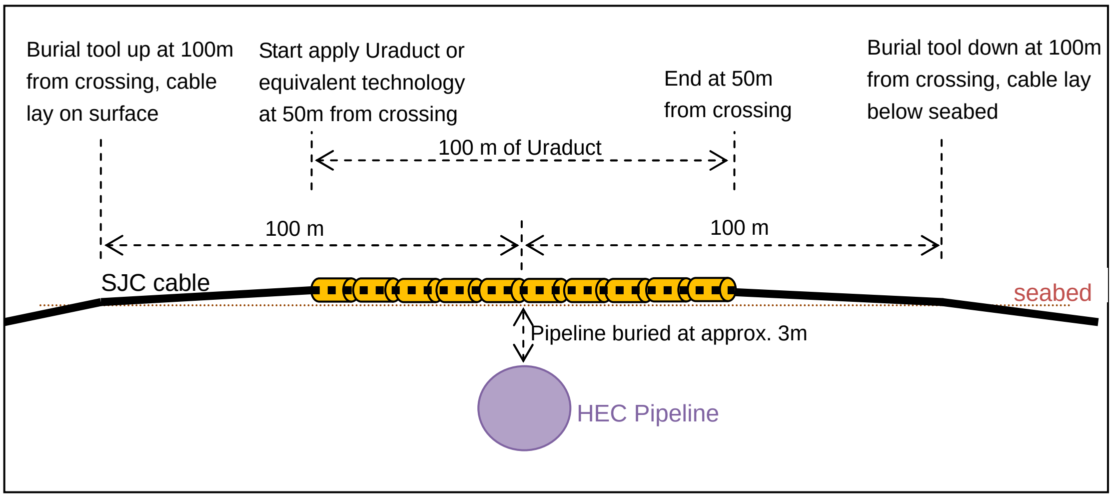
The segment of SJC Cable will cross the Hongkong Electric Company's Submarine Gas Pipeline (HEC Pipeline). The installation method at cable crossing with HEC Pipeline will fulfil crossing requirements of HEC prior to the commencement of the work, as described below.

Surveys at the vicinity of the proposed crossing location will be conducted prior to and after the installation work. The position of proposed crossing will be recorded by DGPS (Differential Global Positioning System). It is required by HEC that the cable shall be surface laid with a minimum clearance of 3m between the Pipeline and the cable. It is understood that the burial depth of the Pipeline is approx. 3 m (as-laid burial depth), as such, no additional work on the seabed will be required to maintain the necessary clearance. A cable laying barge superintendent will advise the Pipeline's owner through their representative on board during the operation and daily progress report will be provided to the pipeline owner.

In order to protect the Pipeline and the cable, Uraduct (or equivalent technology) will be employed at the crossing. Unlike traditional protection with concrete mattressing or rock dumping, high density polyurethane protection technology named Uraduct (or an equivalent technology) is proposed to be applied around the cable at crossing with the HEC gas pipeline. Uraduct had been widely used in oil and gas industry for protection of pipeline and is also used for submarine telecommunication cables. The use of this material directly on the cable (acting as a pipe over the cable) will reduce the area disturbed around the cable, as compared with tradictional rock mattress systems, and also enable a smooth surface that will not catch on fishing nets. The Uraduct material has no adverse impact to the environment and will assist in streamlining the cable laying process (see **Annex A** for details of Uraduct).

The cable laying barge will approach the crossing at a safe distance of 100 m from the pipeline. On approaching at a predetermined position, the burial tool will be recovered on deck and Uraduct will be applied to the cable which will then be surface laid across the top of the existing pipeline. Upon clearing the existing pipeline at the predetermined position, the burial tool will be re-introduced into the seabed at 100 m after the crossing and continue with burial operation, as illustrated in **Diagram 4** below:

Diagram 4: Illustration of HEC Pipeline Crossing



2.3.3 Coastal Protection Area

The beach manhole, beach section of the cable route and the earth electrode system fall within land zoned as Coastal Protection Area (CPA) and stretches along the length of the coastline at Chung Hom Kok (see **Figure 2**.). It has been zoned to "conserve, 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."

The impacts associated with the cable burial works within CPA will be temporary and will not be noticeable upon completion except for markers posting the location of the cables. The trench and earth electrode system on the landing beach will be fully buried and backfilled with excavated materials and the works area will be reinstate to status quo. Flora and fauna will not be adversely affected by the installation work within the CPA and no geological features will be disturbed. Only a small amount of soft sand and existing concrete will be removed and replaced.

Within the CPA, telecommunications systems are permitted to be installed upon approval of application by the Town Planning Board (TPB). Several systems have already been installed and are in operation in the proximity of the project which lead to the cable receiving station in Chung Hom Kok. The proposed cable required soft sand for landing and the entire coast nearby the signal station (GB21) was zoned as CPA (see **Figure 2**), therefore landing at CPA zone was unavoidable. Permission from TPB will be obtained prior to the construction with CPA zone.

2.3.4 Gazetted Bathing Beaches

There are two gazetted bathing beaches along the coast of Chung Hom Kok. St. Stephen's Beach and Chung Hom Kok Beach are located 390 m and 460 m from the nearest proposed cable route alignment respectively. The works well are outside the area of the shark nets and these beaches will not be adversely affected by this project.

2.3.5 Sites of Special Scientific Interest

The closest Site of Special Scientific Interest (SSSI) is the Tai Tam Reservoir Catchment Area SSSI, located 1km away from the cable landing site. This SSSI is terrestrial in nature and hence will not be affected by the Project.

2.3.6 Coral Communities

There are coral communities of ecological importance along the entire coast of Po Toi, Sung Kong, Waglan Island and Beaufort Island which are more than 500 m from the closest route alignment (see **Figure 4**). A dive survey of the cable area has been undertaken and the findings show that the project will not impact any sensitive ecology or corals, as described in the following section.

2.3.7 *Sites of Cultural Heritage*

The closest site of Cultural Heritage interest is the Chung Hom Wan Archaeological Site, about 470 m to the north-west of the landing site. This site of cultural heritage is land-based and hence will not be affected by the cable installation.

2.3.8 *Other Proposed Facilities or Amenities/Cumulative Impacts*

There are no proposed marine facilities or amenities known to be present in the area that will be affected by the cable. Further, there are no known marine works that will be undertaken within 500 m of the proposed project. As such, no cumulative impacts from other projects in the area are expected to result.

3 POSSIBLE IMPACTS ON THE ENVIRONMENT

3.1 Summary of Potential Environmental Impacts

The construction and operational environmental impacts associated with the submarine cable is 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**	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

** 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 B**.

The land-based cable installation activities will involve the excavation of a trench, approximately 2 m deep by 1 m wide, from the beach manhole to the LWM using a small excavator. The trench will be backfilled with the excavated sand material after the cable is installed. Similar excavation and backfill will be apply to the installation of the earth electrode system on the beach, and the area is approximately 20 m x 5 m. 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 150 m 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 1 m to 3 m. The installation process is similar to other submarine cable systems that have been undertaken 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 150 m from the shore) the cable installation machine will be used, burying the cable to depths of 3 to 5 m below the seabed. Prior to the cable installation the seabed will be checked with the tool to ensure there are no obstructions to cable installation. The cable injection tool 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 cable is simultaneously immediately backfilled by the sediment. The installation tool is no more than 250 mm in width and only minimal disturbance is anticipated to the seabed. The cable installation process will be completed at a speed of approximately 800 metres per hour.

The cable installation process will create the temporary formation of localised suspended sediments around the immediate area of disturbance, which is predicted to remain close to the seabed. Based on previous similar projects have been found to be localised to the bottom of the water column and will settle out very quickly. Indeed, water quality monitoring undertaken during cable installation for other similar projects did not detect any increase in suspended solids[1]. 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 (see **Annex B**).

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 will be incorporated into the project:

- Water quality protection measures (such as prevention of leakage from construction equipment and Stockpiles will be covered to reduce the amount of runoff of materials entering the marine water) 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.

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

3.3 Marine Ecology

A marine ecological assessment is provided in **Annex C**.

Based on literature reviews[2],[3] of past surveys in the vicinity of the cable, no coral communities of ecological importance have been identified within the near proximity of the proposed cable route.

1 Environmental Permit (EP-298/2007) Project Profile for Asia-America Gateway (AAG) Cable Network, South Lantau
2 Morton, B., Morton, J. (1983) The Sea Shore Ecology of Hong Kong. Hong Kong University Press. 350pp.
3 ERM (2007) VSNL Intra Asia Submarine Cable System – Deep Water Bay: Project Profile. HKSAR

A subtidal (dive) survey was undertaken to determine baseline conditions of the area and identify corals within the vicinity of the proposed cable and a review of existing information on the marine communities surrounding the cable route was undertaken. The dive survey found that the seabed within the cable landing area is composed of sand and boulders and no species of conservation were recorded. The cable installation will not directly impact any corals in the area as it will only traverse through the soft sand substrate.

The area of the route alignment is 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 route 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 results of the waters along the proposed cable route from Stanley Bay to the Eastern waters of Hong Kong have no observation of Chinese white dolphins (*Sousa chinensis*) and low observations of finless porpoises (*Neophocaena phocaenoides*), particularly when compared to Western waters of Hong Kong[4]. The area which the cable passed through is not considered being a habitat of major importance for cetaceans within Hong Kong.

The diver assisted cable installation in the first 150 m from shore will not impact marine mammals. For offshore installation, visual inspections of finless porpoises will be undertaken in Po Toi area where this mammal was previously observed immediately prior to and during the installation to ensure the work does not affect the finless porpoise as detailed in **Annex G**.

3.4 Fisheries

A fisheries assessment is provided in **Annex D**.

A literature review of the fisheries resources and operations within the Study Area show that areas adjacent to the cable route supports fisheries of different rankings with the highest fisheries production area at Southern Po Toi. There are no Fish Culture Zones within the Study Area, the Po Toi Fish Culture Zone is located over 1km away from the cable route, 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 cable will be buried to a sufficient depth to prevent any accidental interference from fisheries operations.

There is an area of the cable that will involve crossing of the HEC pipeline and the cable will be laid above seabed level. Within this area approximately 100 m of cable will be laid within a cable lining of protection (Uraduct or equivalent technology) with smooth surface and will not foul nets. Compare with the other traditional protection measures (such as rock dumping), Uraduct will have less disruption to the seabed and smaller affected area above seabed level. As such, no impacts to fishery are expected to result this project.

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 E**.

A single backhoe will be utilised to excavate the land based trench for the cable and the earth electrode system, and a temporary generator may be required for the onshore and

[4] AFCD
Website http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_chi/con_mar_chi_chi/con_mar_chi_chi_dis_hk.html
and http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_fin/con_mar_fin_fin/con_mar_fin_fin_dis_wheredo.html Accessed 31 January 2011.

nearshore works. Some noise will be generated from these works but noise levels are minimal and short term in nature (5 - 7 days) and will be located more than 100 m from noise sensitive receivers. Adverse impacts are not expected to occur to noise sensitive receivers in the area during daytime hours and for any emergency works during restricted hours are required, a construction noise permit will be applied.

The diver assisted cable installation in the first 150 m from shore is not likely to impact NSRs.

For offshore installation, a tug boat and a cable laying barge will be employed. The closest distance from NSRs to the vessels is approximately 180 m and adverse impacts are not expected to occur to noise sensitive receivers in the area during daytime.

For any works during restricted hours, mitigation measures such as placing the PMEs as far as possible from the NSRs or screening the noisy parts of the PMEs from NSRs will be applied.

3.6 Cultural Heritage and Archaeological Resources

A cultural heritage assessment is provided in **Annex F.**

The Chung Hom Wan Archaeological Site is approximately 470 m away from the excavation works associated with the proposed cable. It is considered that there will be no adverse impact on the Archaeological Site as a result of the small-scale and temporary excavation work required on the beach.

A desktop marine archaeological assessment has been undertaken and the results showed that there are no features of archaeological value have been identified in the vicinity of the route based on the existing information. A geophysical survey has also been undertaken for the final route alignment. A review of this data showed that the cable does not traverse through any area of unknown features within the seabed.

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 - The trench 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 this submarine cable.

Nuisance / Others - The cable will be landing on Coastal Protection Area (CPA). The Planning Department (PlanD) has been contacted with regard to the project and has requested that if works are within CPA and cannot be avoided, planning permission will be sought on this aspect.

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 alignment during their installation.

4.3 Further Implications

The landing point at Chung Hom Kok for the cable route has 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 Previous Similar Project Profiles for Direct Application

The following projects are of similar natural:

- VSNL Intra Asia Submarine Cable System – Deep Water Bay (AEP-294/2007). The Environmental Permit was approved in November 2007 (EP-294/2007). This cable is installed in the similar area as the proposed SJC System.
- Asia-America Gateway (AAG) Cable Network, South Lantau (AEP-298/2007). The Environmental Permit was approved in November 2007 (EP-298/2007).
- 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).
- 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.
- 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. This cable is installed in the same area as the proposed SJC system.
- 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.

Although there are no unacceptable impacts predicted to occur, as part of the project works, the following will be undertaken:

1. Application of Uraduct or equivalent protection technology at crossing with HEC pipeline, surveys at the vicinity of the proposed crossing location will be conducted prior to and after the installation work.
2. Backfilling the trench on the landing beach with excavated materials and the works area will be reinstate to status quo ante. Stockpiles will be covered to reduce run off of materials entering the marine water.
3. Liaison with LCSD prior to the commencement of the work in Stanley Bay and avoid installation work in peak seasons of bathing and water sports activities and to establish an appropriate notification system and monitoring system prior to and during installation.
4. Visual inspection of finless porpoises will be conducted immediately prior to and during the offshore installation work in Po Toi area to ensure the work is in a porpoise exclusion zone.
5. Undertaking coral survey in the inter-tidal zone immediately prior to installation to ensure corals are bypassed by the proposed cable alignment.
6. If minor alternatives occur to the cable alignment, any unknown features found on the seabed that may be directly affected by the cable installation will be reviewed by a marine archaeologist. It is recommended features with potential archaeological value will be bypassed by refining the proposed cable alignment.

4.5 Without Project Scenario

The SJC system will help meet the growing demand for high speed internet access services and increase bandwidth capacity within Hong Kong. The project is beneficial in that it will provide telecommunication infrastructure to support the public and service industries (such as financial, trading, logistics, tourism and other data intensive industries). Without this project, these benefits may not be realized.

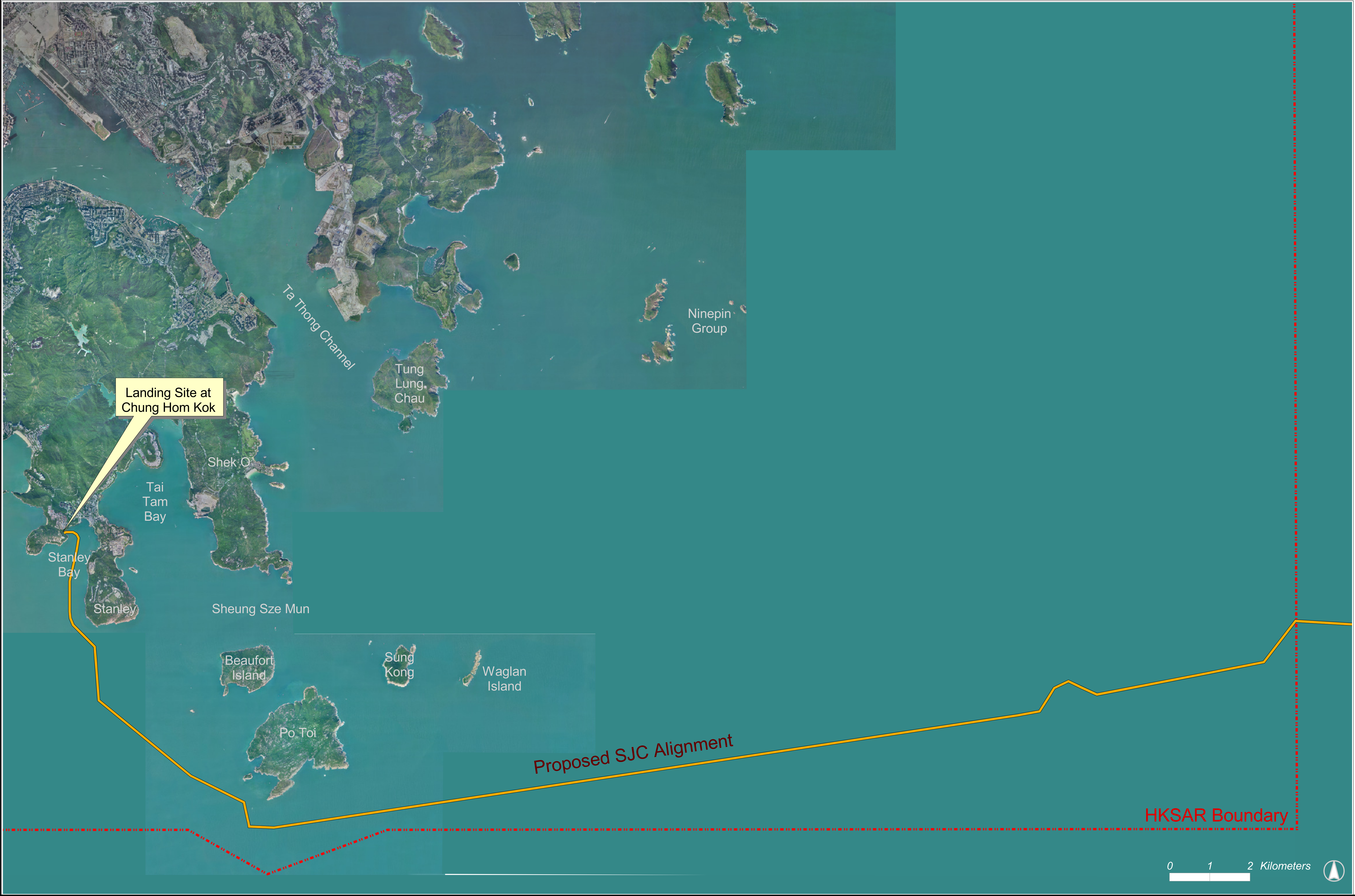
This environmental assessment has identified that the project will result in the temporary elevation of suspended solids at seabed level during cable installation. The increased suspended solids would be generally limited to within the immediate area of cable installation and would settle within about 3 minutes after cable installation. Previous assessments and monitoring results from similar projects in Hong Kong (referenced in Section 4.4) support this. The project is not within close proximity to any marine sensitive receivers. Besides the construction noise and temporary disturbance of the seabed, the project will not arise any air quality impacts, noise impacts, water quality impacts, waste implications, ecological impacts, fisheries impacts, visual and landscape impacts, cultural heritage impacts during its operational phase.

If the project was not constructed, and the SJC cable system was not installed, the temporary elevation of suspended solids associated with the installation of the cable would not result. Measures have been proposed to reduce the adverse impacts associated with cable installation and significant consideration has been placed on the selection of the route alignment of the cable to avoid environmental impacts. Further, a monitoring programme has been proposed to monitor and manage the potential impacts to the environment during cable installation. It is considered that the adverse environmental implications of the project are minimal and temporary in nature and that the benefits of the project are substantial.

4.6 Environmental Monitoring & Audit

Although no significant impacts have been identified for the project, water quality monitoring and marine mammals inspection during the installation of the cable system have been proposed and are detailed in **Annex G**.

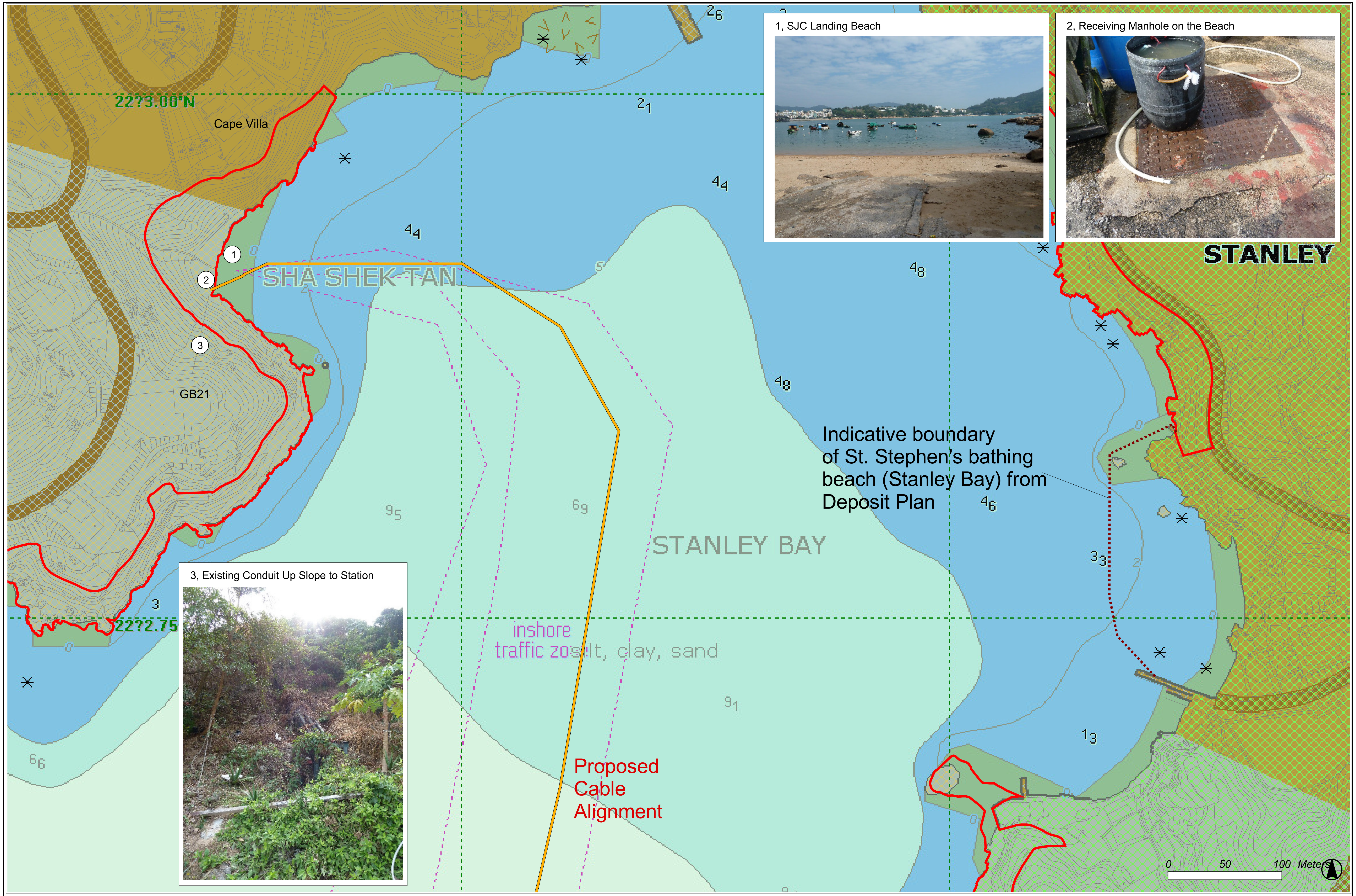
Figure



ATKINS

South East Asia Japan Cable System (SJC) - Hong Kong Segment

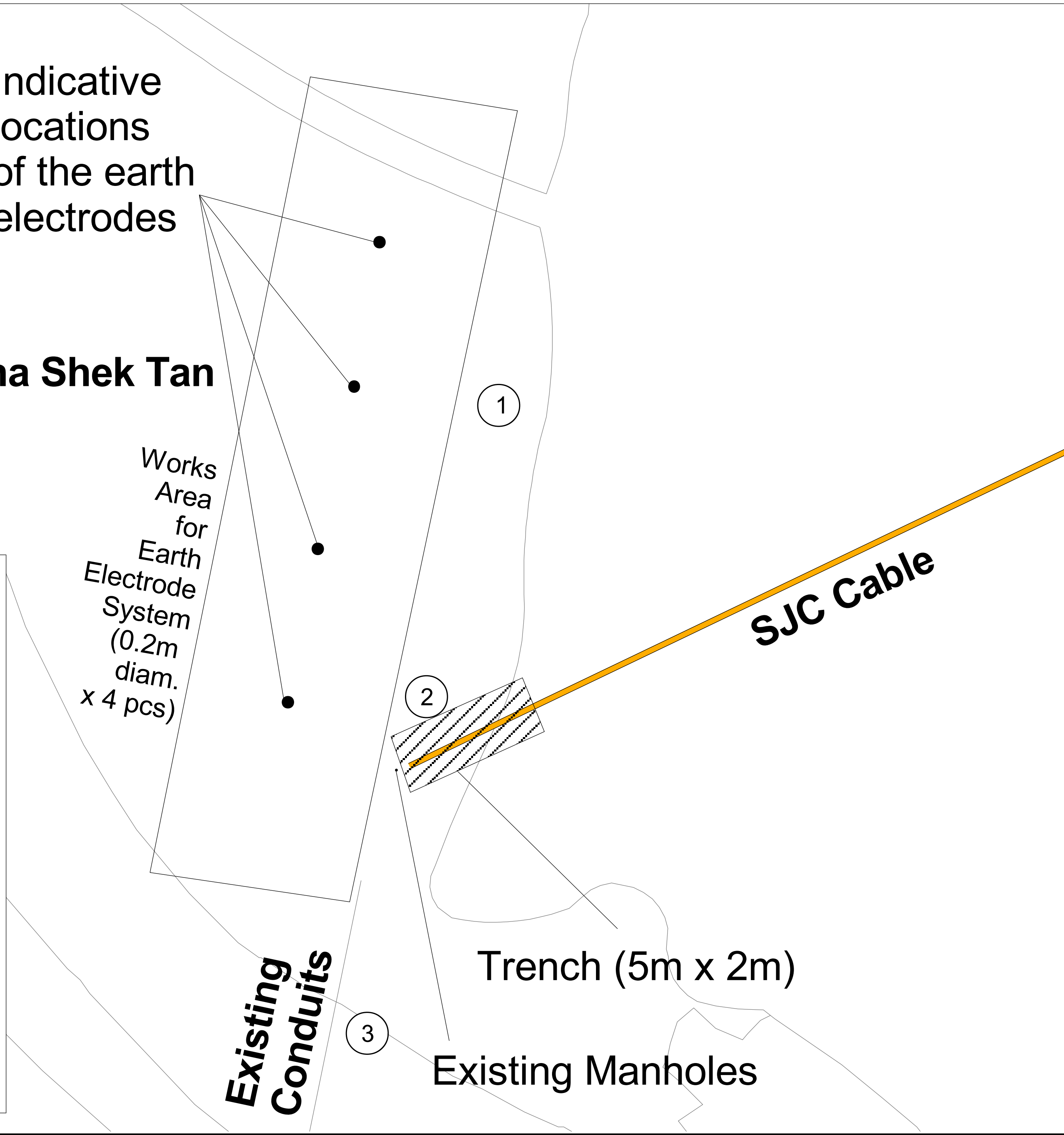
Title		
Location of Alignment in HKSAR Waters		
Scale at A1: NTS	Date: June 2011	Figure No.: 1



South East Asia Japan Cable System (SJC) - Hong Kong Segment

Title		
Proposed Landing Location at Chung Hom Kok		
Scale at A1: NTS	Date: June 2011	Figure No.: 2

1, SJC Landing Beach

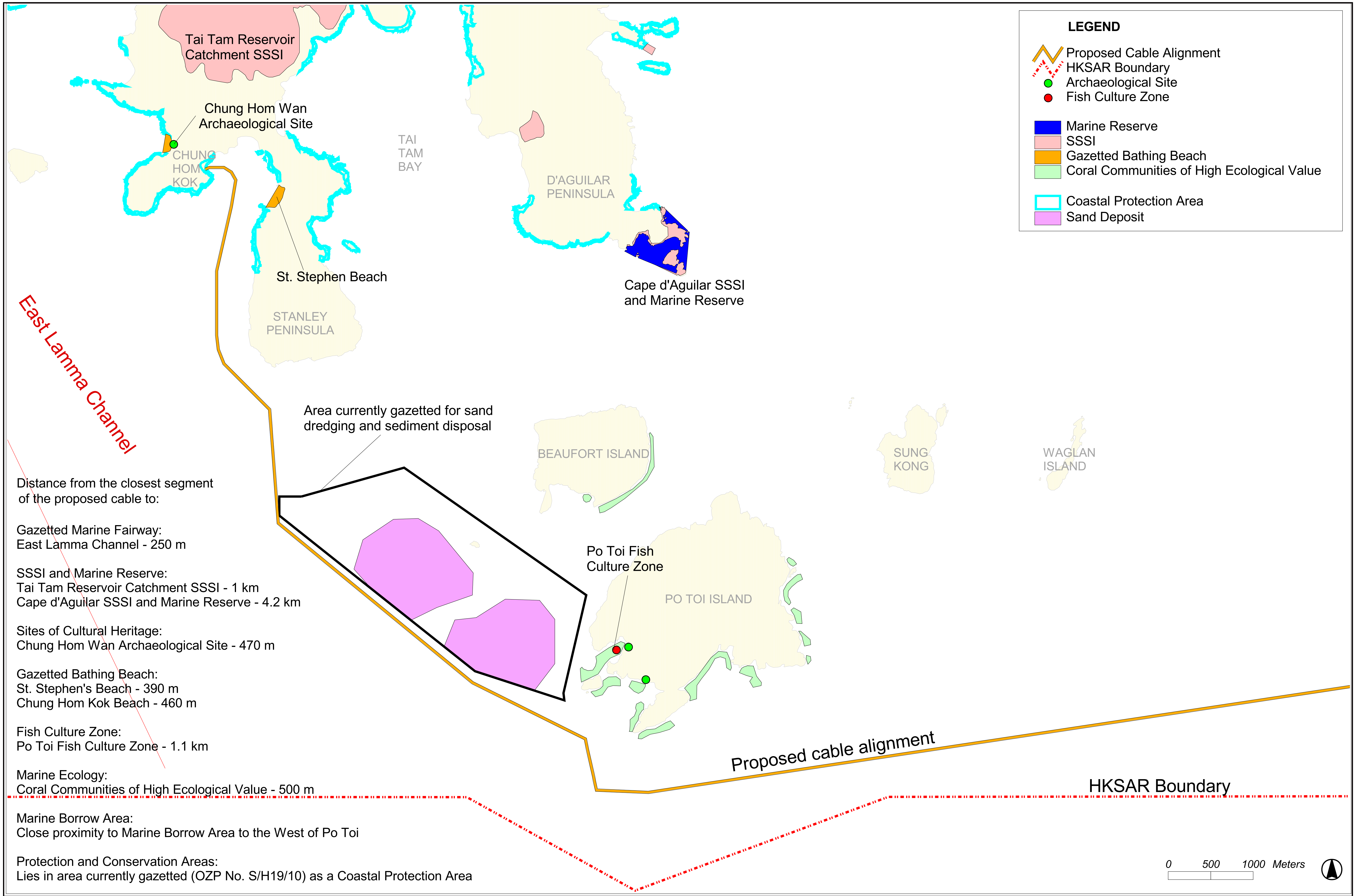


2, Receiving Manholes on the Beach

3, Existing Conduit Up Slope to Station

South East Asia Japan Cable System (SJC) - Hong Kong Segment

Title		
Existing Conditions of Sha Shek Tan Beach		
Scale at A1: NTS	Date: June 2011	Figure No. 3



Distance from the closest segment of the proposed cable to:

Gazetted Marine Fairway:
East Lamma Channel - 250 m

SSSI and Marine Reserve:
Tai Tam Reservoir Catchment SSSI - 1 km
Cape d'Aguilar SSSI and Marine Reserve - 4.2 km

Sites of Cultural Heritage:
Chung Hom Wan Archaeological Site - 470 m

Gazetted Bathing Beach:
St. Stephen's Beach - 390 m
Chung Hom Kok Beach - 460 m

Fish Culture Zone:
Po Toi Fish Culture Zone - 1.1 km

Marine Ecology:
Coral Communities of High Ecological Value - 500 m

Marine Borrow Area:
Close proximity to Marine Borrow Area to the West of Po Toi

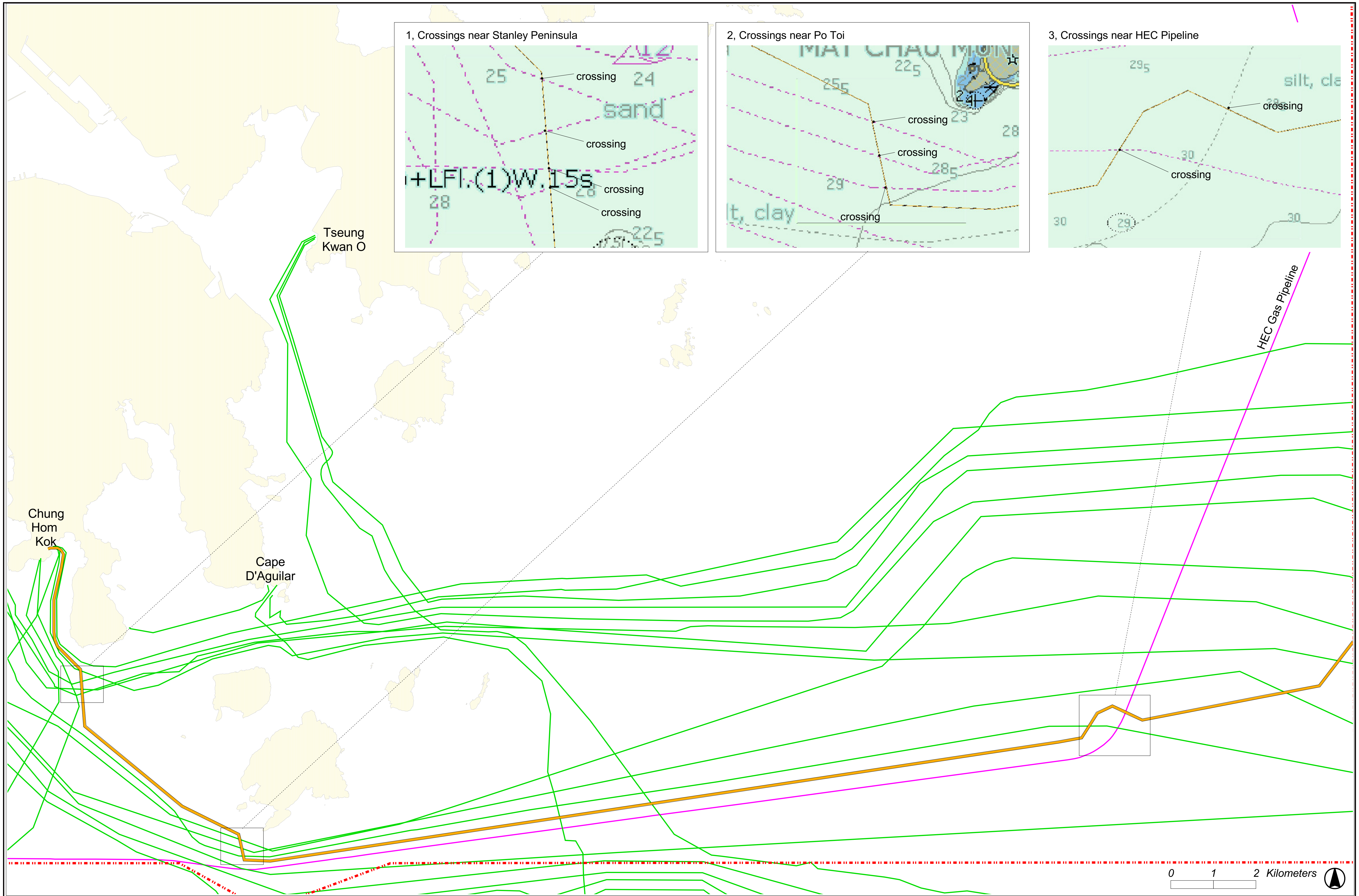
Protection and Conservation Areas:
Lies in area currently gazetted (OZP No. S/H19/10) as a Coastal Protection Area

ATKINS

South East Asia Japan Cable System (SJC) - Hong Kong Segment

Title: Physical Features within the Study Area

Scale at A1	Date	Figure No.
NTS	June 2011	4



ATKINS

South East Asia Japan Cable System (SJC) - Hong Kong Segment

Title	Crossings with the Proposed Cable Alignment
Scale at A1	NTS
Date	June 2011
Figure No.	5

Annex A
Uraduct Technology

Cable and Flowline Protection

Engineered Systems

Trelleborg Offshore

Introduction

With an ever increasing global requirement for data and product transfer, and the necessity for transfer networks to run through ever harsher environments, the demand for highly advanced cable and flowline protection grows.

Throughout their specialist global divisions, Trelleborg CRP has been at the forefront of the telecommunications and oil and gas industries, in terms of the provision of market leading cable and flowline protection solutions to some of the worlds most prestigious projects.

With over 30 years experience and the support of the Trelleborg Offshore network of companies, Trelleborg CRP has become the client's supplier of choice. Having, engineered and produced in excess of 200km of encapsulated cable and flowline protection, which is approximately 80% of the world's total supply - Trelleborg CRP is **Proven** to **Perform**.

Uraduct® protection systems have become the industry standard for the protection of fibre optic cables, power cables, umbilicals, flexible flowlines, rigid flowlines, hoses and bundled products.

All Uraduct® systems are available in various grades of polyurethane to suit a wide range of applications and environments. Further details can be found on pages 16 and 17.

Beyond Uraduct®, Trelleborg CRP's cable and flowline protection product portfolio includes:

Uraduct® +

The ultimate abrasion resistant Uraduct®, incorporating encapsulated banding to reduce installation time and eliminate abrasion of the banding itself.

Retrofit Riser System

A cable & flowline protection system incorporating fixing clamps for location of the line onto existing structures above or below the waterline.

Vortex Induced Vibration (VIV) Suppression Strakes and Fairings

Advanced VIV suppression solutions incorporating stinger compatibility, thermal insulation and ROV installable options.

Polyspace™

Providing regulation clearance at cable and pipeline crossings without the need for costly steel structures, concrete mattressing or rock dumping.

Polymat™

A ballasted ROV installable polyurethane blanket providing impact and abrasion protection.

Spiraduct +

A marine grade rubber cable protection system designed to provide an additional cost-effective protective layer for impact and abrasion protection. It is easy to install and suitable for subsea cables and umbilicals up to 100mm diameter.

Specialist Banding and Installation Tools

Trelleborg CRP is one of the world's largest suppliers of high grade, corrosion resistant banding suitable for a wide range of on and offshore applications. Also offered is the provision of installation tooling and personnel.

Trelleborg CRP also provides valuable client services such as after sales support, on-site consultancy and various installation services. This ensures that Trelleborg CRP clients receive the highest level and best quality of service available in the industry.

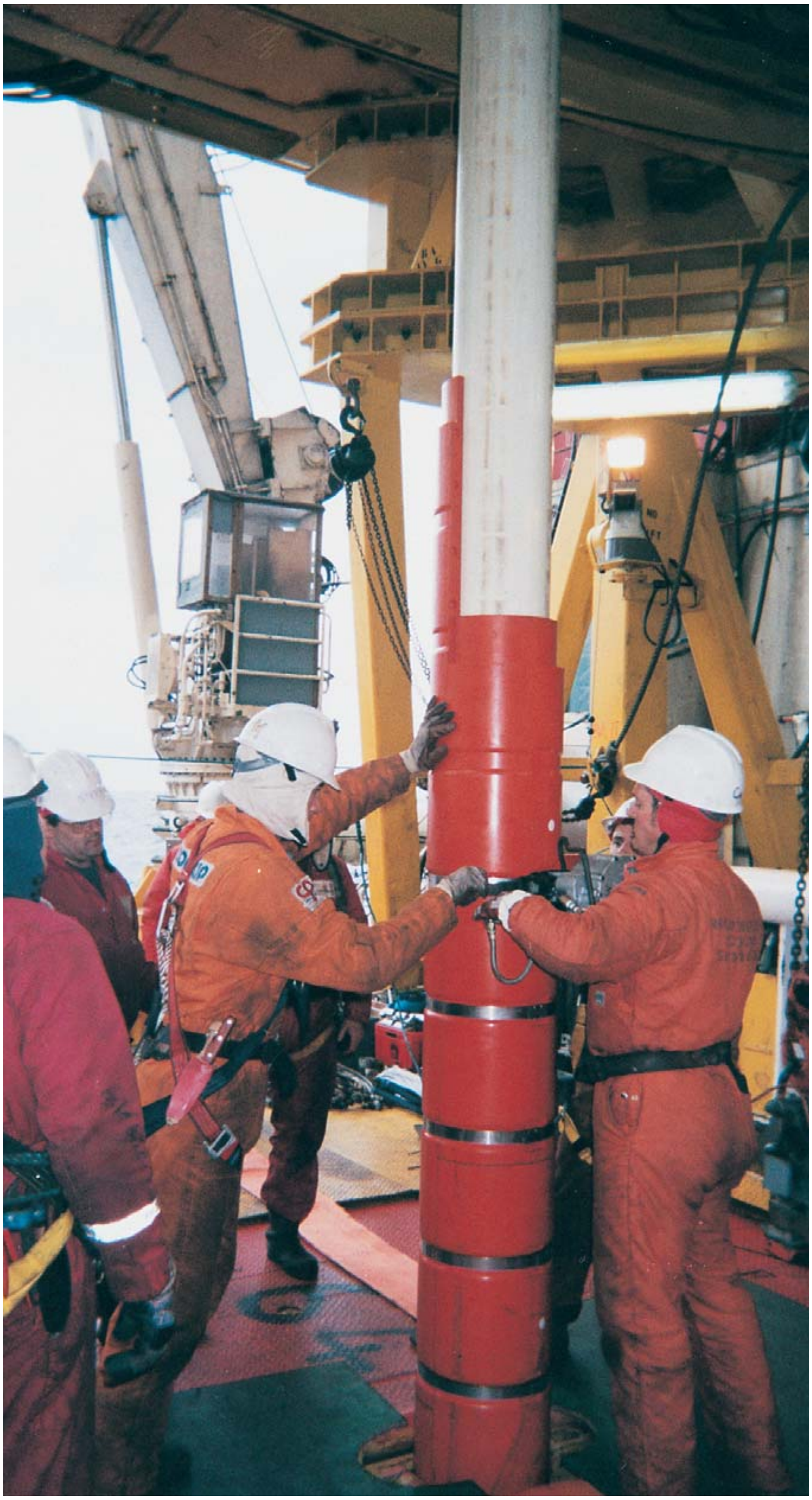
Uraduct®

Uraduct® is a patented product designed and developed by Trelleborg CRP. It has established an enviable reputation as an industry standard for cable and flowline protection. An intensive investment programme has resulted in Uraduct® becoming the universal protection system for fibre optic cables, power cables, umbilicals, flexible flowlines, rigid flowlines, hoses and bundled products.

In areas where additional protection is required, e.g. rocky seabeds, touchdown locations, shore landings or cable/pipeline crossings, Uraduct® provides a high performance technical and cost-effective protection solution in comparison to alternative methods such as rock dumping or concrete mattressing.

Uraduct® comprises of cylindrical half-shells moulded in a range of thicknesses from the most applicable grade of high performance polyurethane (see pages 16 & 17 for material specifications). The half-shells overlap and interlock to form close fitting protection around the core product. For ease of handling and transportation, Uraduct® is manufactured in lengths of up to 2.0m with flexing characteristics to suit the required minimum bend radius of the product or ancillary shipboard lay equipment. Uraduct®, a custom made system, is manufactured to suit the core product with internal diameters ranging from 15mm up to 950mm.

Recent innovation programmes and client requests have lead to a number of key product developments in the Uraduct® range. Trelleborg CRP now offer a 'multi-fit' Uraduct® design which will accommodate a larger range of core product sizes. This solution assists clients in situations where exact core product sizes are likely to vary or are unknown.



The half-shells are secured in place using pre-cut corrosion resistant banding (see pages 14 & 15). The banding is located in recessed grooves that not only ensure a smooth external profile allowing passage through cable engines etc, but also eliminates the need to measure the band spacing. The assembly of the system is quick and efficient being applied simultaneously with product installation. This is a major benefit in weather dependent industries such as the oil and gas and submarine telecommunications industries.

Uraduct® also differs from many alternative protection methods in that it becomes an integral part of the cable or pipeline and is a fully tested system with a proven track record, details of which can be supplied on request - Trelleborg CRP is **Proven** to **Perform**.

Extensive use in the oil and gas industry by most leading oil companies has made Uraduct® the automatic choice for aiding "crossing acceptance" where submarine telecommunication cables or power cables cross existing pipelines or cables. Uraduct® has been specified on an ever increasing range of projects, from flexible riser touchdown over coral seabeds to protection of small fibre optic cables where burial cannot be achieved.

Although Uraduct® was originally designed for harsh offshore conditions; many of Trelleborg CRP's customers appreciate how the protection properties of Uraduct® can also meet the needs of land based projects where operating conditions can be just as onerous. No other protection method can deliver the level of all round protection combined with the economic benefits associated with a Uraduct® installation.

Uraduct® +

In response to client requests and for applications where pipelines or cables are to be subject to high levels of abrasion, Trelleborg CRP has developed Uraduct®+, which is considered to be the ultimate protection solution. Flexible pipes, power cables and fibre optic cables can be protected in any area where abrasion is considered to be a problem and stabilisation cannot be achieved. This includes pipeline touchdown locations, rocky areas and shore landings.

Uraduct®+ is moulded in Trelleborg CRP's "super abrasion resistant" elastomer (see pages 16 and 17 for material specification) and offers all the characteristics of standard Uraduct® with the added benefit of encapsulating the securing bands to prevent premature wear or abrasion of the banding itself.

The polyurethane half-shell mouldings are supplied in loose pre-assembled pairs, with the securing bands fully encapsulated within the body of the PU protection system, with the exception of the seal arrangement. Uraduct®+ is installed onto the pipeline or cable in pairs, with the socket and spigot overlapping and interlocking each pair of mouldings in the assembly. The socket and spigots are designed with a 'dove tail' arrangement, ensuring full system integrity when subject to bending, during either installation or service.

Uraduct®+ is secured in place by 32mm wide x 0.8mm thick Alloy 625 banding. The same pneumatic band tools as used for standard Uraduct® are employed to tension, crimp and cut the bands, allowing for quick and simple installation.

The protection system is also designed to allow for the removal of the securing bands and replacement with new securing bands in the event that the protection system is to be removed and reinstalled on to a new riser system.

Uraduct®+ has undergone full factory testing to ensure that it is fully qualified to meet the stringent requirements laid down by its clients.

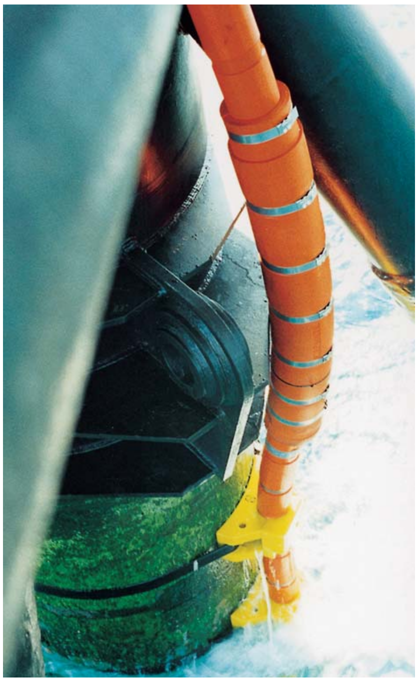
Whilst utilising materials that have been field proven over a number of years, this innovative design has now taken cable and pipeline protection to new levels. No other product on the market can match Trelleborg CRP's Uraduct®+.
Trelleborg CRP is **Proven** to **Perform**.

Uraduct® - Retrofit riser system

In response to the increasing number of additional cables requiring access to and from offshore platforms, Trelleborg CRP developed the Uraduct® Retrofit Riser System, which comprises of Uraduct® and dedicated, high integrity, locating clamps.

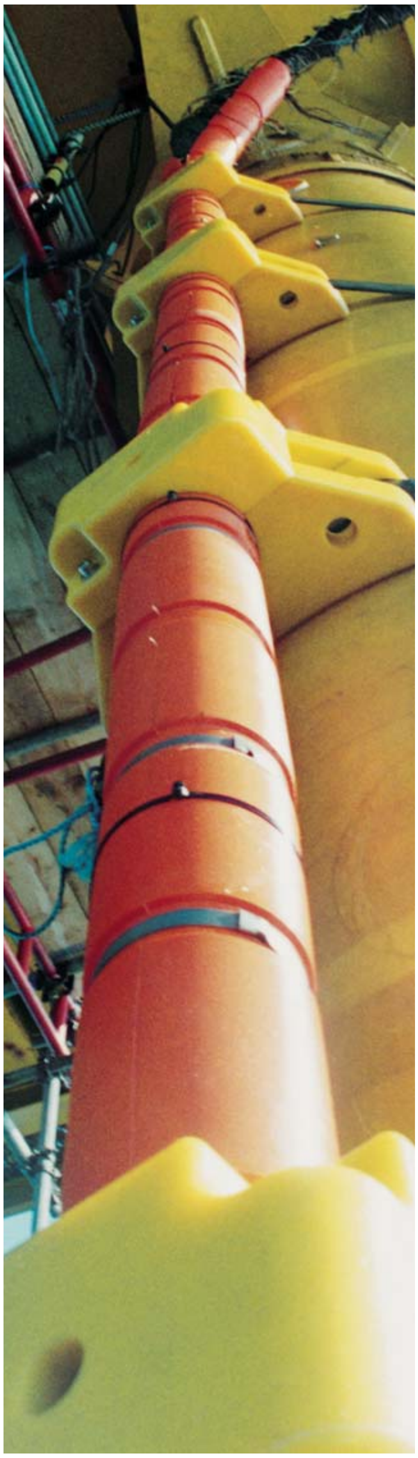
This system provides a very cost-effective solution where cable access to a platform is not possible via existing 'J' or 'I' tubes. Prior to Trelleborg CRP's Uraduct® Retrofit Riser System the only alternative was to install new steel 'J' or 'I' tubes at great expense, compounded with time consuming and problematic installation.

With the introduction of the Uraduct® Retrofit Riser System, substantial cost savings along with improved installation times have resulted in a number of projects coming to fruition which previously would not have been possible.



The securing clamps for this system are designed to withstand the extreme conditions experienced on offshore installations, and can be configured to suit multiple cables. Under normal circumstances the clamps are pre-installed onto a suitable platform leg or structure at regular intervals, the spacing being dependent on the security required. Alternative clamp designs are available where multiple cables are to be installed. The clamp bodies are manufactured from a high performance, rigid, marine grade polyurethane elastomer. No special welding equipment is required as the clamp bases are secured by means of a Polyloop™ high strength Kevlar/EVA coated strap and a highly corrosion resistant metallic tensioning assembly, typically manufactured in Zeron 100 or titanium.

Trelleborg CRP's Uraduct® Retrofit Riser System has been successfully installed on platforms off the coast of Trinidad, in the Gulf of Arabia, and in the North Sea.
This trend is set to grow with particular relevance to submarine fibre optic cables and inter-platform power cables - Trelleborg CRP is **Proven** to **Perform**.



Annex B
Assessment of Potential Impacts to Water Quality

ANNEX B ASSESSMENT OF POTENTIAL IMPACTS TO WATER QUALITY

B1 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 legislation need to be 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).

B2 Description of Environment

Hydrodynamics

For part of the cable route, there is protection from significant tidal currents as it lies within Stanley Bay. The cable which lies beside the East Lamma Channel is mainly affected.by the relatively strong tidal currents since the East Lamma Channel forms one of the main flow paths for waters into and out of the Western Harbour. The cable which is located in the south-eastern waters is mainly influenced by the oceanic water from South China Sea.

Water Quality

The proposed route for the submarine cable passes through the Southern Water Control Zones (WCZ) and Mirs Bay WCZ. There are three EPD routine water quality monitoring stations (SM19, MM8 and MM13) in the vicinity of the proposed cable route. A summary of water quality from these stations is provided in the following Table[5]. Figure B1 showed the location of these stations.

Table B1 : Summary of Marine Water Quality Readings between 2005 - 2009 from EPD Monitoring Stations SM19, MM8 and MM13

Water Quality Parameter	SM19			MM8			MM13		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Temperature (°C)	23.2	14.2	29.4	22.7	13.8	29	22.8	13.3	29
Salinity (psu)	32.5	27.9	34.3	32.9	30.0	34.4	33.0	27.8	34.5
pH	8.2	7.6	8.5	8.2	7.6	8.4	8.2	7.6	8.5
Dissolved Oxygen (% saturation)	89.6	60.0	122.0	91.2	61.0	120.0	92.6	64.0	122.0
Dissolved Oxygen (mg/L)	6.4	4.1	9.7	6.5	4.3	8.9	6.6	4.4	9.1
Total Inorganic Nitrogen (mg/L)	0.10	0.01	0.46	0.09	0.01	0.29	0.08	0.01	0.31
Suspended Solids (mg/L)	4.5	1.0	12.5	3.9	0.9	15.2	4.1	1.0	19.3
Escherichia coli (cfu/100ml)	2	1	13	1	1	12	1	1	10
Chlorophyll-a	2.6	0.4	10.4	2.4	0.3	13.2	2.2	0.5	12.0

5 Environmental Protection Department website http://www.epd.gov.hk/epd/english/environmentinhk/water/marine_quality/mwq_report.html Accessed 31 January 2011.

Water Quality Parameter	SM19			MM8			MM13		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
(microgram/L)									

Sediment Quality

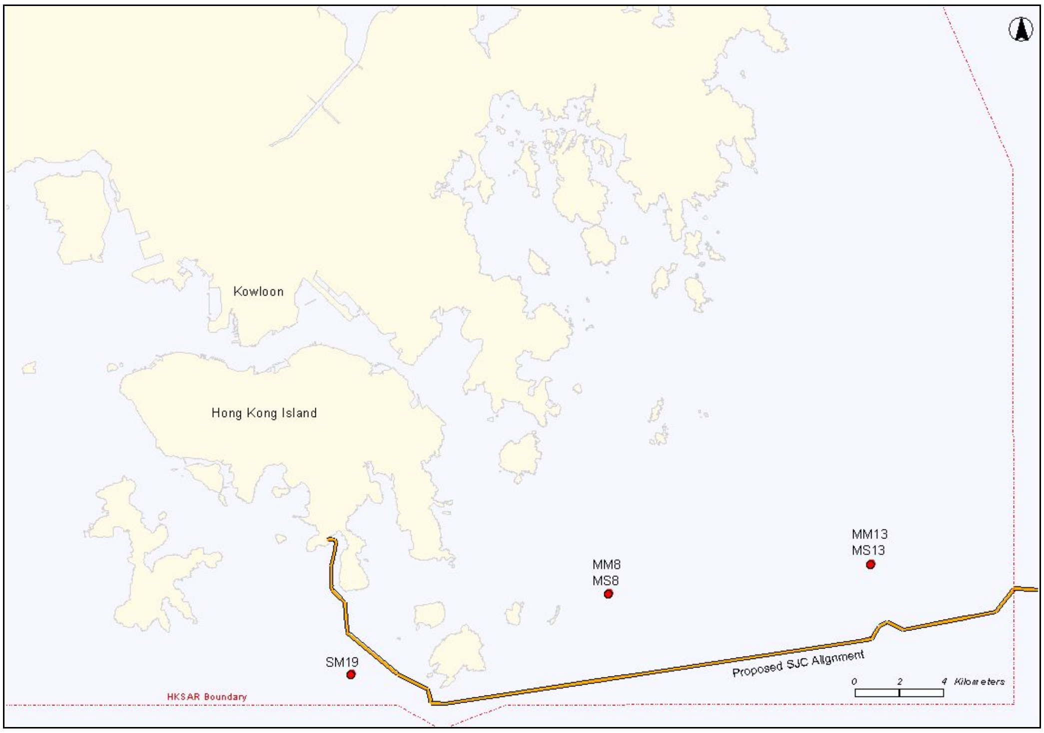
The project is within the vicinity of the routine sediment quality monitoring stations MS8 and MS13 operated by EPD. Marine sediment data has been collected from this station between 2005 and 2009[6] as shown below, which shows the sediment is not classified as contaminated.

Table B2 : Summary of Marine Water Quality Readings between 2005 - 2009 from EPD Monitoring Stations MS8 and MS13

Water Quality Parameter	MS8			MS13		
	Mean	Min	Max	Mean	Min	Max
Nickel (mg/kg)	24	18	29	26	20	45
Arsenic (mg/kg)	6.5	5.4	7.7	7.6	5.7	15.0
Chromium (mg/kg)	31	25	37	34	27	60
Copper (mg/kg)	12	8	16	13	10	22
Cadmium (mg/kg)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Kjeldahl Nitrogen (mg/kg)	430	270	480	370	200	530
Mercury (mg/kg)	0.05	<0.05	0.06	0.06	<0.05	0.08
Zinc (mg/kg)	85	64	100	91	76	160
Lead (mg/kg)	33	29	42	34	27	53

Figure B1 – Location of the Marine Water Quality Monitoring Stations SM19, MM18, MM13, MS8 and MS13

6 Environmental Protection Department website http://www.epd.gov.hk/epd/english/environmentinhk/water/marine_quality/mwq_home.html Accessed 31 January 2011.



Marine Sensitive Receivers

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

(a) Gazetted bathing beaches - Chung Hom Kok Beach and St. Stephen's Beach;

(b) Sites of Ecological Interest - Coral communities around Po Toi, Sung Kong, Waglan Island and Beaufort Island, and;

(c) Fisheries - Fisheries resources and fishing operations at southern Po Toi and Po Toi Fish Culture Zone.

Distances to the Sensitive Receivers

Water Quality Sensitive Receivers	Approx Distance to the Proposed Cable
Gazetted Beachs • Chung Hom Kok Beach • St. Stephen's Beach	 • 460 m • 390 m
Sites of Ecological Interest • Coral communities around Po Toi, Sung Kong, Waglan Island and Beaufort Island,	 • 600 m
Fisheries • Fisheries resources and fishing operations at southern Po Toi • Po Toi Fish Culture Zone	 • vicinity • 1100 m

B3 Impact Assessment

Laying of the Cable at Landing Sites

Preparation of Landing Site - These activities will involve an excavation between the beach manhole 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 150 m (approximately) of cable will be installed by divers using jet probes to bury the cable to a depth of 1 to 3 m 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 150 m area off shore, an injector tool will be lowered onto the seabed off of a barge to the desired burial depth of 3 to 5 m. A pre-run will be undertaken by the tool to ensure there are no problems with laying the cable. The cable will then be laid. 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 approximately 800 metres per hour. 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 B1** (Based on experience of other similar projects) and the sediment plume would be limited to 180 m, 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 to sensitive receivers are expected to result.

B4 Measures Included in Approach

It is considered that there will be only limited effects to water quality arising from the installation of the marine sections of cable, however the following measures will be incorporated into the project works:

- Works carried out within 500m of the St. Stephen's beach will be scheduled as best as possible to avoid the peak bathing season (June through September) or if this is not possible, suitable arrangements with LCSD will be made to avoid impacts to the Beach users during the bathing season.
- Works carried out within Stanley Bay will be scheduled to avoid the peak seasons of water sports activities (during weekends, from Mid-July through August, and on weekends 1 month before the Dragon Boat Festival);
- Water quality protection measures (such as prevention of leakage from construction equipment and Stockpiles will be covered to reduce the amount of runoff of materials entering the marine water) will be incorporated as part of good working practices.

B5 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 G**.

B6 Summary and Conclusions

The installation of the marine sections of the system required the cable to be buried using the cable installation tool to an approximate depth of 3 to 5 m 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 only temporary short term implications of this with no significant adverse impacts to the sensitive receivers identified.

ATTACHMENT B1 CALCULATION OF THE TRANSPORT OF SEDIMENT IN SUSPENSION

1. Cable Burial Machine

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

- VSNL Intra Asia Submarine Cable System – Deep Water Bay (AEP-294/2007).
- Asia-America Gateway (AAG) Cable Network, South Lantau (AEP-298/2007).
- Proposed 132kV Submarine Cable Route for Airport "A" to Castle Peak Power Station Cable Circuit, CLP Power (AEP 267/2007)
- Hongkong Electric Co Ltd 132kV Submarine Cable Installation for Wong Chuk Hang – Chung Hom Kok 132kV Circuits (AEP-132/2002)
- FLAG North Asian Loop. (AEP-099/2001);
- C2CCable Network - Hong Kong Section: Chung Hom Kok, GB21 (Hong Kong Limited) (AEP-087/2000).
- New T&T Hong Kong Limited: Domestic Cable Route, New T & T (AEP-086/2000);
- 1,800MW Gas-fired Power Station for Lamma Extension. (EIA-009/1998);

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. At present the equipment to be used has not been procured but will be similar to the equipment used for the above projects.

2. Release Rate

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

Release rate = 2.5 x 0.22 x 600 x 0.1 = **33 kg s^{-1}**

Depth of disturbance	=	5 m (maximum burial depth of cable)
Width of disturbance	=	0.5m (width of seabed disturbance to bury cable)
Cross Section area	=	2.5m^2
Loss Rate	=	10% (majority of sediment not disturbed)*
Speed of machine	=	0.22 ms^{-1} (800 mph)
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 1 m (See VSNL Intra Asia Submarine Cable System – Deep Water Bay (AEP-294/2007)) 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 0.9m s-1 (See VSNL Intra Asia Submarine Cable System – Deep Water Bay (AEP-294/2007)) to calculate a worse case scenario. A maximum spread of 6 m 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:

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

$$\text{Initial Concentration} = \frac{33}{0.9 \times 1 \times 6} = 6.11 \text{ kg m}^{-3}$$

Current speed = 0.9 ms^{-1}

Height of sediment = 1 m

Width of Sediment = 6 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 1kgm^{-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 10mm s^{-1} is adopted (See VSNL Intra Asia Submarine Cable System – Deep Water Bay (AEP-294/2007)).

Previous studies such as the VSNL Intra Asia Submarine Cable System – Deep Water Bay (AEP-294/2007) 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 5mm s^{-1}.

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

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 0.9 m s-1 has been assumed.

Distance Travelled = $200\text{s} \times 0.9\text{m s}^{-1}$ = 180m

No sensitive receivers are within 180 m metres of the cable laying and marine sensitive receivers identified are generally over 400 m from the works area. Therefore, adverse water quality impacts to the sensitive receivers are not expected to result from the project.

Annex C

Assessment of Potential Impacts to Marine Ecology

ANNEX C ASSESSMENT OF POTENTIAL IMPACTS TO MARINE ECOLOGY

C1 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).*

C2 Description of the Environment

Intertidal Shore Assemblages

The landing site at Sha Shek Tan of Chung Hom Kok is located on a sandy beach sandwiched between rocky/boulder headlands at each end, which is typical of the Southern coastline of Hong Kong Island.

Study has been carried out in the proposed landing site and its vicinity in 2000[7]. The results of this survey indicate that the proposed land point is composed of natural hard rocky/boulder shores and natural soft sandy/pebble beaches and no species of conservation importance were recorded[8].

Subtidal Assemblages

Literature review showed that the subtidal areas in the vicinity of the proposed cable route are of low to medium ecological value in comparison to other areas of Hong Kong[7, 8]. There are coral communities of high ecological value along the entire coast of Po Toi Island, Sung Kong and Waglan Island and along the sourth-eastern coast of Beaufort Island[8]. The shortest distance of the cable alsignment to the sourhtern Po Toi coast is around 600 m.

Survey was carried out on the 20 February 2011 to update the status of corals in these areas; the methodology and results of these surveys can be seen in **Attachment C1**.

In summary, the survey found no rare species of conservation interest was identified. Although there are patches of hard corals were found, the abundance of these organisms was very low with the area.

In the vicinity of the landing site, hard coral cover was below 5% and only 12 colonies (16 to 480 cm^2) from 9 hard coral species were recorded in the REA transects. All species are commonly found in local water. Among these species, *Plesiastrea versipora*, *Goniopora stutchburyi* and *Oulastrea crispata* are more tolerate to sedimentation and more common in the southern and western Hong Kong waters[9].

Marine Mammals

Literature review showed that the Indo-Pacific Hump-backed Dolphin (*Sousa chinensis*) and the Finless Porpoise (*Neophocaena phocaenoides*) are the only species of marine mammal regularly sighted in Hong Kong waters. The population of *Sousa chinensis* is reported to be centred around the Pearl River Estuary and the waters of Hong Kong are thought to represent the eastern potion of this marine mammal's range[8].

The Finless Porpoise, *Neophocaena phocaenoides*, is the most common and important species of cetacean in the southern waters of Hong Kong with its most important habitat appearing to be the waters off the south western tip of Lamma Island[8].

Recent monitoring revealed that the waters along the proposed cable route from Stanley Bay to the Eastern waters of Hong Kong have no observation of Chinese white dolphins

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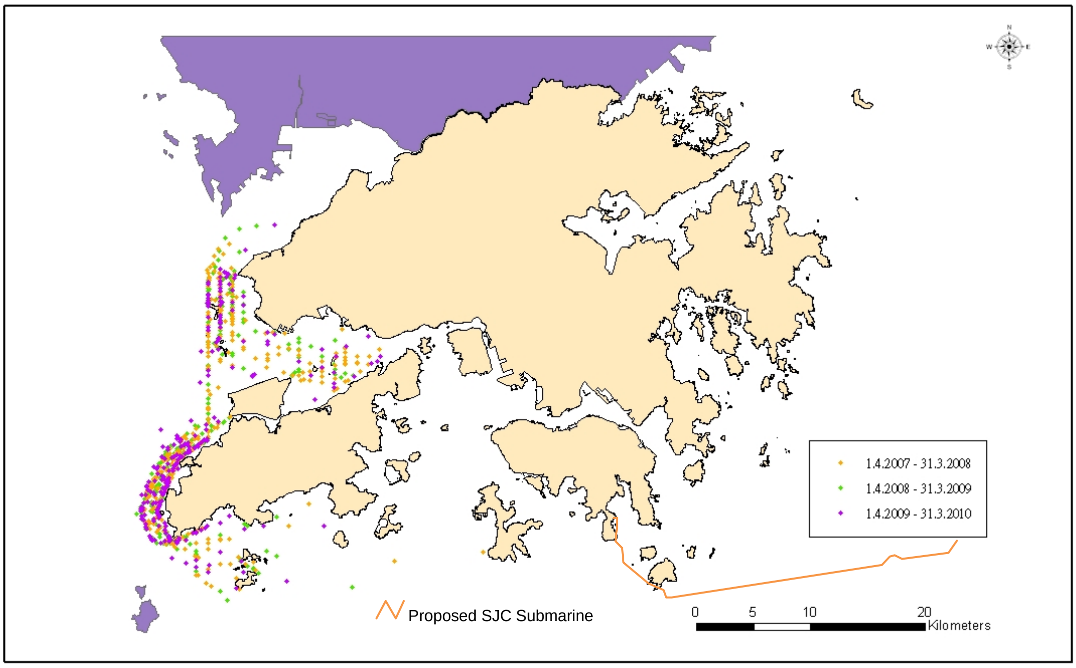
7 Environmental Permit (EP-087/2000) Project Profile for C2C Cable Network – Hong Kong Section: Chung Hom Kok, GB21 (Hong Kong Limited).

8 Environmental Permit (EP-294/2007) Project Profile for VSNL Intra Asia Submarine Cable System – Deep Water Bay.

9 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

(*Sousa chinensis*) and had significantly lower observations of finless porpoises (*Neophocaena phocaenoides*) than the Western waters of Hong Kong[10]. **Figure C1** showed that from 2007 to 2010, there was no sighting of Chinese White Dolphin within the vicinity of the proposed cable route. **Figure C2** showed that there are observations of finless porpoises in the South Eastern waters of Hong Kong, however the distribution is much less than the South Western waters. **Figure C3** further showed that the number of finless porpoises observed along the proposed route during dry season in 2004 to 2009 (top) was not significant, and in wet season (bottom) finless porpoises were infrequently recorded from Po Toi area to the Eastern boundary of HKSAR along the proposed route. As such, the area which the cable passed through is not considered being a habitat of major importance for cetaceans within Hong Kong.

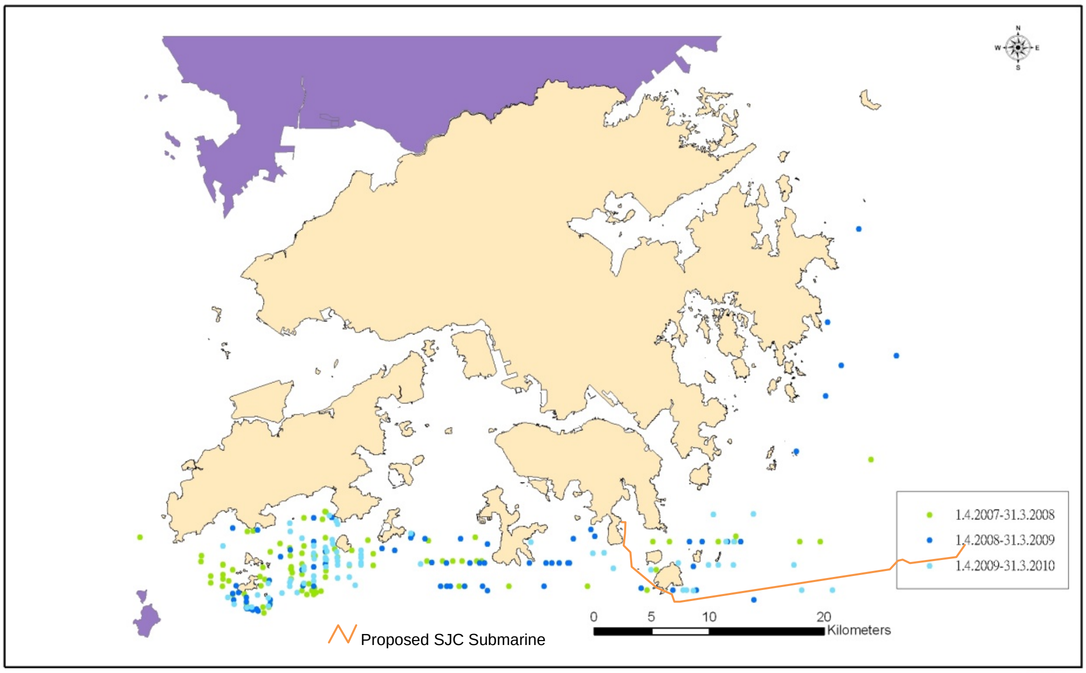
Figure C1 : Distribution of Chinese White Dolphins (2007-2010)



Distribution of Chinese white dolphins (2007 - 10)

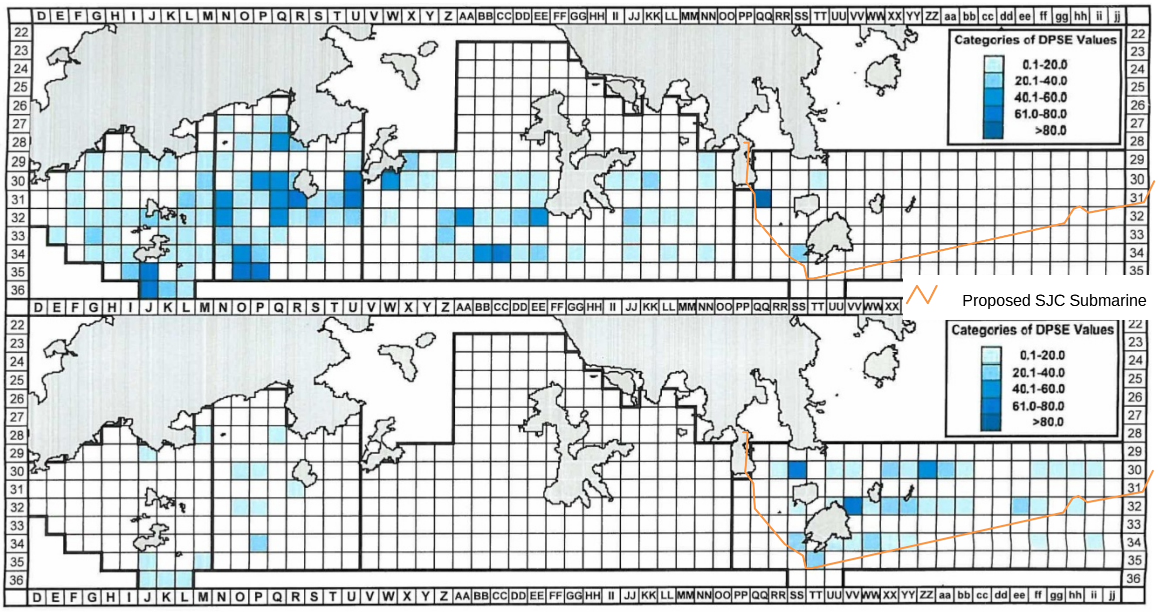
[10] AFCD
Website http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_chi/con_mar_chi_chi/con_mar_chi_chi_dis_hk.html
and http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_fin/con_mar_fin_fin/con_mar_fin_fin_dis_wheredo.html Accessed 31 January 2011.

Figure C2: Distribution of Finless Porpoise (2007-2010)



Distribution of Indo-Pacific finless porpoises (2007 - 10)

Figure C3: Distribution of Finless Porpoise (2004-2009)



Density of finless porpoises with corrected survey effort per km^2 in southern waters of Hong Kong during dry season (top) and wet season (bottom), using data collected during 2004-09 (DPSE = no. of porpoises per 100 units of survey effort)

C3 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 cable 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 route, the study site is 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 cable installation work.

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 expected that the suspended solids generated by the 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.

Cable installation works may result in a minor and short term increase in underwater sound from marine vessels. Given that Finless Porpoises use high frequency ultrasonic clicks for foraging and communication, the low frequency underwater sound associated with vessels, jetting and cable laying would not be expected to interfere significantly with Finless Porpoises. No unacceptable adverse impacts to Finless Porpoises from underwater sounds are expected to occur.

Due to the potential presence of marine mammals, visual inspections of the Chinese White Dolphin and Finless Porpoise will be undertaken immediate prior to commencement of works (see **Annex G** for detail methodology) as precautionary measures. Implementation of this marine mammal exclusion zone avoid any impacts to the marine mammals during the cable installation work.

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 Sousa chinensis and Finless Porpoises *Neophocaena phocaenoides* are known to infrequently occur in the eastern waters.
Size	The proposed cable to be laid of approximately 37km in length within Hong Kong SAR waters, will be laid in the marine environment by divers and using an jetting methodology.
Duration	The period of work is programmed to last about 1 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 alignment passes 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 proposed submarine cable.

C4 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.

C5 Summary and Conclusions

Dive survey and review of available literature has identified the intertidal and subtidal regions of the alignment support fauna of low ecological value, typical of similar habitats in Hong Kong. Due to the relatively low numbers of marine mammals observed from the eastern waters when compared other part of Hong Kong, it is considered that the waters through which the cable route passes 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 route. This is not considered as an adverse, irreversible ecological impact. Re-colonization of benthic organisms on benthic substrates is likely to occur promptly after the cable installation work. As such, impacts are not found to be significant.

ATTACHMENT C1 SUBTIDAL BENTHIC SURVEY RESULTS

1. Introduction

This section presents the results of ecological assessment of benthic cover at the proposed landing site at Sha Shek Tan in Chung Hom Kok.

2. Methodology

Assessment of benthic substrate and community using the semi-quantitative, Rapid Ecological Assessment (REA) method was conducted within the areas of the proposed landing site. The dive survey was conducted on 20 February 2011.

REA has been adopted in many regions to examine baseline information on coral reefs, such as the Great Barrier Reef[11] 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 modification[12]

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 route. Survey was performed along the transect tape. On each transect, a belt area of 100m^2 (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 the proposed landing site was mainly composed of sand and patches of hard rock with overall percentage cover of 70% and 26% respectively. The dominant sessile organisms were erect macroalgae and encrusting red algae with overall percentage cover of up to 26%.

The first three transects were composed of sand with percentage cover of between 70% to 80%, followed by boulders (ranged from 8 to 26%) and rubbles (4 to 12%). The sandy and rocky surface along the first three transects was mainly covered by erect macroalgae (6 to 26%), with a low percentage cover of encrusting algae (4 to 8%) and barnacles (4 to 8%). Few small patches of other sessile animals (all < 5%) along all transects. Few patches of hard corals (<5%) were found along the first three transects but absent in the last two transects.

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11 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.

12 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.

4. Coral community

A total of 12 colonies of 9 hard coral species were identified in the survey including *Favites abdita*, *Porites sp.*, *Favites pentagona*, *Plesiastrea versipora*, *Oulastrea crispata*, *Platygyra carnosus*, *Turbinaria peltata*, *Psammocora superficialis* and *Goniopora stutchburyi* size ranged from 16 to 480 cm^2.

The identified corals were encrusted on boulders and arecommon species recorded in local waters. Among these species, *Plesiastrea versipora*, *Goniopora stutchburyi* and *Oulastrea crispate* are more tolerate to sedimentation and more common in the southern and western Hong Kong waters[13].

No soft coral, gorgonian or sea whip was recorded in the survey.

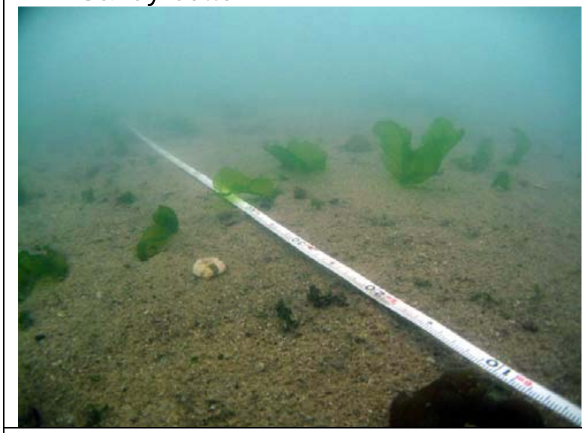
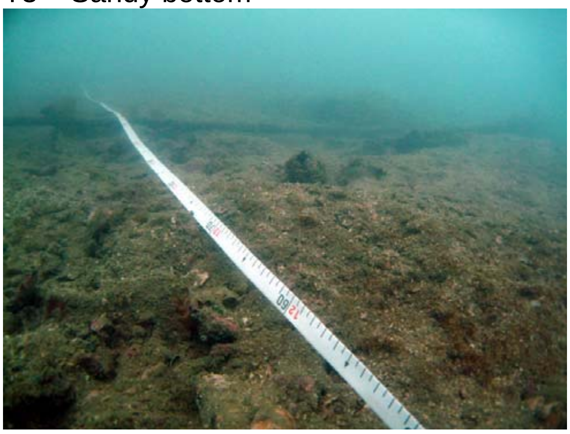
5. Summary and Conclusion

The cable will be installed in soft sand seabed and will not affect coral communities.

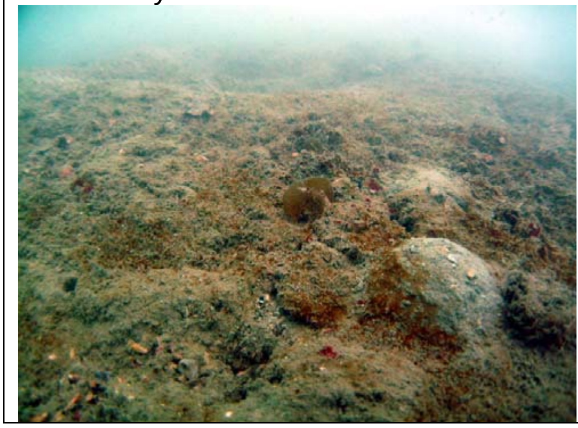
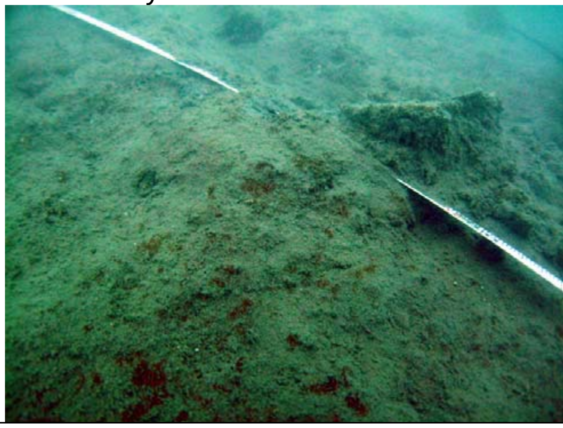
The abundance and number of species of hard coral colonies were low. Only 12 colonies of 9 hard coral species were found encrusted on boulders. Coral cover along each REA transect was < 5%.

The abundance and diversity of other sessile organisms was also low. No soft corals or other species of conservation interest was found.

Photos

T1 - Sandy bottom	Existing submarine cable
	
T2 – Sandy bottom	T3 – Sandy bottom
	

[13] 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.

T4 – Sandy bottom	T5 – Muddy bottom
	

Annex D

Assessment of Potential Impacts to Marine Fisheries

ANNEX D ASSESSMENT OF POTENTIAL IMPACTS TO FISHERIES

D1 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.

D2 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 alignment.

Capture Fisheries

During 2006, AFCD carried out a comprehensive Port Survey to collect updated data on the fisheries production and fishing operations in Hong Kong waters[14]. 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 have been identified as good spawning grounds and nursery areas for both fish and crustaceans. The proposed route traverses 14 Port Survey Grids with 6 are low in fishery production (0 – 100 kg/ha), 5 are medium (100 – 400 kg/ha) and 3 are high (400 – 1000 kg/ha). Generally, the seasonal abundance of fry in Hong Kong is at it's 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 September. Commercially important crustaceans spawn between April and November[15].

Culture Fisheries

The closest culture fishery to the cable alignment is at Po Toi Island, over 1km away from the proposed route. It is considered that the construction and operational phases of this project will not affect this FCZ.

D3 Fisheries Impact Assessment

Construction Phase

Direct Impacts

The proposed submarine cable is to be laid and buried using the jetting methodology. jetting equipment will bury the cable to a maximum depth of 3 to 5m, operating over an area of width of 0.25m.

The seabed will be receiving minimal disturbance for a temporary period, allowing immediate recolonisation by benthic fauna following the burial of the cable. 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 alignment on the sea bed during the cable-laying operation.

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14 Agriculture, Fisheries and Conservation Department Website. <http://www.afcd.gov.hk/english/fisheries/fish_cap/fish_cap_latest/fish_cap_latest.html> Downloaded on 1 March 2011.

15 Environmental Permit (EP-298/2007) Project Profile for Asia-America Gateway Cable Network, South Lantau.

There is an area of the cable that will involve crossing of the HEC pipeline. Within this area approximately 100 m of cable will be laid within a cable lining of protection (Uraduct or equivalent) with smooth surface and will not foul nets. Compare with the other traditional protection measures (such as rock dumping), Uraduct will have less disruption to the seabed and smaller affected area above seabed level. At the point of crossing, the cable will be laid at seabed level.

Indirect Impacts

There will be some minor, short-term impacts by way of elevated suspended solids during the cable-laying operation. As discussed in **Annex B**, only a narrow corridor is required for burial of cable along the route alignment, and much of the suspended sediments resulting from the 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 route. The cable alignment is approximately 37km long in Hong Kong SAR waters.
Size of affected area	The cable route covers approximately 37km 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 cable route passes through areas of different fisheries values (see Figures C1 and C2). The route mainly passes along the grids of low and medium fisheries production, with a short section passes girds of high fisheries production.
Destruction and Disturbance of Spawning and Nursery Grounds	The cable route passes Fishing Zone (Figure C2) which is 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 alignment passes through fishing zones of different 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 over 1km away at Po Toi Island.

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 3 to 5m below the sea-bed, is unlikely to be damaged by any fishing activity.

D4 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.

D5 Summary and Conclusions

The waters through which the cable alignment is to pass are considered to be of varies in 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 jetting process is considered to be negligible for mobile species, such as fish. Cable is to be laid at approximately 3 to 5m under the seabed and are not considered to inhibit any fisheries operations. No negative impacts are expected to arise from this project.

Figure D1 : Distribution of fisheries production (adult fish) in Hong Kong SAR in relation to the proposed cable alignment (Base Map from AFCD Port Survey 2006)

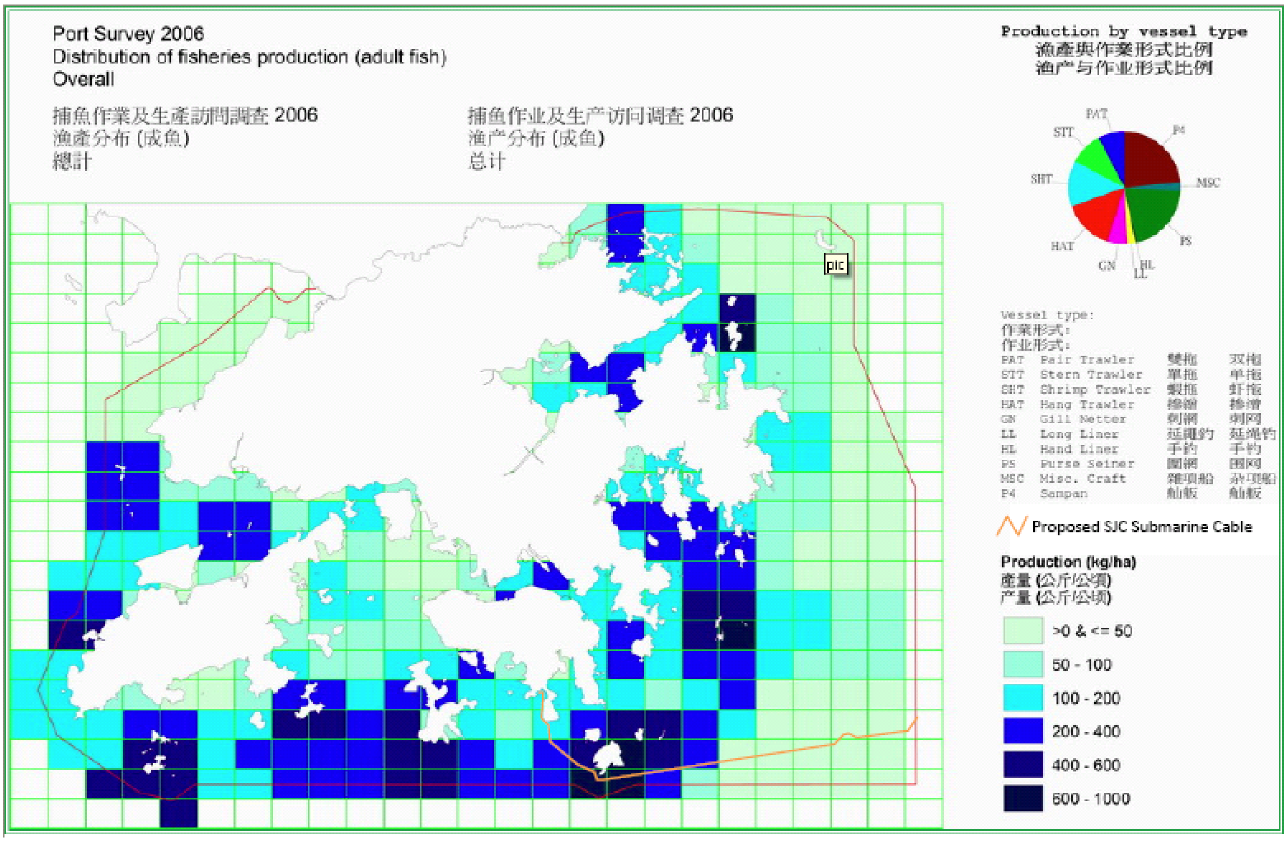
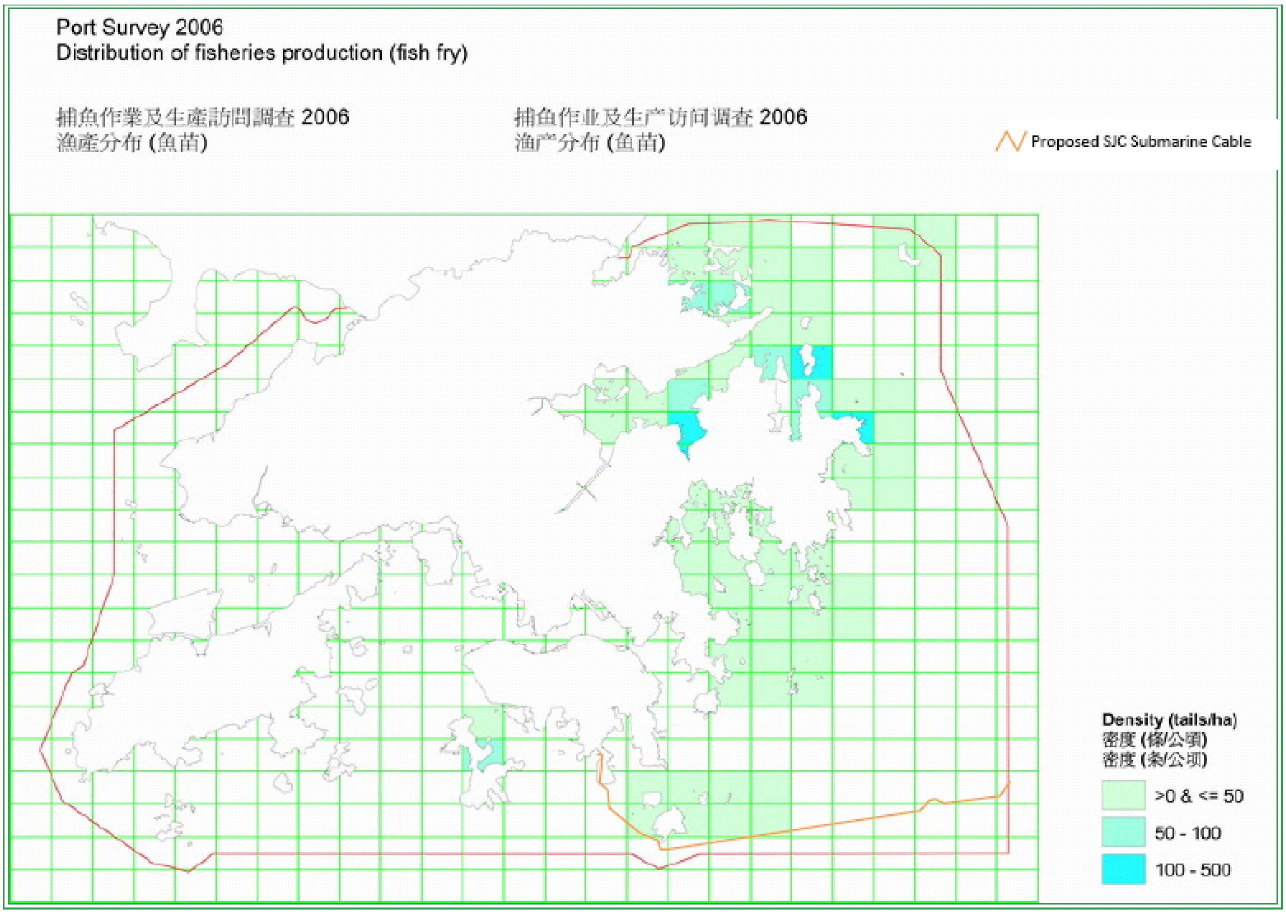


Figure D2 : Distribution of fisheries production (Fish fry) in Hong Kong SAR in relation to the proposed cable alignment (Base Map from AFCD Port Survey 2006)



Annex E
Assessment of Potential Impacts to Noise

ANNEX E ASSESSMENT OF POTENTIAL IMPACTS TO NOISE

E1 Relevant Legislation

EIAO-TM stipulates a noise standard of $L_{eq(30\ minutes)}$ 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.

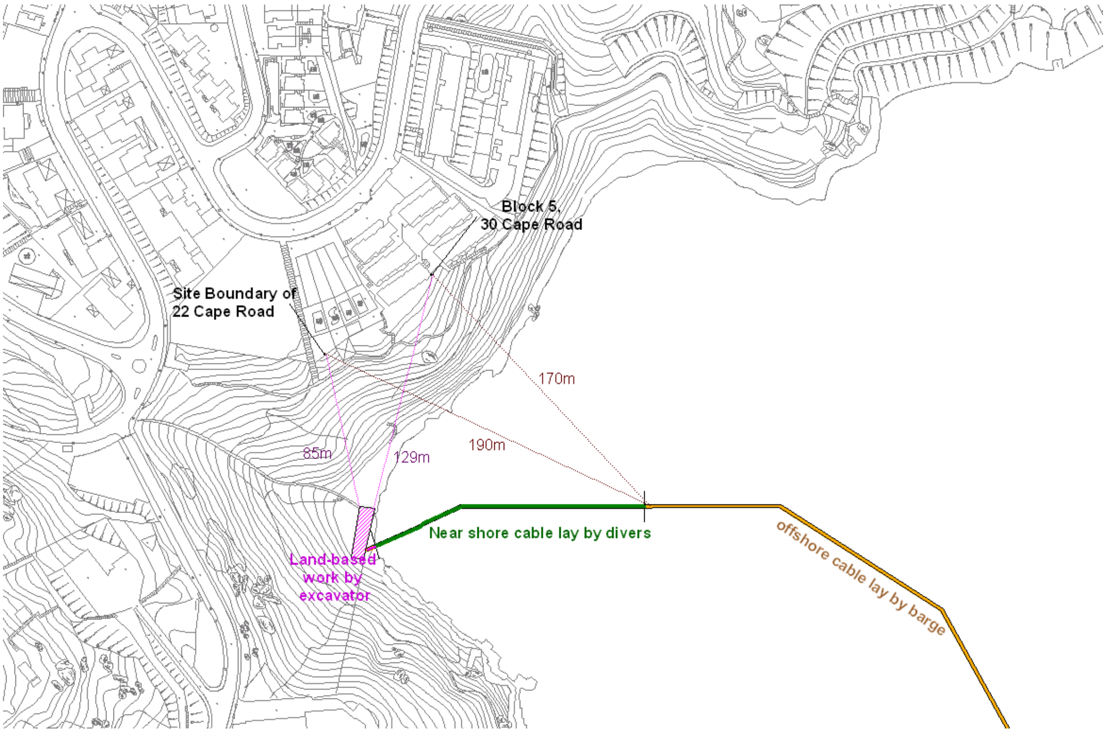
It is not anticipated that there will be evening or night-time (1900 to 0700 hours) construction activities at the works site. However, should there be any construction activities involving use of PME or Prescribed Construction Work (PCW) during these restricted hours, the Contractor will be responsible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

E2 Description of the Environment

Table E1 : 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	22 Cape Road	Residential	85 m	190 m
NSR 2	Block 5, 30 Cape Road	Residential	129 m	170 m

Figure D1: Location of Noise Sensitive Receivers and the Proposed Cable



E3 Impact Assessment

Potential Sources of Impact

The key noise sources for onshore installation will be Powered Mechanical Equipment (PME) used during excavation for the installation of the cable and earth electrode system along the foreshore from the existing beach manholes down to the Low Water Mark (LWM) and a generator station on the beach.

The majority of the cable-laying will be by jetting. The marine equipment that will be required for the cable laying operation will be located between about 150m from the shore, where the depths of water allows the equipment to operate and manoeuvre. The PME will include two tug boats and a barge.

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 E2 : Construction Plant Inventory

Equipment (PME)	GW-TM reference	Number of plant	Sound Power Levels
Excavator (onshore)	CNP 081	1	112 dB(A)
Generator (onshore)	CNP 101	1	108 dB(A)
Tug Boat (offshore)	CNP 221	2	110 dB(A) each
Barge (offshore)	CNP 061	1	104 dB(A)

As the earth electrode system may be installed concurrently with the offshore cable laying operation, the worst case noise impact to the NSRs will be all PMEs as listed in **Table E2** operating concurrently. The results are calculated in **Table E3** below:

Table E3 : Predicted Noise Levels

NSR	PME	Sound Power Levels, dB(A)	Separation Distance, m	Distance Correction, dB(A)	Façade Correction, dB(A)	Predicted Noise Levels, dB(A)	Combined Noise Levels, dB(A)
1	Excavator	112	105	- 47	3	68	70
1	Generator	108	105	- 47	3	64	
1	Tug Boats	113	190	- 54	3	62	
1	Barge	104	190	- 54	3	53	
2	Excavator	112	129	- 50	3	65	68
2	Generator	108	129	- 50	3	61	
2	Tug Boats	113	170	- 53	3	63	
2	Barge	104	170	- 53	3	54	

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

E4 Mitigation Measures

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

E5 Conclusions

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

Annex F
Assessment of Potential Impacts to Cultural and Heritage

ANNEX F ASSESSMENT OF POTENTIAL IMPACTS TO CULTURAL AND HERITAGE

F1 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.

F2 Description of the Environment

Cultural Resource

The Chung Hom Wan Archaeological Site is approximately 450 m away from the excavation work for the shore section of the proposed cable. It is considered that there will be no adverse impact on the Archaeological Site as a result of the small-scale and temporary excavation work required on the beach.

Marine Archaeological Resources

A review of potential marine archaeological features within the area has been undertaken. The aim of the investigation was to locate underwater features 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 reference to the previous similar projects in the vicinity, including the recently granted EP-294/2007 VSNL Intra Asia Submarine Cable System which aligned along the proposed cable offshore and the EP-087/2000 C2C Cable Network with the landing beach manhole is the same as the proposed cable of the project.

The geophysical survey provided 100% coverage of the seabed and sub-surface sediments. The results of the survey data (see **Attachment F1** for details) indicated the presence of 50 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.

F3 IMPACT ASSESSMENTS

Cultural Resources

Due to the distance (450 m) from the shore work required to land the cable for the proposed cable route, it is considered that there will no adverse impacts to the Chung Hom Wan Archaeological Site as a result of the cable landing and laying works.

Marine Archaeological Resources

There are no features of archaeological values identified in the vicinity of the route and the impacts to marine archaeological will be insignificant.

F4 Mitigation Measures

Geophysical survey of the route has been conducted for the project on the route alignment (see **Attachment F1** for details). The route alignment is required to avoid any areas of hard seabed or subsurface features and have been reviewed to ensure such features are not present along the alignment. Should such features be identified, the cable route alignment will be modified to avoid these features. Should features of unknown origin be identified along the cable route alignment, that cannot be avoided, these will be reviewed by a qualified marine archaeologist to review their potential archaeological resource value.

F5 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 features was previously identified to be impacted by the construction of the cable, no adverse impacts on marine archaeological deposits are expected.

ATTACHMENT F1 ASSESSMENT OF MARINE ARCHAEOLOGICAL RESOURCES

F1 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) in May 2011 for the South-East Asia Japan Cable System (SJC).

F2 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.

Survey Scope

EGS (Asia) Ltd collected the following data:

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

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

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 ± 1m or better was ensured by carrying out the above quality assurance checking procedure at the beginning of the survey.

F3 Results

Sonar Contact List

Contact number	Latitude Longitude	Easting Northing	RPL offset	Dimensions (m)	Description
SJC-S10-CHK-SC001	22° 12.954' N 114° 12.521' E	839547.7 808583.4	73m NE	2.5x1x<1	Debris/boulder
SJC-S10-CHK-SC002	22° 12.951' N 114° 12.511' E	839530.5 808577.8	61m N	2.5x2x<1	Debris/boulder
SJC-S10-CHK-SC003	22° 12.947' N 114° 12.506' E	839521.9 808570.4	52m N	3.5x1.5x<1	Debris/boulder
SJC-S10-CHK-SC004	22° 12.946' N 114° 12.502' E	839515.0 808568.6	49m N	1.8x1.8x<0.5	Debris/boulder
SJC-S10-CHK-SC005	22° 12.926' N 114° 12.532' E	839566.6 808531.7	40m NE	2.5x2.5x<1	Debris/boulder
SJC-S10-CHK-SC006	22° 12.923' N 114° 12.523' E	839551.1 808526.2	26m NE	3x1.5x<1	Debris
SJC-S10-CHK-SC007	22° 12.944' N 114° 12.595' E	839674.8 808564.9	129m NE	3x2x<1	Debris/boulder
SJC-S10-CHK-SC008	22° 12.943' N 114° 12.624' E	839724.7 808563.1	162m NE	Linear	Linear debris
SJC-S10-CHK-SC009	22° 12.914' N 114° 12.558' E	839611.3 808509.6	45m NE	3x1.5x<1	Debris
SJC-S10-CHK-SC010	22° 12.921' N 114° 12.585' E	839657.7 808522.5	84m NE	2x1x<1	Debris
SJC-S10-CHK-SC011	22° 12.910' N 114° 12.595' E	839674.9 808502.2	87m NE	2x2.5x<1	Debris/boulder
SJC-S10-CHK-SC012	22° 12.910' N 114° 12.599' E	839681.7 808502.2	93m NE	2x1.5x<1	Debris/boulder
SJC-S10-CHK-SC013	22° 12.930' N 114° 12.690' E	839838.1 808539.1	249m NE	Linear	Linear debris
SJC-S10-CHK-SC014	22° 12.856' N 114° 12.461' E	839444.6 808402.5	121m S	1x1x<1	Debris/boulder
SJC-S10-CHK-SC015	22° 12.905' N 114° 12.709' E	839870.8 808493.0	256m NE	4x1xnmh	Debris
SJC-S10-CHK-SC016	22° 12.841' N 114° 12.613' E	839705.8 808374.9	57m E	Linear	Linear debris
SJC-S10-CHK-SC017	22° 12.829' N 114° 12.612' E	839704.1 808352.7	59m E	2x1.5x<1	Debris/boulder
SJC-S10-CHK-SC018	22° 12.859' N 114° 12.740' E	839924.0 808408.1	281m E	2x1.5x<1	Debris/boulder
SJC-S10-CHK-SC019	22° 12.802' N 114° 12.444' E	839415.4 808302.8	221m S	2.5x1.5x<1	Debris/boulder

Contact number	Latitude Longitude	Easting Northing	RPL offset	Dimensions (m)	Description
SJC-S10-CHK-SC020	22° 12.705' N 114° 12.517' E	839540.9 808123.8	67m W	1x1x<1	Debris/dredging dump
SJC-S10-CHK-SC021	22° 12.652' N 114° 12.359' E	839269.4 808026.0	318m W	2x<1x<1	Debris/ dredging dump
SJC-S10-CHK-SC022	22° 12.684' N 114° 12.511' E	839530.6 808085.1	71m W	1x1xnmh	Debris/ dredging dump
SJC-S10-CHK-SC023	22° 12.611' N 114° 12.609' E	839699.0 807950.4	125m E	4x1xnmh	Debris/ dredging dump
SJC-S10-CHK-SC024	22° 12.567' N 114° 12.531' E	839565.0 807869.1	11m E	6.5x2.5x<1	Debris/ dredging dump
SJC-S10-CHK-SC025	22° 12.220' N 114° 12.351' E	839255.8 807228.7	172m W	2x1x<1	Debris/ dredging dump
SJC-S10-CHK-SC026	22° 12.106' N 114° 12.417' E	839369.3 807018.3	58m W	2x1x<1	Debris
SJC-S10-CHK-SC027	22° 12.020' N 114° 12.520' E	839546.3 806859.6	122m E	3x<1x<1	Debris
SJC-S10-CHK-SC028	22° 11.979' N 114° 12.322' E	839206.1 806783.9	224m W	1.5x<1x<1	Debris
SJC-S10-CHK-SC029	22° 11.934' N 114° 12.398' E	839336.7 806700.9	91m W	1.5x<1x<1	Debris
SJC-S10-CHK-SC030	22° 11.902' N 114° 12.295' E	839159.7 806641.8	271m W	2x1x<1	Debris
SJC-S10-CHK-SC031	22° 11.881' N 114° 12.514' E	839536.1 806603.1	112m E	6x1x<1	Debris/boulder
SJC-S10-CHK-SC032	22° 11.862' N 114° 12.519' E	839544.7 806568.0	120m E	3x1x<1	Debris/boulder
SJC-S10-CHK-SC033	22° 11.811' N 114° 12.309' E	839183.8 806473.8	251m W	3x3x<1	Debris/boulder
SJC-S10-CHK-SC034	22° 11.795' N 114° 12.446' E	839419.2 806444.3	17m W	3x<1x<1	Debris
SJC-S10-CHK-SC035	22° 11.736' N 114° 12.373' E	839293.8 806335.4	159m W	<4x1x<1	Debris/boulder
SJC-S10-CHK-SC036	22° 11.737' N 114° 12.584' E	839656.4 806337.4	183m E	3x2.5x<1	Debris/boulder
SJC-S10-CHK-SC037	22° 11.651' N 114° 12.588' E	839663.3 806178.6	83m NE	3x2x<1	Debris/boulder
SJC-S10-CHK-SC038	22° 11.630' N 114° 12.624' E	839725.2 806139.9	101m NE	3x4x<1	Debris/boulder
SJC-S10-CHK-SC039	22° 11.101' N 114° 12.886' E	840175.8 805163.7	90m E	3x1x<1	Debris
SJC-S10-CHK-SC040	22° 11.035' N 114° 12.868' E	840144.8 805041.9	50m E	Linear	Linear debris
SJC-S10-CHK-SC041	22° 10.783' N 114° 12.857' E	840126.0 804576.8	5m W	2.5x<1x<1	Debris/boulder
SJC-S10-CHK-SC042	22° 10.660' N 114° 12.788' E	840007.5 804349.8	143m W	2.5x1.5xnmh	Debris/boulder
SJC-S10-CHK-SC043	22° 10.457' N 114° 13.403' E	841064.7 803975.4	303m NE	2x<1x<1	Debris/ dredging dump
SJC-S10-CHK-SC044	22° 10.372' N 114° 13.464' E	841169.6 803818.6	248m NE	3x1x<1	Debris/ dredging dump

Contact number	Latitude Longitude	Easting Northing	RPL offset	Dimensions (m)	Description
SJC-S10-CHK-SC045	22° 10.339' N 114° 13.392' E	841045.9 803757.6	121m NE	3.5x1.5x<1	Debris/ dredging dump
SJC-S10-CHK-SC046	22° 10.243' N 114° 13.590' E	841386.3 803580.6	200m NE	1.5x1x<1	Debris/ dredging dump
SJC-S10-CHK-SC047	22° 9.877' N 114° 14.072' E	842215.1 802905.4	206m NE	9x2.5x1.5	Debris/ dredging dump
SJC-S10-CHK-SC048	22° 9.553' N 114° 14.291' E	842591.8 802307.6	69m SW	3x1.5x<1	Debris
SJC-S10-CHK-SC049	22° 9.544' N 114° 14.262' E	842542.0 802291.0	108m SW	4x2x<1	Debris
SJC-S10-CHK-SC050	22° 9.052' N 114° 15.512' E	844691.3 801384.0	179m N	10x4.5x<1	Debris/boulder

*nmh - No measurable height

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

As shown above, the closest contact was SJC-S10-CHK-SC041 which was 5 m from the proposed alignment. The remaining contacts were situated beyond 10 m from the closest cable segment. There were no features found to be directly within the route of the cables.

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

Annex G
Environmental Monitoring and Audit (EM&A)

ANNEX G: ENVIRONMENTAL MONITORING AND AUDIT

PROPOSED WATER QUALITY VERIFICATION MONITORING

G1. 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 jetting. The detailed monitoring programme shall be submitted to EPD for approval prior to the installation works and commencement of the monitoring.

G2. 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 (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 – The instrument shall be a portable, weatherproof turbidity-measuring instrument complete with comprehensive operation manual. The equipment shall use a DC power source. It shall have a photoelectric sensor capable of measuring turbidity between 1-1000 NTU (e.g. Hach model 2100P or an approved similar instrument).
- 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.

QA/QC

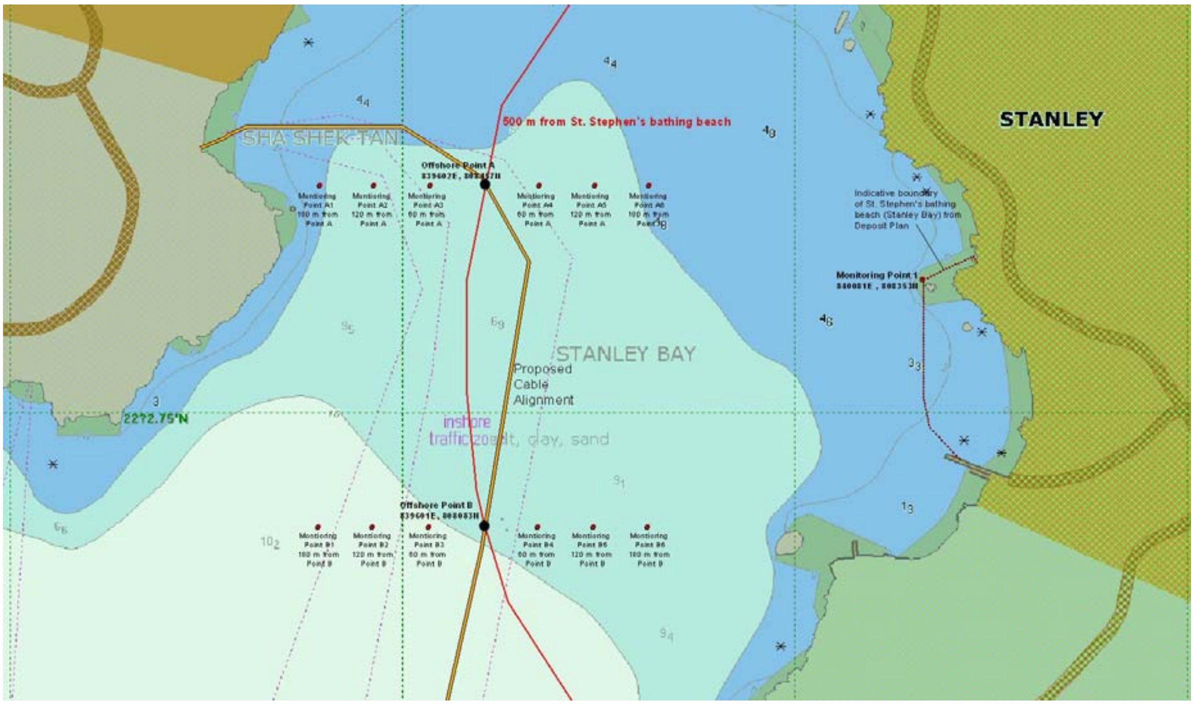
The QA/QC details shall be in accordance with requirements of HOKLAS or another internationally accredited scheme.

G3. VERIFICATION MONITORING PROGRAMME

Monitoring Locations

Monitoring shall be undertaken at 60, 120 and 180 m from two locations (Offshore Point A and Point B) along the cable route alignment where cable is located within 500 m from the boundary of St. Stephen's bathing beach (see **Figure G1**) and from the sensitive receiver (Monitoring Point 1).

Figure G1: Location of Water Quality Monitoring Points



The monitoring shall be undertaken immediately prior to and 20 minutes from the cable laying barge passing Offshore Point A and Point B in **Figure G1** to verify the water quality monitoring predictions. Sampling shall occur immediately prior to and after passing of the cable installation barge to verify the water quality. Replicate samples will be taken at each sampling point. Sampling shall be taken at 3 water depths: 1) 1 m below water surface; 2) Mid-depth; and 3) 1 m above seabed, except where the water depth less than 6m, the mid-depth will be omitted.

Information collected during the sampling will be reviewed with regard to the cable installation practices and reported to EPD as detailed below.

Monitoring Programme

The baseline conditions for water quality will be measured immediately prior to the cable installation to established ambient conditions. Impact monitoring will be measured during the cable installation work. As the cable installation work within 500m from St. Stephen's bathing beach will involve installation of approximately 400 m of cable, the process will take approximately 1 hour and no control station will be set up.

G4. REPORTING

As the sampling will be undertaken for verification purposes only, and the timeframe will be relatively short (within one day), the baseline and impact monitoring results will be provided to EPD in one report that shall include:

- Brief project background information;
- Drawings showing locations of monitoring stations;
- Monitoring results together with the methodology, details of the laboratory and equipment, parameters monitored, monitoring details (locations, depth, date, time, frequency, duration);
- Operating practices of the cable installation process during sampling (including: position, speed, cable burial depth) and;
- Interpretation of monitoring results.

The report will be provided within 2 weeks of the sampling activities.

PROPOSED MARINE MAMMALS INSPECTION

G5. MARINE MAMMALS INSPECTION

Although the area which the cable passed through is not considered being a habitat of major importance for cetaceans within Hong Kong, visual inspection of finless porpoise is proposed due to the potential presence of marine mammals.

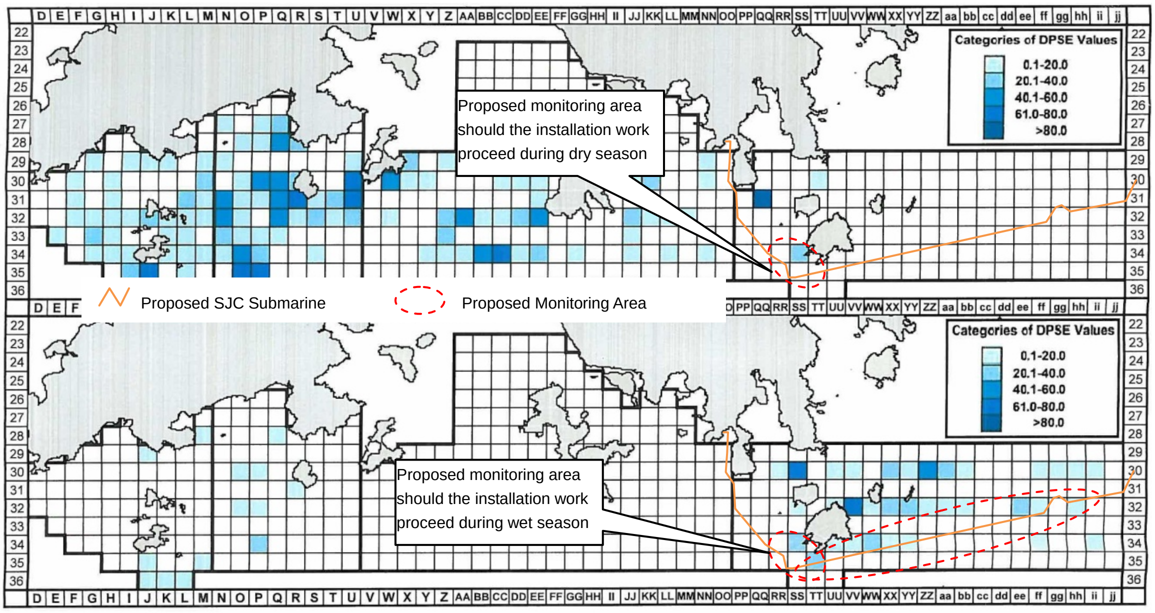
G6. METHODOLOGY AND EVENT AND ACTION PLAN

A finless porpoise exclusion zone within a radius of 250m around the cable installation works shall be implemented near Po Toi area where previous sightings of porpoises were recorded (see **Figure F2**). The area shall be visually inspected for finless porpoises prior to the commencement of works with works beginning once the area is clear of porpoises.

Monitoring of the porpoise exclusion zone shall be undertaken by independent cetacean observers (marine ecologist) with an elevated and clear view of the area. Works shall not commence until the observer confirms that the area is continuously clear of porpoises for a 30 minute period.

Works may commence following the 30 minute monitoring period when the area is found to be clear of porpoises. Should porpoises move into the area during works, cessation of works is required until the area is found to be clear of porpoises for another 30 minute period.

Figure G2: Distribution of Finless Porpoise and Proposed Monitoring Area



Density of finless porpoises with corrected survey effort per km^2 in southern waters of Hong Kong during dry season (top) and wet season (bottom), using data collected during 2004-09 (DPSE = no. of porpoises per 100 units of survey effort)